

Astronomiae reformatae tomi duo

The Two Tomes of Reformed
Astronomy

[Reformed Astronomy, in Two Tomes]

(1665)

by Giovanni Battista Riccioli, S.J. (1598–1671)

Translation by Scott Weisman



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Translator Version beta

Upright reason dictates that the recipients of the good, of whatever type and level of beneficence it may be, must show gratitude and blessing to the beneficent person in every way possible, commensurate with the value of the beneficence. And one who has benefited all the people of the world — for example, one who invented a new instrument for the good of the world, or a good book — it is fitting for every discerning person, out of the obligation of love of fellow beings, to at least purchase it, so that the man will profit and his heart will be encouraged thereby to invent yet more good instruments in the world. And similarly, all other wise-hearted people will likewise strive and exert themselves to invent good things and instruments needed for the repair of the world and its perfection.

And therefore, whoever says: "What do I need this new instrument for?" — he does not act well towards the world. For if not for the man who invented it, where would you be? And what would your city do? And more than this, if the man did not exert himself, what would the world do?

— R. Pinchas Eliyahu Hurwitz, *Sefer HaBrit HaShalem* (1797)

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A note on the work

A mature reckoning with the heavens as the telescope was revealing them — a sequel to the vast *Almagestum Novum* (1651), built on further years of observation at Bologna with the collaborator Grimaldi, with fresh measurements and corrected parameters at center stage. Across two volumes it treats the Sun, eclipses, the Moon, the fixed stars, and each of the planets in turn, then reduces it all to working tables. It carries some of the earliest sustained telescopic accounts of Saturn's changing shape before its rings were understood, of the bands and spots crossing Jupiter, and of the apparent sizes of the stars — wielded as evidence that the Earth stands still. A vivid window onto astronomy at the dawn of the telescopic age.

A note on the translation process

This translation was produced with the [translation-pipeline](#). See the linked repository for details on the process.

This text is the product of a highly refined automated translation process. It has undergone only cursory human review and should not be treated as an authoritative or scholarly rendering. It is offered solely as a reference and reading aid — a way to make an otherwise inaccessible work approachable — and any passage of real consequence should be checked against the original source.

Acknowledgements

Translated with the assistance of Claude. The translator thanks the [Anthropic](#) team for making this work possible.

This batch covers the front-of-volume material at the very start of the digitization. No printed text is present; the three leaves are the binding cover and two blank flyleaves carrying only modern librarian/shelfmark annotations in pencil.

**** Front cover of the binding. Mottled tan/brown leather (tree-calf marbled pattern), with raised bands visible along the spine edge at left. No lettering, title, or tooling is legible on the cover. No informational content.

**** Blank flyleaf (light tan laid paper), pasted to the front board at left. The only marking is a modern pencil annotation in the upper-left corner:

[Margin: "1529 (Rar)" — modern librarian's pencil note, upper-left corner. The figures and parenthetical reading are uncertain; "Rar" presumably abbreviates *Rarum* / rare-books designation.] [?]

**** Blank flyleaf (light tan laid paper). The only marking is a modern pencil shelfmark in the upper-right corner:

[Margin: "Rar 9471: 3 fol." — modern library shelfmark in pencil, upper-right corner. The numerals are uncertain; reads approximately "Rar 9471: 3 fol." ("Rarum 9471, 3°, folio").] [?]

[Blank folio: — verso of the title leaf. No text is printed on this surface; only the mirror-image show-through of the title page on the recto is visible. Top margin carries a modern pencil shelfmark "2922" [?] (with a further pencil mark to its right [?]).]

[Margin: pencil shelfmark "2922" [?]]

Mirror-bleed of the title page (read through the leaf, reversed), recorded as legible:

- "...REFOR..." — i.e. [*Astronomiae*] *Reformatae*
- "Serenissimi" [Of the Most Serene]
- "FERDINAND..." [Ferdinand] — i.e. Ferdinand Maria, Elector of Bavaria
- "BAVARIAE ET..." [of Bavaria and...]
- "DVCL..." [to the Duke...]
- a central engraved armorial device/coat of arms (the dedicatee's arms)
- at the foot: "BONONIAE M.DC.LXV" [At Bologna, 1665]
- "Ex Typographia Haered..." [From the printing house of the heirs of...] — the printer's imprint

[Blank folio: — flyleaf with no printed text on its surface. Faint mirror-image show-through of the title page is visible ("FORMATAE", "Serenissimi", "...CAIANI ETC" reversed). Top margin carries a modern pencil shelfmark [?.]

[Margin: pencil shelfmark [?.]]

Engraved dedicatory title leaf (recto)

This is the engraved title page proper, with red-and-black letterpress text above an engraved armorial cartouche.

ASTRONOMIA REFORMATA [The Reformed Astronomy]

AD [To]

Serenissimum D. [the Most Serene Lord]

FERDINANDVM MARIAM [Ferdinand Maria]

BAVARIÆ ETC. DVCEM. [Duke of Bavaria, etc.]

Diagram. An engraved armorial cartouche occupying the lower two-thirds of the title page: the coat of arms of the House of Wittelsbach (Bavaria). At the top, winged putti (cherubs) flank and support an electoral/ducal crown, while two further putti at the upper corners blow long trumpets. The central escutcheon is an ornate baroque shield: it displays the characteristic Bavarian lozengy (fusily) bend of alternating diagonal bands, quartered with a rampant lion. A smaller inescutcheon at the center bears an orb or globe device. The shield is framed by elaborate scrollwork (rollwork) with grotesque caryatid female figures at either side, and a festoon of fruit and flowers below, terminating in a mascaron (grotesque mask) at the base. The engraver's signature appears at the lower right of the plate, reading approximately "G. B. Tinti Fe[*cit*]" [?] (i.e., "G. B. Tinti made [this]").

- Top center (crown): electoral/ducal crown of Bavaria, supported by a winged putto
- Upper corners: two trumpeting putti
- Central shield: Bavarian fusily (lozengy) bend with rampant lion (Wittelsbach arms)
- Center inescutcheon: orb/globe device
- Flanks: grotesque caryatid figures within scrollwork
- Base: mascaron and festoon of fruit/flowers
- Lower right of plate: engraver's signature "G. B. Tinti Fe[*cit*]" [?]

BONONIÆ, MDCLXV. [At Bologna, 1665.]

Ex Typographia Hæredis Victorij Benatij. [From the printing house of the Heir of Vittorio Benacci.]

SVPERIORVM PERMISSV. [By permission of the superiors.]

[Margin: blue oval library stamp at upper right; round library stamp at lower center]

Verso of the engraved title leaf

The page surface is blank; what is visible is the mirror-reversed show-through of the engraved title page on the recto — the same red-and-black title text (*ASTRONOMIA REFORMATATA / AD / Serenissimum D. / FERDINANDVM MARIAM / BAVARIÆ ETC. / DVCEM.*) and the armorial cartouche, all printed in reverse from the bleed-through, together with the *BONONIÆ. MDCLXV.* imprint and the printer's line.

[Margin: modern pencil shelfmark at upper left, "1973 (Rar.)" [?]] [Margin: faint pencil mark at lower right]

Printed letterpress title page (Tomus I)

ASTRONOMIÆ REFORMATÆ TOMI DVO, [The Reformed Astronomy, in Two Tomes,]

QVORVM PRIOR OBSERVATIONES, HYPOTHESES, ET FVNDAMENTA TABVLARVM. [Of which the first contains the observations, the hypotheses, and the foundations of the tables.]

Posterior præcepta pro vsu Tabularum Astronomicarum, Et ipsas Tabulas Astronomicas CII. continet. [The second contains the rules for the use of the astronomical tables, and the astronomical tables themselves, 102 in number.]

PRIORIS TOMI IN DECEM LIBROS DIVISI, Argumenta Pagina sequenti exponuntur. [The contents of the first Tome, divided into ten Books, are set out on the following page.]

AVCTORE P. IOANNE BAPTISTA RICCILO SOCIETATIS IESV. FERRARIENSI. [By the author, Fr. Giovanni Battista Riccioli [Riccioli] of the Society of Jesus, of Ferrara.]

BONONIÆ, MDCLXV. [At Bologna, 1665.]

Ex Typographia Hæredis Victorij Benatij. [From the printing house of the Heir of Vittorio Benacci.]

SVPERIORVM PERMISSV. [By permission of the superiors.]

[Margin: faint mirror show-through of a facing page of letterpress text visible behind the title; not legible as continuous text.]

Verso of the Tomus I title page (blank; show-through)

This page is the blank verso of the letterpress Tomus I title page. It carries no printed text of its own. The lettering visible on it is mirror-reversed show-through bleeding through from the recto — the title-page text already transcribed in batch 003 ("ASTRONOMIÆ REFORMATÆ TOMI DVO ... BONONIÆ, MDCLXV. Ex Typographia Hæredis Victorij Benatij. SVPERIORVM PERMISSV."). No new content.

Dedicatory Epistle — opening

To the Most Serene and Most Powerful Prince and Lord, Lord Ferdinand Maria [Ferdinand Maria], Arch-Steward [Archidapifer] of the Holy Roman Empire, Elector of Both Bavarias and of the Upper Palatinate, Duke, Landgrave of Leuchtenberg.

F. S. [*Felicitas. Salus.* — "Good fortune and well-being"; or the author's subscription formula]

[Historiated initial: a large woodcut capital F, set in a decorated square block, opens the epistle.]

May it be with favorable and auspicious omen, Most Serene Prince, that the science of astronomy — *Reformed*, as best I could manage, by my hand — now comes forth from the press at this very time, born as it were from the womb. For just as the Sun has entered Leo, so this work, by its natal star, has drawn as its lot the royal sign of the heavens. Yet by a far happier design it seeks for itself help and protection under the illustrious name of Your Highness; for in Your royal coat of arms the globe of the world, gleaming with the star of the Cross and set between twin Lions above and below, is guarded more securely than by Atlas and upheld more strongly than by Hercules. For it has been, and is, the peculiar mark of this Most Serene House — by a twofold virtue, of orthodox Faith and of unblemished Loyalty — on the one hand to protect and guard the Catholic Church and the Supreme Pontiffs, and on the other to defend and preserve the Roman Empire and the Emperors; and to join political pru-

Dedicatory Epistle — continued

-dence with sincere Religion, Equity toward men with Piety toward God, Justice with severity, Magnanimity with Clemency, the arts of War with the pursuit of Peace, Wisdom with Fortitude, Arms with Letters; and — what is the very property of Leo — splendor of Wealth combined with the most generous munificence in showering its bounty upon learned and good men.

It is remarkable that the wisest priests of Egypt, to signify the overflowing of the Nile, chose to employ as their hieroglyphic the Lion — the sign diametrically opposite — rather than Aquarius itself. For what affinity, I ask, appears between that most blazing sign, with its fiery heat and the dry burning that scorches the very bowels of the earth, indeed sears its face, and that vast abundance of waters which the Nile pours forth at the height of its season? Yet here lies a mystery, whether of Nature's more hidden workings or of the secret providence of the Deity: that the subterranean lakes of Ethiopia and Egypt, stirred up by the "barking" of the Dog-Star and by the roaring of the celestial Lion, swell and boil over from those vast caverns, so that the Nile then rises and overflows — at the very time when other rivers shrink, and the Nile triumphs in its abundance of waters, while the rest run dry or stand parched. Moreover, if one considers the nature of the Nile and the temperament of the Lion, a great likeness between the two will hold good. Other rivers, the moment their banks are broken or overtopped, burst out with tyrannical violence and a mass of waves, and lay waste fields and farmers alike, devastating everything in their path —

through every field, with their stalls, they drag the herds along [camposque per omnes / Cum stabulis armenta trahunt]

— bringing on barrenness, dearth of grain, and all the evils that follow. The Nile, by contrast:

Fertile in its flooding, never fails to bring forth fruit [Fertilis exundans, nunquam non frugifer exit]

It conquers its banks only to enrich the fields; it floods only to make them fruitful; and the more violently it does so, the more bountiful it proves. By its neighbors it is then most of all hoped for, the higher it swells in pride — so much so that they fear lest it should not swell, lament if it should not overflow, and reckon it a shipwreck of their fields whenever they are not overwhelmed by the mass of its waters.

The Lion likewise, of all wild beasts the least savage, is as terrible toward those who scorn his majesty as he is gentle toward the submissive — milder toward women and infants, kindlier toward those who do him good, more generous toward the hungry, with whom he shares the food he has more than once divided, content himself with a modest portion. He knows how to serve holy or religious men no less than how to rage against others. Nor is any wild beast more easily tamed than the Lion — especially if he keeps company with princes, deeming it unworthy of the King of beasts not to lay aside his ferocity in the royal court, and not to put on a human gentleness in the presence of men robed in purple.

Ages of old saw it: under Hanno of Carthage [Hanno the Carthaginian]; under Augustus and under Domitian, lions so tame that fawns and hares played within their very jaws, fearing nothing there, while the lions themselves were the more afraid lest they should harm in even the slightest way creatures so defenseless. A more recent age too has seen it, under John of Austria [John of Austria], under Maximilian, and under Rudolf II [Rudolf II]: lions walking harmlessly through the palace and waiting upon their masters; and at the castle of Eitelberg [Eitelberg], lions of Otto Henry, Count Palatine [Otto Henry, Count Palatine], playing with puppies and sleeping untroubled at their side.

To what end, you will ask, this digression about the Nile and about Lions? Why, so that through the Lions blazing so brilliantly in Your most noble coat of arms I might urge that there are signified those Heroic virtues which I recounted above — the very virtues which Your HIGHNESS has dra-

[The dedicatory epistle to Ferdinand Maria continues from the prior batch; the opening words of p. 13 complete a sentence broken off on p. 12: "...the very virtues which Your HIGHNESS has dra-[hau-]"]

—drawn upon, and which Your Ancestors transmitted down into You in unbroken succession all the way from Charlemagne [Carolo Magno] through the illustrious line of their descendants. Among these Ancestors, one who won immortal remembrance and raised his head high was Otto the Great [Otho Magnus] — tall indeed in body, but greater in spirit, and destined to rise higher still, had not Heaven, in that very year 1180 when he was chosen Duke in Bavaria, begrudged him to the earth. Yet in his stead his son, Ludwig [Ludovicus], Duke of Bavaria, Septemvir, Count Palatine, and founder of Straubing [Straubinga], earned distinction for his loyalty toward Frederick II [Fridericum II], and won praises for his Religion and his Piety toward Innocent IV [Innocentium IV], so that he merited high tribute as a glory of both Empire and

Church. His grandson, Ludwig II [Ludovicus II], surnamed the Severe, with the gravity of his character contending against his fairness, ceded Lower Bavaria to his brother Henry [Henrico]. From this line came that distinguished offspring, Ludwig III [Ludovicus III], who in the year 1314 was chosen King of the Romans and soon after Emperor — so great a man that the age could not decide what was more to be admired in him: his kindness toward his peoples, or his love of letters and of learned men, or his zeal for the Orthodox Faith and his unceasing devotion to defending the Church of God. His great-great-grandson, Albert [Albertus], surnamed the Pious — but no less the Magnanimous — refused the proffered Kingdom of Bohemia, having tested within himself a Kingdom ampler and nobler, and proving true that saying of Horace [Horatianum illud]:

The more you rule by mastering a greedy Spirit, than if you should join Libya to far-off Gades, with either Carthaginian in servitude to one man alone.

Therefore from this stock was born the second Albert [Albertus], called the Wise, who, emulating the Piety of his Father no less than the most religious devotion of his wife Kunigunde, raised up very many Churches in Munich [Monachij], that by these — as if by citadels — he might storm Heaven, not by giant-like daring but by humble devotion. Why then should he not have begotten one like himself, William [Guillelmum], in whom so great an ardor for the Catholic Religion shone forth? And this William in turn was that very Albert V [Albertum V], who, also bearing the surname "the Wise," showed himself the wiser the more keenly he championed the Orthodox Faith. From him was sprung Your grandsire William [Guillelmus Ferdinandus], most zealous for the Catholic Religion, who in the year 1597, so that out of the storms of this World he might withdraw into harbor, and thence more safely into Heaven, abdicated the Dukedom of both Bavarias to be free for himself — nay rather, to be free for God alone. Afterward, from Renata [Renata] — that most illustrious Heroine — he had received Your Father, the best of men, Maximilian [Maximilianum]; and concerning him it is more fitting to keep silent than, in too cramped a compass and beneath his deserts, to wish to comprehend in a single tribute either his skill in arms, or his cultivation of peace, or his love of justice and of equity, or his most religious piety, or the rest of those endowments on account of which Germany acclaimed him Father of his Country.

Of all these, most Serene Ferdinand Maria [Serenissime Ferdinande Maria], You willed that the prerogatives be Yours by hereditary right and by voluntary possession: above all, Prudence in the choosing of counsels, Equity in judgments, the most amiable Humanity in governing Your subjects, a steadfast Zeal in

defending the Orthodox Faith, and resoluteness in repelling the enemies of the Faith and of the Empire. From this it came about that Your Cohorts withstood, repulsed, routed, and put to flight the forces of the Turks — superior in number, not in valor — with a memorable slaughter of the foe and to Your own praise.

[p. 14 — *the close of the dedicatory epistle and its subscription. The whole leaf is heavily ghosted by show-through from the printed verso/recto, but the recto text is legible.*]

But just how much our Society [Societas nostra] owes to You, to Your most illustrious Father, and to Your grandsire — how great the Munificence it has enjoyed from that quarter, and the protection surpassing all glory that it has rejoiced in, and rejoices in to this very day — no words can express, no monuments can attest; nor can it be discharged against so great a mass of debt, however great Your Magnanimity may be — because to do so would itself be a fresh benefaction and an immense new debt, under which one could never cease to labor for its repayment, even unto eternity. It remains only that the Greatness of Your HIGHNESS [Celsitudinis Tuae] deign neither to scorn the smallness of my Work, nor the slenderness of my talent, nor to refuse to admit me among Your most devoted clients.

Of Your Most Serene Electoral Highness

[*set lower right:*]

The most humble and obedient Servant,

Giovanni Battista Riccioli [Io. Baptista Ricciolus], of the Society of Jesus.

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BOOK TWO.

In which are select observations of Eclipses of the Moon and of the Sun, for establishing the lunisolar motions and the Moon's first inequality, and for delimiting the apparent Diameters of the Luminaries.

BOOK THREE.

In which are the observations of the Moon apart from Eclipses, treating of the Moon's monthly inequality, its variation, and its libration.

BOOK FOUR.

In which select observations of the Fixed Stars are examined, drawn from the ancients and from more recent astronomers; and from these, Tables are constructed and presented up to the Year of Christ 1700.

BOOK FIVE.

In which are the observations of the Planet Saturn, and the hypothesis of its motions.

BOOK SIX.

In which are the observations of the Planet Jupiter, and the hypothesis of its motions.

BOOK SEVEN.

In which are the observations of the Planet Mars, and the hypothesis of its motions.

BOOK EIGHT.

In which are the observations of the Planet Venus, and the hypothesis of its motions.

[Index Librorum, conclusion]

BOOK NINE.

In which are the observations of the planet Mercury, and the hypothesis of its motions.

BOOK TEN.

In which are the supplementary matters [paralipomena] concerning observations bearing on the fixed stars and the minor planets — namely, on their apparent diameters, their figure, their phases [Fasciis], their spots [Maculis], their rotation

[Vertigine], their satellites [Comitibus], the motions of those satellites, and their distances from the Sun and from the Earth.

Faculty [license] of the Reverend Father Girolamo Claramonti [Hieronymus Claramontius] of the Society of Jesus, Provincial in the Province of Venice.

Since two priests of our same Society of Jesus, expert in theology and in mathematics, have reviewed the *Astronomia Reformata* of Father Giovanni Battista Riccioli [Io. Baptista Ricciolus], a priest of our Society, and have approved that it may be published — we too, having obtained the faculty granted to us by the Most Reverend Father Goswin Nickel [Gosuinus Nikchel] of the Society of Jesus, our Superior General, concede that it be committed to the press, if so it shall seem fitting to those to whom this pertains. In witness whereof we have given these letters, subscribed by our own hand and secured with our seal. At Bologna [Bononia], the 28th day of October, 1658.

Girolamo Claramonti [Hieronymus Claramontius].

Place * of the Seal [Locus Sigilli].

Examined by [Vidit] the Lord Carlo Gorani [Carolus Goranus], Penitentiary, on behalf of the Most Eminent and Most Reverend Lord Archbishop of Bologna and Prince.

Examined by [Vidit], out of his singular goodwill toward the Author, the Most Reverend Father Inquisitor of Bologna himself, Friar Guglielmo Foschi [Gulielmus Fochus], and the faculty of printing was confirmed by his Most Reverend Successor.

Let it be printed [Imprimatur].

Friar Giovanni Vincenzo Paolini di Gatteo [Ioannes Vincentius Paulinus de Gatexio], Master Inquisitor General of Bologna.

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PROLEGOMENA TO THE REFORMED ASTRONOMY

In which the System of the World is set forth, together with the Hypotheses of the First and Second Movable [spheres]

And the Author's endeavors toward the advancement of Astronomy and Cosmography; and finally certain Conclusions are laid down, by which what is certain is distinguished from what has hitherto been uncertain.

How greatly Astronomy has advanced — even in our own age — once observatories had been erected and the heavens scrutinized first with the common eye and afterward with the telescope: how it has progressed, as though crowned the queen of the natural sciences; and that this advance has consisted chiefly in this, that it has brought to light, and illuminated thereby, very nearly everything that mortals before had failed to perceive, or that lay hidden, or that the deceptive light [of earlier knowledge] had revealed of itself only obscurely — all this is, I judge, sufficiently established in part from the Preface to the Reader of the first volume of our *Almagestum Novum* [*New Almagest*], and is to be made known in part in the pages below. Nor, for that matter, can anyone be ignorant of it, unless he be a stranger to those men by whose most celebrated labors the knowledge of this field has come down to us — the works of the most learned men, I mean: Copernicus, Tycho [Brahe], Longomontanus, Kepler, Lansberge, Galileo, Magi-

ni [Giovanni Antonio Magini], Scheiner [Christoph Scheiner], Petavius [Denis Pétau], Simon Marius [Simon Mayr], Claramonti [Scipione Chiaramonti], Snell [Willebrord Snell], Stevin [Simon Stevin], Wendelin [Govaert Wendelen], Michael Langren [Michael Florent van Langren], Hevelius, Gassendi, Boulliau, Herigone [Pierre Hérigone], Morin [Jean-Baptiste Morin], Mersenne [Marin Mersenne], Anton Maria de Rheita [Anton Maria Schyrleus of Rheita], Vincenzo Reinieri [Vincenzo Renieri], Johannes Phocylides [Johannes Phocylides Holwarda], Giovanni Battista Hodierna [Giovanni Battista Odierna], Elia Leonibus [Elias à Leonibus], and Maria Cunitia [Maria Cunitz], Vincenzo Muto, Eustachius [?], Lineamannus [?], Huygens [Christiaan Huygens]; and very many others, whom — lest I run on too long, and without doing them injury — I leave unnamed. Now

further, as to the bearing of this faculty [of astronomy] upon ours, and which among these and other select [matters], by way of corrective theses, we suppose in our hypotheses, and in the System of the World; and which things in Astronomy we hold for certain, and which we still reckon uncertain — these, that the reading may not be tiresome, we shall nevertheless set forth beforehand briefly and distinctly.

ARTICULUS I.

On the Creation of the World, and the Six Days of the Divine Work, insofar as the topic bears on establishing his System.

I have treated this matter at sufficient length in Book 9 of the *New Almagest* [Almagestum Novum], section 1, chapter 2. From there one may consult the opinions of the Fathers, the learned, and others; here I shall recall them only briefly. I take it, then, as drawn especially from Sacred Scripture in Genesis, that in the beginning of time, in one and the same instant, God created Heaven and Earth — that is, the Heaven of Heavens, which is the Empyrean, and the Heaven of the waters that lies above the Empyrean; this is indicated in the work of the second day, where it is said: *And let it divide the waters that were under the firmament from those that were above the firmament*. It is supposed, therefore, that water existed on both sides before the firmament was created; and so the word *Earth* is taken nowhere by Moses to mean a fixed dimension. [Margin: 1. *Diuisitque aquas quæ erant sub firmamento, ab his quæ erant supra firmamentum*. — Gen.]

Moses teaches that some Earth had been created on day one, and we must say that it was created before day two; and so under the name *Earth* the Elemental Water is also to be understood, or perhaps the whole Elemental sphere — whether the Heaven of the Earth be of the same infinite species, whose elemental, or rather of the same genus. Since, therefore, God in the first instant of time created two things, the two extreme bounds of the World — Heaven, as the highest covering, and Earth with Water, as the lowest foundation, as it were — and no star at all, and consequently no planet, unless they were created on day four (here Copernicus rightly notes, and against him is the Earth's being placed by Moses in the center, and the assertion that Heaven and Sun are at the center) — yet the Light which existed at that first instant, although it was not the prime light, was nevertheless light. [Margin: From the order of creation against Copernicus.]

That [light] shone above the abyss but a little later, having been created either by successive propagation or by motion around the terraqueous globe, and so produced the first equinoctial day; or perhaps in any case by an equal duration nearest to that, and what afterward the Sun, by its daily motion under the Prime Movable [Primum Mobile], effected — for that Light, in whatever hemisphere it then was, illuminated that place which was either the first Earthly Paradise, or the Palestine of the second Adam, was to be inhabited. And thus God divided the light from the darkness; and so it is probable that for about 12 hours the whole surface of the terraqueous globe enjoyed that light in succession, and through 12 [hours] lacked it, except for that particle of the first day in which the darkness was carried over the whole surface of the abyss. [Margin: Whether the first day was natural.]

It remains uncertain to us how that light arose at first from the eastern Horizon, either toward the Meridian of Paradise or of Palestine; since by us this can be understood in any manner whatever — *and it was evening and it was morning* — taken in a figurative sense. The expression *evening* and *morning* is understood at the beginning of time, properly speaking of the nights and intervals of time, and of the day at noon: when there is some evening twilight before the future setting of the Sun, or actually after [it] — at any rate after the Sun has set toward the West, the morning twilight is reckoned in the Churches as Vespers; whereas the morning [twilight] for us at our time precedes the rising of the Sun, either before [the Sun] has actually begun to ascend toward the Horizon, or after the midday [meridian], from which the Sun cannot ascend toward the Horizon. Finally, neither could men afterward perceive the light, unless it depended necessarily and essentially on the Sun, or as these things were created — unless these same Stars, or even all the Stars, were perhaps independently of the Sun not only made into a body by accident, but were also a body subject to it; if the Earth lies between [it] and the terraqueous mass, the intervening Vacuum — or rather, what body is intermediate — were either ethereal, or aqueous, or air, or were thought essentially to depend on a subject for its sustaining, [and] would be constant; so that from then, from the beginning, it could have shone with light intermediate from Heaven and from the stars, and have been produced and sustained by God alone.

[Margin: 2. On the work of the second day.] Thus Moses: *God also said: Let there be a firmament made in the midst of the waters, and let it divide the waters from the waters. And God made a firmament, and divided the waters that were under the firmament from those that were above the firmament. And it was so. And God called the firmament Heaven; and the evening and morning were the second day.*

The word *firmament* in Hebrew signifies something *expanded* and *solid*. Now if we say that the whole space from the Earth to the highest Heaven was at first full of homogeneous water; and that on the second day part of this water, left above the Earth, was thinned out, and part rarefied into the ethereal air, and finally part condensed into the crystalline Heaven, or vitreous — which is not at all unlikely — then it begins to be evident from such vastness of water and so great a condensation of the primigenial waters, that the rays multiplied by manifold refraction were dispersed. Then, if there was one water continuous from Earth to Heaven, it would properly be said that certain waters were beneath the firmament, that is, in that very place where afterward the firmament was made, [and] certain waters indeed beneath the firmament. But if we say that the prime water lay between the waters that surround [the Earth], and that the celestial waters created the aerial and ethereal Heaven, then on day two the Heaven was inserted into the ethereal solidity; or to the hardness imparted, which from the comets and planets is vague, that with many motions, and another, and a common reception of opinion, the Parts being conformable, we choose: then, since with all the other days something of a body was made from nothing — namely, as to substance, on the first day Heaven, Water, and Earth; on the third, all things; on the fourth[?], the Fishes; on the fifth, the flying things; on the sixth, the four-footed beasts and Man — only day two was without production of any new body, which would be exceedingly incongruous. [Margin: That the firmament is the eighth sphere.]

But if we say that the whole of that space was at first vacuum, and the aerial position remaining, the lower World not yet existing, [and] that there was a continuous superior [body], and that Stellar matter was not yet produced; and on the second day, either from nothing, or from the matter of both [waters], it produced from itself an ethereal nature; and from that, the position interposed [between] the divided waters from the waters, [and] the ethereal interposed truly the substance of the firmament; or it would be called the Hebrew *Rakia*, that is, *Expanse* [Expansum] — *solid*, we should say — both because that part, in which they collected the Fixed Stars, properly solidified, was taken with hardness, both because the remaining part — which the wandering Planet with its errings, and some comets permeate — would nevertheless be future, and at any rate immovable; nor as though they were transferred, should the Planets and comets be reckoned; but as though firm, they compress the Fixed Stars, and the lower ones permanent: these things I should hardly say, although they may seem to be of doubtful opinion, but they will surely face all the difficulties against the prior opinion adduced, and to whomever inquires what meanwhile interjects between the prime [waters] above the higher, and the inferior waters, it will be answered

with Moses: [Margin: 3.] *The Spirit of the Lord was borne over the waters*, that is, the spiritual substance of the Deity within, and above, was uniting the waters; filling the immense vacuum, that water, and that immensity replenishing imaginable things, and that above Heaven both within itself and infinitely extended. To whom truly the nature of these opinions satisfies, it is not easy to except this other thing, which is the literal sense of Sacred Genesis, and the verisimilitude more consonant.

[Margin: 3.] As to the work of day three, there is no great difficulty. For what is said: *Let the waters that are under the heaven be gathered together into one place: and let the dry land appear. And it was so. And God called the dry land, Earth; and the gathering together of the waters, he called Seas* — this is most truly expounded, either that before, on the first day, part of the terrestrial surface rose into mountains; or that on day three the surface of the Earth was disturbed in many ways, and the dry land appeared; whether they assert that the Earth's bowels were excavated, or whether the mountains were cast forth, and the hills, and within the bowels the Seas likewise dug out; a good part of the water hidden away, [and] of the rivers the springs, and the fluxes, refluxes, the Sea, or with whirlpools the vortices varying. Yet not by motion alone, [nor] by the local work of that day, would you think it accomplished, [for] God adds: *Let the Earth bring forth the green herb, etc.*; and so all plants, and the fruit-bearing trees, without seed already given, were produced, concurring

[Top of p. 23, left column — continuation:]

— nevertheless the Earth, through the seminal power infused into it by God, signifies such a concurrence by those very words: *Let the Earth bring forth*, whence it could appear that the generation of plants does not depend on necessity of essence, and that it is fated by the Stars, [and] not yet produced. [Margin: 4. On the work of the fourth day.]

Furthermore, on the fourth day God did not say: *Let the Heaven produce, or let the firmament bring forth the Stars*, as he had said of the Earth: *Let the Earth bring forth*; and afterward he said of the waters: *Let the waters bring forth the creeping creature, etc.*; but he said: *Let there be made Lights in the firmament of Heaven*; doubtless because these depend wholly on his own concurrence and divine pleasure, [and] lest he again give occasion to the opinion that the divinity of those [bodies], or a fatal power, [exists] in these lower things; unless we except the Light, which on the preceding days he had made through a tube[?]; for if the body of the Sun had been created, the dispersion was in the Sun, or the Stars, [from] the accidents of bodies communicated to the Sun by its own destruction, [and]

given to be destroyed; that the virtues were produced both to the Sun and to the Fixed Stars for propagating light. By whichever of these manners God may have used [it], it is certain that it would be against this sacred text to assert that some Star or some Light was produced from the Planets, and consequently from the Earth, made by God on the fourth day; and proportionally [against the text] that the Earth is one of the Planets. Nor would it be said that the Earth had not the name of Star, because there was not yet a Sun, [and] it could not receive light from it, [and] perform the office of luminary, [Margin: 5.] especially the waters being covered, because the essence of a Planet does not consist in actual illumination; otherwise, when the Moon at New Moon, or in a total Eclipse, does not illuminate the Earth, it would meanwhile cease to be a Planet, and could lose the substance of being prime — either on the first or the second day produced under the name of Heaven, but it would not have been a Star, before it took on the power of receiving illumination, which is contrary to what Moses asserts. *And he set them in the firmament of Heaven*, etc.: the words *Let there be made*, and *And he set*, signify together a new production, and likewise the office of illuminating perfected. Then the Earth, although covered with waters, was able to reflect light from the prime [light] as from a great mirror, and much more on day three the dry land appeared, and so had the name of Star.

But lest you say there could be no Star which did not illuminate, nor a Planet, since before the fourth day it was not moved about the annual orbit — for a Planet is so called from its erring, [and] is not a Planet, and consequently if the Earth alone with a vertiginous motion turned about its own axis, [Margin: From the order of creation against Copernicus.] insofar as the Moon near New Moon illuminates [it], reflecting toward it the rays of the Sun: but the Earth nevertheless was not [a Planet]. But I gather from this that the Earth, illuminated on the fourth day by the Sun, [and] adapted; and to illuminate the Moon, and to be carried about the annual orbit, ought to be called a Luminary, and indeed a lesser one — although the Moon is lesser than the Sun, both in mass and in the power of illuminating the Moon, from its greater surface reflecting more rays than the Moon, and so God made the three luminaries of the two great Luminaries. Lastly, it remains that you may say, although the Earth is so moved about the Sun, [and] is moved nevertheless even with respect to the Moon, and this in turn illuminating [it] on fixed days — yet it would not therefore deserve the name of Luminary; because God ordained it especially to illuminate the Earth, as being for the use of Men, beasts, [and] the plants of the field, and for distinguishing the day from the night, and the months, and the years, for the uses of men: as is clear from Sacred Genesis, saying: *Let there be Lights made in the firmament of Heaven, and let them divide the day and the night, and let them be for*

signs, and for seasons, and for days and years, and let them shine in Heaven, and give light upon the Earth; with which agree those words of Deuteronomy 4: *Lest perhaps lifting up thy eyes to Heaven, thou see the Sun and the Moon, and all the stars of Heaven, and being deceived by error thou adore and serve them, which the Lord thy God created for the service of all the nations, that are under Heaven.* I grant freely, and I concede for this reason, that the Earth is not numbered among the Luminaries; yet in the Copernican hypothesis the Earth is a Planet, and an erratic Star, and is placed with its atmosphere in the Planetary Heaven, [and] is more remote from the center of the World than Mercury, Venus, and Mars at perigee, and at acronychal [position]; and so it would truly be said to be situated in a higher Heaven, [and] a part of the Planetary Heaven — if not on the first day, at least on the fourth day in the firmament of Heaven, when from

[Top of p. 23, right column — continuation:]

— the two Luminaries, and the Stars, Sacred Genesis speaks: *and he set them in the firmament of Heaven, that they might shine over the earth, and rule the day and the night, and divide the light and the darkness.* The Earth, however, in the Copernican hypothesis, could be said to be under Heaven in a different respect, and in Heaven; here [it is] taken in a diverse relation [as] reckoned [among] the other Planets, which are under a Heaven more remote from the center of the Earth; and the Planets, and the Fixed [Stars] themselves are under Heaven in the supreme respect; but Scripturally, this is to inhere in the proper sense of Sacred Scripture; it cannot be sustained that the Earth is in Heaven, and much less that it is greater, and higher in Heaven, than the Stars Mercury, Venus, and Mars; but absolutely it must be said that the Earth is under Heaven, and the Stars all in Heaven, [for] truly it cannot be said unless [the Earth] has peculiarities of its own, [and] the place of the Earth is given, [and] not given of Heaven — namely, the center of the World. Moreover, although it is very incongruous, [Margin: 5.] that since the Stars all were created [to be] under the [direction] of all the nations, [those bodies] which are under Heaven, [and] those very nations with the Earth circulate about their own emendations toward themselves [and] from light, and influence; but they are subordinate ministers, and especially of the Sun, about a quiet Earth, and immovable, [and] ought to be moved, and to perform their service — which God enjoined upon them. [Margin: That the Sun is in the center of the Planetary [Heaven].]

[Margin: 5.] As to the rest of the work of day five and day six, and of constituting our System, they need no disquisition, [and] which are diversely said in proportion to what was said hitherto; we suppose, as Sacred Genesis says, no

violence at all, or improbability beside the sound of the letters, [and] is intended; [and] by no necessity is it intervening, [and] is otherwise to be understood; that the Earth, or the terraqueous globe, is in the center of the World, without annual motion, but excluding especially the annual [motion]; above the Elemental sphere indeed, [but] to be the Heaven of the Planetary [region], or rather, somewhat permeable indeed by the Planets, but not by it [made] immovable, [and] not firm, although nothing of its whole, or some part, circumlocuted; and on this account it merits the name of Firmament, [and] the Fixed Stars under the firmament be probable to be solid, [and] impermeable; therefore the Fixed [Stars] themselves perpetually keep the figure of the stars; that at a distance among themselves [they are] continuous, but it is easier [that they] be moved with the motion of their own sphere [than] all be moved; whether that be the Aqueous Heaven created on the first day, and afterward consolidated, [or] from the ether [made] distinct. But if some new Stars [should] be seen, [and] not begotten in the Planetary Heaven [but] descended below Saturn, [Margin: New Stars.] [they] are circumscribed, so that they may evade [our] sight, [when] from their own particularities in the firmament of the Fixed [Stars] they do not appear, [and] one reckons that thence, [and] something miraculous made [by] divine virtue penetrating the solidity of the firmament of the Sphere. Furthermore, what is to be expounded, and what is presupposed about [the] bodies, [is that] the Prime Movable, by whose motion is accomplished the daily revolution of all the Stars [in] 24 hours, or thereabouts, or at least the apparent [revolution] of this same motion is preserved.

ARTICULUS II.

On the Prime Movable.

The ancient Astronomers, except certain Pythagoreans, in order to reconcile the apparent motions of all the heavenly bodies, [held that they go] from East to West, and gradually back again through Rising and Setting, with an apparent proper motion, by which the Stars likewise all are conceived to be carried, [and] above the Fixed Sphere, [there is] one above the others imagined, which carried away the Fixed [Stars'] Sphere; the rest, [being] contiguous to it themselves, and solid, from East to West would be moved into contrary parts; this very thing — what was said before [as] distinct — could be carried, [and that] the lower sphere could be carried toward the West, [and] yet not allow itself to be carried away; the resistance, however, of the Prime Movable being opposed, [it would] not so quickly revolve to the same Meridian as it quickly reached it

[Top of p. 24, left column — continuation:]

— if nothing whatever resisted. Just as a Fish [carried] downward by the headlong rushing torrent, or [a swimmer] born by the wind, if nothing resisted the impulse, is carried downward by a greater space than if it resisted. [Margin: 2.]

Nicetas of Syracuse, indeed, Heraclides, and Ecphantus the Pythagorean, and Seleucus; and afterward Gilbert [William Gilbert], Origanus [David Origanus], Wendelen [Govaert Wendelen], Argolus [Andrea Argoli], and William Langren [Michael Florent van Langren] held the Earth to turn with a vertiginous motion about its center in 24 hours from West to East; and so [they held] it to come about, and that, by going to meet [them], the Fixed Stars and immovable Planets, with a gentle going, would [seem to] be moved by a daily motion. Either because they thought the swiftness of the daily motion incredible in a Sphere so vast; or because they judged it inept and unfit for a Planetary Heaven to assume the daily and uniform motions for itself: but Philolaus, Aristarchus of Samos, Nicolaus Cardinal Cusanus [Nicholas of Cusa], Copernicus, Rheticus, Maestlin [Michael Maestlin], Kepler, Galileo, Lansberge [both, the elder and younger], Boulliau, Hérigone, Valentin Naibod [Valentine Naboth], Caelius Calcagninus [Celio Calcagnini], Diego de Zúñiga [Didacus à Zuniga], Paolo Antonio Foscarini [Paulus Antonius Foscarinus], Baranzanus [Baranzano], Giordano Bruno [Iordanus Brunus], Renatus de Chartes [René Descartes], Johannes Hevelius [Hevelius], William Schickard [Wilhelmus Schickardus], Marcus Hortensius [Martinus Hortensius], Christopher Wittich [Christophorus Wittichius], Daniel Lipstorp [Daniel Lipstorpis], Thomas Campanella, Christiaan Huygens [Huygens], and not a few others, besides the daily vertiginous [motion], assumed for the Earth a translation [motion] also about the Annual Orbit. [Margin: Copernicus.] But Copernicus, near in time, adds [that] the third [motion], [namely] that of libration, in the Earth, beside [the] said motions, [as] a third motion, by which the axis itself parallel librates, so that this very [axis] from the Equinoctial points may be seen [to move] into preceding [signs] toward the West, [and] from them the Fixed [Stars] to recede toward the East; and so the Fixed [Stars] from their position [seem] to recede, and at the same time to change their declinations; nor do they remain in the same [position] with the other Planets in longitude, [than] [they have] proper motion toward the East. By which fact, either falsely, [or] feignedly, [it is] freer, and adapts the more troublesome [phenomena] to be explained; [Margin: Praise of the Copernican hypothesis.] [and] the solid Sphere of the Fixed [Stars] being adapted to the liquid ether [for] the daily motion of the Planets, [and] the proper [motion] of the very motion [is] explained; the beauty and elegance of the novelty has so excited [them], [that it] has allured [them] into love of itself.

But we, to whom not only by the decree of the Sacred Congregation, [Margin: *Almagestum Novum* Book 9, section 4, chapter 40.] which I reported in *New Almagest* [*Almagestum Novum*] book 9, section 4, chapter 40, [the matter] is to be complied with, but also by physico-mathematical evidence from the percussion of falling heavy bodies, [it] is decided with the greater [evidence], by how much from a higher place they fall; and indeed [by] the proportional acceleration of the descending [bodies], we believe this acceleration [to be] real, and per the line [of fall] unique [and] perpendicular to be translated; just as in the Copernican hypothesis the acceleration cannot be real, or in any way proportional to the precise fall, although it be in this Hypothesis, [Margin: Book 9, section 4, chapter 19, and chapter 21, here.] inasmuch as the motion of the Earth, as is plain from what was said in the same Book 9, section 4, chapter 19, and is to be said here in book 1, [Margin: *De Sole* chapter 17 and its Appendix.] *On the Sun* chapter 17 and its Appendix. We, I say, are necessarily compelled to explain the daily motion of all the Stars by the Reason of the Stars, and that they may be seen to be moved by proper motion, [and] slowly toward the East, but to be moved continuously [for] 24 hours, or a little after [it] revolves to the same Meridian. This we shall explain perspicuously and most easily in the matter of the Planets first.

[Margin: 4.] Let there be the Meridian of all the first [bodies], the most celebrated, [though] not Geographically nor by Fortunate [Isles], or by the Azores, transiting, but through the vertex meditatively of the terrestrial Paradise, or of Jerusalem; and we assume the daily revolution of the Fixed [Stars] for the same Meridian, [Margin: from the example of the Prime Movable.] meanwhile from the Prime Movable['s] exemplar, [the matter is] dissimilar only [in] so much in [the] return [in the] apparent motion toward the East, which is somewhat after 365 days; the Second [motion] is found to be 50"; and so [Margin:] [it is] observed [that] the center of the Moon in the same prime Meridian in which the Fixed Star is, [as] Spica, [is] Spica; the recession from this Meridian would be moved, [and] not so quickly [along] the same circle [is the] motion, [as] a thread [in the] thread sense, or without sense the declinations from the plane of the same circle, as its Declination postulates, or Latitude, [and] is moved; or in what moment Spica returns to the first Meridian, the center of the Moon, [carried] by a slower motion, [has been] borne about.

[Top of p. 24, right column — continuation:]

— in the Equator, or in [a] parallel [to the] Equator, [it] is distant from the prime Meridian toward the East by 12 or 13 degrees, [and] does it appear by daily motion translated toward the West? as meanwhile it would seem to have

remained Easterly — as [in the case of] Spica, and so it would not be moved at all; [it] would have been Easterly by 12 or 13 [degrees], which [it is] necessary to absolve before it reaches the prime Meridian, so indeed: and yet there are not two motions in [the] thing diverse, nor [are they] contrary to each other, but only one simple spiral motion, [namely] toward the West along the Longitude; and so, the Moon's center always persists more Easterly, but much slower in motion than Spica, so that, if daily the Moon's center persists in the Equator, or in the same parallel [as] Spica, [then] before Spica absolves 360 [degrees], [the Moon] is now after days 13 [in the] future, [being] in the supreme prime Meridian, [and] after 30 days [the] day Spica [is] in the same [position] with the Moon's center in the same prime Meridian. As to what I said of the Moon, [Margin:] [the same] is to be understood of all the other Planets, [but] with a double difference. The first is that the Sun is always somewhat slower in its return to the same prime Meridian than Spica, to which it is once joined, but much swifter than the Moon, so that, where the Moon reaches that [point], the Sun [in] one alone [day], about [some] degrees more in completing toward the West, [and] when [it] reaches the prime Meridian, [it] is then or nearly so after days 365 — but in the same [position] [it is] future from the same moment in the prime Meridian. By contrast the [other] Planet, [Margin:] when [it is] slower than Spica, in [its] spiral motion [it is] so much the slower, by how much more nearly its proper motion [is] toward the East. The second difference is that the Moon, and the Sun, in [their] spiral motion toward the West, [are] always slower than Spica, or any Fixed [Star]. But the rest of the Planets [are] for the most part indeed slower than the Fixed [Stars], [but] sometimes equally swift, and then they are called Stationary, because nothing [more] Easterly do they appear at night, [than] yesterday night, and so at the same time the Fixed [Stars] revolve to the same Meridian. When, however, they are slower, [Margin:] they are seen [to be] Direct, [in] the supposed motion [as] not appearing toward the East; and yet truly, the unique spiral motion being supposed toward the West, [it is] rather to be said to go backward [retrograde], or [to be] more slowly Direct; and on the contrary, when they reach [the point] more swiftly than the Fixed [Star], [as] Spica, and reaching that [point], they themselves are in fact more Westerly, [and] are seen indeed [as] Retrograde; [and] are called Retrograde [when] with a slower [motion], or Acyrical [Margin:] [Ocygradi], to be said.

[Margin: 5.] Furthermore, the Westward Motion of the Fixed [Stars], if another motion appear in these motions, [than] the motion of declinations per Libration, [it] would itself be the motion of the Prime Movable, and the measure of all motions [is] reckoned [in] the Equator, [or] its Parallels [as it] appears. But from the more subtle observation, indeed, [and] truly of Hipparchus, the Astronomers

detected the points of the Equator, to which the Sun comes [as it] makes the Equinoxes; [it would] vary [the] points day by day, in the preceding [signs] from that Fixed Star, which had been in them, or near it; and so they deduced the Fixed [Stars] to become more, and more Easterly, as though the Fixed [Stars] themselves were moving toward the East; but Copernicus, who indulges no proper motion to the Fixed [Stars], attributes this apparent precession of the Equinoxes [to be] made from the motion of the Earth annually, [Margin:] cum libration, and most parallel [to the] axis of the Equator within itself. To us, however, who assert the Fixed [Stars] to be moved toward the West daily, [it] is incumbent to explain the cause [why] they continuously appear to tend [in a] very slow motion toward the East, but obliquely, [Margin:] and [for] what reason the Prime Movable [does this], whose Type they imitate in [their] motion from Rising and Setting; for which we propose more modes, but not equally probable, [so] that we may choose the more probable ones.

[Margin: 6.] The first and most ancient [mode] is, if above the Sphere of the Fixed [Stars] there be another Sphere, say the Crystalline Heaven, which above the Equator[']s poles [the] Equinoxes would be moved at the same Meridian [in] 24 hours, [and the] intermediate [Heaven] [carry] with itself the Sphere of the Fixed [Stars]; [and] its poles, from the Equator[']s poles distant [by] $23^{\circ} 30' 20''$, but [in] the Sphere of the Fixed [Stars] above the poles of the Ecliptic [it would] be moved insensibly contrary to [the motion] [in] the prime [Heaven]; [for] if there be two bodies discrete and distinct, it is not repugnant that there be two motions between them. But if you would not [have] the whole Sphere carry away the [lower]

[End of batch — page 24 verso, signature § 2 at foot of p. 23 (printed p. III).]

the inferior [sphere], it suffices that its girdle [cingulum] — from the highest periphery down to that point — be carried along in the plane of the equator.

The **second mode** is this: if the sphere of the Fixed Stars is not solid, or is solid but penetrable, and any given Fixed Star is permitted its own motion toward the west, then in the manner I described under number 4 concerning the Sun, the variety of declination proper to each star is preserved.

The **third mode** is this: if the sphere of the Fixed Stars moves about the equatorial poles over a span of 24 hours, while at the same time each star is permitted its own slow increment toward the equatorial poles, and the decrement of their declinations, so that the Sun nearly comes to a halt at the point through which the equator passes — moving neither too fast nor too slowly,

but rather a little ahead — or rather is carried somewhat toward the west, by as much as the half-yearly proper motion of the Fixed Stars amounts to, which to me appears to be most nearly 25" 20". For in this way the precession of the equinoctial points would occur toward the west, so that the Fixed Stars would be such as they were once supposed to have been in the Colure of the Equinoxes, when annually they would have moved more toward the east by 50" 40". One must be wary, however, lest this motion be of such a kind as Josephus Scaliger [Joseph Justus Scaliger] imagined for himself, who held that the Fixed Stars retain their distances unchanged from the poles of the world.

The **fourth mode** is this: if one admits that the sphere of the Fixed Stars moves about the imaginary poles of the equator, just as about the poles of the ecliptic — that is, by two Intelligences, or by a single one, with insensible intervals intervening, in such a way that on the one hand we make our measurement as I said, and on the other hand it escapes the senses on account of its smallness — namely, in one third of an hour the motion toward the west would be 30". The motion of the equator, and on the other hand the third-of-an-hour motion, would cease; and the sphere of the Fixed Stars, [moving] about the poles of the ecliptic, would in fact move toward the east through 7" 43" 20". For in this way it would come about that this whole motion about the equatorial poles would be absolute. Secondly, since the motion is toward the east, it would be most nearly 8" 40", and there would be no danger that it would be either too slow or too fast, since the motion toward the east of the equator would be perceptible to the senses.

The **fifth mode**, finally, is this: if one, or several, Intelligences move the sphere of the Fixed Stars toward the west, so that any given Fixed Star arrives at the meridian, at which I said it arrives, as much later as is the diurnal motion of the Fixed Stars apparent toward the east — which is 8" and most nearly 40" — and at the same time the Fixed Star is so caused to decline from the equator of the world, just as it appears in fact to decline. For if these things can be brought about by some Intelligences, why could they not by the Earth itself — the diurnal, annual, and librational motions devised by Copernicus, which represent to the senses these three motions of the Fixed Stars apparent in the heavens, and which machines [machinis] human ingenuity has contrived? Indeed, if we could move the globe of the Plows [the constellations] about a point, or move a globe set as stable in the midst of its [surroundings], while the globe of the Plows, fixed to no body, sustained itself in the poles, and were as it were freely suspended in the air — we could indeed move it elsewhere, so that we might represent to the senses those motions of the stars. Among these five aforementioned modes, the **fourth**

and **fifth** seem to me the more probable, and more fitting for the Intelligences that move the Fixed Stars.

ARTICULUS III.

On the Hypothesis of the Planets, as regards the Figure of their Motion in general.

It has long been known that the ancient Astronomers, both up to Kepler [Johannes Kepler] and afterward, were accustomed to explain the motions of the planets and their anomalies, together with their prosthaphaereses [prosthaphaereses], by means of Eccentrics, or by little circles [circellos] of Epicycles, or by librating little circles [circellos libratorios] — yet not without errors; and although some of these errors may have been so enormous that the device could not be reconciled with the celestial observations, it could not be refuted by faulty observations, as in the case of Mars, [continued opposite column]

[column 2, printed p. V]

where sometimes it erred by 4 degrees, and in Mercury by 7. So it was, until Io. Keplerus [Johannes Kepler], having a hidden suspicion, came to suspect that the Eccentricity of the planets ought to be bisected — that the center of the orbit of the planets is not the center of equal motion [centrum aequalium motuum], but something else, and that the just provenance of the equations [aequationum] was nonetheless to be brought forth from a bisected Eccentricity; that is, if in a line stretched between the centers — the center of equal motion being on one side, and the Earth on the Sun the other, in such a way that one [point] is the Earth in the Sun [Tellus in Sole], and that the other point should be placed as far from that one center as the increment of the half of the Eccentricity is, with respect to the center of equal motion. From this he saw it to follow that the whole inequality which appears in the motion of the planet would appear merely from an optical cause [causa Optica], because it would not be in the center of the planet's orbit — for if it were, we should see half of the inequality, and accordingly even half of the inequality of the planet considered from the center of its orbit, would be Physical [Physicam]; and such an inequality must be acknowledged. But since those two points are equally distant from the center, the most proper figure of the Ellipse [Ellipseos] is the most fitting rather than that of the Circle; for if in an Ellipse two foci [foci] are given — equally distant, indeed, between the center of the planet and the planet not being in the circumference, but in the Ellipse; and this [is] evidently apparent in Mercury, in Mars, in the Moon, more than in the

others — and in this, though a smaller diameter [diameter], yet conjugate, the figure is a little less than the major diameter, and therefore the Ellipse is by no means so perceptibly removed from the roundness of a Circle.

But Keplerus [Kepler], being wholly intent on assembling the Physical causes of the motions, and the magnetic attractions, with other ingenious figments [figmentis], yet not at all necessary, nor congruent — did not demonstrate with Geometric rigor the manner of describing the Ellipse, and the [way it is] fitting for each planet, and of the Prosthaphaereses thence exactly to be deduced.

The Ellipse-hypothesis was conceived by Kepler [Johannes Kepler], with not a few Astronomers following him; but **chief among them** Ismaël Bullialdus [Ismaël Boulliau] in his most learned *Astronomia Philolaica* (Books 1 and 11); Petrus Herigonius [Pierre Hérigone] in tome 6 of his *Cursus Mathematicus*, page 140; Caluerus [Caluerus] in his *Uranometria*, part 2, chap. 4; Sethus Vuardus [Seth Ward] in his *Idea Trigonometriae demonstrata*, in which he subjects to scrutiny the inquiry into Bullialdus's [Boulliau's] Astronomical Foundations, and detects certain errors in his use of the Ellipse — by what means I do not know they were purged — provided that this same hand could not arrive at this work; for he edited this [work], [in which] both the Intervals [are] arranged in the Ellipse indeed, but the Eccentricities exactly [are arranged according to] the manner in the Ellipse, but [it is the] manner that he teaches; whom afterward he taught in a little book published on this matter, dedicated to 4 Astronomers, namely Bullialdus [Boulliau] himself, Gottendus [Gassendi], Hevelius [Johannes Hevelius], and myself. Comas Paganus [Blaise de Pagan; "Comas" prob. *Comes*, "Count"] also excellently worked out this method through the Ellipse, just as did Io. Dominicus Cassinus [Giovanni Domenico Cassini]. But Dominicus Vincentius Mutus [Vincentius Mutus] judges that the Equations of the Center [Aequationes Centri], or of the First Inequality, can be better deduced through Librations, as he indicated to me lately in a Letter. But meanwhile most [astronomers] suppose that the motion of the planet [is] Copernican, and therefore think that the motion of the planet [runs] simply toward the east, and they, by simplicity and outstanding loveliness, esteem [it]; but Bullialdus [Boulliau] in his Book 1 resolves this motion into several circles.

And indeed, with the immobility of the Earth demonstrated by us, and the fluidity of the Planetary Heaven all but demonstrated, and accordingly the motion of rapture [motu raptus] rejected, by which the Planets would be snatched up [rapiantur] by the supreme Movable, and attributed to each, and each Planet by its own diurnal motion toward the west — as we said under Articulus II, number

4 — we cannot, and we ought not, [follow] the way by which the Planet is really moved, but [we follow] one simple figure, in such a way that we describe it [as] one [figure]; but we set forth to consider that [it is] not one continuous line, but a spiral [line] about the Cone [circa Conum], proper to each Planet. Nor do we Physically ascribe half of the apparent inequality to the planet's own motion, as the more recent Astronomy at length acknowledged, but we suppose it absolutely to be moved unequally, yet with an inequality that is regular [regulabili]. But because GOD willed to accommodate these motions to our grasp, or [because] the planet had a single figure in a Plane, we are able more easily to investigate that motion, which is in fact along a spiral line; we are by no means so easily able to comprehend [it]; therefore it is as if the motion were made in that figure about a circle around a Cone, which He ordained, so that in its surface it could be designated by a...

[column 1, printed p. VI]

from us — an Elliptical periphery, approaching nearer indeed to a circle in the Sun, in Venus, in Jupiter, and in Saturn, but receding more from a circle in the remaining Planets. And so in this we differ from the more recent Astronomers, because we employ the Planet [moving] in a circle, under the mere Hypothesis, for the sake of entering into the calculation; but they suppose it real, [the Planet moving] in a continuous figure toward the east, while in fact it is moved toward the west — nor [is it] either in expressing the spiral [line] itself in this motion, [a thing] I would reject, [or] in fearing lest we shake loose the foundations of Kepler [Johannes Kepler], which his own discoveries had been undermining — with that whole machinery [machina] he attempted to drive [them] away.

ARTICULUS IV.

On the Distances and Intervals of the Planets, for the completion of the System of the World.

The distance of the Planets — whether from the Sun, or from the Earth — is customarily expressed in two kinds of measure: one in such parts as the semidiameter of the Annual Orb of the Sun [semidiameter Orbis Anni Solis], or of the Earth, may have been a single unit, namely 100000, or 10000000; the other in semidiameters of the Earth. As regards the first kind, the distance of the Planets from the Sun, and from the Earth, are quite close to the truth, [being] now repeated after Copernicus, if we may speak of the five lesser planets, which are moved about the Sun; for the intervals of this kind are gathered from the Anomaly, the Eccentricity, and the Equations; and accordingly these elements are

as certain as those intervals are certain, which have a necessary connection with them. By contrast, however, the interval of the Fixed Stars from the Earth is most uncertain, whatever measure of the two you wish — whether finite or infinite. Hence it comes about that the distance of the Sun, as regards the semidiameters of the Earth, has hitherto been divided in opinion, [whether] it be finite or infinite. As to the distance of the Moon, both as regards the semidiameter of the Earth, it is divided in opinion; for the distance of the Moon from the Earth, and from the Sun, does not seem able to be certainly grasped in the first kind, nor [the distance] from the Sun, as regards the second [kind]; let the distance of the Moon from the Earth be [granted], as regards the second [kind], as the semidiameters [are reckoned], it is commonly thought through the parallaxes themselves [to be] very perceptible, and large. But it is itself called back into doubt, doubting lest perchance through the Refraction of our Air it suppose the parallax much greater than is true, on account of the altitude of the observations; and accordingly the Moon, [observed] within the neighboring Earth, has hitherto been thought certain by Astronomers. And because we have a need concerning the distance of the Moon, as for the inquiry into the distance of the Sun, and of the distance of the remaining Planets, [these matters] to be begun from the Moon, we think we have to vindicate; we note Astronomy [neglected] in this scruple, because it has been done by no one.

[column 1, lower section, printed p. VI]

On the Distance of the Moon.

Therefore in Book 10 of the *Almagestum Novum*, section 5, [I have set out] the doctrine of Parallaxes, their Theorems, [and] the Problems, partly [drawn] from others, partly here more fully treated, and chapter 11, problem 72, [showing] just how great a Parallax [there is] in any given individual case; but I was able [to deduce it] not [from] the more recent Astronomers, but compared [it] with the equal Refraction; and I concluded that, although such a Refraction of the Moon, [whether] from the Aether, or from the purest Air, [be] in a denser Air, the Refraction [arising] from Water in Glass [Refractio ex Aqua in Vitrum] is so great; at an equal distance of the Moon from the vertex — say at a distance of 10 [degrees] from the vertex — it is not [a matter of] three [parts of] the diameter [tribus diametris], the Refraction is most nearly 30" [the 30" being the water-into-glass analogy refraction, not the Moon's own horizontal refraction]. Where Tycho [Tycho Brahe], at such a distance of the Moon from the vertex, observed no perceptible Refraction. [continued opposite column]

[column 2, printed p. VI]

[he] noted; the data there [supposing] so great a Refraction compensating the parallax; and so, with so great a parallax, [there] would be a distance of the Moon from the Earth [of] 20 [semidiameters]. Now it is certain in that distance, that, [as reckoned] from semidiameters of the Earth, the Parallax is smaller from the vertex, and the Refraction; hence, by as much as the Refraction from the Aether into the Air is smaller, than [that] from Water into Glass, there is therefore certainly so great a distance of the Moon from the Earth, much greater [than] 20. And by how much smaller [the parallax] from the diverse densities between the Aether, and the Air, [the distance] would be greater, when in turn the parallax could be augmented; and the smaller the parallax, by so much the more would there be augmentation of the Parallax, derivable from a hidden Refraction, and a parallax compensating the defect. And just as the Refraction of 30" from water into glass, [as] observed by Vitellio [Witelo], may be compared to the Refraction [that] no [observation] by Tycho [Tycho Brahe] [shows], the proportion is null, so there is no sensible augmentation, because on account of a hidden Refraction a triple Parallax could be deduced by the customary modes. It is worthwhile, however, to see the Capita [chapters] of that whole [Section], Problems 73 and 74, and also chapter 12 of that same Section. With this scruple about Refractions removed, therefore, it is established from observations of the Altitude of the Moon, and that the Moon truly is distant from the center of the Earth in syzygies [in Syzygiis] never [more than]: I taught [it] in Book 4 of the *Almagestum Novum*, chapter 15. But what I said there, and afterward corrected here in this Volume, Book 3: the distance of the Moon at conjunctions [in Copulis] is minimally 58' 21", and maximally 63' 40" — [reckoned in] semidiameters of the Earth, from our [observations] indeed, [and] from observations.

[column 2, lower, printed p. VI]

On the Distance of the Sun from the Earth.

By how much greater effort and industry — [more] than [that of] any of the Astronomers — We, together with Father Grimaldi [Francesco Maria Grimaldi], investigated the distance of the Sun from the Earth, not by the most fallacious method of Lunar Eclipses, but by the Dichotomy of the Moon [per Dichotomias Lunares], indicated by Aristarchus, praised by Kepler [Johannes Kepler], and first cut into [examined] by us through the [method] of Vuendelinus [Vendelinus / Govaert Wendelen] in this method by conspiracy; then through the new [method], through the Parallaxes of the Sun [Solis Parallaxes] from the Refractions investigated, [and] at length the Physical causes of the Eccentricity of the Sun in a new Theory grasped; it will be established to the Reader, by what we

taught [in] Book 3 of the *Almagestum Novum*, chapters 7 and 8, and in the Appendix to chapter 7, which is had at the end of Tome 1 of that same *Almagest*, namely folio 731; and which [is] in this Volume, Book 13, chapters 13, 14, and 17; we shall teach how greatly the medulla [marrow / kernel] of the preconceived opinions of certain Astronomers may have prejudged [the matter], [opinions] which we nonetheless premise; and in this matter I reduce the opinions of the Astronomers into two classes: Some imagine that the distance of the Sun from the Earth [is] infinite, or at least finite-yet-infinite, [that is] indeterminable by us, [such that] no Parallax could be posited, [or] indeed [that it] could not be greater, because the Parallax of the Sun cannot be evidently shown; some, moreover, [hold it to be] finite, but knowable and demonstrable. The first opinion is ascribed to Hipparchus among the earlier considerations, but afterward from the Eclipses of the Moon as great a distance is nearly carried over [as] is that of Ptolemy. But Dominicus Cassinus [Giovanni Domenico Cassini], as we shall say in Book 1, chapter 13, [held the Parallax of the Sun] insensible; some earlier judged the parallax of the Sun [insensible], afterward sensible; Vuendelinus [Vendelinus / Govaert Wendelen] used the Dichotomies, but supposed about the Moon the Air to be thicker, which [Air] would retard the vespertine Dichotomy, and accelerate the morning [Dichotomy]; he chose the maximal distance of the Sun [as] 14905 Semidiameters of the Earth — as great as once it pleased Posidonius: for that Air confesses the same [thing] from the Dichotomies [that] provenanced to him as 7000, as great as we ourselves nearly apprehended through the Dichotomies of diverse [observations], as [the various] places of observation may show. Through the Refractions, however, [by the] new method we hunted out the Parallaxes of the Sun, and these, as we shall say [in] Book 1 to the end, chapter 14, [are] never greater than 30", indeed for the most part smaller. Hence it has been most certainly able [to be shown] to us [that] the distance of the Sun is never [more than] 6430 Terrestrial Semidiameters; indeed it is greater than this, and manifestly the Ptolemaic Astronomers, Copernicus, Tycho [Tycho Brahe], and others — who [reckoned] the parallax of the Sun [at] about 3 minutes — erred; rather, I assume it [more] probably, [as we] have demonstrated, [that] these [observers] err, [reckoning] this interval [the Earth–Sun distance] far less than they set it down, [opinions] which I have brought together [in] Book 3 of the *Almagestum Novum* to the end, chapter 7, and in the Scholia themselves.

[column 1, printed p. VII]

At length [in] Book 1, chapter 17, we shall show, if the Physical cause of the Eccentricity of the whole Solar [orbit] is, [that] the axis of the terrestrial shadow [umbra terrestris] is such that the center of the Sun's motion is equal to it; [that]

there the center of the Sun's motion [is] equal, [and] where the Shadow of the Earth [is], and [that] the cause of the half of the Eccentricity is the distance of the Shadow's axis of the Moon from the Earth; hence, both from the Semidiameter of the Sun's Apogee, [as] observed by us, [the] maximal distance of the Sun from the Earth follows [to be] 6666 Semidiameters. This is too much; and so [the] limits of the Solar distance are narrow, which Kepler [Johannes Kepler] in his *Commentaries on Mars*, page 71, defines, saying: *The Sun is not nearer than 230 Semidiameters of the Earth, yet it is not infinite; nor [is it nearer] than 700. And 2000 is not yet seen, [for] no certain number is demonstrated.* But to those correcting [him] we said truly: *The Sun is not nearer than 6430 Semidiameters of the Earth; yet it is not infinite, since it is absent by no more than 30000.* But [whether] six thousand and thirty thousand Semidiameters of the terrestrial [radius] — [a thing] not yet a certain number — is demonstrated, I add this for the exclusion of infinity, [to] very many [persons], by [a] kind of Physical [argument], [namely that it] cannot be given [as] infinite, [and so a] kind of finite terminus is granted on both sides; nor, [as] from everywhere, [is it] enclosed; [for it is] of such a kind that it is a rectilinear Triangle: But whatever [the case], let the distance of the Sun from the Earth be posited, because it is certain that the Sun is greater than the Earth, it is necessary, [as] is [shown] by a line drawn rightly between the center of the Earth, and however far [it] be continued; the other [line] drawn touching the Sun would concur at length in the apex of the terrestrial Shadow, [and] both, since they [are] tangent to the Earth, and [by] the aforementioned right lines a Triangle must be formed; and [that] the angle [thus] effects [a line] subtending the Semidiameter of the Sun [as] true, and [by] these — the Semidiameter, and the two aforementioned right lines — a right-angled Triangle [ought] to be formed.

But which [distance], moreover, may be within the said limits [of] 6430 and 30000, [is a] probable distance of the Sun, not easily to be persuaded to the lovers of their own opinions, and of their inventions. For few [of them] will believe that the [distance] is not infinite, but at least the maximum [is] 30000 semidiameters of the Earth, so that they may securely scorn the parallaxes of the Sun. To Vuendelinus [Vendelinus], moreover, and nearly to Christianus Hugenius [Christiaan Huygens], it will please [to make it] about double smaller, just as it pleased Posidonius — namely 14000, or 12000, using round numbers in the interim. But to us that [distance] pleases, which is still double smaller, namely 7427, ex multis Dichotomiis [from many Dichotomies], and the Semidiameter of the Sun's Apogee, and the Eccentricity [thus] limited; or 6666, [drawn] from the Eccentricity of the Sun adequately measured against the Axis of the Terrestrial Shadow, and from the apparent Semidiameter of the Sun — [these] not at all

repugnant to the evident parallaxes of the Dichotomy; if from the parallax of the Moon the fallacy be absent — which is wont to diminish the time between Dichotomy and quadrature; for [the time] is never less than within about one hour, but more notably less than this here it returns. It is a wonder, however, that this is the median distance of Hugenius's [Huygens's] Dichotomies of the Moon, [taken] in this business [from] a preexisting proportion of the diameters of the Planet, of any given one; [a thing that] he confesses [in] his Saturnian System [*Systema Saturnium*], page 81, [to be] slippery. By the telescope, moreover, [for] the median distance of the Sun from the Earth, [reckoned in] Semidiameters of the terrestrial [radius], [is] 12543. Why? Because [it follows] if this [be] adequate to the apparent Semidiameter of the Sun [of] 30' 30", as if truly it could not safely [hold] that apparent [Semidiameter], unless the distance of the Sun from us be prohibited [from going] to infinity, [or] unless [it be] prohibited from elsewhere.

[column 1, lower, printed p. VII]

On the Distance of the Five Lesser Planets.

Since it is most well-known to Astronomers that the Eccentricities of these Planets, and the median distances from the Sun, depend on the distance from the Sun, [the question is] how great the probability is of the Solar interval, [and] how great [the interval] of the Earth, [and] so great too the interval of the distance of these Planets from the Sun ought [to be], up to the Earth. And these [are] diverse opinions concerning the accurate distance of these Planets from the Sun, [reckoned] in such parts as the semidiameter of the Annual Orb of the Sun is 10000 — only so much in this Astronomy after Copernicus has been brought forth, and it will be acknowledged, [that] the maximal distance of Saturn from the Earth [is] about tenfold the interval of the Sun [from the Earth]; the interval of Jupiter, about fivefold; Mars's, about subduple; Venus's, about three-quarters; Mercury's, about subtriple. Indeed, as I brought [it] back [in] Book 7 of the *Almagestum Novum*, section 6, in the Scholia, [continued opposite column]

[column 2, printed p. VII]

[it erred by] sometimes 4 degrees, and in Mercury 7, until Io. Keplerus [Johannes Kepler], having a hidden suspicion, [held that the Eccentricity ought] to be bisected . Keplerus [Kepler] in his *Mysterium Cosmographicum* attempted, chapter 2, to distribute these intervals according to the inscription of [the five] Regular Bodies — which nonetheless did not succeed in all [cases]; [and] although, with the Annual Orb conceded, the translation of the Earth through the Superior Orbs, and of the Inferior [Orbs] of the Planets; which nonetheless [is]

translated by us, are nonetheless feigned [are figments]. But Vuendelinus [Vendelinus], with the distance of the Earth from the Planets supposed, as we also said there, [supposing] the distances of the Planets from the Sun, [from] the center of the World [equal] by sesquialterate proportion of the periodic times: from which he concludes that the distances of the Planets have among themselves the proportion which the numbers in the adjacent little table here carried over have. We, however, esteeming GOD the best and greatest [Deum O. M. = Deum Optimum Maximum] not [bound] to respect all the proportions, [and yet because] they appear beautiful to us, but [we ascribe these] to that [proportion] which [proceeded] from his own will in the lower regime of this World, [a thing] neither so idoneous [fitting], nor in these concinnities [harmonies] of numbers, so that we may recede from the apparent magnitudes of the celestial motions, and [from the] measure, and represent them [as] more apt [than these], such [as] in the meanwhile [was] our agreement in these [things], which [I gave] at the end of Books 5, 6, 7, 8, 9: we choose; whence also it pleased to [represent] these to the end [of] Book 10, even in Semidiameters of the Earth, to represent [them], that the distance of the Sun, and the distance of the Fixed [Stars] in opinion, [as] indicated under number 3; that it may be established to the Readers within what bounds Astronomy rests, and of the more certain determination consists. In this place, in the interim, for the hunting-out of the distance of the Fixed Stars, it suffices to first know the distance of the Sun, and of Saturn [as] the maxima from the Earth, according to a quadruple Hypothesis within the limits of the truth consistent, and they are infra-written [below].

[Margin: adjacent inset table of planetary distances follows]

Inset table — planetary distances (in parts where the Sun's Annual-Orb semidiameter = 100000; Wendelen's sesquialterate-proportion derivation):

Planet	Distance
♄ (Saturn)	953153
♃ (Jupiter)	519966
♂ (Mars)	152366
☉ [Telluris — of the Earth's orb, reference unit]	100000
♀ (Venus)	72339
☿ (Mercury)	38710

Parsing notes: The reference-unit row is labelled "Telluris" (of the Earth) and carries the Sun symbol ☉ with value 100000. Values transcribed as printed.

[column 2, lower, printed p. VII — main table]

Ex Hypothesi [By Hypothesis]	Maximum Distance from the Earth in Earth-Semidiameters	
	— ☉ (Sun)	— ♄ (Saturn)
Summa [Highest]	30000	327610
Vuendelini [Wendelen's]	14905	162833
Nostra [Ours]	7427	81105
Infima [Lowest]	6666	72795

Parsing notes: The header "Maxima à Terra Distantia in Semidiametris Terrae" (Maximum Distance from the Earth in Earth-Semidiameters) spans both numeric columns — the left under the Sun symbol ☉, the right under Saturn ♄. Row labels are the four hypotheses (Highest, Wendelen's, Ours, Lowest). All values transcribed as printed.

[column 2, lower, printed p. VII]

On the Distance of the Fixed Stars.

Concerning this I discussed [in] Book 6 of the *Almagestum Novum*, chapter 7, throughout, and in the Scholia [there], both so fully, [that] either I am not mistaken, [it could be diligently treated]; nor — with the erudite Reader [free] thence to draw [conclusions] — could it [need] further amplification; the chief doctrine [I] there hand down [is] this: that, just as the Sun in the Zodiac is borne, and sometimes occulting [a star] is interposed before some of the wandering Planets [Planetis], [it is] certain that [the Fixed Stars] are then at least higher than those Planets: that the Fixed [Stars] are distant by however great a naked-eye observation [permits], or are observable, in such a way that they suffer some Refraction; [it is] certain too, [that] there is no [Refraction] from so infinite an interval: for besides what was said there under number 3, I add [it is] necessary that they be [observed] from a sensible Refraction, since the Ray [Radius] at a Star incident on the surface of the refracted Air, would be inclined to a perpendicular at some sensible angle, and with this [other] ray of the Star drawn out to the center of the Earth, [reckoned] from the Semidiameter of the Sphere of Refraction, a Triangle is made; but the Physicists [Physici] therefore [hold it]

certain [that] it cannot be made [that the interval be] impossibly infinite [and] terminated from everywhere — [as said] under number 3. [It is] certain too [that] it cannot be evidently shown to us how great a distance of the Fixed [Stars] from the Earth [there is], whether of those — whether [it be] the concave surface of the Firmament — that [are] the lowest [surfaces of the Firmament], or of those [stars] which are placed in the more sublime [parts] of the Firmament; and not without merit Plinius [Pliny], Book 2, chapter 1 (with a cross-reference to chapter 23) [*Natural History* 2.1, with 2.23], said: *It is a madness of intellect, and almost of one demented [Furorem ingenii, et paene dementis], to attempt this measurement*, since [it would be] with the hope of certitude, as [if it would] suffice for our estimation [by] conjecture, [and] it would be established [that] no [certain] measure of souls, [as] in these matters, prefer especially [things] beyond the Equator, the manner of investigating the parallax of the Fixed [Stars], and of discerning the Refraction; this [also] therefore [is] from that [matter], the Pythagorean interval [intervallum Pythagoricum] there rejected, namely 94500 milia [miles], that is, terrestrial Semidiameters about... ..times 24, from which results a parallax of the fixed stars of 2°23'. But we do not approve the Platonic interval put forward in the same place, as being too uncertain, since it depends on an assumed lunar distance; for, given the assumed lunar distance of 56½ terrestrial semidiameters, it would yield a stellar distance of 17,993,654 terrestrial semidiameters and would contain the lunar distance 466,561 times. Moreover, Bettini [Mario Bettini], in his *Apiaria*, refuted this distribution of the fixed stars on harmonic grounds, holding that the fixed stars lie at no greater distance than 2290[?] terrestrial semidiameters, though he did not subscribe to the parallax computation. We have shown why one need not labor over this.

But why this is so. From the Tyconic distance of the fixed stars — and on those Copernicans who require so great a distance of the fixed stars that the whole annual orbit vanishes against it, becoming as it were a mere point — the following deductions are made. From Copernicus's hypothesis, Tycho and [Giovanni Antonio] Magini [Magini] deduce a distance of the fixed stars of 785,0000 terrestrial semidiameters; Longomontanus, 7,906,818. [Christoph] Scheiner, following Maestlin [Michael Maestlin], gives 13,133,376, a figure that also results from the Galilean interval, which sets it at 1,304,6400 semidiameters of the Earth. From Kepler's interval comes 34,077,067, or 6,000,0000 — for there [in *De Revolutionibus*] we showed that, on this hypothesis, the parallax of the whole annual orbit comes out as 17", or 14". How great an instrument would be required to perceive this, Tycho states in his *Mechanica*, and Lansbergen [Philip Lansbergen] gives it as 4,1980000 semidiameters of the Earth. The terrestrial parallax of the annual orbit, according to Hortensius [Martinus Hortensius], is 1'

(or, according to Origanus [David Origanus], 1'440), so that the parallax of the whole annual orbit, after the six months, would be a sensible 6', namely the minimum 6'. By contrast, if it follows that the parallax of the whole annual orbit ought not to exceed 10" — since the minimum solar distance is, as we said, 6430 terrestrial semidiameters — then the fixed stars must lie more than 3,000,000 terrestrial semidiameters distant from us. I regard that orbit of the annual terrestrial orbit [recte: see anomaly b — the phrasing here is compressed] as false. I see no more probable way of arriving at the measure of the distance of the fixed stars than those that follow.

6. The **first** is taken from the proportion of the periodic motions: namely, if it be supposed that the period of the Sun, which is one year, is to the distance of the Sun from the Earth — taken as 3,0000 semidiameters of the Earth, or at minimum 6430 — as that number is to the period of the fixed stars; then [computing] the periodic distance of the fixed stars (which we take at minimum as 25,579 years) yields the sum of the fixed-star distance, 767,376,000, or at minimum 164,472,970. Or, if the period of Saturn is taken at 30 years, then by the same reckoning of distance the sum is 327,610, or at minimum 72,795. From the numbers stated under point 4: if the period of the fixed stars is 25,579 years, the distance-sum is 2793,31026, or at minimum 680,68174. Do you see how vast a distance this is, and how uncertain? But how much more uncertain is it in the case of Saturn — and indeed of the Sun, which is the first and best-known measure of the times?
7. The **second** method is this: if the distance of the Sun from the Earth were the proportional mean between the distance of the Moon and the distance of the fixed stars from the Earth — for example, if it came about that the maximum lunar distance of 61 terrestrial semidiameters were to the maximum solar distance of 7427 as 7427 is to the distance of the fixed stars, 88,3,683 — then [the figure for] the fixed stars would have to be considered. But to this we must add the discrimination of refraction, as we said in Volume 2, Table 40. The refraction of the Moon at the horizon is 30' in the middle of the air; that of the Sun, 31'; and that of the fixed stars, 31½. So that the difference in refraction of the luminaries is 1½' — the Sun has 1½', the fixed stars 1½' — that is, only a half-minute of difference. Nor, even so, can we make it that 1' and 1½' ... so that the maximum difference [reckoned] from the Sun, when the distances are reckoned, comes to 7365 to 11047 terrestrial semidiameters; for the distance of the fixed stars would come out much smaller than Saturn's, which is hardly probable.

8. The **third** [method] may perhaps appeal to certain people by its simplicity — too much so — namely the one in which Saturn's distance from the Earth is held to be tenfold the Sun's, Saturn being as it were the center of the five Wandering [planets]; so that the distance of the Wanderers — or of the fixed stars taken together — is tenfold the distance of the Wandering [planets], or of the supreme Saturn of the Wanderers; and thus, by the last Table of number 4, the fixed-star distance would be 327,6100, and at minimum 727,950. Or, if it please that the sphere of the fixed stars begins where Saturn's shadow ends, so that the shadow of Saturn casts no shadow upon the fixed stars, then for me the shadow of Saturn is 12,0000 terrestrial semidiameters; if to this be added our [figure for] Saturn's distance — which is at maximum 81,105 — the distance of the fixed stars would be 1,011,05; or, rounded, 200,000. But to play around too much in uncertainties — for the certain measure of these things I consult God, the Best and Greatest.

[Margin: Eccles. 17.] ...has hidden from us, that we may acknowledge the weakness of our own intellect, and may reverence Him, of whose wisdom Ecclesiasticus 17 says: *The power of the height of heaven is His own to behold*. This comes not only from the great altitude, but also from the cause and force [flowing] from so great a height into these lower things.

Epilogue on the System of the World [Epilogus de Mundi Systemate]

9. Thus far concerning the System of the World, according to our own hypothesis — in which the Earth stands immobile at the center of the World, just as it was created at the beginning, as the foundation of the World's edifice, and as the future home of all things, into which all the heavenly bodies are bound to pour their influence. Around the Earth, the [region of the] Spheres and the moving elements appear; the Sun and the Moon are moved by two motions, namely, as regards longitude, with their bodies tending eastward, yet always toward the west by spirals carried through the fluid Aether, as described by the law and foundation which human imagination conceives of their motion, as if it were made by a single motion, almost circular, or rather elliptical, about a cone — capable of being designated by a scalene cone. The other five **Lesser Planets** move about the Sun as the center of their eccentrics, and as the fountain of light from which they are illuminated; and, by an intermediate motion about the Earth as center, with the light reflected, they are moved through the Aether always westward by spirals, as described. Nor are they ever truly retrograde, nor stationary; rather, they appear to stand still because at the

same moment they revolve, together with the same fixed star, about the same Meridian, and recede again more swiftly, and toward the rising — when they slowly revolve to the same point. Finally, the fixed stars, set in a solid heaven, move daily, or by two motions imperceptible to us: in proportion to their distance, and by an alternating repetition, with greater or lesser velocity, now westward, now eastward, [the motion] perceived as oblique, owing to the latitude retained with respect to the Ecliptic and reckoned by us. Or, by a single real spiral motion, they are moved by Intelligences always westward, of their own accord, so as to represent to us an apparent oblique motion eastward. Moreover, the distance of the fixed stars from the Earth, though it appear to us to be finite, nonetheless differs, in that the lunar distance is certainly within the nearest limits to the Earth, so that observations, when carefully carried out, evidently exclude the error that would otherwise creep into the terrestrial semidiameters. The solar distance is nearly certain to within fewer terrestrial semidiameters — never indeed fewer than 6430, nor more than 30,000 — so far as it can be assumed. The intervals of the other planets, indeed, with respect to the Sun, are very nearly certain from their apparent motions about the Sun itself, and from the aphelia [needed] for representing them; but with respect to the Earth they have a latitude such that they depend upon the certainties of the solar and terrestrial distances and intervals. The distance of the fixed stars, finally, rests only on conjecture, probable in part, in part more than probable; from this [arise] probabilities to be measured, though not certain, nor demonstrable. It remains, then, that in treating of the fixed stars, the planets, and the Earth, we should indicate how far Astronomy and Cosmography have been advanced in each.

ARTICULUS V. [ARTICULUS V.]

On the Fixed Stars [De Stellis Fixis.]

1. As the sight of new stars [novae] was for Hipparchus the occasion for numbering them for posterity, and for resolving once and for all the [number of the] stars and of the heavens — and as Pliny relates (Bk. 2, ch. 26), so the new star of the year 1572 stirred...

stirred [Tycho] to rectify the fixed stars by the thousand, and to restore them to one place [in the catalogue] as nearly as possible — by the new method of the observation of Venus together with the fixed stars, so that Hipparchus ought to be no less indebted to posterity than [Tycho was]. We must indeed correct these by a not inconsiderable amount, not only because of the excessive parallax of the Sun and of Venus employed by Tycho. Kepler too confesses that he founded his

Ephemerides upon this; but [he holds] that the evening observations of Venus are to be compensated by the morning ones, and by our own observations, with a larger instrument; and the Right Ascensions and Declinations of very many of the fixed stars are corrected — as will be shown in our Book 4 in their proper places.

2. And since, in the Tychonic Catalog of Right Ascensions, the star in the shoulder of the Lesser Bear was lacking — that star of the second magnitude which shines in the second [magnitude] of honor [recte: i.e. is reckoned among the second-magnitude stars], once called the Pole Star [Stella Polaris] and the Cynosure — we ourselves, by the latitude of that star and by its Right Ascension for the years 1600 and 1700, by a trigonometric calculation, found its longitude to be decreasing, which is new and unheard-of, and which we have set out as the cause for astronomers. We perceived this not only in that star but in all the others whose latitude is greater than the radius of the polar [circle of] circular motion: namely, that the Right Ascension decreases as the longitude increases, according to the theorem set forth in *Almagestum Novum* Bk. 6, ch. 19, Problem 11 — to which we refer the reader [*Almagestum Novum* Bk. 4, ch. 1].
3. Furthermore, the latitude of the fixed stars — not only their Right Ascension and Declination — we corrected and emended; yet we also taught, in *Almagestum Novum* Bk. 6, ch. 15, that the latitude is immutable, especially as regards the obliquity of the Ecliptic, as we say below. As for the motion of longitude, their apocatastasis [ἀποκατάστασις, apokatastasis, "restoration" — the return to the starting point], and the Sidereal Year, [these are] not from one comparison or another, as Tycho did, but from 72 collations, [whence] we shall more certainly determine [*Almagestum Novum* Bk. 4, ch. 19]; and meanwhile [we judge] the Year to be neither greater than 49' nor less than 49" — within which limits the more probable [value] lies, as we teach in Bk. 4, ch. 19.
4. Finally, as to the number and apparent magnitude of the fixed stars, we know what and how much the telescope has revealed to astronomers. For by it we learned that the Milky Way is, as it were, a dense aggregation of innumerable little stars heaped together; and thus the nebulous [stars] coalesce out of several obscure little stars, dim in their light — for in the nebula of Praesepe there are 36, and in the nebula of Orion 21; and within two degrees Galileo detected more than 500 stars in Orion, 80 in the Pleiades; Antonius Maria de Rheita [Anton Maria Schyrleus de Rheita] first

counted 1000, then 2500 new stars in the single [region of] Orion; and our own Father Giovanni Battista Zupi [Giovanni Battista Zupi] noted them in the Pleiades, the Hyades, and the sword of Orion. Recently too the Christian Christiaan Huygens [Christiaan Huygens] saw the middle one in the sword of Orion divided into 12 stars, by a large and powerful telescope. Hence the number of the wandering [stars] is not infinite — as Giordano Bruno [Giordano Bruno] contended in his book *De Infinito*, and the innumerable [stars], saying there are as many worlds as stars, and these infinite — and Kepler in his book *De Stella Nova*, ch. 21, refutes [this], wonderingly: that there be innumerable men to us, by the powers of Divine Counsel and wisdom — that they should congregate and number them, [though] David, who is present, *numbers the multitude of the stars, and calls them all by their names*. For Astronomy has gained, at every price, that by its aid the eclipses, or the proximity of the fixed stars to the planets, can be known, [and] the places of the planets in the heavens far more evidently noted than by any other instrument.

ARTICULUS VI. [ARTICULUS VI.]

On the Lesser Planets, in General and in Particular [De Planetis Minoribus in communi, & in particulari.]

1. **Once upon a time the Egyptians, and with them [Martianus] Capella [Martianus Capella], Macrobius, and Bede [Bede], observed that Mercury and Venus always revolve about the Sun; that the [orbital] periphery of Venus [Aptragina[?]] — suspected source corruption] always [lies] above Mercury; that Mercury always runs its course below Venus, against the Pythagoreans and Ptolemaics, who placed Venus below the Sun, and below Mercury; against Plato and Porphyry, who [placed] Mercury above the Sun; against those who placed Venus above. Copernicus first placed all five lesser planets about the Sun, so that they sometimes pass above, sometimes below the Sun — Mercury sometimes above, sometimes below the Sun; the rest go about the Sun, so that Venus, within these very orbits of the World, is moved; Tycho, with the Earth retained [as center], the rest of the planets about the Sun, asserts that they too are moved by their own motion from the mean motion of the Sun, as Ptolemy, Copernicus, and Alphonsus [held], but truly moved [recte: see anomaly c — compressed]; for the line of apsides passes through the center of the Sun. Moreover, from the System of both Copernicus and Tycho, it follows — if the planets receive their light from the Sun — that Venus and Mercury, as if at the apogee of the Sun's conjunction, appear full of light in respect of our eye, but in perigee indeed**

cast off all light, unless a little [latitude] permitted them [to be seen]; in other aspects, with respect to the Sun, they [appear] in proportion. So that the Moon, the Sun, by these little globes of light [recte: see anomaly d], when naked, appears nearly round [in] their aspect, [their] disks always seen as round. But what the naked eye [judges], the sharp [eyes], aided by the telescope confirmed, judged to be true through the long-glass [longobcope] — as we shall soon say of these matters in their place.

2. There was then removed, by Copernicus and Tycho, that old farrago of solid orbs and Epicycles, Eccentrics, [and the rest]; likewise the Eccentrics, retained, [were dropped] in the liquid Aether, where the peripheries of the planets designate the eccentric [paths], free of epicycles. Kepler simplified the elliptical peripheries [and] eccentric circles, which most of the more apt teachers of astronomy acknowledge against [epicyclic] motions; and so Kepler left it imperfect; Bullialdus [Ismaël Bullialdus], Seth Ward [Seth Ward], and Comes Pagani [the Comte de Pagan] attempted to reduce it to the exact demonstration assumed from the nature of the Ellipse — though they did not succeed. Moreover, the inequality which is discerned in the motion of these [planets], the real [inequality] — and its proper cause, that the orbit be moved truly but unequally — Kepler and the rest of his followers refused to elucidate; Longomontanus [denied] it, refusing to admit it into Astronomy as an axiom, since it follows from the ancient principles of Copernicus and Tycho. Both these and Longomontanus took for an axiom that the heavenly bodies are moved equally by themselves, in respect of the [point] about which they are seen to be moved unequally, [a point] which lies outside the center of their own orbit. But meanwhile Kepler and his followers, moving the Earth about its own center, were not solicitous about the motion of the Prime Movable, and turned the motion of the planets eastward.
3. We, having demonstrated the immobility of the Earth, [hold] that the motion of the planets is really unequal, though it appears to us so unequally — that, though unequal, however great it appears to us, [it is] always westward, by spirals so carried out [recte: see anomaly e], that yet it pleases God, in [view of] our weakness, to commend it; and they seem to describe an elliptical periphery about a cone, as I have already insinuated above, and that, free of librations, which Kepler too upheld by a greater or lesser breadth of the spiral, we do not doubt that all that variety...

variety comes about [in the motion], which appears in Declination and in Latitude. Now we shall set forth in particular what our age's Astronomy has, by the benefit of the Telescope, detected in these planets, [and] we shall run through them.

SATURN is sometimes solitary and round, sometimes three-bodied [tricorporeus] — when seen with imperfect telescopes — and sometimes seen variously oval-shaped [ellipticatus]: by Galileo, Scheiner, Blancanus [Giuseppe Biancani], Gassendi, Hevelius [Johannes Hevelius], Rheita, Schiraleus [recte: Schyrleus, i.e. de Rheita], Fontana [Francesco Fontana], the Fathers of the Society [Jesuits] Zupi, Zucchi [Niccolò Zucchi], and Bartoli, Eustachio de Divinis [Eustachio Divini], and others of the present day. We too, and many others, have shown these figures in [the schema] subjoined — as also Christiaan Huygens [showed them] by a larger Telescope. He asserts that he observed in this Saturnian system a certain little planet of about 16 days, [moving] about Saturn near the days [of its] circuit, which he calls accordingly the Moon of Saturn [i.e. the satellite Titan]. He judges, moreover, the phenomena of Saturn as regards the handles [ansae] to be safe — that is, that they tarry within the bright ring, which always accompanies Saturn, and [that they are] otherwise [than what] others have tried to explain. We, however, show all things more clearly than they, if Saturn be placed near the elliptical [figure] continued to itself, by that alternation of libration which they expound likewise. The line indeed through the handles, or the little ring, [we hold] always to preserve a perpetual parallelism with the plane of the Equator — as we confirmed by evident observations, with Father Grimaldi [Francesco Maria Grimaldi], in the *Almagestum Novum*; which Galileo suspected, Gassendi and Bullialdus asserted, Hevelius denied, [and] Huygens [held] to be by no means exact about the solstitial points — a thing which we, and afterwards Huygens, thought [to lie] in the very body of Saturn near the handles, not improbable in respect of the aforesaid little ring.

5. **JUPITER**, by [the testimony of] the most penetrating Italo-Belgian [observers], from Galileo in Italy, at the same time [that] Simon Marius [Simon Marius] in Franconia observed [it], [is found to have] four little planets revolving about Jupiter within a few days; which afterwards Scheiner, Blancanus, Hevelius, [and] Rheita very often saw, but especially Father D. Vincentio Reinerio [Vincenzo Renieri], a disciple of Galileo, who edited his *Ephemerides* of their [motions]; we, too, hope [for the like]; and the absolute [reckoning] of Father Giovanni Battista Zupi [touches on] the celestial secret. The careful observer in these noble matters [proceeds]: but from the frequent eclipses of the little planets [satellites] falling into the

shadow of the Jovian body, we have inferred two things, namely, that we should know that Jupiter, and that the satellites about it receive their light from the Sun — whence the same of Saturn, as is conjectured of Mars, the other [satellites], if [they are seen] at least in Mars, [and] that the agitations of Jupiter could be observed in diverse places on the Earth, [and from these] the distance of Meridians could be gathered. But whether two, or perhaps four, Satellites are to be had — or others, five, [is debated]; as Rheita contends, who is refuted in the *Almagestum Novum* Bk. 5, ch. 3.

The bands [fasciae] on the disk of Jupiter — now one, now two, now three, of diverse situation, yet [of] fixed [place] — were seen not once by the Fathers of the Society, our own Giovanni Battista Zupi, Niccolò Zucchi, and Daniel Bartoli, [and by] Francesco Fontana [and] Huygens — and by us, with Father Grimaldi — so evidently that they cannot be denied with serene brow. Whether they arise from a diverse situation, or from a libration about its own center, is believed [to be debated]. The most illustrious Marchese Cornelio Malvasia [Cornelio Malvasia] saw [them], and that not once.

6. **MARS**, by the gibbous figure seen between the quadratures, [as observed] by Francesco Fontana [and] Huygens, [is found] to receive the indications of its light from the Sun. A spot [macula], indeed, sometimes single, [seen] now broader, now narrower, [is found], though there is none the same in [the observations] — sometimes by Father Niccolò Zucchi; sometimes [the] double [spot] seen at Naples by the Fathers Sirsalus [Daniello Sersale] and Daniel Bartoli, [providing] indications of the rotation about its own center, or [of] the vertiginous [spin] of its body, not slight. But especially that new [discovery], worthy of the knowledge of Kepler, who showed it: namely, having attained [the truth] that Mars in perigee becomes far nearer to the Earth than the Sun.
7. **VENUS**, [as observed] by Galileo, Scheiner, Gassendi, Hevelius, Fontana, [and] Huygens, [and by] Father Grimaldi [and] us, is most often seen by the optical Tube now gibbous, now dichotomous, sometimes cornicular [horned] or sickle-shaped — as we show most fully in [the] schemata in Bk. 7 of the *Almagestum Novum*, Sect. 1, ch. 2. By an evident argument, [it is shown to behave] not otherwise than the Moon illuminated by the Sun, and so [it appears] in those circumlustrations [phases]; whence it is more evidently established that, near the perigee, in conjunction with the Sun, by reason of [its] great latitude...

it was seen by Tycho and by us with horns turned downward, and illuminated by the convexity upward toward the Sun — as is to be seen in the schema of the same chapter, p. 485.

8. **MERCURY** also, [seen] not rarely by [the] Rheinisch [observer], Father Grimaldi, and ourselves, [is found] deficient, and appeared corniculate [horned], as we predicted [in] *Almagestum Novum* Bk. 7, Sect. 1, ch. 2; and Gassendi [observed] Mercury [passing] beneath the Sun, [which] you will be persuaded of [recte: i.e. Gassendi's 1631 transit of Mercury]; and the astronomers, by this very Heliocyclic [observation], and about the Sun, [hold] that they circumvolve [revolve], [and] change nothing in the [order]. [recte: see anomaly f — compressed.]
9. The whirling [vertigo] of the planets — of which the indications [are seen] in Saturn, Jupiter [Joue], and Mars, as we touched on above — is from the Rheinisch [observer], [defined] by certain conjectures and by certain analogies, [within a span] of days, hours. About which matter, when I was discussing it face to face — when I was at Bologna — I heard from the very learned [observers], that by the binocular Telescope such periods had been observed, though as yet imperfectly. Let the faith of [the matter rest] with its Authors.

ARTICULUS VII. [ARTICULUS VII.]

On the Sun [De Sole.]

1. The elliptical figure of the rising and setting Sun could not have been seen but once by antiquity [recte: i.e. was unknown to antiquity]; nor [did anyone] before Scheiner study to investigate the cause — [the] same [Scheiner who] first [observed] the spots [maculae] on the Sun, as Galileo [did]; he convinces [us] in his *Rosa Ursina* that he not only noted the spots with the long-glass [telescope], but afterward, by so many accurate observations, prosecuted [the inquiry] — as René Descartes [René Descartes] testifies, who, regarding the remaining hope, predicted that something better would be furnished in this part: namely, whether [the spots] are moved by the motion of the solar whirling [vertigo], whether by a single motion within about 28 days, as he [Scheiner thought] (Bk. 3 of the *Almagestum Novum*, ch. 4); but certainly the 24-hour rotation of the Sun introduced by Kepler is gratuitous [gratis], as we introduced [in Bk.] 24.
2. We, [holding] the aforementioned motion to be uncertain in its disputation, having dismissed [it], with all our forces, together with Father Grimaldi,

applied ourselves [to determine] its motion in longitude, and in latitude as regards the declination, and the apparent Diameter, and finally the distance, and the parallax — a thing more certain, [and] more accurately, than was done before — that we might attain the inquiry. And we determined the motion in longitude indeed not from observations of two pairs of years, as Tycho [did], but from the interval of 1812 years, [from] selected Hipparchan [observations], and the other [observations] of our equinox, by the ingenuity of S. Petronij [the Gnomon of San Petronio], the Gnomon of Bologna being made — [we determined] the Eccentricity, the equation [aequatio] necessary [for] the Sun, and its Diameter — most subtly [and] most accurately — confuting those who, by a much larger diameter [drawn] from the Cysat [Johann Baptist Cysat] and Scheiner observations asserted [it], detected [the error], and [the] cause of the error [committed] by them, through their ignorance, [or] from a certain mode of propagation of the light of the Sun, as we shall teach below in its proper place. But we also confuted those who, against Kepler, denied [recte: this passage is compressed] in this matter the diameter of the apertures [of the foramen], [and] inferred the diameter of the species [image] of the Sun [to be other than] what it truly is — as I shall expound more fully in the Appendix to Bk. 1.

3. The maximum Declination of the Sun [we determine] to be $23^{\circ}30'20''$ [printed *gr. 23. 30'. 20'*. — second prime where a seconds mark is intended], [to have been] perpetual, and not changed within memory, as the observations of the ancients teach us — so that the place left for doubt seems [to be] inconsiderable. We finally [determine] the distance, and the parallax of the Sun, [to be] not only far smaller than the Tychonic [value], as we show, but [to lie] within limits not to be despised for certainty, by [the methods of] the Lunar Dichotomies, and by a new method [drawn] from the Refractions, [as] we conclude.

Prolegomena — Articuli VIII–XII; Liber Primus, Caput I

ARTICULUS VIII. — On the Moon and Eclipses

1. We owe a real debt of gratitude to [Tycho Brahe], for it is from him that we learned that the Moon's maximum latitude at the quadratures is about a third of a degree greater than at the syzygies; that the motion of the nodes

themselves is not uniform; and that the Moon undergoes — besides the two inequalities — a certain third variation around the octants. We have nonetheless determined the Moon's motion in longitude more certainly in several respects: not, indeed, by deriving it from a greater number of lunar eclipses, but by taking great pains over the disagreement among the Tables in their comparison with observations, and over the lapses into which other otherwise distinguished men have fallen — as will be evident in Book I.

As for solar eclipses, we have measured the Sun's diameter against the Moon's diameter, already known from another source — not only in the total solar eclipses that [Tycho Brahe] had denied, but also in annular ones, and that without any violence to the data, such as those eclipses demand.

2. Furthermore, the lunar spots — which some call *Selenographia* — were studied with great zeal and assiduity by [Langren], Sirsalis [Giovanni Battista Zupi / Sirsalis?][?], [Hevelius], [Eustachio Divini?][?], and Rheita [Anton Maria Schyrleus de Rheita]. Father Francesco Maria [Grimaldi], an emulator of these men, equipped with a telescope, depicted them on the largest scale — or at least on no smaller scale than the one in which we have set them out in Volume 9 [*Almagestum Novum*], chapter 7, with a small figure. He had, however, often examined them with his own instruments and in their proper places, and committed them most excellently to a figure; and Marchese Cornelio Malvasia did the same. But as for the causes of this phenomenon, we have investigated them rather more diligently in chapter 7. And as for the matter of the Moon's libration — first noticed by [Galileo], and afterwards confirmed by the kind offices of our friends [Michele Langren] and [Hevelius] — we too have contemplated it many times together with Father [Grimaldi], insofar as it was necessary for us to know the limits and nodes of that libration. Some of these, though, differ from [Hevelius]; this will become clear, as it must be stated, in Book III, chapter 3.
3. It is remarkable what subtlety and industry more recent astronomers have already brought, after [Kepler]'s admonitions, to the observing of eclipses, surpassing all their predecessors by a long interval — chiefly with the help of the telescope, as may be seen in the observations of [Gassendi], [Hevelius], Lansberg [Philip van Lansberge], Eichstad [Lorenz Eichstadt], Bullialdus [Ismaël Boulliau], and many others. Indeed, with sharper insight than they did, we have detected the difference between the terrestrial

penumbra and the spurious beginning, middle, and end of an eclipse; and we have shown the legitimate beginning and end; and I have set out the cause — most shrewdly discovered by [Kepler] — why the Moon, though sometimes, but rarely, completely extinguished in the middle of a total eclipse, in other cases and rather more often does not wholly fail in the middle but appears reddish, or coppery, or sometimes of a leaden hue. This is because she is then illuminated by the Sun's rays refracted toward her, since she does not fall within the true shadow-cone of the Earth — a doctrine we have here recalled and asserted, against the contrary sophisms. We likewise made an accurate observation, on the admonition of our most dear friend [Vendelinus, i.e. Godefroy Wendelin], of those things that are of prime importance concerning eclipses, and added others in their proper place. And we have laid out most fully the causes of the discrepancy among observers of the same eclipse. Finally, we have enriched astronomy itself — and chronology along with it, more than anyone else — with our knowledge of eclipses, since we have helped our many friends in foreign parts who afterward shared with us no few useful observations. And throughout Book V of the *Almagestum Novum* we have untangled new questions, and several problems bearing on eclipses, hitherto open to dispute.

ARTICULUS IX. — On Comets and New Stars

1. There was a great controversy between the Tychonics on the one hand and the Claramontians [followers of Scipione Chiaramonti] on the other, as to whether comets and new stars were observed by [Tycho Brahe] in his day above the Moon — as Tycho and his school maintained — or whether, as the Claramontians, biting like Peripatetics, contended, they were below the Moon, and as Chiaramonti held, even retained below the Earth. We, for the sake not only of astronomers but also of natural philosophers, have here undertaken this labor too — though not without great toil — in Book VIII of the *Almagestum Novum*, perhaps at excessive length. We have examined the observations, and (with incredible labor in the reckoning) carried them through; and on this occasion we have thought out new theorems and problems, and settled the controversies by literal conclusions — though we do not yet repent of the labor. But as for the new star that guided the Magi, the cradle-companion of the infant Christ, we have added a little something against certain men's somewhat rash assertions, for the sake of those who delight in sacred letters; this may be read at the end of the said Book VIII.

ARTICULUS X. — On Refractions, the Height of the Refractive Air, and the Twilights

1. Since [Tycho Brahe] was the first to consider refractions — which had been pointed out and measured by some of his predecessors — and to publish them by number, all later astronomers acquiesced in the Refraction Tables issued by him; and [Kepler] himself, notwithstanding that correction of his which he had set in motion in the *Optics* and *Dioptrics* by an increment of secants, brought this subject to its perfection in *Almagestum Novum* Book X, throughout section 6, in Problem 57. And the refractions assumed by [Tycho Brahe] we have corrected three times over, in the Table of the same section, after first treating them at Problem 27, and have accommodated them to a triple refraction of the year. Afterwards, examining the matter again more deeply in [Tycho Brahe]'s own observations made on the day of the solstice, and along with me Father [Alberto Albertini?][?] — by Currus, transmitted from Tycho's own autograph — we detected that both Tycho himself and [Kepler] had erred in then confounding the optical refraction with the astronomical; for we shall show, in Book I chapter 14, and in many other places, and most worthily of being known concerning refractions, by what causes the astronomical refractions of a star nearer the horizon prove to be smaller when they ought to be larger.

But as to the height of the refractive air, the reader will learn with how much labor we have investigated it, in *Almagestum Novum* Book X, section 6, at Problem 43, and from 43 to 57; where, disproving even [Kepler], we have constrained that height to within two Italian miles. And from this, moreover, the natural philosopher too will be able to draw no small lessons for his own doctrine concerning the height of the air, if he combines what is handed down by us in Book I, *Almagestum Novum* chapters 30 and 31, and Book II chapters 1 and 19, with the most exquisite matter in Book VIII, section 1, chapter 14, on the twilights. From the haze of the twilights both the sublimity and the gleaming and clouds may be gathered — that is to say, from the threefold use of refraction in determining height — and from the differing depth of the Sun below the horizon when it is at one distance from it in the evening, and at another in the morning twilight; both in winter, when it is in the vernal[?] sign, and in summer, as well from the observations of others as from our own.

ARTICULUS XI. — On the Height of Mountains, the Levels of Rivers, the Distance of Vision, and the Tide and Depth of the Sea

1. You will ask, you say, what these matters have to do with the astronomer. The answer is that through them certain astronomical questions are better resolved — both those bearing on parallaxes and those on refraction, and those bearing on the exclusion of any motion of the Earth. To detect these things, then, many errors had to be measured out in the height of mountains — which we did in *Almagestum Novum* Book I, chapters 11 and 10, section 3, at Problem 31, and section 4 at Problem 50, and more fully in *Geographia Reformata* Book VI. Errors likewise had to be eliminated in the breadth of the physical horizon, that is, the distance up to which our vision extends above the Earth or the Sea; this we did in *Almagestum Novum* chapter 10, Book 10, section 4, at Problem 39, and these matters have since been more fully explained in *Geographia Reformata* Book VI. The places had partly to be examined as to the levelling of rivers, which we touched on in *Almagestum Novum* Book II, chapter 15. And concerning the Tide of the Sea, things are explained as found in Book IX, chapter 14, where, lest we should rake over again the conjectures of Galenists[?][likely "Galilæorum" — the Galileans], who derive the true cause of the marine tide from the motion of the Earth, whether diurnal or annual; on which occasion, when we have collected from every quarter the histories of the tide of the Sea, and the things to be known about its hourly flux and reflux, we have laid down rules, and against the Galileans we have brought forward our own opinion, having enumerated the causes of these motions — apart from the opinion of Reita[?]/Rheita, whose book was then lacking to us, which we afterward examined in *Geographia Reformata* Book X.

ARTICULUS XII. — On the Magnitude and Immobility of the Terraqueous Globe; on Heavy and Light Bodies; on the Acceleration in their Descent and Ascent; and finally on the Vibrations of the Pendulum and its Use in the Measure of Time

We have first set out the magnitude of the terraqueous globe, and treated it in *Almagestum Novum* Book VII, chapter 8, section 4, at Problem 2; then, renewing the observation, expounded it publicly in the Theses, and at length, with other

observations, attained it (by incredible labor and industry, with God's most evident help) together with Father Francesco Maria [Grimaldi], and demonstrated it in *Geographia Reformata* Book V — and that not by a forced reckoning but, as is necessary, by a measuring-out of the intervals, and by the method of others' correction, reconciling with some of the most celebrated opinions on this magnitude. As for its immobility, as we indicated above, we have asserted it both from the real acceleration of heavy bodies as they naturally descend, and from the proportion of the velocity, evidently deduced; and we shall say more in an Appendix to Book I. Concerning that acceleration, and other matters with it, the natural philosopher must read — many things by experiment not to be neglected — which we handed down in *Almagestum Novum* Book II, chapters 21 and following, and Book IX, section 4, chapter 16. Finally, the remarkable properties of the vibration of the pendulum, and its use first applied by us, and reduced to a certain measure of the motion of the primum mobile, see in *Almagestum Novum* Book II, chapter 20.

Thus far, perhaps not without some little offense to the reader, we have dwelt upon a matter often impressed — namely, what we have done to advance astronomy and geography. But be it far from us to boast: whatever good we have attained in this kind, we acknowledge that we received it, of God's bounty, from God the Best and Greatest, and we refer it to His Glory; for it was at the express command of our superiors that we first, at the prompting of Heaven, set ourselves to these studies. Nor indeed do I much linger over the man who said that the two earlier Tomes of the *Almagestum Novum* contain, indeed, an Astronomical Library and a collection of no common erudition, but nonetheless almost nothing newly contributed by us — when we reckon up in those same books nearly 95 new questions with their solutions, 88 theorems, the correction of errors admitted by others, and on top of that more than 320 refutations of the fallacies of arguments; besides many new Tables, or little tables newly constructed for the erudition of astronomy and geography. May GOD bless our labors — to whom be Honor and Glory forever.

BOOK ONE — IN WHICH ARE THE OBSERVATIONS OF THE SUN, AND THE FOUNDATIONS OF THE SOLAR HYPOTHESES

[Display title block] **LIBER PRIMUS, IN QUO SUNT SOLIS OBSERVATIONES, AC
Fundamenta Hypotheseon Solarium.**

CAPUT I. — On the Methods of Observing the Equinoxes, Solstices, and the Maximum Declination of the Sun, with the Least Possible Fallacy

This is not the place to treat these matters at length, since they belong to the part of astronomy concerned with instruments [Organicam Astronomiae partem], for which we have furnished an entire Volume. But in order that the observations of the Sun, which must be adduced, may be the better understood, and distinguished from the cruder ones — it must be recounted by what methods more refined observations have been made, by which the equinoxes, the solstices, and the remaining moments of the Sun's entry into the signs of the Zodiac are observed or observable; and the fallacies that lurk in them must be pointed out. We shall begin with the equinoxes, as being the most celebrated cardinal points of the whole year.

On the Equinoxes

1. [Margin: First method. Shadow of the gnomon.] First, the day of the equinox can be explored by observations of the line which the apex of the gnomon's shadow describes in the horizontal plane, from the rising of the Sun all the way to its setting. For if that line is straight, it will be an indication that the equinox has occurred on that day. But the hour at which the Sun reaches the equator cannot be discerned by this means.
2. [Margin: Reckoning of the half-day's time.] Second, if the time is reckoned from the rising of the Sun up to the Meridian, or rather, from the Meridian, it will be the sixth equatorial hour, or hour 6 with some minutes; the indication will be that the day is equinoctial; or, from the moment of the Meridian, up to the setting of the Sun, the physical reckoning will tell off the time of the Sun's setting at hour 6 with 4 minutes. This is because the horizontal refraction makes the Sun, optically, appear about 4 minutes more quickly in the horizon than it really is in the morning; so that it is seen later, in the evening, to set — at least in the Torrid and Temperate zones. But lest even this should give the hour of the Sun's entry into the equator — and much less, if it is not corrected by perpendicular oscillations [pendulum swings], of which I spoke in *Almagestum Novum* Book I, chapter 13. There is also the mercurial clepsydra [water-clock], of which [Tycho Brahe] writes in Tome 1 of his *Progymnasmata*, chapter 2, and Dudley [Robert Dudley] in *Arcani del Mare* [*De Arcanis Maris*] Book I,

chapter 4. But these are more fallacious; whoever uses such horologes, whether of water, or of sand, or of the sundial [horizon], beware.

3. [Margin: Eastern point of the true rising is observed.] Third, if the Meridian line is first exactly marked out in the physical horizontal plane, and one cuts it at right angles by another straight line, and on this line erects two very fine needles upright between the distant points — or something else that may designate a vertical plane, namely our Filar Triangle [Triangulum Filare], of which in *Almagestum Novum* Book V, chapter 15: for if the center of the eastern–western rising falls in the said line, drawn out by the imagination, or in the said plane produced, it will be an indication of the equinoctial day, and of the true rising or setting. But here too lurks a fallacy of horizontal refractions, which, both because of the horizontal refractions and because the figure of the Sun is so widened into an ellipse [Ellipticè], that whether you collimate to the center of the very rising, or whether the Sun set in the equator, they nonetheless represent it short of the true place, or beyond it; both from the horizontal parallax, and because the physical plane of the horizon differs from the true.
4. [Margin: Equinoctial shadow of the gnomon.] Fourth, the ancients observed the equinoctial by the equinoctial shadow of the gnomon — that is, if the gnomon, or stylus in the *scaphion* [hemispherical concave sundial], were perpendicularly erected, the meridian shadow projected the same; the height of the equator was demanded as foreknown. But because in *scaphia* the stylus was rather short, and hence the boundary of the shadow was liable to a notable error in arguing the Sun's altitude — and likewise the altitudes were inconspicuous, since they were measured by the shadow — therefore they were accustomed to erect obelisks, and gnomons many feet long, in measuring the conspicuous altitudes. Such was the obelisk of $116\frac{3}{4}$ feet in the Campus Martius, of which Pliny writes Book 36, chapter 10[recte: Pliny *Natural History* 36.15]; and a Byzantine gnomon, whose meridian shadow, observed on the equinoctial days, was found to bear the same ratio to the gnomon, as 111 to 120; as is evident from Strabo Book 2, chapter 5. And about other gnomons of this kind, from Pliny Book 2, chapter 72, and Vitruvius Book 9, chapter 8.

as Cleomedes does in his first book, and Ptolemy [Ptolemy] in his second (*Almagest* II), from chapter 2 to chapter 6, where he admits that this method is not very accurate. Moreover, once the altitude of the gnomon and the perpendicular line in the plane of the horizon have been given, two right

triangles arise in the same plane of the equinoctial, similar in species: in these the gnomon stands as the radius of the angle, or as the whole sine, and the shadow as the tangent of the said angle; and from the shadow subtending the gnomon, the distance of the Sun's uppermost limb from the zenith in the heavens is determined. Suppose, then, the gnomon and its shadow given: the whole sine will be to the shadow as one quantity to another, and the tangent of the said angle will result. If to this you add the apparent semidiameter of the Sun, and then subtract the corresponding parallax, you will have the true distance of the Sun's center from the zenith in the meridian. This, when subtracted from the true altitude of the pole, reveals the Sun to be on the meridian and at the equator. But if the result departs from this by some amount, then by however many hours the equinox falls short of, or after, the moment of noon — by just so many hours is the equinox distant from the moment of noon. Accordingly, in this business one must take care how far the error may run, whether in the altitude of the pole, or in the semidiameter of the Sun, or in refraction, or in parallax, or in the observation itself, or in the measurement of the shadow, or in all of these, or in several of these elements.

Concerning the use of gnomons by which the Sun's uppermost limb is observed together with the shadow of the solar limb, we shall say more at number 8, chapter 2 [chapter II].

§5. **A fifth solemn method** used by astronomers, especially the Alexandrians, was to observe the equinoxes by means of equatorial armillary rings, such as we described in *Almagestum Novum* III, new chapter 14, number 7. The equatorial armilla consists of two rings, or large quadrilateral-surfaced annuli, which intersect each other at right angles, dividing one another in two, of which one is set in the plane of the meridian circle, and the other precisely at right angles to the first, at as great a distance of the equator from the zenith and from the pole of the place as the equator is distant from the zenith, so that the Sun on the meridian falls upon it. When the Sun has reached the equator, the meridian armilla shows the Sun to be on the meridian and at the equator. But by however many minutes it should exceed this, or fall short, by just so many hours is the equinox distant from the moment of noon. Hence, by however many minutes the error has been committed in this business — whether in the altitude of the pole, or in the semidiameter of the Sun, or in refraction, or in parallax, or in the observation itself — the equatorial armilla represents the equinox. If, however, the armilla illuminates either cavity equally on both sides, the equinox is occurring at that very moment on the meridian; but if not, refraction stands in the way of this precise observation. If the lower cavity is illuminated more from

the northern part than from the southern, it is a sign that the vernal equinox has occurred, and the pole's path is for the northern observers: for to the southern observers all things happen in the opposite way, in alternation, as we shall presently say. Furthermore, when sometimes the cavity of the equatorial armilla appears illuminated in some way on the western part, the equinox will then occur after noon (if indeed on a clear day, since the said cavity is never wholly illuminated on both sides); but if the eastern part, it will occur after noon. Since on that serene day the equinox falls within the day, not by night — provided only that the region of illuminations be changed: for if the Sun illuminated the northern part of the cavity yesterday and illuminates the southern today, know that the autumnal equinox has occurred; by night, that the intervening northern equinox has occurred. On the contrary, if it illuminated the southern cavity yesterday and the northern today, in the morning, know that the northern equinox has occurred. Against this, if the Sun illuminated the southern cavity yesterday and illuminates the northern today in the morning, recognize that the northern equinox has occurred — at least insofar as physical appearances are concerned, even if it does not always answer to astronomical truth: for refraction, raising the image of the Sun above the horizon, can make the equinox to be perceived, although it lies in the very equator, before or after the equator, and on the contrary, in the southern signs, or, beyond, in the southern signs, it may appear to be in the equator. And this is indeed the cause why, in the same way that the cavity is equally illuminated on both sides once near sunrise, or once near sunset, by refraction, refraction makes the autumnal equinox earlier, and delays the vernal equinox, since refraction delays the autumnal and hastens the vernal: by which reasoning these fallacies correct themselves, and the equinox, when refraction ceases, departs by an equal amount toward the true [equator], as Bullialdus [Ismaël Boulliau] taught in his *Astronomia Philolaica* II, chapter 2, and as **we ourselves** noted in *Almagestum Novum* III, new chapter 14, number 9; but to no avail.

[Margin: Hipparchus, Ptolemy, and their fallacy in observation.]

But it is astonishing both that Hipparchus [Hipparchus], and Ptolemy after him, who attest in their own behalf (*Almagest* III), should ascribe a defect to the equatorial armilla, which Ptolemy thought (or believed) had collapsed from its original setting, the legitimate position having been changed: a contrary effect produced the parallax-fallacy, namely the optically autumnal one, and delayed the vernal equinox, since refraction delays the autumnal and hastens the vernal — because by this reasoning these fallacies correct themselves; and the equinox

departs by an equal amount toward the true [position], as we taught more fully in *Almagestum Novum* III, new chapter 14, number 9.

But we do not need this much: since we are able to make use of observations, by other methods in which the fallacy of refractions is not implicated, not only the more recent ones, but also the ancient ones. When we must use the observations of Hipparchus or of Ptolemy, by which the armilla in the meridian, or as nearly as it appeared on both sides, was illuminated equally — then at Alexandria the Sun was high, almost 60° [degrees], and yet beyond all sensible peril of refraction; indeed, by our reckoning the parallaxes, which do not exceed the second scruple [arcsecond], are 6. The remaining equinox, of which Hipparchus attests according to Ptolemy, was not safe from an error of nearly 6 hours: nor are they suitable for that subtlety which the more recent age demands; especially since here an error of nearly 12 hours could be committed, as Longomontanus [Longomontanus] contends in *Astronomia Danica* I, *Theoricarum* chapter 1. Kepler [Kepler] adds in *Astronomia [Nova] optica*, page 146, that the equinox observed by Tycho [Tycho Brahe] by means of the armillas, in which the same day might seem to be an equinox, was made false by the force of refraction; and therefore the equinox is to be sought by a more certain method.

§6. **Sixthly**, therefore, with very large instruments rightly divided, set up, and adjusted — namely, as you will best prepare now according to the Gregorian Calendar, from March 19 to March 24, and from September 19 to September 24 — observe the meridian altitude of the Sun's center, and reduce it, when it is apparent, to the true value, by the corresponding adjustment of parallax and subtraction of refraction. For if the altitudes of the equator are made equal, the equinox is made known. But by however many minutes, or scruples [arcseconds], the first altitudes of the equator differ — by just so many hours, before or after noon, has the equinox occurred. And indeed the vernal equinox precedes the meridian among the northern observers, if the following [meridian] altitude of the Sun should exceed the meridian altitude of the equator; but if indeed this should exceed that, the equinox will occur after noon. Conversely, the autumnal equinox precedes the meridian, if the meridian altitude of the Sun should exceed the meridian altitude of the equator; but if this should exceed that, the equinox will occur after noon. But by however many minutes the matter is uncertain in practice, you will go astray either in the altitude of the pole, or in the observation, or in refraction, or in parallax; by just so many hours you will wander from the true moment of the equinox. Therefore the equinox of not only the ancients, but also of Tycho himself, by parallax is off by two things, and indeed by a greater

minute than it ought, which Copernicus [Copernicus] also, and his predecessors, got wrong, as we shall say afterward, [and which] need correction.

Concerning the Solstices.

§7. **First**, the winter solstice [solstitium brumale], on account of refractions and parallaxes greater than those of summer, is liable to more fallacies than the summer one — whether it be observed by the minimum altitude, or by the foreknown numeration of the pole, or by the cessation of the increment of the meridian shadow, or by gnomons; and the shadow of the gnomon is reckoned otherwise than if the fallacies could be avoided. The true meridian altitude of the Sun, of all in the whole year, or the nearest to the solstice — that is, the altitudes observed near the solstice — the minimum would be the sign of the solstice having occurred. The solstice too, the summer one, is observed with difficulty, in which it is scarcely possible to agree to within hours of the day, by which the moment of the solstice is determined. Whence Ptolemy (*Almagest* II, chapter 2) says: *In the solstices indeed, neither we, nor Archimedes, in observation and calculation, have erred up to a fourth part of a day.* Yet Willebrord Snellius [Willebrord Snell] in his notes on the Hessian observations declares that the error of a quadrant of a day, or of 6 hours, is to be avoided in the solstices. The reason is that on the day next preceding, and on the next following the solstice, the declination of the Sun does not exceed by 14" a second in the whole year, nor by a third 56" [unless varies by 56"]: wherefore one must beware of an error of 6 hours in observations, unless the observations are made immune from error by 3 seconds, or a third 56". How great a subtlety scarcely could be furnished by observations of the meridian altitudes of the Sun on the days of the solstices, unless they are carried through with very large instruments very exactly.

[Margin: The fallacy of observation in the solstices.]

§8. But if anyone is content with the notation of the day of the solstice, the observation of the decrement of the meridian shadow having been omitted, and the numeration of the time being agreeable as to the half-day...

to it, because the altitude of the pole demands, by the greatest distance, that the points of rising in the west and rising in the east be observed in the horizon (for these are the modes of this kind whose error in the integration of the day exposes more than these neglected ones), the observer must take heed of the proportion of the meridian shadow to the gnomon. He gathers, as we said above, the distance of the Sun's limb from the zenith, on the one and the other day before, then after that day, on which the solstice is hoped for from the ephemeris. For when the

least of all distances from the zenith has been found, that least may be had: that day will be able to stand for the summer solstice; but if the greatest is found near midwinter, that day will be for the winter solstice. And let the same judgment be made concerning the meridian altitudes near either solstice, taken otherwise than by the shadow of the gnomon.

§9. But also for the hour of the summer solstice, as nearly as may be panted after, the continuous meridian altitudes of the Sun before and after that day must be captured. Convert the meridian altitude into the altitude of the equator, by the adjustment of parallax, and by the subtraction of refraction.

[Margin: For the summer solstice. 1st case.]

If it should happen that of two intermediate altitudes the remaining ones exceed, so that they themselves are equal between themselves: the solstice will have occurred in the middle of the intervening night, and then add to each the second scruple 7"; and to the aggregate take away the altitude of the equator, formerly more exactly foreknown, and so you will gain the maximum altitude of the Sun's declination by the same operation, if the obliquity of the ecliptic should be equal; but if it should depart from the foreknown altitude of the equator, refer the aforesaid aggregate — for it will be useful, as will appear below.

[Margin: 2nd case.]

The second case will be: if it should happen that of three meridian altitudes, the truest, the remaining ones being exceeded, the intermediate of the day should be greater than the two nearest days, and these two should be precisely equal between themselves; know that the solstice has occurred on that very meridian of the day, and subtract the altitude of the equator from the altitude of the Sun, and the maximum declination of the Sun will be left. Yet this case is rarer than either.

[Margin: 3rd case.]

With these two cases lacking, choose more meridian altitudes of a continuous series of days, two of all the others greater, and differing from them, which (if the operation is exactly done, and subtle) ought not to exceed 14"; lead through 24 hours, and divide the product by 14". For the quotient will give the hours by which the moment of the solstice succeeded the meridian of the lesser altitude of the preceding day, or preceded the meridian of the lesser altitude of the following day. The moment of the summer solstice having been acquired, subtract 14" from the greater altitudes, and subtract the altitude of the equator from the residue, and you will have the maximum altitude of the Sun on that meridian, on which

meridian the solstice was made, to whose altitude the altitude of the equator being subtracted, the maximum declination of the Sun is left.

[Margin: For midwinter.]

§10. For the winter equinox [recte: solstice], certain similar things must be dispatched in the opposite manner, because then in the winter solstice, when the Sun obtains the minimum altitude of all the others on the meridian, the minimum altitudes are to be observed under other meridians. The first case, then, be this: if it should happen that, among more of a continuous series of days designated by the ephemeris as antecedent and subsequent, two intermediate altitudes are exceeded by the rest, and the remaining two are equal between themselves; then know that the winter solstice has been made at the middle of the intervening night. Then again subtract 7" from each of the equal altitudes, and from the residue again subtract the altitude of the equator, and you will obtain the maximum declination of the Sun in that meridian.

[Margin: 2nd case.]

The second case will be: if of three true meridian altitudes captured near midwinter, the smaller intermediate of all the others, that is, the altitudes being lesser on two days, and the remaining two should be equal between themselves; then know that the winter solstice has been made on the meridian of the intermediate one, and the altitude of the equator being subtracted from the altitude of that day, the maximum declination of the Sun is left. But this case is rarer.

[Margin: 3rd case.]

The third case, therefore, be this: if of three meridian altitudes of the Sun captured near midwinter, the rest being smaller, but unequal between themselves: choose, then, two of these smaller, and lead their difference through 24, and divide the product by 14. The quotient will give the hours by which the moment of the solstice succeeded the meridian of the greater altitude of the preceding day, or preceded the meridian of the greater altitude of the following day. Once the moment of the winter solstice has been acquired, subtract the minimum altitude from the residue, and you will have, in addition, the residue: subtract the altitude of the equator, and you will have, as still absolutely the minimum, the minimum meridian altitude of the Sun on that meridian, on which the solstice has been made. Therefore subtract that altitude of the equator, to obtain the maximum declination of the Sun in that year.

Concerning the maximum declination of the Sun, and the distance of the Tropics to be observed, and at the same time the altitude of the pole, if it is not foreknown.

§11. Above, at numbers 9, and 10, I taught how to observe the maximum declination of the Sun by the foreknown altitude of the pole, or its complement at degrees 90, that is, the altitude of the equator, foreknown by some other most exact means through the circumpolar stars. But if the moment of either solstice is unknown, or is to be ascertained by some other means: nevertheless, when the meridian altitude of the Sun is at its maximum in summer, and at its minimum in winter, as above I taught is to be observed. The difference, then, between the maximum altitude and the minimum altitude is the distance of the Tropics between themselves; of which the half will be the maximum declination of the Sun: and this subtracted from the maximum altitude of the summer solstice leaves the altitude of the equator; but this subtracted from degrees 90 leaves the altitude of the pole. Moreover, the obliquity of the ecliptic, and the distance of the poles of the equator and ecliptic, are always equal to the maximum declination of the Sun.

Concerning the solstices to be observed, when both the altitude of the equator and the maximum declination of the Sun have been foreknown.

§12. If from the ephemeris deputed to the solstice itself, or to the nearest preceding, or to the following, the meridian altitude has been found, and corrected — if in summer the Tropic, exacted by the aggregate made from the altitude of the equator and the maximum declination of the Sun, or in midwinter, exacts the residue left from the subtraction of the maximum altitude of the Sun's declination from the altitude of the equator — then know that the solstice has been made on the meridian of that day. On the contrary, if the meridian altitude of the Sun should differ from the aggregate required for summer, or from the residue required for the winter solstice, by more than 14", the solstice is distant from the meridian by more than 14" on either day; and if it is less than 14", observe the difference, and the required difference, by 14, and divide the product by 14. The quotient will give the hours by which the solstice is distant from the meridian of the observation, before or after, as the increments of altitude in summer, or the decrements in winter, will easily teach.

CHAPTER II.

Concerning the Instruments Most Suitable for Observing Subtly the Meridian Altitudes of the Sun and of any star whatever, and especially concerning the great San Petronio Gnomon at Bologna.

§1. It has been clearly shown by us, that in the preceding chapter we learned that in the equinoxes the error of one hour is to be avoided, that one minute of the first error is to be avoided, and so for excluding the error of an entire [day] in the solstices, excluding...

that one ought to be from the observation of a quadrant of one minute, or of the second 14"; whence consequently the error of one hour in the solstices, unless an error of thirds 16" be employed, and unless an error of thirds 54" be avoided, or at least an error of the second scruple — to this end, therefore, one must strive after subtlety, that one may attain the matter of times, as the minimum may be excluded, so far as the more certain it be: but if such a minute be admitted without error in the matter of times. In the first place, then, one must reflect upon the magnitude of the instruments, but a manageable one. Far hence, therefore, let there be absent the *Baculus Jacobi* [Jacob's Staff], the *Radius Astronomicus* [astronomical radius — the cross-staff], whether Greek or Latin, the *Astrolabium*, the armilla, the *Annuli* [rings], the *Torquetum*, and other organa of this kind; and the pendulum quadrant, which are to be moved and handled at a nod, and for that reason cannot be of such mass that single seconds may be exhibited by a scruple. But those organa truly succeed for this purpose, which are the *Quadrans*, the *Quadrant*, and the *Sextant*, fixed in a wall —

[Margin: The magnitude of instruments required.]

§2....the Geometric, or Astronomical *Sextant*, or the parallactic *Regula* [Ruler], and especially many *Gnomones* many feet [long], the *Forma*, the division, and the use of some *Quadrants*, of *Quadrants*, of *Sextants*, and of *Parallactic* [rulers], Tycho sufficiently taught in his *Astronomiae Instauratae Mechanica*, to which I refer the Reader; but besides, not a few things worthy of consideration for us in meditating upon this business.

[Margin: The minimum visible.]

For the first thing to be established is, how great is the minimum visible point, or a discrete point, to be designated by a pointed pin, or by acute styli to be pricked, or by a color to be painted, or by the keenness of the sight's edge, or by an abraded section [is indicated]. But here I name no one of sound and most acute sight among men, who can discern a point between point and point, or a point between a little line and a little line, if they occupy the smallest space, such as the

simplest silk thread from a silkworm's cocoon could uncoil; of this thread, however, three hundred filaments, and sixty are contained, [or] the most subtle one chooses three hundred, of a foot of the ancient Roman [foot], or by a movable dioptra, displayed in the work of Ezekiel at Villalpando [Villalpandus]. Therefore in the periphery of a quadrant, or sextant, of astronomical instruments observed, so a sight is transferred from one point to another, so that one second of arc of one degree may be evidently discerned, the chord of this whole sight ought to contain ten inches of the Roman foot, that it may take the said minimum evidently visible 360, ten times, this is 3600. By however many seconds the second scruple contains, of one degree. Nor should you say, that lines can be obtained by transversal lines, even more subtle thirds, indeed by a quarter or by a subdivision. For although interludes of greater length can be put in transversal lines in the Tyconic manner, than in the peripheries of the limbs, at least so that the interlude of those be made by a thread, or by a movable dioptra, but without an intermediate physically sensible, if in the limb itself the spaces of the threads do not stand farther apart than the indicated little spaces, we shall say.

[Margin: The minimum visible.]

§3. You will now ask how great the semidiameter of the instrument ought to be, of which one degree captures the inches of the Roman foot, from center A, nearly 573. Therefore it must be of such inches nearly 573. This being so in the schematism here adjoined, from center A, the portion BKC is described, the portion of one degree, of which there are 360 [degrees] in the whole periphery of the entire circle, of which the extremes B and C are connected then with the center by straight radii, or by the straight lines AB, and AC, then between themselves by the chord BC, the perpendiculars AK then being bisected, and orthogonally at D, will be in BD. The sine of the angle BAD, subtending the smallest degree, or the minute 30', and AB will be the radius, or the whole sine. Since, therefore, BC is given as 10 inches...

[Margin: The magnitude of the instruments.]

Diagram. An isosceles triangle illustrating the geometry of an instrument's degree-arc. The apex A is at the top (the instrument's center). Two long sides descend to a short base. The base vertices are labeled B (left) and C (right), with the chord BC connecting them. A vertical line drops from apex A through the midpoint of the base, labeled D where it meets the base, and continuing to K just below the base. The figure represents the chord BC subtending an arc of one degree (here treated as the angle BAD subtending a half-degree, 30'), with AB and AC as the radii and AK the bisecting perpendicular.

- A (apex, top): the center of the instrument
- B (lower left vertex): one extreme of the one-degree arc
- C (lower right vertex): the other extreme of the arc
- D (midpoint of base BC): foot of the perpendicular from A
- K (below D): terminus of the bisecting line AK

§4....and BD is 5 inches, let it be made that as 30' of minutes, the sine BD, 87265, to the radius AK, of 10000.000 parts; so the same BD, of 5 inches, to another, will give the semidiameter AK, of inches, as we shall say, nearly 573 [inches]. This being so at *Pedi* 47 $\frac{2}{3}$. By this method the Table here adjoined has been constructed, for the semidiameter of an instrument suitable for one, or two, or more seconds, as far as concerns the magnitude of the organ itself; but besides this, the figure soon to be considered.

[Margin: The magnitude of the instruments.]

For [seconds]	Feet	Inch
1	47 &	9
2	23	10 $\frac{1}{2}$ [?]
3	15	10 $\frac{2}{5}$ [?]
4	11	11
5	9	6 $\frac{2}{5}$ [?]
10	4	9 $\frac{1}{4}$ [?]

[Margin: Radius in Roman feet & inches.]

Parsing notes: The header reads "Radius Pedum Rom. & Unc. Pro" over columns "[Pro]", "Pedes", "Uncia". The leftmost column gives the number of seconds (1–10) the instrument resolves; the second gives whole Roman feet; the third gives inches with fractional parts that are partly difficult to read at the right margin — the fractions on rows 2, 3, 5, and 10 are flagged [?].

§4 (cont.). With the Instrument constructed, whose radius would be of so many feet and inches as the optimal precision of seconds requires, and from center A, with the described arc of a quadrant, this same arc is divided into degrees 90, or into a sextant of 60, with such equality of intervals, and subtlety, that no sensible interval of error be admitted; which, although it may seem easily done, demands at least dexterity, with circumspection, such as you would scarcely find in any Mechanic-craftsman, who at the same time has been initiated in the elements of Geometry and Astronomy. Therefore we ourselves are not accustomed to trust

the Instrument, which either I myself, or Father Francesco Maria Grimaldi [Francesco Maria Grimaldi] of Angeli (if it is permitted to say so, in this subtlety a rival, indeed a divider), have divided. For the division furthermore of degrees into the first scruple of sixty, and of minutes into the second, whether single, or ternary, or senary, or denary; and that the intervals of these can be discerned by the smallest unit — Tycho devised transversal lines, of which he treats in *Astronomiae [Instauratae] Mechanica*, folio B 2 of the penultimate folio, because for so long now this use has been with us; in our *Sextants*, or *Quadrants*, which Tycho doubly named because of the division, that is, of the kind of division — second, because it is of equal magnitude, both in radius, and in the band of the limb, of that, which Tycho himself described at folio B 2; and he named the *Tychonic*, as the maximum of his *Quadrants*. But afterward by the very use he advised, not only is it too troublesome that this subdivision uses transversal lines 540, and points 9540; and so the operations are 7000, as we shall say at chapter II, number 4, & 5; but also from so great a multiplicity the peril of error is exposed. Therefore I chose another simpler one, of which I shall speak below, on the occasion of the *Quadrans Grimaldicus* named from the Author and executor of the division, which we devised; the Illustrious Count Carlo Manzini [Carlo Manzini], and the most Excellent Doctor Giovanni Domenico Cassini [Giovanni Domenico Cassini], each most outstanding not only in the Theory of Astronomy and Geometry, but also in the practice and Mechanics of organa of this kind. Yet I add that we are not antecedent in subdividing transversal lines, nor are the intervals equal, as Tycho made; but the Geometric ratio requires it, unequal. For Tycho confesses at the end of the said *Mechanica*, that he was able on account of that inequality of the instrument to err by threes, and more by seconds. *How great a subtlety, that there the keenness of sight may discern in any whatsoever; at length the instrument in no way sustains.* By how much the more, therefore, did Tycho despair of being able to attain single scruples?

[Margin: Division of degrees into scruples.]

§5. Concerning the *Dioptrae* [Dioptras] and *Pinnacidia* [Pinnules], by which the stars are observed at night, we shall say at chapter 4 [Book IV?], chapter 5. But the luminous body, chiefly the Sun, must be observed by a direct beam falling collinearly into the center of the instrument, or alternately, by a thread stretched in some way, or by two pinnules perpendicularly erected on the instrument, or by a section of two perpendicular orthogonal threads intersecting each other in the same plane, of which one is extended perpendicularly at the center of the instrument, the other represents the vertical plane, or by a Cylinder, whose axis

is fixed perpendicularly at the center of the Instrument, and which is of such thickness, that to the eye placed at the center of the Instrument the whole...

[Margin: Solar dioptras.]

the whole disk of the Sun, so that it does not obstruct it, but lets the parts be clearly discerned as equal — the part above, say, and likewise the part below — and does not deceive. Most often, however, the Sun is observed either by a beam reflected from the Sun itself onto the instrument [aversô à Sole intuitu], or through a perpendicular cylinder set at the center of the erect instrument in a small board, marking the middle of the shadow; or else by admitting the bright image of the Sun through a small aperture and setting it likewise on a board fixed there. By marking that middle, or by capturing the bright image of the Sun in a proper arrangement of board, cylinder, plumb-line, needle, and so forth — and provided that the silken threads be subtle enough — one can make out as many seconds as there are threads on an instrument of 48 feet. And the finer the threads, the more accurately one is brought to the very point at the center; or by a line at whose extremity stands the other pinnule [pinnacidium].

[Margin: Examination of the Tyconic Quadrant]

But on an instrument whose radius is only 24 feet, this would require either pairs of seconds, or a board of 9 feet to locate them upon. For if one were to lay down so many seconds on a board, the multiplication of the error of the seconds in proportion to the smallness of the instrument would be very great. And it is of great necessity to us that a small shadow be cast on instruments with small shadow; for the bright image, by reason of the diverse disposition of the boards, deceives — to the extent that on great instruments the error introduced into the very measurement of a foramen [aperture], or of the shadow, is so great that the boundary of the bright image, or of the shadow, can scarcely be discerned uniformly. The first danger of error lies in the use of it: that the measurement comes out either too great by the middle of the bright image, or too small by its margin, by so great a space as the silken thread [filum sericum]; or that error is incurred in the seconds, to within a few minutes, or that error arises in proportion as above indicated.

[The text is dense and the column-edges are tight at the gutter; the foregoing renders the substance of §5's continuation: comparison of thread-, cylinder-, and aperture-dioptras and the magnification of subdivision error on a small instrument versus a large one.]

Further, on a quadrant a plumb-line, or a movable perpendicular, indicates a single point; and a movable sight [dioptra mobilis] indicates the degrees and minutes; and its place is fixed by the mobile dioptra. But since this very motion of itself, on a vertical plane, requires firmness of the thread — and so a rather thick thread, of a coarser sort than the simple silken thread — therefore some fallacy of a few seconds is introduced into the reckoning.

Finally, I warn that it is not enough to have set up the Quadrant or Sextant stable in its own situation, unless you are certain of the level of the pavement [pavimentum]; otherwise, even an instrument set up at rest will, when moved from its former situation, become a matter for investigation. Concerning the Rule [Regula], moreover, if the instrument's other extremity has been rightly placed, so that it stands at right angles both to the horizon and to the same vertical — this Tycho [Tycho Brahe] proved in his *Mechanica*. And we ourselves likewise, however great our industry, would frequently fall into errors of two, and even more, minutes.

—even if we should grant a parallax of 8 minutes.

[7]

Up to this point, the things we have said tend toward this: that we first recognize how probable is the fear of an error of one minute in Tychonic observations, as we shall confirm both by examples and by authorities in Book 4, chapter 4. From this I infer that astronomers who study with too little diligence are prone to incur a second error — beyond the first — when they neglect some second error, namely, the imperfection of our nature; and so, generally, into the scope, or the proposed quantity, they let a declination slip. Certainly in the Altitude of the Pole, and in observing the Equinoxes, and the Solstices, and the obliquity of the Ecliptic — which are the primary elements and, as it were, the foundations of Astronomy — no diligence ought to seem superfluous. Hence, all things considered, in the perfecting of the customary instruments we run no small risk regarding the **Gnomons** [Gnomones]: which some even of the ancients are known to have employed — not only in obelisks, but also elsewhere.

[Margin: The great Altitude of Gnomons]

For although the Gnomon is nothing other than a kind of style, of which Strabo speaks (Book 2). At Byzantium, indeed, the longest day is of fifteen equinoctial hours, with the Quadrant. But the Aestival [summer] Solstice — the Gnomon, by the shadow which it has at the ratio that nine has to forty-two — even though twenty-five was assigned to it; yet to a sufficiently great extent it is gathered, from

the parts which the more discerning, and commonly the more learned, used to require, by the division [diuisio]. Greater still was that one which Gassendi [Pierre Gassendi] attests (in his *Life of Tycho Brahe* [*Vita Claudii Fabricii Peireskii*]), and in the little work *On the proportion of the Gnomon to the Solstitial Shadow* employed: that of Pytheas of Marseilles [Pytheas Massiliensis], which obtained the Solstitial shadow there as 213. And likewise Gassendi, in the year 1636, made use, in the two said little works, for the Gnomon of the College of the Fathers of the Congregation of the Oratory at Marseilles — whose roof was higher than that of the Orgyia, about 9 feet, or 52 Parisian feet; albeit in altitude it was reduced to another shadow-reckoning, and at the same time was divided into parts about 90000, that is, exactly into the parts 89328. And of such a Solstitial shadow he found it there to be 21743.

[Margin: The Gnomon of Pytheas, and of Gassendi]

Before this, at Gratianopolis [Grenoble] he employed the *sphaeristerium* [vault] of the Comestabulis, whose roof for the Gnomon by his own style — at the circle of the Orgyia, or of the said parts — exactly indeed for the particular part 64690; but the summer shadow as 5410. By far the greatest was that Gnomon-Quadrant which Ulugh Beg [Ulug Beigh], grandson of the great Tamerlane [Timurlanus], employed about the year of the Lord 1437. For, as Johannes Gravius [John Greaves] asserts in his *Epistle on the Persian Tables of the Ulughbeigian* (set forth above) — to which is added that altitude of the summit of the vault of the Temple of Sancta Sophia [Hagia Sophia], whose hemisphere at Constantinople surpasses one hundred and eighty Roman feet. From these examples too I gathered, by the most subtle reckoning, the Altitude of the Pole of Bologna [Altitudo Poli Bononiensis], having weighed two Gnomons of the Temporals in this Bolognese Gymnasium [the University of Bologna]. Of these, Giovanni Domenico Cassini [Giovanni Domenico Cassini], at the Palace of Malatesta, set forth with me, in our College, in the new Temple of St. Lucia, the Gnomon not under the vault, but brought out under the open sky — those Gnomons which, with their observations, I set forth in Book 4 (which is *On the Fixed Stars*, chapter 4), with that observation made per a fixed star [per stellam] from the circumpolar absolute, with respect to its place. But by the Equinoxes, the Solstices, the Diameter of the Sun, and the maximum declination, we choose, from those stable Gnomons in the Temple of San Petronio in Italy — I will not say, of all Europe, the most outstanding — concerning which a separate discourse must be given.

[Margin: The Gnomons of Cassini, and the Authorities]

On the Gnomon in the Temple of San Petronio formerly raised by Egnazio Danti

[De Gnomone in Sancti Petronij Templo ab Egnatio Dante olim excitato]

As the controversy was growing concerning the Precession of the Equinoxes — which already for nearly ten whole days had been displacing the days that ought to precede, as established in the old Calendar — and as Gregory XIII, Supreme Pontiff, was earnestly soliciting the foremost astronomers to undertake the reform of the form of the Calendar: the Reverend Father Master Egnazio Danti [Egnazio Danti] of Perugia, of the Order of the Friars Preachers [Dominicans], in the renowned Bolognese Gymnasium [University of Bologna] Professor of Mathematics, and afterward Bishop — by the Authority of the most illustrious Senators, namely Count Giovanni Pepoli, perpetual Prefect of the Fabric of the Temple of San Petronio, and of his Colleagues — in the same Temple in the Year of Christ 1576, in the Month of April, erected a vast Gnomon, to demonstrate clearly, to those moderately learned, the anticipation of the Equinoxes and Solstices, and other matters; observations notable in Astronomy. And this Gnomon lasted right up to the Year 1656 — that is, for 80 years — of which arrangement, of whatever sort, we here append the following.

[6]

Diagram. A geometric figure illustrating the San Petronio gnomon as a vertical aperture-gnomon casting the Sun's image onto the pavement. At the upper left, a tall shaded vertical bar (the wall/column of the temple's south side) is marked **A** at its top. From **A** a sheaf of straight lines (the solar rays through the aperture) descends rightward to a long horizontal base line running from **B** (lower left) to **D** (lower right) — the meridian line laid in the pavement. Along the base, between the foot of the vertical bar and **D**, are marked the points **G, H, E, F** (clustered near the foot), then **I, M, C** toward the right end near **D**. Small ellipses are drawn on the base near **F, I/M**, and **C**, representing the elliptical solar images at different seasons. The vertical edge of the bar is **AB**; the meridian base is **BD**.

- **A** (top of vertical bar): top of the wall, where the aperture is
- **B** (foot of vertical bar): base of the wall on the meridian line
- **D** (far right end of base line): southern end of the meridian line
- **G, H, E, F** (clustered near foot of wall): points marking the summer-solstice solar image positions
- **I, M, C** (toward right of base): points marking equinoctial / winter-solstice solar image positions

AB, on the wall of the Southern side of the Temple, and on the left, was the chosen Altitude from the pavement to the vault, namely all the way to **BC**. A marble band [zona marmorea] was laid in the pavement of the Temple, whose straightness from the Meridian line **BD** declined westward toward the degrees, about 9; for if it had been constructed on the Meridian itself, Egnazio would not have fallen into an error in the pillars, or columns sustaining the vault, or would have come out somewhat shorter than the length of the Winter shadow, and yet he reckoned it could be on **BC** itself — judging from the hour of the Equinox. The reason, moreover, why the diameter of the aperture of Bologna is 5: in a metal plate of a thickness of half a digit, enclosed in the wall, and to the vault of the Temple itself. **IC** was the diameter of the elliptical Solar image, and as it were Elliptical, transmitted through the said aperture on the day of the Winter Solstice; and then **AC**, the radius of the lowest limb of the Sun; and **AI**, the radius of the highest limb. But there are also, by another disposition of the marble boards, four little marble tablets, noted with the marks of the remaining eight Signs of the Zodiac, one for each, so that one might know on what day the Sun would enter them. Suppose, therefore, the marble line **BC** to be parallel to the Horizon, and **AB** straight to the Horizon, and the quantity of each to be known: Egnazio believed, by the quantity, that in the triangle **BAC**, at right angles to **B**, he could know the angle **BAC**; by measuring the distance of the lowest limb of the Sun from the vertex of the triangle, and likewise **BI**, the distance of the highest limb; and so the Solar distance at the center, in the very Solstices of the Sun in the winter Solstices — not otherwise in the Equinoxes, and in the semidiameters of the Solar Solstice — observed by the quantities **BG**, **BH**, and in the Equinoxes, observed by **BE** and **BF**. And being known, the distance of the Equator from the vertex of Bologna, namely the Altitude of the Pole, one can know the hour of the Equinox, and of the Solstice, and the middle of the day.

[Margin: 6 LIBER I.]

But because the masons, not once in repairing the plate of the aperture **A**, removed it from its former place, or inclined it, and because the pavement frequently subsided near the side door **B**, and removed our measurement from the Horizontal plane — for that reason the measure of the altitude **AB**, and the length **BC**, and the rest, as Egnazio once handed down, or as others have handed down, do not exactly agree with our own, except that they differ by diverse diligence; nevertheless I am pleased to refer the Equinoctials from the point **B** to the center **Q** of the Ellipse, and to the center **V** of the Solstices, and the Winter ones from the point **B**, and the extreme **C**: the intervals of the remaining Signs are treated by the Appendix to Tome I of our *Almagestum Novum*, page 736. For three

sufficient observations, afterwards recounted, of the Elliptical Diameters we add — when we made the observation of the Sun's diameter in this Temple.

[Margin: Measurement of the Bolognese Gnomon of Egnazio]

[Table — dimensions of the San Petronio gnomon as measured by successive surveyors. Columns: the measurers (Dimensores); Bolognese feet (Pedes Bonon.); inches (Uncia). The first column also carries the segment label (AB, BV, BQ, BM, BC) at the left.]

Segment	Dimensores [Measurers]	Pedes Bonon. [Bolognese feet]	Uncia [inches]
AB	Egnazio Danti	67 (circiter [about])	—
AB	Nobis [By us]	65	9 $\frac{3}{4}$
BV	Co.[unt] Carlo Ant.[onio] Manzini	26	0
BV	Bartholomaeo Pronalio [Bartolomeo Pronalio]	25	6
BV	Nobis [By us]	25	6 [?][?]
BQ	Com.[es / Count] Manzino [Manzini]	65	1
BQ	Barthol. [omaeo] Pronalio	64	7
BQ	Nobis [By us]	64	7 $\frac{22}{?}$ [?]
BM	Com.[es] Manzino [Manzini]	167	7
BM	Nobis [By us]	166	8 $\frac{7}{?}$ [?]
BC	Egnazio Danti	170	—
BC	Nobis [By us]	169	2 $\frac{7}{?}$ [?]

Parsing notes: The fractional inch-denominators in the right column are partly obscured at the printed fraction-bar (small superscript/subscript type in the gutter-side column); flagged [?] where the denominator could not be resolved. The "Dimensores" column groups, per segment, the figures of Egnazio Danti, Count Carlo Antonio Manzini, Bartolomeo Pronalio, and Riccioli himself ("Nobis").

The whole **IC** was once for us 4 inches and 11 $\frac{1}{2}$; the aperture **A**, as I said, partly 3 [parts], partly 4 inches of a Bolognese foot, that is, 5: therefore, of whatever sort **AB** may be, of parts it would be 101. Of 100000 such parts the diameter of the aperture **A** was of parts 101, or roundly 100. And its finest part is always to be added: the length from the highest limb, and the date from the radius of the lowest limb, that it might have a length — which agrees with the radius per the center of the aperture **A**; and as we pass through, the imagination of the aperture meets there in indivisibles, and there they cut one another.

On the Gnomon in the Temple of San Petronio lately raised by Giovanni Domenico Cassini

[De Gnomone in S. Petronij Templo nuper à D. Io. Dominico Cassino excitato]

The Egnazian Gnomon, besides an intrinsic defect — in that it exceeded the Meridian by some degrees [from the true meridian] — wandered by two other defects of the times, having contracted them: namely, a disturbance of the plate of the aperture admitting the Sun, brought about by the masons' workmanship, and the wearing-down of the pavement by the trampling of feet, on account of which the angle **ABC**, otherwise right, had become acute. And although, in our time, it still supplied some notable uses, yet I often thought of having it restored, and of correcting it; and about this, with certain persons to whom the fabric of this Temple had not yet fully pertained, we sometimes consulted — among them, the most excellent Doctor Giovanni Domenico Cassini, a Genoese, for whom the Chair of Mathematics, and especially of Astronomy, in this Bolognese Gymnasium [University of Bologna] had been destined. Therefore, occasion being given that the aperture in the southern wall had to be removed, and the fabric of the rest restored — the work having been begun, and obtained from the most illustrious Marchese Facchinetti, Prefect of this fabric, and his Colleagues, or, by the assumptions [made], it being at the expense of the fabric itself — it was permitted to him to erect a new Gnomon on the very Meridian line, and at more exact ratios, which was sought after. But that the foundation of all great things might be a novelty, [and] solicitude for the success was a matter of consultation: D. Cassini, doubtful regarding the ratio of some things, with that subtle ratio undertaken in Astronomy with Geometrical certitude, which he promised he

could exhibit — I, among all the consulted and eyewitnesses, having been a witness before, and an observer betrothed to him as initiated, and, as regards the most subtle designation of the Meridian line, an assistant, and corroborator — being more certain of the man's outstanding talent, and of his prudent skill, I pronounced the business would proceed most excellently, and with outstanding success.

[Margin: 9 — and at the column: see the following figures]

Therefore that most ingenious man saw that the Meridian could be led well lengthwise, in such a manner that, by alternation, the columns might lie open all the way to the wall **AB**, [the columns] being Boreal [northern], and the aperture **AB**, in the very thickness of the Temple, parallel to the Horizon, having been arranged so that it could be located, from a certain center of the apparatus at the pavement — by a plumb-line, at length by titubation [wobbling], and at rest in the spinning — he noted, on the plane of the horizontal marble of the stone, the point **D**, over which perpendicularly hangs the center **C** of the aperture; and the Altitude **CD** by wooden brackets fitted together, and likewise let down from **C**, in **D**, and afterward...

[Margin: See the following figures]

[7]

Diagram. A geometric figure for the Cassinian San Petronio gnomon. At the upper left a small circle marked **S** (the Sun) with a point **P** beside/within it (the aperture-image point), from which dashed and solid rays descend rightward and downward. Below, a short horizontal segment carries the points **A**, **C**, **B** (the aperture region, with **C** the aperture center). The rays converge on a long horizontal base line at lower portion of the figure, marked with the points **D**, **M**, **H**, **O**, **K** and ending at **L**, **N**, **E** toward the right. The base line is the meridian line on the pavement; **DE** is the swept length, and the rays from **S/P** through the aperture strike the pavement at the seasonal image-points.

- **S** (small circle, upper left): the Sun
- **P** (point at upper left near **S**): the aperture/image point through which the ray passes
- **A**, **C**, **B** (short upper segment): the aperture, with **C** its center
- **D**, **M**, **H**, **O**, **K** (along base line): pavement points along the meridian (seasonal solar-image positions)

- L, N, E (right end of base): the far (winter) end of the meridian line / extreme image positions

afterward stretched out over the horizontal plane, [the altitude **CD**] was measured, and the ancient Roman feet were found again (such as Villalpando exhibits in Ezekiel) to be $95 \frac{3}{4}$; but the line **DE** [was] of 238 [parts] [?/?]: yet, the more expediently to serve the finding of angles, since the Radius **CD** is 100000, of such [parts] it makes the Tangent **DE** of parts 251100; and of the aperture the Diameter **AB** of parts 100. The angle **CDE**, moreover, is right, since the channel of the water-level lies along the line **DE**, by the level [ad libellam]; and so, the experiment having been more often repeated, by equidistances on both sides, the marble [edges] being bound fast, provided that the line **DE**, at the said equidistance, can endure for very many years. Furthermore, the elliptical Solar image, on the Equinoctial days, occupies a longitude in three Roman feet — the greater [feet] subtending — and in the Sky about 32 minutes; and so, degree 1 occupies feet 6 very nearly: at such a time, therefore, if in the determination of the boundaries of the Ellipse the keenness of the knife should hit upon any errors, it would surely come out imperceptible, and far smaller than in the maximum Tyconic Quadrant, whose degree 1 occupied about 1 inch of a Roman foot.

[Margin: 12]

The use of the Gnomon will become clearer by example, supposing it demonstrated (Book 1 of the *Almagestum Novum*, chapter 5) with Nonius [Pedro Nunes] and Snellius [Willebrord Snellius], that the Sun's Rays, propagated to the earth from that very point of his, [namely] **SH** and **SO**, are sensibly parallel; and (from the things to be demonstrated in Book 4, chapter 4) the Altitude of the Pole of Bologna in the Temple of San Petronio to be degrees 44, 30 minutes, 20 seconds; and [the Altitude] of the Equator [to be] degrees 45, 29 minutes, 40 seconds.

[Margin: On the discrepancy of the Solar Diameters; and of the Declinations; and of the Equinoxes]

SO LET THIS BE AN EXAMPLE

[SIT ERGO EXEMPLVM]

In the year 1656, on the 21st day of March, at midday, in the presence of expert witnesses, the distance was observed from the point **D** of the plumb-line to the boundary **H** of the Sun's Ellipse — that is, the Tangent **DH** — of parts 95225; and

to the other extreme **L**, the Tangent **DL**, 97098. But the semi-aperture **AC** [was] of parts 50, and likewise **CB**; therefore, by the parallelism of the Rays **SH** and **SO**, **HO** was as parallel as **KL**, namely parallel to **ACB** itself, of parts 50. Add, therefore, **HO** — that is, parts 50 — to the Tangent **DH**; it was **DO** 95275. The Tangent of the Angle **DCO**, [is] degrees 43, 36 minutes, 50 seconds [gr. 43. 36'. 50"], which **S** of the higher limb of the Sun is the distance from the vertex. Contrariwise, [take] the Tangent **DL**, deduct **KL**, of parts 50; there remains **DK** 97048. The Tangent of the Angle **DCK** [is] degrees 44, 30 minutes [gr. 44. 30'.], measuring the distance of the lower limb [of the Sun] from the vertex. The difference [is] in fact 53 minutes 40 seconds [53'. 40"], which gives the apparent Solar diameter **IS**, of which the half [is] 15 minutes 50 seconds [15'. 50"]; the added degrees 43, 30 minutes 50 seconds [43. 30'. 50"], give the distance of the center **P** of the Sun from the vertex degrees 43, 52 minutes 40 seconds [43. 52'. 40"]; to which, if you add a refraction of seconds per our theses, [namely] 5 seconds [5"], and at last subtract the parallax [parallaxis] 1 minute, there remains the corrected distance of the center of the Sun from the vertex degrees 43, 52 minutes 34 seconds [43. 52'. 34"]. And this distance subtracted from the vertex, [there is] left the Solar Declination [Declinatio Solis] toward the North, degrees 37, 46 minutes [37. 46'.]; to which, in the Table of Declinations, according to our obliquity of degrees 23, 30 minutes 20 seconds [23. 30'. 20"], there correspond degrees 23, 14 minutes 43 seconds of Aries [Arietis gr. 23. 14'. 43"]. But the Sun (as it was in the Equinox) [was reckoned] by collecting the Declinations of the single minutes, the single hours of the false Equinox [aequinocetium falsum] [at] hours 17 minutes 46 [horis 17'. m. 46.] before the midday of the 21st Day of March. Likewise one must proceed in the other observations of the Equinoxes, which we press upon in the more recent chapter following.

[Margin: Observation of the Solar Diameters; and of the Declinations; and of the Equinoxes]

CHAPTER III

[CAPVT III]

Observations of the Equinoxes, or near the Equinoxes, from the Year 162 before Christ, up to the Year of Christ 1656

[Aequinoctiorum Obseruationes, vel prope Aequinoctia ab Anno 162. ante Christum, vsqz ad Annum Christi 1656]

1. Ptolemy [Ptolemy] (*Almagest* I.3, chapter 3) reports 9 Equinoxes, related to Hipparchus [Hipparchus] (in the Book *On the magnitude of the Year*), and

observed by himself at Alexandria from the Armillae Aequinoctiales [equinoctial armillary rings], and likewise (chapters 6 and 8) he adds 3 Equinoxes observed by himself. But Hipparchus...

assigns these to the Years of the Third Period of Callippus [Periodus Callippi]. Ptolemy, moreover, indicates the years of Alexander for Hipparchus, and the years respectively for these, and likewise for Nabonassar [Nabonassar], for Adrian [Hadrian], and for Antoninus. We, from the Reformed Chronology, add in the subjoined Table all these years, with one cumulative sum before [each], or after; the Epoch of Christ being employed, and the days of the Julian Months responding to the Egyptian, or to their Intercalary [days].

[Table — Equinox observations with their dates reckoned in several era-systems. Spanning the page; the table continues below. Columns: Aequinoctia (equinox type / observer group); years of the III Period of Callippus; years of Nabonassar; year of Christ; Months & Days, Egyptian & Roman; parts of the Day at Alexandria. The left margin groups the rows under the observer headings "Autumn. Hipparchi" (Autumnal, of Hipparchus), "Verna" (Vernal), and "Ptolemaei" (of Ptolemy).]

Aequinoctia	ANNI	ANNI	Anno Christi [Year of Christ]	Menses & Dies Aegyptij & Romani [Months & Days, Egyptian & Roman]	
	LABENTES — III Per[iodi] Callip[pi]	LABENTE S — Nabonasari		Aegyptij & Roman]	Diei partes Alexandriae [Parts of the day at Alexandria]
Autumn. Hipparchi [Autumnal, of Hipparchus]	1 — 17	162	586	162	Messori 30. Sept. 27
	2 — 20	165	589	159	1 Intercal. Sept. 27

	ANNI LABENT ES — III	ANNI LABENTE S —	Anno Christi [Year of Christ]	Menses & Dies Aegyptij & Romani [Months & Days, Egyptian & Roman]	Diei partes Alexandr iae [Parts of the day at Alexandr ia]
Aequinoc tia	3 — 21	166	590	158	1 Intercal. Sept. 27
	4 — 32	177	601	147	1 Intercal. Sept. 26
	5 — 33	178	602	146	4 Intercal. Sept. 27
	6 — 36	181	605	143	4 Intercal. Sept. 26
Verna [Vernal]	7 — 32	178	602	146	Mechir 27. Mart. 24
	8 — 43	189	613	135	Mechir 29. Mart. 23
	9 — 50	196	620	128	Phame[n oth] 1. Mart. 23
		Adriani [of Hadrian] / Alexandr i [of	Nabo. nass.	Christi	

	ANNI LABENT ES — III	ANNI LABENTE S —	Anno Christi [Year of Christ]	Menses & Dies Aegyptij & Romani [Months & Days, Egyptian & Roman]	Diei partes Alexandr iae [Parts of the day at Alexandr ia]
Aequinoc tia	Per[iodi] Callip[pi]	Nabonas sari			
		Alexande r]			
Ptolema ei [of Ptolemy]	1 — 17 (Antonini [of Antoninu s])	456	880	132	Athyr 7. Sept. 25
	2 — 3	463	887	139	Athyr 9. Sept. 26
	3 — 3	463	887	140	Pachon 7. Mart. 22

Parsing notes: This table is laid out in narrow vertical rules and packs two parallel era-systems (Callippus-Period years and Nabonassar years) plus the Year-of-Christ column. For the "Autumn. Hipparchi" and "Verna" blocks the leftmost numeral pair is the observation index (1–9) followed by the year in the Third Period of Callippus; the "Anno Christi" column gives years *before* Christ (the chronology runs backward from 162 BC). For the "Ptolemaei" block the era-heading switches to Adriani/Alexandri/Nabonassar; the row "1 — 17 / Antonini" links Antoninus's reign. Several values verified against Ptolemy's *Almagest* equinox list. The day-parts column gives the time of day (Evening/Morning/Midday/Midnight) at Alexandria. Table continues into the following text/page.

2. Furthermore Hipparchus — a lover of truth above all [φιλαλήθης [Greek: philalēthēs, "truth-loving"]], faithfully relating to Ptolemy — confessed that the Autumnal [equinoxes] of [observations] 2, 4, and 6 appeared by a quarter of a day [quadrante diei] sooner than they ought; and that he had observed, by the magnitude of the year, an error of $365 \frac{1}{4}$ and $\frac{1}{6}$ — which was for the Vernal: the

Armillæ appeared twice, equally illuminated on both sides, namely in the morning, and again at the 5th hour of the day, near midday. Which defect was attributed to the Armilla, since the rising of the Sun could be represented higher than it really is, that is, [the Sun] ought to be said to rise. These Equinoxes — all of them, and some others — Christmannus [Christmann] expends in Alfraganus [al-Farghānī] (page 328); Mulerius [Muller / Nicolaus Mulerius] in the Frisian tables (figure 86); Longomontanus [Longomontanus] (*Astronomia Danica* I.1, Theoretical chapter 1); Petavius [Denis Pétau] (Book 4, *On the doctrine of times*, chapter 19, and chapter 2); Lansbergius [Philip Lansberge] (in the *Thesaurus*, observed, class 2); Bullialdus [Ismaël Boulliau] (*Astronomia Philolaica*, chapter 2); and Franciscus Levera [Francesco Levera] (*Astronomy*, chapter 5). To me, now, the Chronological errors of certain men around the said Equinoxes are evident: the Fourth, indeed, [the] Autumnal — they note [it at] the Year of Alexander 178. Albategnius [al-Battānī] (chapter 27); Regiomontanus [Regiomontanus] (in the *Epitome* of the *Almagest* I.2); and Longomontanus, above, on account of the version of [the era of] Trapezus[?]....

[Margin: Chronological errors of some men]

the [era of] Trapezus[?] must be read; that is, for 178, [the] year 177. Christmann, above, p. 341, and Boulliau, above, in his account of the Autumnal Equinoxes, place it likewise as 177; and so does Lansberge, above, Book 3, ch. 13. As for me, in Book 3, ch. 14, I too maintain it should be year 177, and indeed I have demonstrated this. By contrast, the *Alphonsine Tables* place it in Year of Christ 147, where Pétau too errs in saying it had thus far been the third year of the [Callippic] Period — that is, year 1 — whereas it was in fact year 31. Pétau likewise, Book 4, ch. 26, assigns this same equinox to [Year of] Christ 147. He notes correctly that it began in [Julian] Period 4567, namely Year of Christ 147, on September 27, at the start of Feria 1 [Sunday]. Then he immediately adds: "*In this year, Thoth 1 of [the era of] Nabonassar 602 begins September 29. Therefore Day 31 of September; not yet had it entered Nabonassar 602. The slip of the pen is to be excused, or the failure of memory.*" But page 27 of Pétau is faulty: "*This equinox observed by Hipparchus is designated in the Year from the death of Alexander 178, [Year of] Nabonassar 602, [Julian] Period 4567.*" This Year from [the death of] Christ 147 — that is, the Day of the Equinox, September 27 — Nabonassar 178 had not yet begun, nor Alexander 178; and besides, [Year of] Christ 147 began only two days after [the equinox]. But it is certain that Ptolemy, in Book 3, ch. 8, and Censorinus, ch. 8, reckon from the first day of Thoth the years both of Alexander the Great and of Nabonassar.

[Margin: Errors of certain men: Longomontanus, p. 4; Levera, p. 4.]

Moreover, Longomontanus errs, as also does Levera, in assigning all the Autumnal Equinoxes of Hipparchus to the year following the one to which they truly belong, and likewise [a year off] in [the era of] Nabonassar. Levera, furthermore, has no scruple in calling them by their relation to Ptolemy, which Hipparchus had been [using], and erroneously names them; for in the three last Autumnal [equinoxes] of Hipparchus he substitutes 31 for [the year] of the Callippic Period; and for 31, he substitutes 32; and for year 31 — what is most absurd — he gives 36; and year 33, while pursuing his own commentaries of years, [he follows] the epilogisms. The cause or occasion of the error was the nearness of the year of the death of Alexander — or rather it was Ptolemy's subjection, when he followed Ptolemy and Hipparchus, because they use the first day of Thoth, the Egyptian month, the year of the first day of Thoth of [the era of] Nabonassar, and the beginning of [the era of] Alexander, which Christmann had supposed in al-Farghānī, p. 305, but afterward retracted, pp. 329 and 338. He retracts this falsely: false [too] that Hipparchus took the beginning of the Callippic years from a preceding Summer Solstice, when they were beginning the year of the Olympiad; and likewise Ptolemy — let alone that Hipparchus should reckon the beginning of the Callippic exordium from the [Year of] the Prutenic [Tables], as Reinhold wishes, before [chapter] 4; Boulliau and Pétau, above, and these clearly contradict Ptolemy, Book 3, ch. 1.

[Margin: Year 1 of the Callippic Period, that is, its terminus; for thus it would be held in Greek; therefore around the Summer Solstice of the Callippic year 51, when Alexander died.]

There is another cause of error in marking the Equinoxes a day too early, which was the false supposition presupposed by Levera, p. 4. He brings out, p. 10, the page 228 of the year 1, the first year from the death of Alexander, both Lucidus and Saliano assign as before [Year of] Christ 321. He adduces, for Reinhold, who nevertheless, before [chapter] 6, expressly says: "*If the first day of Thoth, the year 314 before Christ, that is, the first year from the death of Alexander:*" The same Levera, p. 227, makes the first year of the Olympiad agree with Saliano's 775 before Christ, but on p. 228 he makes the first [year] of Nabonassar 747; whereas in order that they cohere with Saliano (yet erring), he would have to make it 746; and on pp. 214 and 235, the year conceived and the [year of the] Nativity of Christ — in which he ought to make Christ consequently agree with Saliano — he places as 44. He misreckons with Saliano, both, p. 20, 102, and 117, [perpetrating] false Chronology; he draws it from himself and incurs imprudently into another false

[chronology]. For he supposes the opinion of Saliano and of those who assign the beginning of the years of the Olympiad, Nabonassar, and Alexander to one and the same year to be false — which in our *Chronologia Reformata* we have demonstrated from the Eclipses noted among the Historians, together with a series of Consuls and of Censorinus (whom the Chronologists acknowledge as their master) [as] authority. For...

[Margin: Saliano's faulty Chronology.]

for example, [the testimony] of the Consular *Fasti*, which are corrupt in the first Julian year and right up to Trajan, and certainly with the consensus of all, it is agreed that they begin from Julian year 90. He maintains the Consuls were M. Vinicius and Statilius Corvinus; but in these same Consuls there happened, on the day of the birth of Claudius the Emperor — that is, on the Kalends of August — an Eclipse of the Sun, as Suetonius and Dio relate. But that Eclipse [fell] on the Kalends of August: in no other year of the Era of Christ does any Astronomical Table show it, except by 45 [years] subtracted; for from the Kalends of January in the Julian year 45 — complete — and from the 90th [year] there follows the beginning of the Era of Christ, which I maintain to be in the Julian year 45, as Censorinus too, ch. 8, asserts was written by him in the Book *On the Day of Birth* [*De Die Natali*], to have been [Year of] Christ 238.

[Margin: Nabonassar and Alexander, the true Eras.]

This same author, in that very year, says the year of Nabonassar 986 there began, and Alexander 562, so that each at noon, by exactly counting backward through the individual years in our canon — for the years are expanded — the first year of Nabonassar began February 26, year 747 before the Epoch of Christ, and the first [year] of Alexander on November 12, in the year before Christ 324, together with [year of] Nabonassar 425, since the very same kind of years runs; and by counting backward in the same way Ptolemy [in] Book 3, ch. 8, computes — what he says of Nabonassar — at the beginning of Alexander, that from the death of Alexander he reckons completed years 424. Therefore the first year from the death of Alexander began with [year of] Nabonassar 425. At last, from Censorinus above it is established, [in] the Julian year 283 — this [year], and that we show from the Eclipses, [Year of] Christ 238 — around the Summer Solstice the year of the Olympiad 776 began. The first Olympiad therefore [began] around the Summer Solstice [of the] Olympiad 776, and the year 777 [began]; and the first [day] of the Olympiad before Christ 776, around the Summer Solstice [at] the New Moon, current and before Christ 776. The first Olympiad began around the Summer Solstice, year before Christ 224. Since Alexander died, the [first] year

before [Year of] Christ 324 was the Olympiad 114. Arrianus, Book 7, and Diodorus, Book 17, indeed profess this, as Josephus too [does in] Book 1, *Against Apion*; Eusebius, however, [in] Book 8 *On the Preparation of the Gospel*, ch. 2, asserts that Alexander died ἐν ἀρχῇ τῆς ἑκατοστῆς καὶ τεσσαρεσκαίδεκάτης Ὀλυμπιάδος [Greek: "in the beginning of the hundred-and-fourteenth Olympiad"]; that is, in the beginning of the first year of the hundred-and-fourteenth Olympiad. Hence it is confirmed that [Alexander] died in the year before Christ 324; and Levera reckoned this badly, not 323; nor did Lucidus and Saliano feel correctly.

[Margin: Olympiads, the true Era.]

[Section] 5. Now from Ptolemy, Book 3, ch. 1, and Aristarchus, defining the beginning of [year] 10 of the first Callippic Period; Aristarchus [places] the Summer Solstice in [year] 44 [before] Alexander; therefore the Callippic Period 50, before [year] 44, is absolute; and the [year] before Alexander 44 began at the Summer Solstice [of] the Callippic [Period] 51, since [year] before Alexander 45 [began] with [year of] Nabonassar 469; nor did it begin except on the Kalends following [in] November, in the year before Christ 280: the period of the Callippic years was 76; by the witnesses Geminus, Ptolemy, and Censorinus; therefore, at the Summer Solstice it began the first Callippic Period, the year before Christ 330. And [year] 178 before Christ — and 274 from the second [period] — and the year 17 began, in the year before Christ 162, current [and] before Christ 162: now the year of Alexander 163, with [year of] Nabonassar 587, did not begin except on October 3, in the very year of the Equinox; the first [equinox] of Hipparchus, day 27 September, pertains to Alexander 162. [Year of] Nabonassar 586, and so to Christ 162; and of the rest of the Autumnal Equinoxes of Hipparchus, which few authors have noted, except this Alexandrian beginning (which Longomontanus, and as to the three first, Levera note).

[Margin: The true Chronology of the Callippic years.]

Albategnius' Equinox [Aequinoctium Albatenij]

[Section] 6. [al-Battānī] Albategnius, ch. 27, *On the Science of the Stars* [*De scientia stellarum*], says that the Autumnal Equinox observed by him [in] the year 1206 from the death of Alexander, on day 19 of the month Elul (that is, [the month] Pachon), day 8 — that is, the 19th of September — before sunrise by about 4 hours 45 minutes; and within this [interval] the Ptolemaic Autumnal [Equinox] elapsed. Egyptian years 743 elapsed, days 178, 17 hours, and 36 minutes about; and therefore, in so great a time the Chords for finding the Equinox so far surpass it by 7, 8, [and] 12 days. Behold, therefore, the synopsis:

[Margin: The true Era of the Olympiads.]

Table. Boxed table headed *Aequinoctium Autumnale* ("Autumnal Equinox"), giving al-Battānī's observation:

Year from death of Alexande r [Ann. à morte Alexandr i]	Year of Christ [Anno Christi]	Month [Mensis]	[Pachon]	Reduced Hour p.m. [Aractâ Horâ p.m.]
1206	882	Septemb. 19	Pachon 8	13 15'

Remember that al-Battānī, in this same ch. 27, supposes the Reduced [hour] more easterly than Alexandria by 40 minutes of one hour. Copernicus, Book 3, ch. 13, and Longomontanus, above, in his commentary *On the Sun*, have seen that the anticipation of the Equinox is least, and so they suspect that al-Battānī had a flawed observation, the manner of which al-Battānī does not disclose. And yet Lansberge, in his *Thesaurus*, pp. 3 and 50, calls this observation *especially distinguished*, and [says] the Reduced [hour] was 13, 14, 15; he prefers the Reduced [hour] to be 13, 14, 15 for himself, and al-Battānī contradicts him; because the very moment of this Equinox is obtained for this same time, [reckoning] from the manner before [given] in the Prutenic, Danish, and Rudolphine [Tables], so that the Reduced [hour] gathers to 23, 40 after noon in the Prutenic [Tables], but in the Rudolphine [Tables] the hour after the following noon [is] 3, 55, which he calls intolerable errors of parallaxes, hour 2, 21; that is, [he places it] after noon for the day 18 September, at hour 14, 21; and badly does Scaliger add Year 884 — which he passes over with Christ 883 — contrary to which see Pétau, Book 4, ch. 6, *On the Doctrine of Times* [*De doctrina temporum*].

[Margin: Lansberge notes this. Joseph Scaliger's faulty Chronology.]

Regiomontanus' Equinoxes [Aequinoctia Io. Regiomontani]

[Section] 14. In the *Little Book of Observations* [*Libellus observationum*] of [Regiomontanus] and of Walther we have two pairs each, for both Equinoxes, observations of the Sun's distances from the vertex at Nuremberg, the Altitude of the Pole of which by Tycho's reckoning [is given in] Tomus I of his

Progymnasmata, p. 48, and [in] our *Geographia Reformata*, p. 49, 26. For by the Ptolemaic [method of] Rules, or Parallactic [instrument], the elders [observed] foot by foot [in] the year 1473, March, on day 11, at the meridian, the Solar Distance from the vertex [was] 83600 hundredth-parts, such as the Radius — that is, the length of either Rule — represents [as] a whole sine [of] 100000 semichords; in the *Tables of Sines* it gives the arc [of] Degree 49, 24, 17; which, doubled, makes the arc 49, 24, 54 — namely [the] apparent distance of the Sun from the vertex after our parallax in such an altitude, not exceeding the second of parallax by 10; that is, the apparent distance of the Sun from the vertex [is] degree 49, 24, 44; which, subtracted from the distance of the Equator from the vertex [of] Degree 49, 26, leaves the Northern declination of the Sun [of] 1 minute, 16; since therefore the Sun was in the sign of the Northern signs, the Equinox was thus made now within the same hours, and the minutes before noon, by however many minutes [the Sun] declined northward from the meridian: Therefore the Equinox occurred at hour 21, 44, after noon of the preceding day 10. By this method and of the same Year 1473, we have gathered the Autumnal Equinox to have been made on day 13 September, at hour 17, 30 after noon at Nuremberg; look upon the synopsis of each in the subjoined table.

Table. Boxed table headed *Aequinoctia Regiomontani in Horis post merid. Norimbergæ* ("Regiomontanus' Equinoxes, in hours after noon at Nuremberg"):

Year [Anno]	Christ [Christi]	At meridian [In meridie]	True Distance ☉ [Dist. ☉ vera]	True Declinati on ☉ [Decl. ☉ vera]	Equinox [Aequino ctium]
	M. D.	Chorda	G. ' "	' "	D. H. '
1473	Mart. 11	83600	49 24 44	1 16 B	10 22 45
1473	Sept. 14	83810	49 32 30	6 30 A	13 17 30

Parsing notes: The declination column carries B (Borealis, "northern") / A (Australis, "southern") markers; in the spring observation the declination is northern (B), in the autumn observation southern (A). The "Equinox" column gives Day, Hour, Minute after noon at Nuremberg.

if you choose the apparent distance of the Sun from the vertex as observed, add to the true [distance] the second [of arc], 10, [for] our Parallax.

Walther's Equinoxes [Aequinoctia Vualtheriana]

[Section] 15. Indeed, I should wrongly deserve [criticism] of Bernhard Walther, who [was] of the highest merit in Astronomy up to his old age, observing now this and now that, then around the days of the Equinoxes, by the Parallaxic Rules, the distances of the Sun from the vertex at Nuremberg by Chords, sometimes adding those, which [he observed] in clear light, and with diligence; in which [matters] one may have confidence that he made [his observations] correctly from himself, if he did not refer them hither, which [observations] of the Equinox he made; particularly when I have seen them [were] undeservedly neglected by the Astronomers of a later age, and so I have selected Tycho himself. The method by which from such Chords the time of the Equinox is brought out is the same as number 14. So, that you may enter the following Catalogue, and [to find] the Distances of the Sun from the vertex add the second 10 of our [Parallax] in your parallaxes, you will have the observed distance of the Sun from the vertex at Nuremberg, or that arc which by the doubled Sine responds for each of Walther's Chords.

Table. Large boxed table headed *Aequinoctia Vualtheri in Horis post merid. Norimbergæ* ("Walther's Equinoxes, in hours after noon at Nuremberg"). The "Order" [Ordo] column is the row index; the observation-quality notes appear beneath each date.

Order [Ordo]	Time of observati on from Christ [Tempus observati onis à Christo nato] / Yr. Mo. D. [Ann. Mens. D.] / quality note	Reduced to 100000 [Ad Radium 100000] (Chord) [Chorda]	True Distance ☉ from vertex [Distanti a ☉ vera à vertice] G. ' "	True Declinati on ☉ [Declinat io ☉ vera] ' "	Apparent Equinox [Aequino ctium apparens] D. H. '
16	1477 Martt. 11 — <i>Obs.</i>	83675	49 27 46	1 46 A	11 1 45

Order [Ordo]	Time of observati on from Christ [Tempus observati onis à Christo nato] / Yr. Mo. D. [Ann. Mens. D.] / quality note	Reduced to 100000 [Ad Radium 100000] (Chord) [Chorda]	True Distance ☉ from vertex [Distanti a ☉ vera à vertice] G. ' ''	True Declinati on ☉ [Declinat io ☉ vera] ' ''	Apparent Equinox [Aequino ctium apparens] D. H. '
	<i>certa</i>				
17	1478 Martt. 11 —	83820	49 32 58	6 58 A	11 7 0
	<i>Diligens</i>				
18	1479 Sept. 14 —	83490	49 20 40	6 40 B	14 6 40
	<i>Diligens</i>				
19	1480 Sept. 14	84600	49 24 44	1 14 B	14 14 0
20	1488 Mart. 10 — <i>Radij debiles</i>	84090	49 45 23	17 23 A	10 17 22
21	1488 Sept. 14 — <i>Clara, & diligens</i>	84067	49 42 34	16 34 A	13 7 26
22	1489 Mart. 11 — <i>Clara</i>	83625	49 25 26	0 34 B	10 23 26

Order [Ordo]	Time of observati on from Christ [Tempus observati onis à Christo nato] / Yr. Mo. D. [Ann. Mens. D.] / quality note	Reduced to 100000 [Ad Radium 100000] (Chord) [Chorda]	True Distance ☉ from vertex [Distanti a ☉ vera à vertice] G. ' "	True Declinati on ☉ [Declinat io ☉ vera] ' "	Apparent Equinox [Aequino ctium apparens] D. H. '
	<i>diligens</i>				
	1491 Mart. 11 — <i>Non valdè, sed sat clara</i>	83940	49 37 42	11 42 A	11 41 [?]
23	1491 Mart. 11 — <i>Satis clara</i>	83325	49 34 26	8 26 A	8 26
24	1491 Sept. 14 — <i>Satis clara</i>	83680	49 28 0	2 0 A	13 22 0
25	1493 Sept. 14 — <i>Clara eodê instanti</i>	83934	49 36 28	10 28 A	13 13 32
26	1496 Mart. 11 — <i>Clar. sat diligens</i>	83785	49 32 0	6 0 A	13 13 8

Order [Ordo]	Time of observati on from Christ [Tempus observati onis à Christo nato] / Yr. Mo. D. [Ann. Mens. D.] / quality note	Reduced to 100000 [Ad Radium 100000] (Chord) [Chorda]	True Distance ☉ from vertex [Distanti a ☉ vera à vertice] G. ' "	True Declinati on ☉ [Declinat io ☉ vera] ' "	Apparent Equinox [Aequino ctium apparens] D. H. '
27	1496 Sept. 14 — <i>Sat clara diligens valdè</i>	84125	49 44 39	18 39 A	13 5 21
28	1501 Mart. 11 — <i>Clara certissim a</i>	84234	49 50 0	33 0 A	11 9 0
29	1501 Sept. 14 — <i>Praeclara certissim a</i>	83990	49 39 32	13 32 A	13 10 28
30	1504 Mart. 12 — <i>Clara præcerta confide</i>	82750	48 52 43	33 17 A	13 9 17

Parsing notes: Two rows are dated 1491 Mart. 11 — the row carrying the *Non valdè, sed sat clara* note appears un-numbered (no Ordo), squeezed between Ordo 22 and Ordo 23, suggesting a duplicated/rejected observation; transcribed as printed. The declination column carries A (Australis, "southern") / B (Borealis, "northern") markers. Several entries in the apparent-Equinox column were tight in the gutter; the Ordo-22 extra-row Equinox minute is flagged [?].

[Margin: Tycho's use of these observations.]

At Tycho, Tomus 1 of his *Progymnasmata*, p. 51, [and in] all the others, which he had seen, he sets before [us his] observations; but to us, in this order, the marginal [note] is the twentieth, and thence he gathered the Equinox to be made [on] day Martii [March] 10, hour 15, 40, after noon at Nuremberg.

But if I had used the Tychonic parallax in that position [of] 2, 18, it would have come out everywhere, the true distance from the vertex [being] degree 44, 41, 15, and the Southern declination [being] 15, 15; and so at that hour the Equinox [fell at] 15, 15. I judge, however, that it pleased Tycho [to use] 10 [for] the observed Radius, as Walther wished; because in the year 1488 the distance was off by 100 [years], and [there was] an integer of reckoning for [the determination] of his Vernal Equinox observation made in the year 1588, just as I am about to compare an observation made [at] the Autumnal Equinox of the year 1588. The Autumnal [Equinox] of Walther I have chosen, which in our order is at [number] 21, that is, the Year 1488; from which, p. 53, I gather the Equinox at Nuremberg to have been made [on] September 13, hour 7, 20 after noon. He differs from our reckoning by 2, and more, by hours on account of an excessive parallax of 2, 18, [which Tycho] assumed, because nevertheless in his observations [there is], in a certain manner, a compensation, in the order for gathering hence the quantity of the Year, on which afterward [more]. Therefore Longomontanus, trusting Tycho, commends the examination of these two observations in his own reckoning.

The Gelalaeian Equinox of the Persians [Aequinoctium Gelalaeum Persarum]

[Section] 31. Joseph Scaliger, Book 4 *On the Emendation of Times* [*De emendatione Temporum*], p. 304, relates that Alp Arslan, Sultan of Khorasan or Mesopotamia, by edict convoked eight of the most distinguished men in [his] kingdom, among whom were Omar and Avicenna [Ibn Sīnā], or Avicenna, to constitute the [Persian] Year [as] an Annus [for the] Equinox; and these, in the Year of the Christian Dionysian Era 1079, namely [the year of the] Hegira 471, and at [the city of] Sezdagird 448, observed the Vernal Equinox [on] day 14, Feria 5 [Thursday],

that is, day 18 of the month of the Persians of Arabia, [namely] Ramadan; [in the] Cycle of the Sun 12, the Moon 16, hour 2, 33[?] after noon. He who [was] called Oromazda [Ahura Mazda?], a Persian of the Neuri[?], Esfehani[?]; this [is] the New Moon of the Equinox of the Imperial Persians. Boulliau also, Book 2, ch. 2, [drawing] from the MS. of the Royal Library of Georgius [George], Chrysococca, asserts that the Persian Tables show the true Vernal Equinox [in] the Year of Christ 1079, under the meridian of Aleppo, by hour 1, 26, distant toward the rising [point] by Martii [March] day 14, hour 11, 4; which Vranburgus [Tycho/Uraniborg] thinks; and so [Boulliau] confesses [it is] his own, that is, [the] Philolaic [Tables exhibit it the] hour 11, 27, exceeding the [Philolaic] by hour 15. As for the true [equinox], Longomontanus in his commentary *On the Sun* thinks the Equinox is not accepted from a corrected [reckoning], unless Scaliger wishes [it] thus constituted from the Annual quantity, which al-Battānī repeats, the reckoning of years had [been] $197 \frac{1}{3}$ (thus correcting the Typographical error in Longomontanus, who has $193 \frac{1}{3}$); he [places] the Albatenian Equinox [in] the Year 882, up to the Persian [Equinox] of the Year 1079, [which] flowed [from it]; on which point, the matter being pending, we cannot as yet make a firm foundation in such an Equinox.

The Equinoxes of Cardinal Cusanus and of Prophatius [Cardinalis Cusani, & Prophatij Aequinoctia]

[Section] 32. Nicolaus de Cusa [Nicholas of Cusa], Cardinal, in his treatise *On the Reparation of the Calendar* [*De reparatione Kalendarij*], affirms [in] the Year of Christ 1290 the observation of some [men], whom he does not name, [to have] entered the Sun into [the sign of Aries], and so by the observation it is established by days 6, 5, 49, 16. Reinhold too, in his *Theorica* of the eighth sphere, fol. 168, has these [words]: "*The Alphonsine [reckoning], and so by name reprehending Petrus de Alliaco [Pierre d'Ailly], because [their] water [reckoning] and the quantity of the year constitute [it], with both the ancient and recent observations manifestly conflict.*" For he relates that in the Year of Christ 1290, on day 13 of the month March, the ingress of the Sun into Aries [occurred at] 16 hours, after the Alphonsine reckoning had been made [at] 12 hours; which relation does not agree with Cusanus' [observation], because those 16 hours he both refers to and underestimates, [the difference] before the preceding 12 hours, per Boulliau, Book 3, [on] his Alphonsine Equinox: the Vernal Equinox of the Year 1290 in the Frisian meridian, by the Alphonsine reckoning, was [at] Martii [March] 12, hour 6, 4, hour 6, 59 after noon: but if the observation [were] of the ingress was [at]

hour 16 after noon of day 13, the reckoning differs from the observation by 33[?] hours.

[Margin: Joseph Scaliger's faulty Chronology.]

which is inconsistent [as reckoned] from the observation of day 13. Therefore, by the Roman manner — that is, the day on which the observation was made — the Equinox is shown [at] hour 8 after noon; that is, in the Astronomical manner, hour 16 after the preceding noon. The same Boulliau, however, draws this sense up to now, repeating the words of Cardinal Cusanus from below: "*In the Year of the Lord 1290, on day 13 March, the Sun is found to enter into Aries after hour 16.*" But Cusanus does not say the observation was made by him, or [that it was made] in Frisia, nor is Reinhold's consequence necessary, or [drawn] from Allacensis [Pierre d'Ailly]. Alphonsine reckoning was able to abandon the observation, not so much the proper [reckoning] equal to the [true] reckoning, on account of the quantity of the Year, and of the Anomaly, and of the Prosthaphaeresis, and of a false dissipation [diffusion] of the Meridians, and of the Equation of the natural days, and of an excessive parallax; by these things simultaneously assumed, an error of many hours could be brought about.

[Margin: ...Era.]

This same Cardinal Cusanus, in the same work *On the Calendar*, has these words: "*Prophatius too, a Jew, and some observers, [in] the Year of Christ 1303, [observed] the Sun [entering] Aries [at] hour 14, after the middle of the night, [the] Aries-ingress; but here Boulliau, Book 2, ch. 2, [says] that day 14 was made for the observation, [whether] it should be understood in the Roman manner [or] the Astronomical, [namely] that day 14 was the hour 8 after the middle of the night [of] day 12, [or rather] after the preceding noon, [it] declaims; and the subsequent observations, and the Alphonsine Calculus, which exhibit [the] Year 1303 — the Equinox in Frisia [on] Martii [March] day 12, hour 11, 12, 25 after noon — [in] the Philolaic [reckoning], which Vranburgus [Uraniborg] exhibits [as] that [of] day 12 Martii [March]; this [is at] hour 18, 35.*"

[Section] 33. The greater difficulty is concerning that Equinox, which the same Cardinal in the same work adduces in these words, speaking of the *Alphonsine Tables*: "*Experience finds [it] as if [at] hour 13, deviating thus, that even Master Henricus Batem of Mechelen, in [his] little book of the Tables, [following the manner of] al-Battānī by Alphonsine [reckoning], then experience taught [in] the Year 1490; and after this, [in] many years, [at hour] 12, [the observers] erred by those same [reckonings].*" For if Cardinal Cusanus died in the Year 1464, as is established

from his *Life*, and from our *Chronicon of the Mathematicians*, which we set at the beginning of Tomus I [of] the *Almagestum Novum* — how could he relate an observation [of the] Year 1490? Boulliau, Book 3, ch. 2, in the margin notes that, since Reinhold in his account [of the] Theory of the eighth sphere recounts the Equinox observation [of the] Year 1346, [says] it ought perhaps to be read [in] Cusanus' [text] as Year 1346, [rather than] for 1490; this is most weakly conjectured, and [more] credible that Cusanus rather wrote 1460; and indeed it is by typography easy to invert these numbers, and to set 9 for 6, p. 9. As for the rest of the Equinox observation [of the] Year 1346, [Cusanus] says was observed [on] Martii [March] day 12, almost two hours before noon; but he does not express the place of the observer.

Copernicus' Equinoxes [Copernici Aequinoctia]

[Section] 35. Nicolaus Copernicus, Book 3 of the *Revolutions [De Revolutionibus]*, ch. 13, says: "*We have observed and noted the Autumnal Equinox at Frauenburg, [in] the Year of Christ 1515, the eighteenth before the Kalends of October; it was, moreover, [in] the Year of the Egyptians 1840, the sixth of the month Paophi, after sunrise by half a day.*" And by this account [Copernicus] supposes the Autumnal Equinox at Frauenburg, oriented from hour 1, and 8; he gathers the Autumnal Equinox observed by al-Battānī [Albategnius], and adds his own Egyptian years 633, days 153, and hours 6, 45; and afterward adds a few [things].

[Margin: Order.]

[Section] 36. "*We received also the Vernal Equinox, which was made in the year following from the noted Christ 1516, hour 4, and the trine, before the middle of the night, the ninth before the Ides of March.*" But Tycho, [in] Tomus 1 of his *Progymnasmata*, p. 34, and in the *Epistles*, p. 74, [says] Copernicus erred in the declination of the Sun everywhere, by an error of 2, 45; and so by an interval the Vernal and Autumnal Equinoxes exceeded by hours 5 $\frac{1}{3}$; [Copernicus] promoted [the equinox] one way, and retarded [it] the other, by hour 2, 45, since [it was made] in the altitude of the Pole, and the Equator he raised [too high] by 2, 45, on account of an omission of Refraction. For Copernicus, Book 2, ch. 2, relates [the equinox] observed by himself and others, the distance of the Tropical points not more than 46, and 38 minutes of first [arc] about.

approximately, and the angle of section — namely of the zodiac signs — is 23°28', and that of two-fifths of one [degree]. Then in Book III, Chapter 2 [Copernicus] says: "the latitude of Frauenburg was found to be 54° $\frac{2}{5}$ scruples of the first kind [i.e. 54° and $\frac{2}{5}$ of a minute], 19 $\frac{1}{4}$." From these consequences it follows that the

Sun's solstitial altitude at Frauenburg in the winter solstice [in Bruma] was $12^{\circ}12'1/4$; and at the summer solstice [in Solstitio aestivo] $59^{\circ}8'1/4$. But the winter [altitude], once the subtraction of refraction of $8^{\circ}54'$ is corrected according to Tycho [Brahe] in his Table of Refractions, would then have made the equator's altitude come out as $35^{\circ}36'3''$, and the pole's [latitude] $22^{\circ}57'$ — and the obliquity of the ecliptic $23^{\circ}31'51''$.

But because Tycho — having sent Elias Olsen [Olaf], a man of the finest skill and equipped with instruments, to Frauenburg — found from the circumpolar stars that the altitude of the pole at Frauenburg was $54^{\circ}22'15''$, he thereby concluded that the refractions at Frauenburg had been smaller than in Denmark. Whatever Copernicus added to the parallaxes of the Sun, and to whatever degree the use of the instruments was [defective] in magnitude, this was the case — especially since, on the testimony of Georg Joachim Rheticus [Rheticus] in the preface to the Ephemerides, Copernicus had not been at all careful about seconds, and indeed had sometimes neglected several minutes outright [in his first observations]. Therefore, on account of these uncertainties, I do not judge it worth the effort to try to extract the true equinox of the years 1515 and 1516 from these observations. But it is enough that one can suspect an error here of three, four, or more hours in them.

The Equinoxes of Pitatus, Nonius, and Landgrave [Wilhelm] of Hesse

[Margin: §37] [Margin: §38] Petrus Pitatus [Pietro Pitati] of Verona, in the preface to his Ephemerides, relates that at Rome in 1520, together with Paolo, Bishop of Forlì [Forosempronensis], he noted the vernal equinox to fall on the 10th day of March, after midday, at 3h, 28m. And in 1521, likewise on March 10, at 9h17m after midday at Rome. Petrus Nonius [Pedro Nunes] of Salacia [Salacensis], in Book III of his work *De observationibus, regulis et instrumentis* [On Observations, Rules, and Instruments] (Geometrical Chapter 14), asserts the distance of the two solstitial points to be 47° in diameter. At Coimbra [Conimbrica], over many years of observation, he found the minimum distance of the Sun from the vertex [zenith] to be precisely 17° , and assuming the maximum declination of the Sun to be 23° at that time, he concludes [the latitude of Coimbra to be] roughly $40^{\circ}30'$.

[Margin: §39] But shortly afterward he revises this. Later, however, in the year 1555 from the birth of Christ, on the 14th day of the month of September, he found the minimum distance of the Sun itself from the vertical point to be $40^{\circ}40'$. Therefore the Sun declines at the meridian of that day $10^{\circ}40'$ to the south; and

since near the equinoctial points the Sun declines about half a degree in a single hour, it follows that on that 14th of September, 10 hours before midday, the Sun was in the section of the autumn [equinox]. When in fact this is found in that very *Liber initiorum* [Book of Beginnings] from the Tables of Alfonso, which the Spaniards praise — namely Hispalensis — he had said a little before [§38]. For he does not follow the Alfonsine [Tables], but reckons everything in agreement with itself, and in this he agrees with many observations, as it is well established; yet the smallness of the astrolabes and his zeal for the Alfonsine hypothesis render his observations suspect.

[Margin: §40] The most illustrious Wilhelm [Wilhelm], Landgrave of Hesse, in the year 1572, on March 7, took the meridian altitude of the Sun at Cassel [Kassel] to be $38^{\circ}40'7''$; and from this, by [subtracting] the just refraction [iusto Byrgio — i.e. as corrected by Jost Bürgi], the altitude of the equator is $38^{\circ}40'7''$. Therefore from the southward declination [declinatio] reduced to the equator [ad Austrum], it is $1^{\circ}10'11''$. If the altitude of the Sun (as Jost Bürgi [Lansbergius] says in the *Thesaurus*) you add $1^{\circ}49''$, who has these observations 9 [degrees], then it follows: *The Sun runs through near the equinoctial an arc of $1^{\circ}10'11''$, in the space of two days, and 22 hours. Therefore the true vernal equinox occurred at Cassel on the 9th day of March at 22h11m after midday.* But he gathers from his own tables that this equinox at Cassel — he says — *had been on the 9th day of March at 22h11m after midday*, entirely as the Most Illustrious Prince observed it. But Tycho [Brahe] in Tome I of the *Progymnasmata*, reporting this on page 75, says that this Landgrave's equinox was observed there at a meridian altitude of the Sun of $17^{\circ}28'\frac{3}{4}$ on March 7; and once the addition of parallax of $2^{\circ}22''$ and the subtraction of refraction of $22''$ are reduced to the true [altitude] of $17^{\circ}30'30''$, and supposing the elevation of the equator there to be $38^{\circ}41'$, he gathers the southern declination of the Sun to be $1^{\circ}10'30''$. He says this corresponds to a place [of the Sun] in Aries [♈] of $27^{\circ}4'\frac{3}{4}$, by the calculation of his own Tables; but [it would be] $27^{\circ}4'30''$ by the Alfonsine [Tables], $27^{\circ}19'$ by the Alfonsine [reckoning?], and $26^{\circ}36'$ by Copernicus — and a difference of two [degrees], and more...

[Margin: Ordi. (Order)]

The Landgrave's Equinoxes, by Hours from the Meridian, at Cassel

Order	Year of Christ	Month and Day	True altitude at meridian — G(°) / M(′)	Declination of Sun — true: ° / ′ / ″ / (N/S)	Apparent equinox — D(ay) / H(our) / (min)
41	1567	March 11	38°41′	1°40′ B[orealis/ N]	10°22′20″
42	1568	Sept. 13	38°30′	10°2′A[us tralis/S]	12°13′40″
(*)	1571	Sept. 13	38°46′	5°40′B	13°5′40″
43	1572	March 7	17°28′¾	71°50′A [?]	9°23′30″
44	1572	March 11	39°1′	3°22′40″B	9°2′30″
45	1573	March 11	38°36′	1°40′B	10°8′20″
46	1578	March 11	38°14′	13°40′B	10°5′40″
47	1578	Sept. 14	38°23′	17°20′A	15°6′40″

Parsing notes: This table is degraded; column boundaries between "altitude" and "declination" sub-columns are hard to align, and several second-place values are uncertain. The Declination column header reads "Declin. ☉ vera" with sub-columns I / II (minutes/seconds) and a B/A (Borealis/Australis = North/South) marker. Row marked (*) carries an asterisk rather than an order number in the source. Values flagged for further review.

The Tycho's Equinoxes, from his own Observations

Tycho [Brahe] himself, in Tome I of the *Progymnasmata*, page 13, reports five vernal equinoxes and the same number of autumnal ones, by the days of the Old Style [of the old calendar] and by hours from the meridian, at Uraniborg, where he determines the altitude of the equator to be 34°5′22″. He uses no refraction in calculating parallax. The parallax of the Sun [he takes as] 2°1′29″. He takes the refraction at the second [degree] as 44″. Therefore when he says he observed the equinox for himself in the year 1584 on March 9, at 2h30m after midday, this is to say that he observed the meridian altitude of the Sun on that day to be 35°42′. For to this, adding the parallax of 1°29″, and subtracting the refraction of 44″, the

corrected altitude becomes $35^{\circ}43'45''$; and once the southern declination of the Sun ($21^{\circ}30'$) which corresponds to it is subtracted from the elevation of the equator ($34^{\circ}5'22''$), it leaves the southern declination of the Sun as $21^{\circ}30'$ — to which there corresponds the hour $1^{\circ}30'$ for the subsequent equinox to be celebrated.

By this method we obtain five [equinoxes]; and the aforesaid equinoxes [taken] from Tycho — without any observations of the altitudes [retained] — will come to us from these very Tychonic observations; but we will correct them by adding our own parallax, which in such a situation is $16''$ according to the second [degree], and by subtracting the refraction of $44''$. Likewise we shall make [adjustments], by which from other meridian altitudes near the equinoxes — and from those reported by [Longomontanus] in Book I, Theoricae, Chapter 2, in his commentary on the Sun — emerging there, we shall distinguish the moments of the equinoxes both according to the Tychonic parallax, and according to our own emerging [parallax], which we shall accordingly distinguish by the characteristic T.N.

[Margin: Ordi. (Order)]

The Equinoxes from Tycho's Observations, by Hours after Midday, at Uraniborg

Header structure: Order | Year of Christ (Old Style) | Month, Day | Altitude observed — M(°)/D(')/G('') | Altitude true — G(°)/I(')/II('') | Declination true — G(°)/I/II + (A/B) | True equinox — D(ay)/H(our)

Order	Year (O.S.)	Month, Day	Altitude visa (M.D.G)	Altitude vera (G I II)	Declination vera (G I II) / A,B	True equinox (D H)
48	1584	Mart. 9	$33^{\circ}42'5''$	$33^{\circ}43'50''$ $33^{\circ}41'37''$	$21^{\circ}30'A$ $/ 21^{\circ}43'$	$9^{\circ}21'30''$ $T / 9^{\circ}43'$ N
49	1584	Sept. 11	$34^{\circ}19'35''$	$34^{\circ}21'0''$ $34^{\circ}19'7''$	$16'0''B$ $/ 3^{\circ}47'$	$12^{\circ}16'0''$ $T /$ $12^{\circ}13'47''$ N

Order	Year (O.S.)	Month, Day	Altitud e visa (M.D.G)	Altitud e vera (G I II)	Declina tion vera (G I II) / A,B	True equino x (D H)
50	1585	Mart. 10	34°16'	34°2'1" / 33°59'4 8"	3°19'A / 5°32'	9°3'19" T / 9°5'32" N
51	1585	Sept. 12	34°25'2 4"	34°27'9" / 34°24'5 6"	21°49'B / 19°36'	21°21'4 9" T / 21°19'3 6" N
52	1586	Mart. 10	34°54'2 7"	34°56'1 2" / 34°53'5 9"	9°8'A / 11°21'	10°9'8" T / 10°11'2 1" N
53	1586	Sept. 13	34°7'13"	34°8'18" / 34°6'5"	3°58'B / 1°25'	3°3'38" T / 3°1'25" N
54	1587	Mart. 10	33°48'3 9"	33°50'2 4" / 33°48'1 1"	14°16'A / 16°29'	14°14'1 6" T / 14°10'2 9" N
55	1587	Sept. 13	33°13'1"	34°14'4 6" / 34°12'3 3"	9°16'B / 7°13'	13°9'26" T / 13°7'13" N
56	1588	Mart. 9	33°42'0"	33°44'3 5" / 33°42'2 2"	20° [?]A / 21°58'	9°20'45" T / 9°18'15" N
57	1588	Sept. 11	34°18'5 0"	34°20'5 5" / 34°18'3 2"	15°15'B / 2'	12°2'15" T / 12° [?]15" N

Order	Year (O.S.)	Month, Day	Altitud e visa (M.D.G)	Altitud e vera (G I II)	Declina tion vera (G I II) / A,B	True equino x (D H)
58	1589	Mart. 11	34°24'5 5"	34°26'4 5" / 34°24'3 2"	21°25'B / 19°12'	10°2'55" T / 10°4'48" N
59	1590	Mart. 11	34°18'3 5"	34°20'2 0" / 34°18'7"	11°0"A / 13°9'	10°10'0" T / 10°11'1 3" N
60	1590	Sept. 12	34°30'1 5"	34°32'0" / 34°29'5 7"	26°40'B / 24°27'	13°2'40" T / 13°0'27" N
61	1593	Mart. 10	34°1'30"	34°2'0" / 34°1'2"	9°2'A / 11°15'	10°2'5" T / 10°4'52" N
62	1594	Mart. 9	33°56'2 0"	33°58'5" / 33°55'5 2"	7°15'A / 5°2'	10°7'15" T / 10°5'2" N
63	1594	Sept. 13	33°6'20"	34°8'5" / 34°5'53"	5°2'A / 0°32'	9°2'45" T / 9°0'32" N
64	1596	Mart. 11	34°30'4 5"	34°30'4" / 34°27'1 7"	27°10'B / 14°57'	9°2'35" T / 9°23' N
65	1597	Mart. 11	34°33'1 0"	34°33'2 2" / 34°29'4 1"	31°12'A / 11°4'	12°18'4 8" N

Order	Year (O.S.)	Month, Day	Altitud e visa (M.D.G)	Altitud e vera (G I II)	Declina tion vera (G I II) / A,B	True equino x (D H)
66	1597	Mart. 10	34°2'20"	34°4'50" / 34°4'53"	0°50'A / 0°32'	9°0'50" T / 9°22'37" N

Parsing notes: This is a very densely set five-column table with stacked two-line cells (visa/vera split across rows) and tightly packed second-of-arc figures. Many cells are uncertain; the "visa," "vera," and "declination" columns each carry an upper and lower line per order-row. A/B = Australis/Borealis (South/North). T = Tychonic, N = Nostra (our/Riccioli's) reduction. Several values flagged for further review. The whole table is a strong

[Footnote text below the left table:] Jost Bürgi [Lansbergius] in the *Thesaurus*, from so many Tychonic equinoxes, selects a single one for the verification of his own Tables — which holds at 52' in our order; and that [equinox] not at 9h8' after midday — Tycho does not have it [so], but [rather] at 9h2'. As from Tycho via [Christoph] Clavius in the *Apologia Kalendarii*, but at 9h34' at Uraniborg, because at an altitude of 34°. Tycho assumes the parallax of the Sun [to be] 2'½, nearly; Jost Bürgi [Lansbergius], however, [takes] 2'. But [in computing the moment of] mid-minute about the equinox in the declination of the half-hours [in declinatione semihorarum]. Yet both [men's] parallaxes are faulty, as is evident. [Boulliau] also, in Book II, Chapter 2, from a single Tychonic and a single Hipparchan annual quantity, elicits [a value] — as is evident from the equinoxes in our order, marginal [items] 5 and 56.

The Lansbergian Equinoxes

In the *Thesaurus* of observations, [Philip van] Lansberge [Lansbergius] draws forth two vernal and two autumnal equinoxes of Goes [Goésae].

[Margin: Ordi. (Order)]

The Lansbergian Equinoxes of Goes, by Hours after Midday, Old Style

Order	Year of Christ (A.)	Month, Day (M.D.G)	Altitud e visa (G I II)	Altitud e vera (G I II)	Declination vera (G I II)	True equinox (D H)
67	1589	Mart. 9	38°0'30" / 38°0'44"	38°2'19" / 38°2'18"	26°41'A / 16'	10°2'41" L / 4°16' Nos
68	1589	Sept. 13	38°22'0" / 38°23'4 8"	38°23'4 8" 38°22'1 4"	5°12'A / 6°46'	12°18'4" L / 18°17'1 4" Nos
69	1599	Mart. 10	38°13'2 0" / 38°15'1 9"	38°15'9" / 38°15'2 6"	13°51'A / 13°51'	10°13'5 1" L / 13°51' Nos
70	1599	Sept. 12	38°33'1 5" / 38°35'3"	38°35'3" / 38°33'2 9"	6°3'B / 4°29'	12°6'3" L / 6°4'29" Nos

Parsing notes: Two-line stacked cells again (visa/vera upper-lower). L = Lansbergian, Nos = Nostra (our reduction). A/B = South/North declination. Second-of-arc figures uncertain throughout.

[Right-column prose, top of folio 12 verso, continuing the Lansbergian discussion:] observed by himself, and not differing by even a single second from his own tables. But the altitude of the equator is 38°29', by the use of refraction; nor is the parallax 1'48", but 49" — with mine never being greater [than] 14"; the difference of these is 1'35", which varies the declination by the same amount, and the time of the equinox by 1h35'. We therefore append from Lansberge's [data], and from our own parallax, the equinoxes, deduced from his very observations, that they may be referred to him. Wherefore, if our parallax is the true one, his Tables err in this place by 1h35'.

Four Equinoxes Observed in the Years 1536, 1574, 1575, 1581

[Margin: §71] I confess I ought to have reported [these] before the Tyconic ones, but [they are] little related. So then, for the year 1536: as Daniel Santbech

[Santbechius] relates concerning the observation in *Phaenomena*, Proposition 11. At Tübingen [Tubingae] the exact equinox was observed in March on the 10th day, at that very midday — from which fact [Santbech], following Ptolemy's vernal [equinox] and supposing Alexandria to be more eastward than Tübingen by 1h28' — gathers the annual equinoctial [interval to be] 365 days, 5h48'41"42"', 33" 50" 10"'''.

[Margin: §72] In the year 1574, [Ignazio] Dante [Egnatius Dantes] of Florence [Florentinus], in the presence of many witnesses, observed at the equinox of March, 12 hours and 1°36'; before midday, on an equinoctial armilla equally illuminated on both sides [as to] its cavity, he judged the equinoctial moment to have occurred at that instant from the steady passage of the Sun across [the line] between [it and] the north, as he relates in *De Astrolabio*, part 6.

[Margin: §73] Thus in the year 1575, with the instrument set up at the same place, the equinox of March was observed at 12h4'12" after midday. Moreover, at an altitude of the equator of 46°, my parallax [is] 10"; the same number of minutes by which it is retarded [makes the] equinox.

[Margin: §74] In the year 1581, Cesare Lucchino [Caesar Luchinus] of Bologna [Bononiensis] observed at Bologna the equinox of March at 11h. At the southern meridian altitude of the Sun of 45°15'15", [recorded] in a great geometric quadrant — as I read it in his manuscript — with a parallax of 10" added, it gives the true altitude of the Sun here as 45°25'40"; [this] subtracted, leaves the northern declination of the Sun as 2°45". Therefore the equinox is here elicited as the 10th day, 2h1'15" after midday — or [at] 2h0', if you wish, with the refraction of 5" diminishing the altitude of the Sun.

Equinoxes Observed at Bologna by the Reverend Fathers Giovanni Battista Riccioli [Riccioli] and Francesco Maria Grimaldi [Grimaldi]

I had indeed thought to pass over these, after our solar observations made from the year 1641 to 1656 by the Gnomon of S. Petronio [San Petronio] succeeded one another — to which, on account of the magnitude of the instrument, ours must in any case yield. Especially when, on those occasions, we determined certain equinoxes by applying the altitude of the equator [as]...[continues]...

45°30'30", which we shall afterward teach (as in Book IV, Chapter 4) was found in our observatory to be 45°29'50". Nor does the parallax of the Sun at such an altitude hinder us further [from] holding [it]. These notwithstanding, it pleases

[us] — from the meridian altitudes accepted by us, and indeed assembled by the three quadrants — at the same time to adjoin such equinoxes as ought to be reckoned by them at S. Petronio; and [the equinox] deduced thence by the Annual precession, which is 1h14'14", with respect to the Julian year of 365 days. And the refraction in the meantime — 5" — we disregard as uncertain.

[Margin: §85] Giovanni Domenico Cassini [Cassini], in the book entitled *Specimen observationum Bononiensium, quae novissime in D. Petronii Templo &c.* [A Specimen of the Bolognese Observations, most recently made in the Temple of S. Petronio, etc.], page 10, asserts that the autumnal equinox was observed by himself in the year 1655, on September 22, at 5h4'55" before midday, at the apparent time, that is, on the 22nd day at 18h57'55" [?] [or 18h25"] after midday. But neither the observation, nor the method by which it was extracted, do I believe — because [it is] of a kind [too] high — caused [it] in [his computation of] the equinox of 1656. He supposes, however — for both observations, concerning which the obliquity of the ecliptic is 23°30'20", and the parallax of the Sun, [and] the altitude of the equator observed here [to be] 45°29'40" — to be either nothing, or scarcely sensible. Yet he communicates to us the Tangents of the distance of the Sun's two limbs from the vertex, namely [those] of this year 1655, [on] September 22 and 23, observed at the meridian — from which we shall elicit those distances by the method already handed down in Chapter 2, item 13.

Year 1655, September 22 (Tangents)

Quantity	Tangents	G(°) / I(') / II('')
Lowest margin of the Sun [Inferi Solis marginis]	98135	44°27'36"
Highest margin of the Sun [Supremi Solis marginis]	96344	43°56'0"
Difference of Sun = apparent diameter [Different. ☉ ☉ diamet. apparens]		0°31'36"
Semidiameter [semidiameter]		0°15'48"
Distance of the Sun's center from the		44°11'48"

Quantity	Tangents	G(°) / I(') / II('')
vertex [Solaris centri distantia a vertice]		
Distance of the equator from the vertex [Aequatoris distantia a vertice]		44°30'20"
Therefore the northern declination of the Sun [Ergo Solis Declinat. Borealis]		0°18'32"
And the place of the Sun in the Zodiac by the Logarithmic Trigonometry [Et locus Solis in Zodiaco per Trigonometriam Logarithmicam]	♍(Virgo)	29°16'2"
With the obliquity of the ecliptic posited [Posita obliquitate Ecliptica]		23°30'20"

Year 1655, September 23 (Tangents)

Quantity	Tangents	G(°) / I(') / II('')
Lowest margin of the Sun	99483	44°51'8"
Highest margin of the Sun	97672	44°19'29"
Apparent diameter of the Sun [Solis diameter app.]		0°31'48"
Semidiameter		0°15'48"
Distance of the Sun's center from the		44°35'17"

Quantity	Tangents	G(°) / I(') / II('')
vertex		
Distance of the equator from the vertex		44°30'20"
Therefore the declination [Ergo Declinatio]	Australis (South)	0°4'57"
And with the obliquity of the ecliptic posited [Et Posita Obliquit. Eclipt.]		23°30'20"
The place of the Sun in the ecliptic [Locus Solis in Eclipt.]		0°12'24"

Quantity		Value
Therefore the true diurnal motion of the Sun from day 22 to 23 [Motus igitur diurnus Solis a die 22 ad 23]	Verus (true)	0°56'22"

Therefore if [the diurnal motion is] 56'22", [computing the moment] requires 24 hours in any case [for the full distance]; the distance of the Sun from the beginning of Libra [□], which on the 23rd day was 12'24", requires 5h17' [?]. Therefore by this method — which is Cassini's — the equinox would have been at 5h17' before midday on the 23rd day, or at 18h43' after midday on the 22nd day. He himself, however — I believe on account of the refraction of some seconds — limited that to the hour 18h55'25", from which I do not dare to depart. From Tycho's equinox of the year 1587, which we have corrected from that number 55, and by reductions of that kind for [the difference of] 68 years [hours 5°43'45'''], with the days abandoned, this very equinox of the 22nd day arises at hour 18h28'6"8''' — later by 27'18"52''' than [the one] observed.

[Margin: §86] In the year 1656, Giovanni Domenico Cassini [Cassini], as he reports in the aforementioned book, observed the vernal equinox at the apparent time of March 19, at 9h50'50", after midday — by the following method: from the observations of March 19, 21, and 23, at the meridian — for [on] the 20th and 22nd it was cloudy.

Year 1656, March 19 (Tangents)

Quantity	Tangents	G(°) / I(') / II('')
Lowest margin of the Sun	99762	44°55'54"
Highest margin of the Sun	97940	44°24'14"
Apparent diameter of the Sun [Diameter Solis apparens]		0°31'40"
Semidiameter		0°15'50"
Distance of the Sun's center from the vertex [Centra Solis distantia a vertice]		44°40'4"
Distance of the equator from the vertex		44°30'20"
Therefore the declination [Ergo Declinatio]	Austrina (South)	0°9'44"
Obliquity of the ecliptic [Obliquitas Ecliptica]		23°30'20"
Therefore, by the right-angled spherical triangle, the place [Ergo per triangula spherica rectangula locus]	♋(Pisces)	29°35'36"

Year 1656, March 21, clear [serenis] (Tangents)

Quantity	Tangents	G(°) / I(') / II('')
Lowest margin of the Sun	97048	44°8'30"
Highest margin of the Sun	95275	43°36'50"
Apparent diameter of the Sun		0°31'40"
Semidiameter		0°15'50"
Distance of the Sun's center from the vertex [Distant. Solaris centri a vertice]		43°52'40"
Distance of the equator from the vertex		44°30'20"
Therefore the northern declination of the Sun [Ergo Declinatio Solis Borealis]		0°37'40"
Obliquity of the ecliptic		23°30'20"
Therefore the place of the Sun in the ecliptic [Ergo locus Solis in Ecliptica]	♈ (Aries)	1°34'30"

(Caput III, continued — Aequinoctiorum Observationes)

§88. 1656, March 23, clear.

	Tangents	G [°]	I [']	II ["]
Of the Sun's lower limb [Inferioris]	94407	43	11	8

	Tangents	G [°]	I [']	II ["]
Solis marginis]				
Of the Sun's upper limb [Superioris Solis marginis]	92683	42	49	51
Apparent diameter of the Sun [Solis Diameter apparens]			31	37
Semidiamet er [Semidiame ter]			15	48
Distance of the Sun's center from the vertex [Centri Solis distantia à vertice]		43	5	19
Distance of the equator from the vertex [Aequatoris distantia à vertice]		44	30	20
Therefore the Sun's north declination		1	35	0

	Tangents	G [°]	I [']	II ["]
[Ergo Solis Declinatio Borealis]				
Obliquity of the ecliptic [Obliquitas Ecliptica]		23	30	20
Therefore □ the Sun's place on the ecliptic [Ergo locus Solis in Ecliptica]	□	3	33	16

Now indeed on the 19th the Sun was distant from the beginning of Aries by 24°24"; on the 21st it stood at □ 1°34'30"; and on the 23rd at □ 3°33'16". Therefore over the two preceding days the Sun's true motion on the ecliptic was 1°58'54", half of which gives a daily motion of 59'27", while over the four days [from the 19th to the 23rd] it was 3°57'28", a quarter of which is again 59'27". Now since the Sun on the 19th was distant by 24'24" — that is, its distance from its entry into Aries requires that we compute backward — it requires 24'24" of arc; this, traversed at a daily rate nearer to the equinox itself, gives 24 hours, and is reckoned as 24'24". Thus the distance from the entry into Aries requires 9 hours, 50'40", or 9h50'41" p.m. Therefore Cassini states that the apparent equinox fell on March 19 at 9h50'40" p.m. — which, by the method common to all because of the south declination of 9°44", would have fallen at 9h44", as if by the first method; but by the second method, on account of the south declination of 37°40", it would have fallen at 17h40" a.m. of the 21st [?], that is, at 17h10" a.m. — yet this is more subtle than the earlier method. Furthermore, if we accept Cassini's correction to the year (which has been treated above of [?]), and from the aforesaid equinoxes the equinoxes of several following years may be predicted, as in the table written below — by adding to the equinoxes of individual common years 5h49', but in a leap year, after the said addition, subtracting one whole day from the sum.

Year at Bologna [Bononiæ Anni]	March, after midday [Martij post meridiem] D. / H. / I.	September, after midday [Septembr. post merid.] D. / H. / I.
1655	20 / 4 / 2	22 / 18 / 55
1656	19 / 9 / 51	22 / 0 / 44
1657	19 / 15 / 40	22 / 6 / 33
1658	19 / 21 / 29	22 / 13 / 22
1659	20 / 3 / 18	22 / 19 / 11
1660	19 / 9 / 7	22 / 1 / 0

Let us now see whether the observations of Sir Cassini, or those of associated investigations made at the gnomon of San Petronio, correspond.

§89. Year 1656, September 22.

	Tangents	G [°]	I [']	II ["]
Of the Sun's lowest limb [Infimi Solis marginis]	99130	44	44	59
Of the Sun's highest limb [Supremi Solis marginis]	97335	44	13	55
Apparent diameter of the Sun [Solis Diameter apparens]			31	24
Semidiamet er [Semidiame ter]			15	42

	Tangents	G [°]	I [']	II ["]
Distance of the Sun's center from the vertex [Centri Solis distantia à vertice]		44	29	17
Distance of the equator from the vertex [Aequatoris distantia à vertice]		44	30	20
Therefore the Sun's north declination [Ergo Declinatio Solis Borealis]			1	3
Obliquity of the ecliptic [Obliquitas Ecliptica]		23	30	20
Therefore □ the Sun's place on the ecliptic [Ergo locus Solis in Ecliptica]	□	29	57	22

§90. Year 1656, September 23.

	Tangents	G [°]	I [']	II ["]
Of the Sun's lowest limb [Infimi Solis marginis]	100495	45	8	30
Of the Sun's highest limb [Supremi Solis marginis]	98670	44	37	0
Apparent diameter of the Sun [Solis Diameter apparens]			31	30
Semidiameter [Semidiameter]			15	45
Distance of the Sun's center from the vertex [Centri Solis Distantia à vertice]		44	52	45
Distance of the equator from the vertex [Aequatoris distantia à vertice]		44	30	20

	Tangents	G [°]	I [']	II ["]
Therefore the Sun's south declination [Ergo declinatio Solis Austr.]			22	25
Obliquity of the ecliptic [Obliquitas Ecliptica]		23	30	20
Therefore the Sun's place on the ecliptic [Ergo locus Solis in Ecliptica]	□	0	56	11

Therefore on the 22nd the Sun was distant from its entry into Libra by 2'38", while on the 23rd it had already entered by 56'11". Hence the daily motion was 58'49", which requires 24 hours; therefore 2'38" requires [...continuing on next page...] 1°4'18". Therefore the equinox emerges from this observation as September 22, at 1h40'28" p.m. Now in the preceding Table it had been put at 0°44". Some small inaccuracy [vitiolum] therefore lies hidden in the observation, and in the omission of the parallax, or of the refractions, for from these jointly an error of 20" could arise; and this in the time of the equinox, that is, 26' of [time] minutes, and at the same instant the Sun's diameter is somewhat less, which I gathered in the accurate observations of the equinoxes — but the diurnal motion is small. From the aforesaid precession our 11'12", concerning which see Chapter, following, no. 10, ought to have been at 0°43'48".

§91. I add that [Hevelius] recently sent me an observation he had made: it was indeed in the year 1654, September 23. He observed the Sun's meridian altitude at Gdańsk [Gedani] of 35°28'40", where the equator's altitude is 35°38'; from this, neglecting parallax and refraction, there results an equinox at 9h20" a.m.

CAPVT IV.

De Quantitate Anni Aequinoctialis motuque Diurno, & Annuo Solis. (On the Length of the Equinoctial Year and the Diurnal and Annual Motion of the Sun)

§1. The equinoctial year is the revolution of the Sun from one of the equinoctial points back to the same point. We have already laid down in Book 3 of the *Almagestum Novum* (*Almagestum Novum* III, ch. 30) that a year of this kind is always of the same length. The mutation of the apogee and of the eccentricity of the Sun is no obstacle, for from these it does not follow that the years are unequal, but rather that within one and the same year the Sun's motion is unequal and the boundary-points vary, while the year is bounded by the same species. If the equinoxes could be immediately observed, of the same species, the matter would be without doubt; but since the equinoxes are observed with an error exceeding 1'5", then if we had a sufficient length for the equinoctial year to determine past and future equinoxes for years around 1600 — before, and by just as much after — we should arrive at greater certainty. Yet for greater security two equinoxes of the same species ought to be chosen, of which the observations are more certain than the others, and which are separated by the greatest possible interval of years, observed without disturbance, among many distributed years, and reckoned with contemptible error. Let this be that of Sir Giovanni Domenico Cassini, who, relying on the magnitude of the gnomon of Bologna, judged that the revolution of a single year would suffice to avoid an error of 1' — and four years to avoid an error of 1'5". But to avoid an error of 1' at a single moment of the equinox, one must avoid the Sun's altitude and the pole [Poli], from which the declination is derived: an error of one second [arises] in the second [of declination], though indeed the magnitude of this gnomon is abundantly secured, yet its use is rarely employed by me and others, and as it happens to those skilled in the matter. Certainly Cassini himself, in the work praised above on p. 18, suspects a refraction of nearly 1' at an altitude of degree 45, but it is not constant at that altitude. [Tycho Brahe], in Tome I of the *Progymnasmata*, set forth an interval of 100 years, [preferring it] over the many centuries among his observations and those of Hipparchus, Ptolemy, or [al-Battānī], which he judged slippery and untrustworthy, or implicated in the threefold difficulties of chronology. But the observation of [Bernhard Walther] [Bernardi Vualtheri], made on the equinox in the year 1488, he held to be much more certain than those; and therefore he compared it with his own made in the year 1588 — which are stated in chapter 3, order 20 and 56 — especially since, by

these means, the universal restitution of the solar course, competent for all ages, would be measured.

[Margin: Requisite ad Annuam Quantitatem determinandam — Requisites for determining the annual length.]

	D.	H.	I [']	II ["]
From [Hipparchu s] to [Ptolemy] [Ab Hipparcho ad Ptolemæu m]	365	5	55	12
From [Ptolemy] to [al- Battānī] [A Ptolemæo ad Albategniu m]	365	5	46	20
From [al- Battānī] to [Tycho Brahe] [Ab Albategnio ad Tychonem]	365	5	49	29
From [Ptolemy] to [Tycho Brahe] [A Ptolemæo ad Tychonem]	365	5	47	52

But if the Sun's course is sufficient, adapting it [the determination] within 300 or 400 years [suffices], and from these by collation he establishes the equinoctial year [as] on p. 53, written below.

Of days 365, Hours 5, 48', 45". [Dier. 365. Hor. 5, 48', 45".]

[Margin: Annual length according to Tycho — Anni Quantitas Tychonica.]

§2. Sir Giovanni Domenico Cassini, in the aforementioned *Specimen* of observations, p. 15, supposes Hipparchus's observations to be uncertain within a half-day, and Tycho's within a half-hour; and that for the same reason a half-hour [is uncertain] within a half [day]; just as is the interval of 72 years between us and 1728. Therefore it is altogether the same as if one used the interval of 72 years between us and Tycho, as between Hipparchus and Tycho, for the interval is 1728 years. From these positions, since indeed [Tycho Brahe], in his *Commentary on the Sun*, in the year 1584, March 11, accepted as the Sun's meridian altitude by his style [stylo] the meridian degree $54^{\circ}29'55''$; the equator's altitude at Uraniborg being subtracted, $54^{\circ}5'$; there remains the Sun's north declination $24^{\circ}35'$. But the daily mutation of declination at the equinoxes is $23'42''$; therefore from the declination $24^{\circ}35'$ there fits 1 day, and over and above an hour of $0^{\circ}54'$; and by just so much time before the perfected equinox the meridian of the 11th [precedes], and at Bologna this fell on the 23rd. In the year 1656, the observation and the equinoxes of the year sought by Cassini, on March 9 by the old style, was 9h50' p.m., therefore by 72 years the year was anticipated by $13^{\circ}12'$, and for individual years 11', which subtracted from the Julian year of 365 days, 6 hours, leaves the equinoctial year [as] 365 days, 6 hours, less 11', that is, 5h49', which after many considerations Cassini reckons safer; and the same Petavius elected, in *Doctrina Temporum* book 4, ch. 36; and Tycho in tome 1 of the *Progymnasmata*, p. 12, was lacking in it.

[Margin: Annual length according to Cassini and Petavius — Anni Quantitas Cassinæ & Petauio.]

§3. But I do not concede to Cassini that the equinox observed by Hipparchus is not certain except within a half-day, with some difference of a few hours, just as that of Tycho is certain within a half-hour, and Hipparchus himself, the equinox assumed by Cassini from the observation of the 9th, as is clear from chapter 3, number 48: I find Tycho's [equinox] from the parallax to have been the 9th, hour 21, 30". But our [observation], with the parallax applied, hour 23, 43", with no parallax; hour 23, 53"; and Cassini from another observation noted above hour

23, 6". Therefore they are not certain within a half-hour of Tycho; and consequently it suffices that it recur at a doubled equinox over longer intervals.

[Margin: (—)]

§4. [Longomontanus] therefore, in his *Commentary on the Sun*, having corrected his own principles, the equinoxes [reckoned] from the ancient [observations] of the earlier [astronomers], chooses Hipparchus's, of which see ch. 3, num. 7: that is, the vernal [equinox] in the year before Christ 146, March 23, hour 13, p.m., celebrated at Alexandria, with which he compares the equinox of 1587, observed at Uraniborg, but at Alexandria hour 14, 56". At Uraniborg, but at Alexandria hour 16, 31"; and on account of the unequal *prosthaphaeresis* [prostaphæresim] added hour 3, 56"; and on account of the unequal precession, the equinox brought back around hour 7, and thus it reduces the equinox to hour 8, and at hour 3, 21" p.m. [is] the meridian. Therefore in the year 1733 it anticipated the equinox by 11 days, hour 9, 39"; but it lies open per the error of calculation [as] hour 19, 39"; and roundly again hour 12, hour 10, 20", which, distributing over the individual years of 1732, repeats the precession with respect to the Julian [years] as 10'40"; and therefore the year is bounded by the Sun's course [as] D. 365, h. 5, 49', 20", vel limited on account of the course of the Moon D. 365, h. 5, 49', 30".

[Margin: Annual length according to Longomontanus — Anni Quantitas Longomontano.]

§5. Ismaël Boulliau [Ismaël Bullialdus], in *Astronomia* book 2, ch. 2, chooses the first vernal equinox of Hipparchus, of which ch. 3, see also num. 1 of ours, namely the year before Christ 146, March 24, where the refraction having been subtracted, the equinox was made on the 25th hour 23; but in such a way that at Uraniborg on the 25th hour 8, 11', 22', 35". At Alexandria, but at Uraniborg hour 10, 1', 35". This he compares with the equinox of '56, in the order of our chapter 3, observed at Uraniborg March 9 hour 10, 45" p.m. — which on account of the *prosthaphaeresis* is reduced to the mean equinox made on March 11, hour 11, 25', 15" — between these two equinoxes a mean equinox is gathered [as] the year of the Egyptians 1734, days 15, hour 2, 24', 45", which time divided by the Julian years 1733 gives the annual length written below.

D. 365, h. 5, 49', 4", 21", 4". [D. 365. h. 5. 49'. 4". 21". 4".]

[Margin: Annual length according to Boulliau — Anni Quantitas Bullialdo.]

§6. [Kepler], in the *Epitome of Astronomy* and in the *Rudolphine [Tables]* [Rodulphinis], uses a year of 365 days, 5h48'57'36" — not expressing the manner in which he uses it; just as neither does Lansberge [Lansbergius] in his *Thesaurus of Solar Observations* at the end of Class 3, where he defines the annual Tropical year [as] of days 365, H. 5, 48', 57", 2", 22", 24"; though even some equinox is set forth, by which it is reckoned, yet he does not explain it. But [David Origanus?] / Wendelinus [Vendelinus], in his letters as in his *Idea of the Atlantic*, sets down no fundamentals on which he might establish the quantity of the Tropical year, unless what he fixed in *Annus Tropicus* 33, having days 120539, [which is] sufficiently precise; whence, by the by, divided by 33, gives that the year is 365 days, 5h49', 4", 27", 16"; if indeed it is what Cassini states [as] 330, [it would] yield 120539, whence indeed it is reduced to 120529, but the year [is] less than Wendelinus's. His therefore, setting aside the dismissed [ones], who established the year, not led by observations — our opinion we bring forth in the middle.

§7. That we may inquire into the quantity of the equinoctial year, we choose the equinox most exactly observed at Bologna in the great gnomon of the Temple of San Petronio in the year of Christ 1665, the 22nd day of September by the Gregorian style, hour 18, 5', 23" p.m., as above, retaining the eternal hour with the Sun aggregating in Cancer [in Cancrici], degree 8, 35', 45", as in num. 1 of Sir Giovanni Domenico Cassini, just as in the recent observations there held, the eccentricity by the apparent Diameters is deprehended; and how much by our eccentricity the whole partition is 3480, of which the Radius is 100000: it follows in the distance of the beginning of Libra from the Apogee degree 81, 24', 15". The *prosthaphæresis* [Prostaphæresis] degree 1, 58', 17": this mean motion having been subtracted, but the mean being added, just as is the middle; but the Sun's mean motion of the equinox the medium goes before; and therefore the medium was on day 10 September by the old style, h. 18, 53', 23" p.m.; but at Alexandria, by my *Geographia Reformata*, it was h. 20, 28', 5". And it was the third year after the bissextile [leap year].

[Margin: (—)]

§8. It is fitting now, among the most ancient equinoxes, and those observed by Hipparchus, to choose one, and that in the third year after the bissextile; and of which hour we can attain as great a certainty as possible. Such is that which Ptolemy in book 3, ch. 2 reports as observed in the year 21, in the third Callippic Period, on the first Intercalary day, hour 6 [?], that is, the night [or: at the sixth hour, that is, the night] [...]; but Ptolemy reckoned a true equinox at Alexandria, collocated [as]: now in our Chronological Apparatus that year [falls] before the

vulgar Epocha of Christ 158, and day 1 of the Intercalary period began at midday, or at the end of the sixth hour, that is, September 27; therefore we have an interval truly the longest among the equinoxes: namely [an interval of] 1812 whole years.

§9. As regards the hour of the equinox, although Hipparchus estimated that it was made at the sixth hour, this indeed [happened] at midday itself; yet from the preceding observations of these, [it is shown] that it preceded the meridian moment by several hours. For Ptolemy himself narrates that Hipparchus narrated, or preceded, [in] period 20, the third Callippic, that he had observed the Autumnal equinox in the morning of the day before the Intercalary [day]; therefore in the morning, the Sun having risen, or a little after, he saw the Armilla [the ring of the armillary instrument] equally illuminated everywhere both ways, and therefore reckoned that it was then the Solar equinox [that is, by the horizontal armilla; or one might doubt that it was necessarily so, since the Sun had not yet appeared, when it appears to be still in the south, and crossing the equator, when it appears at the equator; therefore that most certain equinox is here at some particular hour, and at the Sun's rising, namely at the hours nearest, 4, as we shall show]. But it is certain that, with all the astronomers, the equinoctial year is said [to be] 365 hours, 5 [days] and 48' minutes [recte: 365 days, 5h48'], and certainly something obtained from the Sun's signs [as] the year of days 365, hour 5, 49'; and granting that the equinox preceded the year of days 365, hour 5, 49'; if the equinox had been made on the 20th before the Sun's rising — granting that it could not be on the 21st before the Sun's rising, that is, hour 2 before the Sun's rising — this is the hour nearest, that is, on the 26th of September, or the first Intercalary, that is, hour 4 before the following midday.

Now indeed from what has been said in Book 3 of the *Almagest*, ch. 1, num. 8, and from Boulliau book 2, ch. 2, it is sufficiently established that the Sun, around the quadrant after its rising, on account of refraction, appears more southerly [australiorem] in the circle of declination, by some 4 or 5 minutes — which [error] of just as many minutes the [Sun's] arrival retards while it appears in the equator; and this still in the Boreal [northern] signs is represented. Since Hipparchus had judged the morning to be the time of the first civil intercalary [day], and reckoned the equinox to be 20, and that in the morning the meridian had not yet seen the Sun still Boreal, nor unless under the sixth hour it crossed to the south, nor sooner — than 6 hours after the preceding day the equinox, that is, the sixth hour from rising, was made the subsequent equinox. He could have [judged]; to this deception something might contribute, the Armilla's situation, or the placing by one or another minute declining from the plane of the equator.

Therefore let the true equinox at Alexandria in the year 158 before Christ be held as nearly certain, [made on] September 26 in the morning, hour 6 p.m. [recte: a.m.] [...]

§10. But the Sun's apogee was then, by our observations (of which below, in Gemini degree 7, 21'), distant from the autumnal [equinox] by 112°39'; and so the *prosthaphaeresis* is degree 1, 26', 16". Hence at the same time there fits [a correction]: 1°, hence 6'; therefore the equinox at Alexandria was made the 24th, hour 23, 9', 49' at the mean equinox of the year 1655 — it was September the 10th, hour 20, 28', 5". Therefore the Precession of the equinox was of days 14, hour 2, 41', 44". This having been resolved into seconds is 1219304"; and this divided over the elapsed years 1812 gives an annual precession of 11'12".

[Margin: Ptolemæi nimia fiducia. — Ptolemy's excessive confidence.]

§11. This precession, while I weigh it with a profound mind, betrays a certain Ideal beauty, congruent with the seventh diameter, with the integer of the seven [intervals] in the seventh century [hebdomadas seculorum], by a multiplied beauty of 11' and 12" over 900 years, giving exactly days 7, in which the equinox precedes; and this so marvelous an analogy makes it not doubtful, since indeed it is received with such great beauty, and over and above based upon the observational foundation, that this very same secular [interval], leaning on 18, betrays itself.

§12. Therefore, the Sosigenian days 365 having been subtracted, and the hours 6, minus 11' and 12", there comes forth for us *the Equinoctial Year of days 365, Hours 5, 48', 48"*. Resolving the day, it is *the Equinoctial Year of days 365, in second [degree] 31' 5698" [?]*; but *the common year of days 365 in second 153600"*. In *second 1296000"*. For if the Zodiac be multiplied per the common year of days 365, and divided as the equinoctial year, there comes forth *the Sun's Mean Annual Motion*; but indeed *the Day, the Month [vel Mensis] [...]* divided per the Zodiac, and the sum divided per the Equinoctial year, we shall have the *Diurnal* and *Menstrual* [monthly] *Motion*, as below, reduced to seconds in such a way; and by sixth [order] scrupulously [computed] in compiling the Tables to many years the ratio is to be held.

Motu s	Sign.	Gr. [°]	I [']	II ["]	III	IV	V	VI
Annu us [Ann	11	29	45	40	30	56		1

Motus	Sign.	Gr. [°]	I [']	II ["]	III	IV	V	VI
ual moti on]								
[Mot us Annu us]								
Dieru m [of Days]								
[Mot us Dieru m]								
1	0	0	59	8	19	48	35	25
28	0	27	35	53	14	39	36	20
30	0	29	34	9	14	16	47	30
31	1	0	33	18	14	5	23	5

By which foundation we have constructed our Tables, to be displayed at the end of the Work.

CAPVT III.

Solstitiorum Observationes. (Observations of the Solstices)

§1. I have said in the notes to the observations of [Snellius] [Snellij] in *De Observationibus Hassiacis*, [to those] pronounced by Hercules [Herculei], that the labor must be avoided of observing errors in observing the solstices.

[Margin: (—)]

Now indeed from what has been said in Book 1 of the *Almagest*, ch. 3, and from Boulliau book 2, ch. 2, it is sufficiently established that the Sun, around the quadrant after its rising, on account of refraction, appears more southerly [australiorem] in the circle of declination, by some 4 or 5 minutes — which [error] of just as many minutes the [Sun's] arrival retards as it appears in the

equator; and this in the Boreal signs is represented; for at that time the difference of diurnal declination is of seconds 14" or 16"; by which, if the whole be in error, the error will arise integer, even with a single minute; but the error of half a day [arises], with an error of 6 hours; the cause [is] in the obscured altitude of the Sun, [an error of] 4" of seconds. Whence Ptolemy had so great a subtlety of his instrument that — as he confidently states in Book 3 of the *Almagest*, ch. 2 — he said: "*But in the solstices we hope, neither we nor Archimedes in observation, and by calculation up to the fourth part of the day to have erred.*" It is added here in addition the uncertainty of refraction at the Sun's altitude of Bisaltimum [?] observations being equal [for] frequent [ones], we ingest, and the sixth [part] depending on parallax, the Sun being horizontal, which some reckon at 3'; some at 2'; others at 1', they establish; Wendelinus [Vuendelinus] reckons 15". We scarcely [reckon] 30". On account of which doubts, and the most slow [motion] near the Tropics, the change of declinations, Ptolemy book 3, ch. 2, said: "*For the sake of antiquity, then, the Solstice of Meton and Euctemon, and afterwards that of Aristarchus observed in our time, these are to be conferred which were of our times. But since the Solstitial observations are discerned with difficulty, and which equinoxes by their handing down are not exquisitely captured, they appear; what indeed are most exquisite of the equinoxes observed by Hipparchus. We also, [observing] a few things together, do not [adduce] from the ancients.*"

[Margin: Prolemæi [recte: Ptolemæi] nimia fiducia. — Ptolemy's excessive confidence.]

§1. Ptolemy narrates, in book 3 of the *Almagestum Construct.* [*Magnae Constructionis*] ch. 1, from Hipparchus, concerning the magnitude of the year — [that] Aristarchus, in the year 50 of the first Callippic period, and 44 from the death of Magnus [Alexander], which is 280 years before Christ, observed a Solstice on a certain day, that very year [as] 152: now the year [had begun] before Christ 432. Meton and Euctemon, with Abscondus prefect of Athens, made the Solstice on the 21st [of] Phamenoth [?]; Scaliger book 2, *De Emendatione Temporum*, p. 76, and book 5, p. 410: and Petavius in *Uranologion, Variarum*, discourse [differt] book 6, ch. 10, say that it was [in] the year of Nabonassar 316, day 27, feria 1, one [day] before the Solstice: for Meton from his observation of the True [solstice], being elected, made [it] of his own Cycle to run in, just as Meton's day [feast] was said; and so is to be understood that Festival of Avienus in those verses:

*primam Meton ex ordio sumpsit ab anno Torrentem rutilo cum Phoebus
sidere Cancrum*

[Margin: Mesonis [recte: Metonis] Solstitium. — Meton's Solstice.]

For at Athens in that year Meton's Solstice fell on the 27th day of June, hour 10, 43' after the middle of the night; the True [solstice], however, on the 28th day, hour 19, 13". But Petavius added that, in Hipparchus's time, the Solstice [fell] in the middle on the 25th of June; the True [as] on the 28th, and the Solstice in the mean on the 14th. But the True, on the 25th, was wont to fall. But Lansberge [Lansbergius] in his *Thesaurus*, Class 4 of solar observations, against the *Syntaxis* draws back this chronological observation to that of Nabonassar (when it behoved [him to use] that of the Athenians), gathers [it] from his own Tables, the solstice [as] hour 16, 41' p.m. of the 20th [of] Phamenoth, at which moment he asserts the Sun to have entered Cancer, and therefore wishes it to have been the True equinox [recte: solstice]; that is, the year of number changed. Certain, however, it is to me that the 21st of Phamenoth was the 16th of June.

[Margin: Lansbergij lapsus. — Lansberge's error.]

§2. Ptolemy, book 3, ch. 2, subjoins an observation made by himself at Alexandria of the summer Solstice in the year 463, from the death of Alexander, the day 11 [of] Messori, after the middle of the next following night, made; he repeats ch. 4, [that] it was the year of Christ 140, day 22 [of] June, which followed; but he places Lansberge [Lansbergius] in his place — recently adduced — to be forgetful of the bissextile. From the beginning of the years of Christ, to the said Solstice there are full Julian years 139. Common months 5, day 24, hour at Alexandria 13, 17'. As to the apparent time, but as to the True the hour [is] 13, one before the middle of the night. But he ought to have taken the months of the bissextile year. See our Chronological Apparatus.

[Margin: Lansbergi error. — Lansberge's error.]

§3. [Bernhard Walther], at Nuremberg [Norimbergæ] in the year 1478, by Christ's [reckoning], observed by the rules of Parallaxes on the 11th of June, exactly the partition [altitude] of 44°80" [?]; and the same most exactly on the 13th of June, hour 44°80" [?]. Hence it follows that the Sun equally declined in either meridian from the equator; and therefore the Solstice, and the maximum declina-
[...continues next batch]

[Margin: Vualtheri [recte: Vualtheri] Solstitia. — Walther's Solstices.]

[the maximum declina]tion fell on the meridian of June 12. Yet the chord corresponding to it, with our parallaxes subtracted, leaves the true distance of the Sun from the vertex of Nuremberg as 25°56'29"; from this, subtracting the true

declination, namely $23^{\circ}29'36''$ — the latter being from the observations of Cassini, $23^{\circ}29'20''$ — it follows that on June 11 and 13 it was $44''$ short of the maximum, which would require these to be $44''$ apart; and so the solstice occurred either on the 10th or the 11th of June. But if we wish to retain that figure of June 12, on account of the equality of declination between June 11 and 13, and also to retain the maximum obliquity of the Sun at the vertex as $23^{\circ}30'20''$, then the true distance of the Sun from the vertex must have been $25^{\circ}56'55''56'''$ [?] as seen, whereas it was seen as $25^{\circ}56'1''$ — and so on that reckoning the solstice occurred at $44876''$ [?]. Or certainly the altitude of the pole of Nuremberg was $49^{\circ}26'28''$, unless the parallaxes are increased, and indeed at such a latitude by $53'$ [?]. One may see how slippery and tangled the solstitial observations are.

§4. In the year 1487, the same Walther, at the same place, on the meridian both of December 13 and of the 14th, observed by strong rays [per Radios fortes], and with diligence. The chord of the distance of the Sun from the vertex was 118790, the partition being $25^{\circ}56'29''$. Therefore, from the equal declination it follows that the winter solstice was celebrated between the mid-moment of the two, that is, between December 13 and 14. But if anyone wishes, through the perplexities of refraction and parallax — from the altitude of the pole and the obliquity of the ecliptic discussed above — to track down the diverse timing of this solstice, he will only distract his mind without profit.

§5. In the year 1490, the same Walther, on June 11 and 12, by a clear and diligent observation [Clara, & diligenti observatione], obtained the meridian distance of the Sun from the vertex of Nuremberg. The chord, the partition being 44900 — therefore, from this equality, it would follow that the summer solstice occurred at the middle of the night intervening between June 11 and 12. So, in the same Epilogism, since the result emerges far more diverse and perplexed, although it pleases [Riccioli] to exercise himself in such calculations, I have set down the chosen observations of the solstitial days for Walther by adding the arc corresponding to the chords, and the declination as seen there; the altitude of the pole is $49^{\circ}26'$.

Solstitial Observations of Walther at Nuremberg.

Order	Years of Christ (Yr. M. D.)	Note added by Walther (in the Observat ion)	To Radius 100000 (Chord)	Distance of Sun from vertex as seen (Deg. ' ")	Declinati on of Sun as seen (Deg. ' ")
	1476 Junij 12	certain [certa]	44890	25 56 29	23 29 31
	1478 Junij 11	exactly [exactè]	44890	25 56 29	23 29 31
	Junij 13	exactly [exactè]	44890	25 56 29	23 29 31
	Dec. 11	strong rays, dilig. [Radij fort. dilig.]	118760	72 51 15	23 25 15
	1487 Dec. 13	strong rays, dilig. [Radij fort. dilig.]	118790	72 52 30	23 26 30
	14	strong rays, dilig. [Radij fort. dilig.]	118790	72 52 30	23 26 30
	1488 Dec. 11	clear, diligent [Clara diligens]	118780	72 52 8	23 26 8
	1489 Junij 12	clear, diligent [Clara	44890	25 56 29	23 29 31

Order	Years of Christ (Yr. M. D.)	Note added by Walther (in the Observat ion)	To Radius 100000 (Chord)	Distance of Sun from vertex as seen (Deg. ' ")	Declinati on of Sun as seen (Deg. ' ")
		diligens]			
	1490 Junij 11	clear, diligent [Clara diligens]	44900	25 56 15	23 29 45
	Junij 12	clear, diligent [Clara diligens]	44900	25 56 15	23 29 45
	Dec. 12	clear, diligent [Clara diligens]	118790	72 52 30	23 26 30
	Dec. 13	clear, diligent [Clara diligens]	118788	72 52 25	23 26 25
	1493 Dec. 13	clear, diligent [Clara diligens]	118800	72 52 15	23 26 55
	1496 Dec. 11	very clear & dilig. [Clar. valdè dilig.]	118800	72 52 55	23 26 55
	1498 Junij 11	very clear & dilig. [Clara	44890	25 56 29	23 29 31

Order	Years of Christ (Yr. M. D.)	Note added by Walther (in the Observat ion)	To Radius 100000 (Chord)	Distance of Sun from vertex as seen (Deg. ' ")	Declinati on of Sun as seen (Deg. ' ")
		valdè dilig.]			
	1500 Junij 11	remarka bly certain [Præclar a certiss.]	44883	25 56 14	23 29 14
	Junij 13	very clear & dilig. [Clar. valdè dilig.]	44890	25 56 29	23 29 31

Parsing notes: The "Order" column is left blank for all Walther rows in the source (the ordinal sequence 7–17 is used in the adjacent Tychoic table, not here). The June observations (small zenith-distance ~25°57', chord ~44890) and the December observations (large zenith-distance ~72°52', chord ~118xxx) are interleaved by date, not grouped; the year column carries a year only on the first row of each block (1476, then 1478, 1487, 1488/89/90, 1493, 1496/98/1500), with blank year-cells continuing the prior year as printed. All chord values and the December declination-degree column ("23") were resolved on further re-read (): 118760 / 118780 / 118788 / 118790 / 118800 and 44883 / 44890 / 44900 confirmed; no chord cell remains [?]. Two rows are transcribed as printed and flagged as suspected source/observation outliers: 1500 Junij 11 (chord 44883 with Dist. 25°56'14" / Decl. 23°29'14", anomalously low against the recurring June 44890 / 23°29'31") and 1493 Dec 13 (Dist. 72°52'15" paired with Decl. 23°26'55", which breaks the December seconds-matching pattern and may be a compositor carry-down from the 1496 row).

[Margin: Note for Refraction.] If the observations of the winter solstices are correct, taking the correct altitude of the pole of Nuremberg and the correct obliquity of the ecliptic, that is, the maximum declination of the Sun as 23°30'20",

with our parallax of 14", then at an altitude of the Sun of 17° the Refraction at Nuremberg never on those days exceeded 4'40"; indeed it was often only 3'26" [?], and sometimes, if the observations were made at the very moment of the solstice, less than that. For the difference between the seen declinations is not so great, and at most can be referred to Refraction.

§6. **Egnatius Dantes** [Egnazio Danti], in a folio work which he published on the use of the great Gnomon erected by himself at Bologna in the Church of San Petronio, says that in the year 1576, on December 11, he reached the maximum declination of the Sun at the extreme edge of the solar image; and that on the following day it diminished, so that he discovered the winter solstice to have fallen between December 11 and 12. The same man, however, earlier, namely in the year 1570 at Florence, had observed the maximum declination in both [solstices]; he reports the Sun's solstitial declination in Part 2 of his *Astrolabe* (Chapter 24), but he was deceived as to the maximum.

From the Tychonic Solstitial Observations, I have selected four summer and three winter ones, handed down partly in **Longomontanus** Book 2 of the *Theoricae*, in [Riccioli's] Commentary on the Sun; partly from Father **Alberto Curzio** [Albert Curtz] of our Society, who transmitted them to me from an autograph of Tycho, out of his singular liberality. Assuming the altitude of the Equator established at Uraniborg by Tycho as 34°5'30" [recte: the co-latitude], and our parallax of 7", in the apogee [?] of altitude as 57½; our obliquity of the ecliptic as 23°30'20". The solstices, however many, I shall indicate among the winter solstices.

Tychonic Observations Selected on Solstitial Days.

Order	Years of Christ, Days in old style (Yr. M. D.)	Altit. seen (G. ' ")	Altit. true (G. ' ")	Declinati on true	Solstice p.m.
7	1586 Junij 12	57 35 36	57 35 43	23 30 13	11 13
8	1587 Junij 14	57 34 30	57 34 7	23 29 7	12 1
	1589 Junij 11	57 35 50	57 35 57	23 30 27	11 1
9	Per	57 35 45	57 35 52	23 30 22	11 0

Order	Years of Christ, Days in old style (Yr. M. D.)	Altit. seen (G. ' ")	Altit. true (G. ' ")	Declinati on true	Solstice p.m.
	Tychonic i p. quadr. volub.				
	1593 Junij 11	57 35 0	57 35 7	23 29 37	12 3
10	1589 Dec. 15	10 44 48			
	1590 Dec. 10	10 43 15			
	1594 Dec. 10	10 41 10			
	1589 Junij 12	57 35 50	57 35 57	23 30 27	
	Per Tychoni	57 35 50	57 35 57	23 30 27	
	Per Volubil.	57 35 45	57 35 52	23 30 22	
	Per Armillas &			23 29 50 / 23 30	

Parsing notes: The Tychonic table's "Order" column carries the ordinals 7, 8, 9, 10 (grouping rows). The right two columns ("Declinatio vera" and "Solstitij p.m.") are sparsely filled and several lower rows give only a declination value; alignment by column position. The bottom block records alternative instruments for the 1589 reading — resolved on further re-read () as "Per Tychonici p[er] quadr[antem] volub[ilem]" (by Tycho's revolving quadrant), "Per Tychoni," "Per Volubil[em]" (by the revolving quadrant), and "Per Armillas &" (by the armillae) — with the trailing "23 29 50 / 23 30" being two declination variants (the second printed without a seconds figure). The three December "Altit. visa" readings (1589, 1590,

1594) are given without corresponding true-altitude or declination entries (blank as printed, not illegible).

§11. **Lansberge** [Philippe van Lansberge], in Class 1 of his Observations, recounts the solar [observations] made in the year 1589. Apart from the two observations noted on certain days, the solstitial altitudes accord with the southern meridian of the Sun, taken just as Goesa[?]. But afterward he claimed, by his own peculiar ingenuity and the highest skill[?], to have detected the solstitial altitude before, just as after.

[Margin: Lansberge's Solstice.] In the year of Christ 1599, June 11, at hour 17, after midnight at Goesa, when likewise he reckoned the Sun to have entered Cancer by his own Tables, but since at an altitude of the Sun of 62° he allows a parallax of $1'4''$ — which is nothing unless $1'[?]$ — he erred by nearly a whole minute, and most of all in the hours at the solstice.

§12. In the year 1636, the solstice observed at Marseilles [Massilia] before himself by Claude **Fabri de Peiresc** [Nicolas-Claude Fabri de Peiresc], in the College of the Fathers of the Oratorian Congregation, is recounted by **Gassendi** both in the *Life* of the same Peiresc, and in Epistle 3 to **Wendelin** [Govaert Wendelen], now published at The Hague, printed after Gassendi's *Astronomical Institution*. Therefore in the said College he erected a Gnomon, of an alternate height — others give it as Parisian feet 32, others as 90000 or 89328 parts — afterwards divided, and the shadow of the highest edge of such [a Gnomon] in the meridian on June 19 was found to be 31766 parts. But at the meridian on the 20th it was 31753, and on the 21st 31759, and on the 22nd 31752, on which day a parallax of nearly $1'4''$ occurs, which is nothing unless $1\frac{1}{2}''$. He erred by almost a whole minute, and in most of the hours at the solstice.

[Margin: Gassendi's Solstice.] In the year 1636, the Marseilles solstice was probably, from Tycho, in the 10th minute of the first degree of Cancer, and he had diminished the declination by about two...

[two] seconds; that this [shadow] could be reckoned as that solstitial partition 31750, from which he gathers the solstitial altitude of the Sun, insofar as it surpasses the highest margin by $70^\circ 24' 59''$; and, the semidiameter being added, the partition is $1'4''[?]$; and, the parallax of Wendelin being subtracted of $20''$, he gathers the true altitude of the center of the pole[?] of the Sun as $70^\circ 11' 15''$. In the rest of Epistle 3, edited likewise there, he confesses that on account of the variation of the meridian line by the magnetic deviation it was a false altitude of the Sun, and that the altitude ought to have been corrected to $70^\circ 12' 16''$; indeed,

from our parallax of 14", it comes out as 70°12'4". Wherefore, if the polar altitude at Marseilles in our *Reformed Geography* stood at 43°20', it would have been the declination 23°32', which however Gassendi gathers as smaller elsewhere. From this, nevertheless, we cannot gather the moment of the solstice with certainty.

§13. In the year 1644, June 21, **Albertus Linemann** [Albert Linemann] reckoned the meridian altitude of the Sun as 58°47'30", at Königsberg in Prussia [Regiomontum Prussiae], where he asserts in the memory of the age 7°8'8". From this the declination would be 21°50'; but our parallax is greater, by 16". On account of the uncertainty whether parallax corrected the altitude, the moment of the solstice remains uncertain.

[Margin: Linemann's Solstitial Observations.] [Riccioli], in Book 3 of the *Almagest* [Almagestum Novum], Chapter 27, [recorded] the solstices of the years attempted, but laboring with some little defect of instrument and an excess of parallax compared with the altitude of the pole, which does not exceed 69°[?], not by 5" or 6". And we then used a false altitude of the pole; whence in our Observatory it is found, with these corrected, to yield the solstices more emended, as below.

Solstices observed by Us at Bologna.

Order	Years of Christ (A. M. D.)	Altit. seen (G. ' ")	Altit. true (G. ' ")	Declin. of Sun (Gr. 23.½?) (' ")	Solstice after meridian (D. H. ')
14	1643 Junij 21	69 0 0	69 0 6	30 16	21 6 52
15	1644 Junij 20	68 59 58	69 0 3	30 13	20 12 42
16	1645 Junij 20	68 59 54	68 59 59	30 9	20 18 32
17	1646 Junij 20	68 59 50	68 59 55	30 5	21 1 40
	Junij 21	69 0 5	69 0 10	30 20	21 0 0
	Junij 22	68 59 50	68 59 55	30 5	20 22 20

Parsing notes: The declination column is headed with the constant degree value "Gr. 23." (with what appears to be a fraction or "30" prefix); only the minutes and seconds vary by row (30 16, 30 13, etc.), so the full declinations read 23°30'16", 23°30'13", etc. The "Solstice after meridian" column is day/hour/minute (D. H. ').

Ordo 17 spans three observation rows (June 20, 21, 22) all under the single year 1646. All cells resolved on further re-read (); the final-row "Solstice after meridian" cell reads 20 22 20.

From this last solstice we are quite certain that the altitudes of the Sun found on June 20 and 22 are altogether equal at the meridian itself; therefore the altitude of the day of the 21st is certain. With second-order parallax added of only a few seconds, by 5", whence we are confirmed in the maximum declination of the Sun of 23°30'20"; and on what day the 20th and 22nd were 15" short, the difference between them then being 14" a day — therefore by 15" it would require 14 hours; wherefore on the day added to the 20th, the solstice would fall on the day 21, hour 1, 40' after the meridian. And at the same reasoning, taking June 21 short, it would fall on the day 21, hour 1, 1/3; this is the meridian; or on the day 20, hour 21, 20' after the meridian. Altogether, keeping the middle day, the solstice was at the meridian.

There follow now the Observations of **Dom. Io. Dominicus Cassini** [Giovanni Domenico Cassini], who has it thus in a Book published at that time, inscribed *Specimen Observationum Bononiensium*, page 3: "In the year 1655, on the day June 21, in the Summer Solstice, in the Church of San Petronio at Bologna, at an altitude of the Bolognese feet of 71, we observed the distance of the Sun's center from the vertex at the meridian point itself, 20°50'50".

"But the distance of the Equator from the vertex is 44°30'20". Therefore the apparent distance of the Sun from the Equator [its declination] is 23°30'30". The distance of the Sun from the Tropic [Tropicus], and the Parallax in this case, are imperceptible: wherefore it retains the maximum solar declination of 23°30'30". Since, however, the marble band [fascia] of the Gnomon, and the iron, were not yet finished — and these designations marked on the sides themselves — to examine the faculty I reserved for myself, as I gather from page 19; therefore in his autograph, and in the document most liberally communicated to me for his Truth, no less than [out of love] toward us...

[with] love and with study, it is thus read: "I examined the observation of the day June 21 of the year 1655, the solstitial [observation] impressed on the sides, which I more evidently recognized, and I found the distance of the lower margin of the Sun from the vertex — the Tangent — to be not 38904 but 38909; and of the upper, not 37860 but 37870. Thus then:

Gr. ' "

Of the Tangent 38909. ARC

21 15 38

	Gr. ' "
Of the Tangent 37870	20 44 30
Difference & Solar Diameter	0 31 8
Semidiameter	0 15 34
Distance of Sun's center from vertex	21 0 4
Distance of Equator from vertex	44 30 20
Therefore the declination of the Sun then was	23 30 16
Because the distance of the Sun from the start of Cancer is added	0 0 4
Therefore the maximum declination of the Sun	23 30 20

[Margin: Maximum Declination of the Sun.]

"This is afterward confirmed from the emended solstitial altitudes of Tycho. Now if on that day it were 4" short of the maximum declination, and required 14", it would require hours 24, and a quarter; that is, by 4" it would require hours 6.12': by which the solstice would have fallen after the meridian of day 21. On account of the omitted parallax, however, the parallax is the same, and there is a somewhat dubious connection of the observation; this observation will seem postponed, as soon as from the same Authors, etc.

"From the same year 1658, the solstitial observation, and the documents, which I shall presently show from the same Autographs and documents."

In the year 1658, June 20.

	Gr. ' "
19 — Tangent of the lowest limb of the Sun 38912	21 15 44
Tangent of the highest 37876	20 44 40
Apparent Solar Diameter	0 31 4
Semidiameter	0 15 32
Distance of Sun's center from vertex as seen	21 0 12

	Gr. ' "
True, to us	21 0 7
Distance of Equator from vertex	44 30 20
Declination of Sun then	23 30 13

In the same year 1658, June 21, more accurately.

	Gr. ' "
Tangent of the lowest limb of the Sun 38911	21 15 42
Tangent of the highest 37871	20 44 32
Apparent Solar Diameter	0 31 10
Semidiameter	0 15 35
Distance of Sun's center from vertex as seen	21 0 7
True, on account of our parallax 5 $\frac{1}{4}$ "	21 0 1 $\frac{3}{4}$
Distance of Equator from vertex	44 30 20
Therefore the true declination of the Sun	23 30 18 $\frac{1}{4}$
And the maximum solar declination being placed	23 30 20

The solstice was on the day June 21, hour 11, 45'. Hour after the meridian. Because if the solstice of our year 1646, and by our Revolutions it ought to have been hour 21, 45', 5", 12"; therefore I still allow a parallax of 1 $\frac{1}{2}$ ", because that one [allows] 5" in this way, or 6". It rarely satisfies the Epilogisms of Astronomers. It is necessary, therefore, to correct the Tangents of day 20, so that the true declination comes out as nearly 23°30'7".

CAPVT VI.

Observations of the Obliquity of the Ecliptic, or of the Maximum Declination of the Sun.

[Obliquitatis Ecliptica Observationes, seu Declinationis maxima Solis.]

§1. **Pytheas of Marseilles** [Pytheas Massiliensis], who flourished in the age of Alexander the Great, who died in the 113th Olympiad — that is, in the year 324 before Christ — as many gather from Strabo, who says that the writings of Pytheas were difficult to be credited. It was reported by Aristarchus, a disciple of Pytheas, in the time of Scipio, who lived around the 140th Olympiad, the year before Christ 216; if indeed it was Pytheas, of whom Polybius, while Scipio, questioning the Massilians, contends — as Gassendi cites in his Epistle 3 to Wendelin: it is Pytheas, referring to Gassendi in the *Life* of Claude Fabri de Peiresc, who in the year 1636 observed at Marseilles the proportion of the solstitial summer shadow to the Gnomon, as 209 to 600, that is, as $41\frac{2}{5}$ to 120. From these two sides...

[Margin: Order.]

[Margin: Pytheas.]

[a right] angle is gathered: the altitude of the highest limb of the Sun as seen, $70^{\circ}47'42''$; to which if we add the semidiameter of the Sun, $15'5''$, there remains the true altitude of the Sun's center as seen, $70^{\circ}32'41''$; and from this, subtracting the Marseilles altitude of the Equator, $46^{\circ}40'$, there remains the maximum declination of the Sun as $23^{\circ}52'41''$. Yet **Gassendi** thinks Marseilles to have had that proportion easily as great as Gassendi himself found, of partition $42\frac{3}{5}$ — the Gnomon being 120, or partition 1750, the Gnomon being 89328. Whence the seen altitude of the highest limb of the Sun comes together as $70^{\circ}25'59''$; and at the center, $70^{\circ}10'54''$; and the seen $70^{\circ}10'58''$; and the maximum declination of the Sun as $23^{\circ}30'58''$. But Gassendi, from that place, and from Epistle 2 to Wendelin (which he inscribes *On the Proportion of the Gnomon to the Solstitial Shadow*), concedes that it was at one age and another expressly that observation of Pytheas. Only Strabo, Book 2, under the end of Hipparchus, brings forward the proportion of the Gnomon to the summer shadow as 120 to 42; but, on the contrary, a fifth, namely that Byzantium was thought by Hipparchus to be in the same parallel in which Marseilles, on account of the same proportion of the Gnomon at Byzantium as at Marseilles by Pytheas — therefore the same is believed observed at both places nearly, although it differs a little, yet not soon emended out of Ptolemy, who in Book 3 of the *Almagest*, Chapter 6, [reports it] from Pytheas, or from Hipparchus; he affirms Marseilles, where the Gnomon being to the summer shadow as 209 to 60, that is as 120 to $41\frac{2}{5}$, nearly; to which the aforesaid altitude of the highest limb of the Sun corresponds, $70^{\circ}51'7''$. From the shadow of the Equator the said altitude of the highest limb of the Sun follows, $47^{\circ}1'5''$; and at the center of the Sun, $47^{\circ}46'0''$; but it was seen as $47^{\circ}46'5''$ — as

great as the Equator of Marseilles, which was found from the fixed stars by Gassendi, unless by 46'40" nearly; whence it is easy to gather that the trifling errors which were observed are not at the very moment of the equinox or the solstice, but at the moment after taken for the Equator, or the solstice.

§2. **Hipparchus**, in Snellius [Willebrord Snell] Book 2 of Eratosthenes the Batavian, under the end, handed down the equinoctial shadow at Byzantium to the Gnomon, repeated as 111 to 120; therefore by the laws of right-angled plane Triangles, the altitude of the highest limb of the Sun is 47°13'45". Again, through Strabo, Book 2, the Gnomon at Byzantium in the Summer Solstice has the same proportion to the shadow which 120 has to 42, less a fifth. Therefore by the same laws the altitude of the highest limb of the Sun is 70°47'42". From these differences of altitude follows the obliquity of the ecliptic, or the difference of the Solar declinations of the Summer [solstice] from the Equator and the equinox, none other than 23°33'57" — in the time of Hipparchus, not to say of Strabo, who flourished under Tiberius. How much it would err in these two doubtful minutes, the difficulty of avoiding these errors teaches, even in this age, unless we use the highest diligence. But if you heed **Pliny**, who in Book 6, Chapter 34, [says] that in the parallel of Byzantium the Gnomon yields shadows in the ratio of 9 to the equinoctial Gnomon, and that the equinoctial Gnomon yields shadows of 8 feet, the altitude of the highest limb of the Sun would be 48°12', whence subtracting the declination of 24°24'42", the maximum declination of the Sun comes out as 23°48' — and this is ridiculous. But Pliny gives the reasoning of the whole Climate, and does not speak of the shadow of the Gnomon at Byzantium, but of the shadow of the Climate, in which Byzantium, Rome, etc. nearly are.

§3. The ancient observations, which defined the distance of the Tropics from the Equator as 24 degrees, we can thus interpret, since it does appear in a greater degree, 23 $\frac{2}{3}$; if they chose a round number 24 rather than 23 $\frac{2}{3}$. So Geminus reckons the equinoctial distance from both Tropics, of partition 47, as great as the whole meridian is 83 $\frac{1}{3}$; that is, 23°51'20" for the distance of the Sun from the Tropics. So Eratosthenes and Hipparchus, in **Ptolemy** Book 1 of the *Almagest*, Chapter 9, [say] that from the summer Tropic to the equinoctial Equator are parts 24 [recte: differently]; and afterward, seeing it to be in a smaller degree, 24 and a greater of 23 $\frac{2}{3}$, they said that the distance between the Tropics themselves is nearly partition 11, as great as the whole meridian is 83 $\frac{1}{3}$; this is the distance of the Tropics 47°40'40"; and the distance of the Equator from the Tropics 23°51'20".

§4. For **Eratosthenes**, with Scipio, assumed the proportion of the solar rays — abusing that opinion of the distance of the Equator and of the Tropics, with the

magnitude of the Terrestrial circumference — but did not insert it. The method of Eratosthenes is set forth by **Cleomedes** Book 1, the Cyclic Theory, Chapter 10, and from him by **Petrus Nonius** [Pedro Nunes] Book 2 *On Observation*, page 132, and by **Willebrord Snell the Batavian** Chapter 9, in a far better scheme than the dialogue 2 of Maurolyco *On Cosmography*; or from Maurolyco, Clavius Book 1 of the *Sphere*. But since at that very source of Cleomedes we have drawn Eratosthenes' own method, then we shall set forth other experiments; and lastly from his observation we shall derive the Distance of the Tropic from the Equator corrected.

First, Eratosthenes — and with him Cleomedes — assumed Alexandria A, and Syene B, to be under the same meridian. Secondly, the arc AB to be among the towns five thousand stadia. Thirdly, that the rays sent down to different parts differ; the Tower of parallels [parallelos]...

Diagram. A geometric figure at the lower right of the page illustrating Eratosthenes' measurement of the Earth's circumference. At the top, two nearly parallel slanting lines run from upper right (point C) down toward the left; D is at the upper left end and C at the upper right, forming the line of the Sun's rays. From these descend lines to a lower assembly: a small circle (representing the Earth) with center F, on which points are arranged. Around the circle the letters I, B, G, H, K, L, E mark the scaphe (bowl-sundial) and gnomon positions at Alexandria and Syene; A and E mark the parallel rays' endpoints near the upper region.

- D (upper left): endpoint of one solar ray
- C (upper right): endpoint of the other solar ray
- A (left, mid-height): top of the gnomon / endpoint of parallel ray
- B (right of circle): a point on the rays meeting the circle
- I (above circle): point on ray near the scaphe at Alexandria
- G (on circle): point near center-line of the circle
- H, K, L, E (left/lower around circle): points marking the scaphe (hemispherical bowl HEI) and gnomon AG
- F (center of circle): center of the Earth

The figure accompanies the text describing Eratosthenes' construction: ray CB produced to the imaginary radius toward the Earth's center F; gnomon AG set in the scaphe (the hollow hemisphere HEI); the angle EGF at Alexandria equal to angle BFG (the arc AB subtended); from which the arc AB is shown to subtend $7^{\circ}12'$ of the whole circle, hence the whole Earth's circumference is 250000 stadia.

(Two labels — the small interior points near G — were difficult to resolve and are given by best reading.)

[Margin: Gassendi.]

[Margin: Pytheas.]

thus Cleomedes expressed, and the radii [drawn] from the Sun's center C, and to Syene, and DE, from the highest extreme limb of the Sun, to the scaphe E at Alexandria, to be among the parallels. Fourthly, a straight line drawn through the parallels to make alternate angles equal, the angles being made equal; and so, the imaginary radius CB being produced to the Earth's center F, alternate at Alexandria on the day of the Summer Solstice the gnomon, or style AG, of the scaphe, that is, of the hollow hemisphere HEI; and so, the style being continued to the center F, the straight line FG, to fall in the parallels CF and DE. Therefore the angle EGF is equal to the angle BFG. Fifthly, therefore, the arc AB, subtended by the angle BFG, is equal to the arc AE, subtended also by the angle AGE. Sixthly, Syene to be under the summer Tropic, since the Gnomon at the meridian of the Summer Solstice casts no shadow at all for 300 stadia. With these established, on the day of the Summer Solstice he noted that Eratosthenes had observed the arc AB, marking the shadow EA, terminated at the ratio DE in the bottom of the scaphe at Alexandria; circling about, he found there the fiftieth part of the whole little circle, this is $7^{\circ}12'$. He concludes therefore that the arc AB also is 5000 stadia, and is of degrees $7^{\circ}12'$; therefore the whole Earth's circumference is 250000 stadia.

But the first and principal error of Eratosthenes, which even the good Cleomedes acknowledged, was in the parallelism. For Geometers have demonstrated the falsity, and Cleomedes subjects it: that the rays from the different solar parts, and to the diverse parts of the Earth, are not parallels; since indeed the rays of which one is propagated from the center, the other from the margin, even if one falls on the place B, the other...

Liber I — De Sole (continued)

Caput VI — Observations of the Obliquity of the Ecliptic, or the Maximum Declination of the Sun (continued)

[Riccioli continues his critique of Eratosthenes' measurement of the Earth's circumference, carrying over from the previous folio.]

to the point K, the rays would strike almost at the quadrant BK, and at such a distance they could not even appear sensibly parallel, because the Earth's semidiameter KF is not equal to the physically true semidiameter of the Sun, since the latter exceeds and contains terrestrial dimensions five and a half times over. From Ptolemy's data, in our judgment and as Snel [Snellius] reports earlier, the Sun's diameter is 33 and a little more times the Earth's diameter [*Almagestum Novum* I.3, ch. 5]. At all events the truth of the demonstration is not destroyed: by Nonius [Pedro Nunes] and Snellius (cited above, I.3, ch. 5), the rays CB and CGL, drawn from the same point of the Sun and from a different part of the Earth's surface, cannot be assumed parallel. For if the rays CB and CGL are parallel, then by means of the gnomon AG, the apex G, and the chord G, it must happen that, the angle BFG being equal to the angle AGL — and so equal to the arc AB — the arc EL, which is as great as the angle EGL, that is, equal to the angle CGD, subtended at the Sun's semidiameter (namely the minute $1^{\circ}5' [?]$), and observed in our parallaxes (and these too must escape detection [recte: must be set aside]), the arc AL must necessarily come out as gr. 7. 27'. 5". And yet this arc AB, namely "the summer tropic" or the Syenian summer zenith, and "the vertex of Alexandria in Egypt," is, at the vertex of Alexandria, distant — and Ptolemy affirms [*Almagest* I.5] — and the great *Syntaxis* [*Almagest*] ch. 12 and 13, and book 4 of the *Geography* ch. 5, table 13, places it distant from the Equator by gr. 30. 58'. He says, then, in the demonstrated chapter 12, that *from the point of the vertex of Alexandria to the equinoctial line there are demonstrated 30. 58'*. By thus subtracting the arc AB, falsely supposed by Eratosthenes to be gr. 7. 12', from the tropic, or from the equator, gr. 23. 46' remain. But what came out at gr. 23. 51'. 20", Eratosthenes asserted, came out at gr. 23. 51'. 20", [Riccioli notes:] Eratosthenes wished the altitude of the Pole at Alexandria to be gr. 31. 3. 5. [?]

[Margin: The true obliquity of the ecliptic according to Eratosthenes, gr. 23. 51'. 5".] [The Latin margin reads: *Vera obliquitas Eclipticæ Eratosthenis 23. 51. 5.*]

Hence, by subtracting the true arc AB gr. 7. 27'. 5", the true distance of the tropic from the equator at Eratosthenes' time comes out as gr. 23. 31'. 5", with the parallax set aside, gr. 23. 31'. Therefore why Ptolemy, wishing to retain the altitude of the Pole at Alexandria, and the distance of the tropic from the equator, took the latitude as the maximum at gr. 20. 6, in such a way that the obliquity of the ecliptic was at that time gr. 23. 46'. As we said, this came out about 20 minutes less than Ptolemy supposed, and as we said in *Geography* I.7, and in *Geographia Reformata* 128 [recte: CXXVIII = 128], we shall say when treating of the observations of the Moon's latitudes.

§5 — Ptolemy, *Almagest* I.2, ch. 6, parallel 11. In the *Geography* I, ch. 23, parallel 10, he says that the maximum day in Rhodes — and from observations the altitude of the Pole there is gr. 36 — cannot be assembled here; the maximum declination is gr. 23. 51'. He used this same maximum declination in his Tables, and likewise Ptolemy in the *Prima Mobilia* [recte: *Almagest*] places the altitude of the Pole at gr. 36, and the semidiurnal arc corresponds to hr. 7. 15'; and the diurnal arc hr. 14. 30'.

§6 — Pappus of Alexandria, who flourished about the year of the Lord 390, in his *Mathematical Collections* I.6, theorem 35, assumes for his demonstrations this hypothesis: *that the diameter of the sphere has the same proportion to the diameter of the summer tropic as 629 has to 529; and likewise that a straight line drawn from the center of the sphere to the center of the summer tropic has the same proportion to the semidiameter, namely as 115 to &c.* Where Commandinus [Federico Commandino] adds in his commentary: *the maximum right sine of the declinations is of the degrees 23. 51', and is 23924; the semidiameter of the sphere, on which we hold the maximum declination, is 60000 &c., or it is 39874, of the kind in which the semidiameter is 100000, so that it is clear from the Tables of Sines.*

[Margin: Pappus' opinion on the obliquity of the ecliptic.] [Latin margin: *Pappi sententia de Obliquitate Ecliptica.*]

But this could not be otherwise unless the maximum declination were gr. 23. 51'. 20", as Ptolemy wishes, or because it follows from Pappus' time gr. 23. 50'. If his sine were such, the long-different semidiameter would be 40468, since it is clear that Pappus also followed that maximum declination, which Ptolemy and Eratosthenes before him had taken.

§ — Albategnius [al-Battānī], ch. 4, asserts from the knowledge of the fixed stars that he, diligently as far as could be done, observed the distance of the Sun from the vertex at midday to be a minimum of gr. 12. 26'; the maximum, by contrast, gr. 59. 26'; and he stated the distance of the tropics between themselves to be gr. 47. 10'; and from the equator gr. 23. 35'; and thus indeed the distance of the tropics gr. 23. 35'. And although it could happen that in all five minutes others should appear differently, it does not seem to me impossible — indeed very...

[Margin: Albategnius' observation.] [Latin margin: *Observatio Albateny.*]

easy. Moreover, he flourished about the year of Christ 880.

§8 — In the year of Christ about 1070, Arzachel [al-Zarqālī] the Spaniard related the distance of the tropic from the equator as gr. 23. 33'. And in the year 1140,

Almæon [Albumasar / al-Ma'mûn's astronomers?] of Almansor, item gr. 23. 33'. 30". And in the year 1210, Thebit [Thābit ibn Qurra], the son of Chora [Qurra], item gr. 23. 33'. 30". And in the year 1300, Prophatius the Jew [Prophatius Judæus / Jacob ben Makhir], gr. 23. 32'. From these, Copernicus, I.3, ch. 2 [*De Revolutionibus* III.2], deduces the obliquity of the eighth sphere in his theory. Peter Apian [Petrus Apianus], in *Observationes* II, [reports] Regiomontanus in the *Epitome* of the *Almagest*, prop. 17. Clavius [Christopher Clavius], in *Sphæra* p. 262, and Lansbergius [Philippus Lansbergius] in his *Thesaurus*, observed; the *Solarium Classe* I, [reports] those who placed the Prophatian-Jewish [value], collected about 68' [?] after Almeon, since they took it after that interval of 160 years, and after Arzachel of 130 years; and Lansbergius from this confirms Copernicus, and he praises this; I trust that he draws his observation from it for his own Tables. So that he assigns it to Albategnius at gr. 23. 38', using neglected refraction. But these foretold observations differ by very few minutes, or with respect to the matter observed at different times, so that we are not so certain about the error of three or four minutes deviating; nor does it diminish the obliquity of the ecliptic below gr. 23. 30', or 31' thereabouts.

[Margin: Arzachel.] [Margin: Almæon. Thebit. Prophatius.] [Margin: Lansbergius notes.]

§9 — In the year about 1460, Purbachius [Georg Peurbach] and Regiomontanus of Vienna in Austria received the meridian altitude of the Sun at the summer solstice as gr. 66. 6'. And in the winter [solstice] gr. 18. 10'; he says Lansbergius in his *Thesaurus* observed; and adds the obliquity of the zodiac gr. 23. 28'; but proper to him the parallax in the winter is gr. 4. 11', and refraction 5'. 4". The parallax was inscribed at the summer tropics as gr. 46. 59'. 51", or most nearly gr. 47, and the obliquity of the ecliptic gr. 23. 30'. Certainly, although Regiomontanus in the *Epitome* of the *Almagest*, prop. 17, may set it observed at gr. 23. 28', nevertheless this does not adhere to him, since from these Tables he chose gr. 23. 30'. Which also Clavius confesses in his *Sphæra* ch. 2, where nevertheless there is by far a different reading of the Regiomontanus observations and of Lansbergius; for he relates the observation of Vienna at the summer solstice altitude gr. 66. 30'; and the winter [solstice] gr. 18. 30'; whence he considers the altitude of the Pole at Vienna gr. 48. 6'; and from the Lansbergian observation gr. 48. 20'; whereas from our [observation in] *Geographia Reformata* it is gr. 48. 22'.

[Margin: Regiomontanus.]

§10 — In the preceding chapter, among all the solstitial observations of Bernard Walther [Bernardus Vualtherus], relation 3, none is found whose maximum

declination of the Sun exceeds gr. 23. 30', but many fall infra [below], which Clavius constructs in his *Sphæra*, and indeed Dominicus Maria Ferrariensis [Domenico Maria Novara], as Clavius has it in his *Sphæra* p. 2, where nevertheless there is by far a different reading of the Regiomontanus observation and of Lansbergius; for he relates of Vienna [gap]. Johannes Werner [Joannes Vernerus], in *Observationes* II, p. 28', [reports] and it is credible that he proposes the equation of the cause of Copernicus, who neglected refraction, and repeats his own from the major degrees, gr. 23. 28'. 30"; he affirms it true, *De Revolutionibus* I.3, ch. 2. As one who said *De Revolutionibus* I.2, ch. 2 [recte], a discrepancy [is] found in himself from the distance of the tropics [taken] together, gr. 46. 58'. nearly; and *De Revolutionibus* I.3, ch. 2, he adds the latitude of Nuremberg [Fruemburg/Frauenburg?] repeated at gr. 54. 19'. 30", to which if you add gr. 23. 28'. 30", he considers the maximum declination of the Sun; he gathers that he observed the winter altitude of the Sun at the meridian gr. 12. 12'; about the altitude of the Pole at Frauenburg through Tyconic instruments from the surrounding parts at Tycho's [base?] I.1, *Progymnasmata* p. 34; whence he gathers the calculation of refraction gr. 2. 45'. or as someone wishes, [a difference] from the altitude gr. 12. 12'; and there remains the altitude correct at gr. 12. 7'. 40", by which the altitude of Frauenburg [taken from] the equator is gr. 35. 37'. 45"; refraction subtracted leaves the maximum declination of the Sun gr. 23. 30'. 5".

[Margin: Copernicus corrected.]

§11 — Deservedly, then, Peter Apian, in the *Primum Mobile*, year 1530; and Orontius [recte: Orontio] Finæus [Oronce Finé], book 2 [reports]; Cosmogr. [Cosmography], under the same time; and Werner, *Nominis* [recte] II, [reports] from the observation of the year 1555, declared the obliquity of the ecliptic to be gr. 23. 30', which we agree with the opinion that Clavius elected in his *Sphæra* p. 262, and Scheinerus [Christoph Scheiner] in the *Rosa Ursina* p. 356, and Galileo [Galilei] in the *Dialogo dei Massimi Sistemi* p. 34 — although they do not add the observations. Nor are the opponents reluctant: Ignatius Danti [Egnatio Danti], part 2 of the *Astrolabio* ch. 54, where he relates that in the year 1570 at Florence he took the altitude of the summer solstice of the Sun at the meridian gr. 69. 49'; and the winter [solstice] gr. 22. 51'; whence...

[Margin: Apianus. Orontius. Nonius.] [Margin: Clavius. Scheinerus. Galileus. Dantes.]

whence he gathers the obliquity of the ecliptic gr. 23. 29'; for if to the winter altitude you add our parallax 5'; and at the winter [solstice] 20"; but to subtract the refraction from this gr. 5. 25"; the summer altitude comes out gr. 69. 49'. 5";

and the winter gr. 22. 51'. 20"; and the distance of the tropics gr. 47. 1. 10"; and the distance of the tropics from the equator gr. 23. 30'. 35".

§12 — Christophorus Rothmannus [Christoph Rothmann] and Justus Byrgius [Jost Bürgi], illustrious Landgraviaal astronomers of Hesse, in the year about 1570, found the corrected altitude of the equator at Kassel to be gr. 38. 46'. 40"; and the solstitial altitudes of the Sun, as Snellius has it, mostly gr. 62. 11'; rather gr. 60. 12'; whence, subtracting the altitude of the equator, the obliquity of the ecliptic gr. 23. 30'. 20" is left, just as much as Cassinus [Cassini] also collects for us in the year 1655.

[Margin: Hassiaci. (The Hessians.)]

Likewise, Johannes Homelius [Johann Homelius / Hommel], in the year 1570 — Tychone testifying, *Progymnasmata* p. 631 — observed the meridian altitude at the summer solstice gr. 62. 11'. Lipsiæ [at Leipzig], whose altitude of the equator, as Tycho says, is gr. 38. 41'; therefore the distance of the equator from the tropic gr. 23. 30'.

[Margin: Homelius.]

§13 — Tycho, however, from his own observations, *Tom. I, Progymnasmata*, p. 17 and 28, and in his *Epistolae* p. 40, stated the obliquity of the ecliptic gr. 23. 31'. 30"; for the maximum scilicet parallax of the Sun; and so Kepler corrects this excess in the *Rudolphine [Tables]* p. 27 and 116, saying that it could not be done at gr. 23. 30'; but already from his own selectissimis [most select] Tychonic observations, from nos. 7 and 10, deduced from the truer parallax, he reduced the minimal solstitial declination of the Sun to gr. 23. 29'. 7"; maximal gr. 23. 30'. 27"; and median gr. 23. 30'. 22".

[Margin: Tycho.]

§14 — Lansbergius, in the first class of solar observations, narrates that there was observed by Goëse [Goes] in the year 1589 the altitude of the Sun at the meridian at the summer solstice gr. 61. 58'; in the winter, by contrast, gr. 15. 2'. 30"; but, his own parallax and refraction being applied, he gathers that altitude at gr. 61. 59'; and at the winter [solstice] gr. 15. 4'; hence gr. 14. 58'. 43"; or from the difference, or the distance of the tropic gr. 47. 0. 11"; and the obliquity of the ecliptic gr. 23. 30'. 5"; just as much as for the Landgraviaals. But the Lansbergian refraction being retained, the 6'. nearest minute, in the winter, and the parallax being applied, our 23'. in the summer solstice, the summer altitude comes out gr. 61. 58'. 6"; the winter gr. 14. 56'. 46"; and therefore the obliquity of the ecliptic gr. 23. 30'. 40".

[Margin: Lansbergius.]

§15 — By which observation Gassendi of Marseilles detected the obliquity of the ecliptic gr. 23. 30'. 58", as we said; on the first occasion of Pytheas. Therefore in the *Institutiones Astronomicae* I, ch. 8 [recte], he said it to be gr. 23. 31'; seu [or] tantam tantam [recte: just so much], and not more; indicating his judgment that it should be at least one minute less. But Gottefridus Wendelinus [Govaert Wendelen], in an erudite epistle to me, full as it were of all the gems of astronomy, asserts, while he was living in the province of Forcalquier, that he obtained the altitude of the Pole from the observation of the fixed stars at gr. 43. 54'; and the meridian distance of the Sun from the vertex at the summer solstice he found again gr. 20. 24'; subtract my parallax 6'; it becomes gr. 20. 23'. 54"; and these, the altitude of the Pole being subtracted, leave the distance of the tropic from the vertex gr. 23. 30'. 6"; albeit at Gassendi's, in *Epistola* 2, [it is said] to Wendelinus; Wendelinus is said, in the *Diatriba* which he entitled *Loxias, seu de Obliquitate Solis*, in which nevertheless he is mistaken, while at Pappus of Alexandria he gathers the obliquity for the year of Christ 400 at gr. 23. 42'. 6", as is clear from what was said in no. 6 above, ex Commandino [from Commandinus].

[Margin: Gassendus.] [Margin: Vendelinus.]

§16 — We, however, in the preceding chapter from nos. 14 and 17, from our own observations, have deduced the maximum declination of the Sun never less than gr. 23. 30', nor greater than gr. 23. 30'. 25"; but for the causes there stated, we choose, as constant from use, that it is gr. 23. 30'. 20" in our Tables, taking no account of the anomalies, which others also, like Wendelinus, in the said *Opusculum*, edition of the year 1626, have endeavored to introduce, especially from the inconstancy of refractions in the Hibernial [winter] solstice. Therefore, that we may add two conclusions to be soon inferred, it pleases [us] to give in conspectus the opinions of the Authors, both as they lie among themselves, and after observation, deduced with their correction added, the marginal numbers being added, so that the places of the Authors and the examination of this observation may be found again.

§17 — In Albert Lisnemann [Albertus Lisnemannus], *Memoria* 9th century, I find Venceslaus de Nova Pilsna [Wenceslaus of Nová Plzeň / Vinceslaus de Nova Pilzna], year 1416. With a great quadrant, and the iron Ptolemaic rules four cubits in length [*Regulae Ptolemaicae ferreae quadricubitis*]...

to have observed the Sun at Prague at the beginning of Cancer at the meridian altitude gr. 63. 26'; from which, the altitude of the equator gr. 39. 55'. 30" being subtracted, the distance of the tropic remains gr. 23. 30'. 30".

Table. "Obliquity of the Ecliptic, or the Maximum Declination of the Sun." A historical survey table listing each authority (cross-referenced to the marginal numbers in the preceding text), the obliquity/declination value each obtained (in degrees, minutes, seconds), and the year — most "Before Christ" (*Anni ante Christum*) for the ancients, "After Christ" (*Post Christum*) for the later ones.

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
1	Pytheas of Marseilles (<i>Pytheas Massiliensis</i>)	23	52	41	324
2	Hipparchus, related from Strabo (<i>Hipparchus ex Strabonis</i>)	23	33	57	140

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	<i>relata</i>)				
3	But from Ptolemy (<i>Sed ex Ptolemæ o</i>)	23	51	20	140
3	Geminus, Proclus, Achilles Tatius, in round number (<i>Geminus , Proclus, Achilles Tatius rotundo numero</i>)	24	0	0	After Christ (<i>Post Christum</i>)
3	Ptolemy (<i>Ptolemæ us</i>)	23	51	20	140
5 [?]	Ptolemy elsewher e	23	30	0	140

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	(<i>Ptolemæ us aliunde</i>)				
6	Pappus of Alexandr ia (<i>Pappus Alexandri nus</i>)	23	30	0	350
4	Eratosthe nes, falsely (<i>Eratosth enes fallaciter</i>)	23	46	0	Before Chr. (<i>Ante Chr.</i>)
—	or (<i>vel</i>)	23	51	20	230
7	But necessari ly corrected (<i>Sed necessari ò</i>)	23	31	5	Years before Chr. (<i>Anni ante Chr.</i>)

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	<i>correctus</i>)				
7	Albategni us (<i>Albateni us</i>)	23	35	0	880
8	Arzachel the Spaniard (<i>Arzachel Hispanus</i>)	23	34	0	1070
8	Almæon of Almanso r (<i>Almæon Almansor is</i>)	23	33	30	1140
8	Thebit, son of Chora (<i>Thebit Coræ</i>)	23	33	30	1210

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	<i>filius</i>)				
8	Prophati us the Jew (<i>Prophati us Iudæus</i>)	23	32	0	1300
9	Purbachi us and Regiomo ntanus, and he elected this afterwar d (<i>Purbachi us, & Regiomo ntanus, sed elegit hic postea</i>)	23	28	0	1460
9	[continua	23	30	0	—

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	tion]				
10	Bernardu s Walther, not greater, nor lesser (<i>Bernard us Vualther us non maiolem, nec minorem</i>)	23	30	0	1476
10	[continua tion]	23	29	31	1498
10	Dominic us Maria Ferrar[ie nsis] (<i>Dominic us Maria Ferrar.</i>)	23	29	0	1500

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
10	Johannes Werner (<i>Ioannes Vernerus</i>)	23	28	30	1500
10	Copernic us, falsely (<i>Copernic us fallaciter</i>)	23	28	30	1525
10	but corrected (<i>sed correctus</i>)	23	30	5	—
11	Peter Apian and Oroncius (<i>Petrus Apianus, & Orôtius</i>)	23	30	0	1530

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
11	Peter Nonius [Pedro Nunes] (<i>Petrus Nonius</i>)	23	30	0	1555
11	Egnatius Danti, falsely (<i>Egnatius Dantes fallaciter</i>)	23	29	0	1570
11	but corrected (<i>sed correctus</i>)	23	30	35	—
12	Christop horus Rothman nus and Byrgius (<i>Christop horus</i>)	23	30	20	1570

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	<i>Rothman nus, & Byrgius</i>)				
12	Johannes Homelius , corrected (<i>Ioannes Homelius correct.</i>)	23	30	0	1570
13	Tycho, but falsely (<i>Tycho, sed fallaciter</i>)	23	31	30	1587
13	but corrected , as the maximu m (<i>sed correctus , vt summû</i>)	23	30	27	—

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
13	and twice [the median?] (<i>& bis</i>)	23	30	22	—
13	Kepler (<i>Keplerus</i>)	23	30	0	1617
14	Lansberg ius, falsely (<i>Lansber gius fallaciter</i>)	23	30	10	1589
14	but corrected (<i>sed correctus</i>)	23	30	40	—
11	Clavius, Galileo, Scheiner (<i>Clavius, Galilæus,</i>	23	30	0	1612

Num. margin.	Authoriti es named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	<i>Scheineru s</i>				
15	Peter Gassendi, not greater (<i>Petrus Gassendu s nō maior</i>)	23	31	0	1636
15	We, by contrast (<i>Nos ex Vendelin o</i>)	23	30	0	—
15 [?]	Gottefrid us Wendeli nus (<i>Gottefrid us Vuendeli nus</i>)	23	30	24	1650
16	We, with	23	30	20	1646

Num. margin.	Authorities named above under the marginal numbers (<i>Auctores suprano minati sub numeris marginali bus</i>)	Obliq.- Eclip. Gr.	'	"	Years before Christ (<i>Anni ante Christum</i>)
	Father Grimaldo [Grimald i] (<i>Nos cum Patre Grimaldo</i>)				
17	Wencesla us of Nová Plzeň (<i>Vincesla us de Nona Pilzna</i>)	23	30	30	1416

Parsing notes: The "Num. margin." column repeats marginal numbers from the preceding text (some authorities share a number, e.g. several at "3," "8," "10," "11," "15"). Several rows are continuation rows for a multi-line authority entry (e.g. Purbachius/Regiomontanus and Bernardus Walther each occupy two value-rows). The "vel" (or) and "sed correctus / sed necessariò correctus" rows give alternate or corrected values for the authority immediately above. The fifth-from-top row's marginal number is ambiguous (printed "5" or possibly a re-use of "3") — flagged. The year column mixes *Anni ante Christum* (BC, ancients) and *Post*

Christum / AD years (later authorities); the header reads "ante Christum" but the lower entries are clearly AD dates.

I. Conclusion (*I. Conclusio*)

In our own age and in the preceding one — if a second of arc is to be despised in the scruple — the obliquity of the ecliptic was, and is, gr. 23. degrees 23. minutes 30. or thereabouts. Since most of the observations and authorities attest, if a reckoning is to be had of seconds, it is to be chosen as gr. 23. 30'. 20"; on account of the most recent and greatest instruments and the most accurately conducted observations, so that whoever should contend to augment or diminish it by about ten seconds is not severely to be condemned.

II. Conclusion (*II. Conclusio*)

It is much more probable that the obliquity of the ecliptic was immutable, and however great it now is, was once such, and will be such. First, because — apart from the 4 or 5 minutes in which the ancients could have erred — neither so great nor so manifest is the diminution of the ancient obliquity [claimed by] Eratosthenes, Hipparchus, and Ptolemy, or by Pappus of Alexandria. Secondly, because, although a few of the ancients may favor the variation of the latitudes of the fixed stars by the invention of Tycho — who thinks they vary in latitude by an extrinsic cause, namely by a variable obliquity of the ecliptic — yet more men oppose this opinion, and retain the same latitude, which others, and most nearly, suppose to vary; than which the *Almagestum Novum* ch. 15 [demands]. Thirdly, because if the obliquity of the ecliptic of the ancients were anything, it would now be reduced to gr. 23. 30'; now the maximum latitude of the Moon in the quadratures, [if observed] from Ptolemy's observations, is elicited as great as Tycho found it — which indeed is an indication, but not a necessary one; yet it is more probable in our opinion. Fourthly, because to affirm a maximum moment, with maximum need of a foundation; but the mutation of the obliquity of the ecliptic is of maximum moment, since it flows into very many astronomical operations, and, it being changed, it is necessary that individual ages should construct very many Tables of the Primum Mobile and of the Fixed [stars]. It is hardly worthwhile to construct anew from the very beginning, while we have a posteriori sufficient fundamentals, indeed the maximum and most constant, of this mutation, as is clear from the observations recorded above at great expense [of effort]. Fifthly, finally, not a few — and indeed those not to be repented of — Astronomers stand for its immutability. Namely: Ptolemy, *Almagest* I, ch. 11; Thebit, in Maurolycus' *Cosmographia*, dialogue 3; Augustinus Riccius [Agostino Ricci] in his treatise *De Motu Octavæ Sphæræ*; Athanasius Kircher in his *Magnis*

p. 477, first edition; Simon Stevin [Stevinus] in Hortensius, vol. 1 p. 579; Vincentius Reinerus [Vincenzo Renieri] in the *Tabulæ Mediceæ*, denuo editis [newly edited], ch. 7, no. 7; Petrus Gassendus in the *Vita Peireskii*, year 1615, and in the epistle to Wendelinus *De propositione Gnomonis ad Umbram Solstitialem*; and Kepler ch. 12, [in the] *Rudolphine [Tables]*, saying: *that the obliquity of the ecliptic was once of a certain ratio — that is not so doubtful, but by valid arguments from the observations of the ancients themselves it is shaken, and beyond doubt plainly false.*

[Margin: Immutability of the obliquity of the ecliptic. (*Immutabilitas Obliquitatis Eclipticæ.*)]

Caput VII — Observations of the Quadrants and Semicircles of the Year (*Anni Quadrantum Observationes, & Semiculorum*)

The year is divided into four parts by the cardinal points of the ecliptic, or by the points and moments of the equinoxes and solstices. The first quadrant comprises the time from the vernal equinox to the summer solstice. The second, from the summer solstice to the autumnal equinox. The third, from the autumnal equinox to the winter solstice. The fourth, from the winter solstice to the vernal equinox. These times, from astronomical observations, are manifestly unequal. But the inequalities are: the time from the entry [of the Sun] into ♈ [Aries] up to the entry into ♋ [Cancer], the time from the entry into ♋ [Cancer] and the entry following into ♌ [Libra], again the time from the entry of the Sun into ♌ [Libra] up to the entry into ♍ [Capricorn], and the time from the entry into ♍ [Capricorn] up to the following entry into ♈ [Aries]. Because from the equinoxes observed at ch. 3, and the solstices at ch. 5, it can to some extent be established, and also from the opinions soon to be referred to.

Table I. "First Table. The Tarrying [delay] of the Sun in the Boreal [northern] and Austral [southern] Semicircles." The dwelling-time of the Sun in each semicircle of the ecliptic, per authority, given in Days (D.), Hours (H.), and minutes ('). Two value-blocks: "From the beginning of ♈ [Aries] to the beginning of ♌ [Libra]" (northern semicircle) and "From the beginning of ♌ [Libra] to the beginning of ♈ [Aries]" (southern semicircle).

Authorities (Auctores)	From beginning to beginning —			From beginning to beginning —		
	D.	H.	'	D.	H.	'
Hipparchus & Ptolemy [<i>Almagest</i> III.3, ch. 2 & 4] (Hipparchus, & Ptolemaeus l.3.c.2. & 4.)	187	0	0	178	5	55¼
Ptolemy corrected by Longomontanus & Bullialdus (Ptolemaeus correctus à Longomontano, & Bullialdus)	186	11	50¾	178	18	2

Authorities (<i>Auctores</i>)	From beginning to beginning —			From beginning to beginning —		
	D.	H.	'	D.	H.	'
The same corrected by us (<i>Idem correctus à nobis</i>)	189	19	0	178	10	55¾
Pliny I.18, ch. 25, from Solinus [recte: Sosigenes] (<i>Plinius l.18. c. 25. ex Soligene</i>)	186	0	0	179	6	0
Albategnius ch. 27 & 28 (<i>Albategnius c. 27. & 28.</i>)	186	14	45	178	14	30
Albategnius correct	186	14	15	178	14	0 [?]

Authorities (Auctores)	From beginning to beginning — D. H. '	From beginning to beginning — D. H. '
ed by Longo montanus (<i>Albatinius correctus à Longo montano</i>)		
Peter Pitatus [Pietro Pitati] according to Nonius in the <i>Theoriae (Petri Pitati apud Nonium in Theoriae is)</i>	186 23 38	178 26 [?] 11
Copernicus I.3, <i>De Revolutionibus</i>	186 2 0¾	179 3 48¾

Authorities (Auctores)	From beginning to beginning — D. H. '	From beginning to beginning — D. H. '
<i>ionibus</i> ch. 16 (Copernic. l.3. Reuol. c. 16.)		
Regiomontanus from ch. 3, no. 15 (Regio montanus ex cap. 3. num. 15.)	186 18 45	— — —
Walther in ch. 3, nos. 21 & 22, & 23, & 24, & 28, & 29 (Vualtherus in c.3. num. 21. & 22. & 23. & 24. &	186 13 24	178 16 0

Authorities (Auctores)	From beginning to beginning —			From beginning to beginning —		
	D.	H.	'	D.	H.	'
28. & 29.)						
[Walther r continuation]	186	1	28	—	—	—
Reinholdus in the <i>Theoriae</i> of Purbachius p. 31 (<i>Reinholdus in Theoriae as Purb. pag. 31.</i>)	186	8	13	178	21	42
[Reinhold] but p. 39 (<i>sed pag. 39.</i>)	186	0	0	178	23	20
Maginus in the <i>Theoria Solis</i> ch. 9 (<i>Magin</i>	186	7	46	178	22	10

Authorities (Auctor es)	From beginni ng □ to beginni ng □ — D.	H.	'	From beginni ng □ to beginni ng □ — D.	H.	'
<i>us in Theoric a Solis c. 9.)</i>						
Langra uus [Landg rave] of Hesse from ch. 3, no. 43 (Langra uus Hassiae ex c. 3. à num. 43.)	186	20	0	178	19	0
Tycho, <i>Tom. I, Progym nasmata</i> , p. 13, 19, & 107, [varian t reading s] (Tycho <i>Tom. 1. progym</i>	186	18	40	178	11	49½

Authorities (Auctor es)	From beginni ng □ to beginni ng □ —			From beginni ng □ to beginni ng □ —		
	D.	H.	'	D.	H.	'
<i>n. pag. 13. 19. & 107. sed ex correct. de qua cap.3. num. 48. ad 66. variè, scripsi tamen, vel aliquan do)</i>						
[Tycho variant]	186	15	4	178	15	44
[Tycho variant]	186	19	45	178	15	46
Gocleni us in the <i>Urania</i> p. 53 (Goclen ius in <i>Vrania</i> pag. 53.)	186	8	0	178	19	0

Authorities (Auctor es)	From beginni ng □ to beginni ng □ —			From beginni ng □ to beginni ng □ —		
	D.	H.	'	D.	H.	'
Argolus in the <i>Pandosi</i> o I, ch. 8 (<i>Argolu</i> <i>s in</i> <i>Pandosi</i> <i>o l. 1. c.</i> 8.)	186	18	30	178	12	13
Lansbe rgius observe d in the <i>Thesau</i> <i>rus</i> , or from what was said ch. 3, num. 67 (<i>Lansbe</i> <i>rgius in</i> <i>Thesau</i> <i>ro</i> <i>obserua</i> <i>t. vel ex</i> <i>dictis c.</i> 3. à <i>num.</i> 67.)	185	16	12	179	13	37

Authorities (Auctor es)	From beginni ng □ to beginni ng □ —			From beginni ng □ to beginni ng □ —		
	D.	H.	'	D.	H.	'
Wendel inus in letters [sent] to me (<i>Vendeli nus in litteris à me datis</i>)	186	15	0	178	13	49½
Vincent ius Mutus [Vicent e Mut] in the <i>Sol Alphon sinus (Vincen tius Mutus in Sole Alphon sino)</i>	186	23	54	178	5	55½
We, from ch. 3, nos. 75 & 79 (<i>Nos ex c. 3. à</i>	186	14	53	178	14	56

Authorities (Auctores)	From beginning to beginning — D. H. ' .	From beginning to beginning — D. H. ' .
---------------------------	--	--

num.

75. &
79.)

Joh.	186	14	53	178	14	56
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Domini

cus

Cassinus

s

[Cassini

] in the

Helio-

metro (D.

Io.

Domini

cus

Cassinus

s in

Helio-

metro)

Parsing notes: Several authorities (Walther, Tycho, Reinhold) span multiple value-rows for variant or corrected readings; their continuation rows are tagged in brackets. The Tycho block consolidates the long parenthetical citation (*Progymnasmata* pp. 13, 19, 107, with corrections discussed at ch. 3 nos. 48–66). Two cells flagged [?] for ink-faded digits.

[Note] Do not be surprised if the Time compounded from the Tarrying of the Sun in the Boreal semicircle and from the Tarrying in the Austral [semicircle] does not correspond to the quantity of the equinoctial Year asserted by the Authors; for that correction would require it, and from this rather the diverse quantity of the Year is gathered among the Authors.

Table II. "Second Table. The Tarrying of the Sun in the Vernal and Summer Arc of the Ecliptic." The dwelling-time of the Sun, per authority, in two arcs: "From the Sun's entry into ♈ [Aries]" and "From the entry into ♋ [Cancer]" — i.e. the vernal-arc time (in ♈) and summer-arc time (in ♋). Given in Days, Hours, minutes.

Authori- ties (Auctor- es)	At entry into ♈ /			In ♋ / In		
	At entry into ♈ — D.	H.	'	♋ — D.	H.	'
Ptolem- y <i>De</i> <i>Revolut-</i> <i>ionibus</i> [recte: <i>Almage-</i> <i>st</i>] III, ch. 2 & 4, with Hippar- chus (<i>Ptolem-</i> <i>æus lib.</i> <i>3. cap.</i> <i>2. &</i> <i>4.cum</i> <i>Hipparc-</i> <i>o</i>)	94	12	0	92	12	0
Pliny I.18, ch. 25, emende- d by Petaviu- s [Petau] I.2, <i>De</i>	94	12	0	92	12	0

	At entry into □ /				In □ / In □ — D.	H.	'
Authori ties (Auctor es)	At entry into □ — D.		H.	'	□ — D.	H.	'
<i>Doctrin a Tempor um [differt. Vran.] ch. 5 (Plinius l.18.c.25 .emenda tus à Petauio l. 2. differt. Vran. c.5.)</i>							
Ausoni us in the <i>Eclogae de ratione dierum (Ausoni us in Eclogis de ratione dierum)</i>	94	12	0	92	12	0	
Albateg	93	14	0	93	0	45	

Authorities (Auctores)	At entry into □ / At entry into □ — D.	H.	'	In □ / In □ □ — D.	H.	'
nius ch. 27 & 28 (<i>Albatenius c.</i> 27. & 28.)						
Pitatus according to Nonius in the <i>Theoria</i> (<i>Pitatus</i> <i>apud</i> <i>Nonium</i> <i>in</i> <i>Theor.</i>)	93	10	1¾ [?]	93	1	36¾ [?]
Goclenius in the <i>Urania</i> (<i>Goclenius</i> <i>in</i> <i>Vrania</i>)	92	21	0	93	15	0
Walther from what was said ch. 3, nos. 3	92	17	0	92	18	50 [?]

Authorities (Auctores)	At entry into □ / At entry into □ — D.	H.	'	In □ / In □ — D.	H.	'
& 5 (<i>Vualtherus ex dictis c. 3. & 5.</i>)						
Tycho <i>Tom. I,</i> p. 13, 19, & 107, likewise from what was said ch. 3 & 5 (<i>Tycho l. 1.</i> <i>pag. 13.</i> <i>19. &</i> <i>107.</i> <i>simul</i> <i>ex dictis</i> <i>c. 3. &</i> <i>5.</i>)	93	4	17	93	14	5
[Tycho continuation]	93	1	40	93	14	5 [?]
Lansbergius from	93	2	27	92	14	8

Authorities (Auctores)	At entry into □ / At entry into □ — D.	H.	'	In □ / In □ — D.	H.	'
what is laid down in the <i>Thesaurus</i> (Lansbergius expositis in <i>Thesaurorum</i>)						
Maginus in the <i>Theoria Solis</i> (Maginus in <i>Theoria Solis</i>)	92	20	49	93	10	57
We, from what was said ch. 3 & 5 (Nos ex dictis c. 3. & 5.)	93	0	36	93	14	18
Joh. Domini	93	2	50	93	11	12

	At entry into ♎ /					
Authori- ties (Auctor- es)	At entry into ♎ — D.	H.	'	In ♎ / In ♏ — D.	H.	'

cus
Cassinu
s
[Cassini
(D. Io.
Domini
cus
Cassinu
s)

Parsing notes: The two column-blocks are headed by zodiac symbols (♎/♏ for the first arc-pair, ♏♏ for the second). The Tycho entry spans two rows (variant readings). Several minutes-cells with fractional values (¾, etc.) and a few ink-faded digits flagged [?].

Liber I — De Sole (continued)

Caput VII (continued)

III. TAB. The Sun's tarrying in the autumnal and winter arc of the ecliptic [*Mora Solis in Ecliptica Arcu Autumnali, & Hyberno*].

The table records, for each authority, the time the Sun takes from its entry into ♎ (Libra) to its entry into ♏ (Capricorn) — the autumnal arc — and from its entry into ♏ (Capricorn) to its entry into ♈ (Aries) — the winter arc, given in days, hours, and minutes.

Authori- ties [Auctor- es]	♎ to ♎ — D.	♎ to ♏ — H.	♎ to ♏ — M.	♏ to ♏ — D.	♏ to ♈ — H.	♏ to ♈ — [M.]
Pliny, bk. 18, ch. 25,	89	3	0	90	3	0

Authorities [Auctores]	□ to □ — D.	□ to □ — H.	□ to □ — M.	□ to □ — D.	□ to □ — H.	□ to □ — [M.]
corrected [<i>emendatus</i>]						
Ausonius in the <i>Eclogues</i> [<i>Eclogis</i>], above	88	6	0	90	0	0
Maginus in his <i>Theoria Solis</i>	89	18	9	89	4	1
Tycho [Brahe], tome 1, above	89	10	37	89	0	47
or corrected by us [<i>correctus à nobis</i>]	89	10	40	89	0	44
Walther [Bernhard Walther], from the	90	10	46	88	5	15

Authorities	□ to □ — D.	□ to □ — H.	□ to □ — M.	□ to □ — D.	□ to □ — H.	□ to □ — [M.]
statements of chs. 3 & 5 [<i>ex dictis cap. 3. & 5.</i>]	89	14	11	89	0	45
We [Nos], from observations						

Caput VIII.

Selected observations of the Sun's meridian altitudes outside the equinoxes and solstices [*Altitudinum Solis Meridianarum Observationes extra Aequinoctia, & Solstitia selectae.*]

To gain thorough knowledge of the Sun's motion, the moments of the equinoxes and solstices are not enough; observations made at other times are also needed — times when the Sun is found at some other point of the ecliptic besides the four cardinal points, and especially in the neighborhood of the middle portions of Taurus, Leo, Scorpio, and Aquarius. Then, by comparing these positions with the positions drawn out from the astronomical tables, one can establish how trustworthy those tables are. And from this comparison the tables themselves may be constructed, once one has found the place [of the Sun] and quantified the motion of the solar apogee and the magnitude of the eccentricity.

The inequality of the Sun's motion is plainly evident in the unequal tarrying of the Sun: in the northern semicircle it tarries more than 8 days longer than in the southern, and, by these observations of ours, more than 14 hours 18 minutes longer in the vernal quadrant than in the summer one, and more than 13 hours 26 minutes longer in the autumnal quadrant than in the winter — unless astronomers are mistaken. This is more easily accounted for by the eccentric circle of the Earth, or by an eccentric ellipse, than by an epicycle equalizing the

eccentric, in the manner I set out more fully in *Almagestum Novum*, bk. 3, ch. 17, and again at ch. 24.

I pass over the whole medley of observations to be found among the authors — chiefly Walther, the Landgraves of Hesse [*Lantgravianos in Hassiacis*], Tycho, [Jakob] Kristmann [*Kristmannumque*], and others. I select the more reliable ones, the ones better suited to advancing the astronomical study, and I add to them other observations of ours; nor do I attach to those the [solar] parallaxes or refractions [*Parallaxes, aut Refractiones*]. The only places of the Earth used are those where altitude observations were made, [recorded] together with the year, month, and day. Afterwards these were tested for soundness against our *Geographia Reformata*. Then, in the following chapter, we shall hunt out the place of the Sun in the ecliptic from these very observations.

The right-hand column begins a long table of observations:

Selected meridian distances of the Sun from the zenith [Vertice] at Nuremberg [*Distantiae Meridianae Solis à Vertice Norimbergae, selectae ex Bernardo Vualthero inter eas, quibus additur Clara, Diligens, vel Praecl. certa, aut certiss.*] — selected from Bernhard Walther [Walther], among those to which is appended "Clear" [*Clara*], "Careful" [*Diligens*], or "Excellent" [*Praecl.*], "sure" [*certa*], or "most sure" [*certiss.*].

Years of Christ [<i>Anni Christi</i>]	Month / Day	Chord [<i>Chorda</i>]	Dist. of Sun from zenith — G. —' —"
1476	June 12	44890	
	Sept. 13	83400	
	Sept. 19	87090	
1477	[—]	83675	
Anno 1478	March 11	83820	
	March 31	71434	
	June 11	44890	
	June 13	44890	
	June 21	45267	
	Sept. 10	81190	

Years of Christ [<i>Anni Christi</i>]	Month / Day	Chord [<i>Chorda</i>]	Dist. of Sun from zenith —		
			G.	—'	—"
	Sept. [—]	81800			
	Sept. 1	82430			
	Sept. 13	82050			
	Sept. 30	91410			
	Octob. 8	98040			
	Novemb. 26	117300			
	Decemb. 11	118760			
Anno 1479	Febr. [—]	94860	56	37	40
	March 28	74350			
Anno 1487	Decemb. 7	118625			
	Decemb. 13	118790			
	Decemb. 14	118790			
Anno 1488	Januar. 2	116525			
	Januar. 7	116275			
	Januar. 9	114725			
	Januar. 31	106240			
	Febr. 1	105750			
	Febr. 10	101200			
	Febr. 17	97338	44	15	20
	March 1	89010			
	March 3	88400			
	March 19	78460			

Years of Christ [<i>Anni Christi</i>]	Month / Day	Chord [<i>Chorda</i>]	Dist. of Sun from zenith — G. —' —"		
	March 24	75134			
	March 25	74710			
	April 9	65780			
	August 27	55950			
	Sept. 1	71975			
	Sept. 6	79090			
	Sept. 10	81550			
	Sept. 11	82190			
	Sept. 15	82434			
	Octob. 8	98350			
	Octob. 31	109675			
	Decemb. 11	118780			
Anno 1489	Januar. 7	115075	41	33	21
	Janu. 22	109880			
	March 2	89188			
	March 11	83625			
	March 24	75480			
	April [—]	68834			
	April 28	46200			
	June 7	45043			
	June 10	44940			
	June 12	44890			
	June 19	46534			
	July 31	57750			
	August 24	70950			

Years of Christ [Anni Christi]	Month / Day	Chord [Chorda]	Dist. of Sun from zenith — G.	—'	—"
	Sept. [—]	79550			
	Sept. 11	82040			
	Sept. 27	91870			

Parsing notes: This table extends over several pages; the "Chord" column gives a five-digit value (the chord of the zenith distance, in the work's internal units). The "Distance of the Sun from the zenith" (G./'") is filled in only for occasional benchmark rows. Several day-figures in the left two columns are faint or abbreviated in the scan; abbreviated month names (Iunij, Sept., Octob., Novemb., Decemb., Januar., Februar., Martij, April, Maij, Iulij, Augusti) are transcribed as printed. Cells left blank in the source are left blank here. Faint/ambiguous day numbers marked with [—] where unresolved.

[table continues]

Left column header: *Selectae ex Vualthero* — "Selected from Walther" — with columns: Year / Month·Day / Chord / Distance of Sun from zenith (G. '").

Year	Month / Day	Chord	Dist. of Sun from zenith — G.	—'	—"
1489	Octob. 28	108513			
	Nouemb. 30	118013			
Anno 1490	Febr. 28	90550			
	Maij 2	54350			
	Iulij 12	44900			
	Iunij 21	45325	26	11	48
	Augusti 5	60140			
	Decemb. 12	118790			
	Decemb.	118788			

Year	Month / Day	Chord	Dist. of Sun from zenith —		
			G.	—'	—"
	13				
Anno 1491	Ianuar. 6	115490			
	Ianu. 11	110480			
	Febr. 14	98860			
	Mart. 13	82680			
	April. 18	61210			
	Iulij 18	51925			
Anno 1492	Iunij 11	44888			
	Iunij 12	44888			
	Sept. 27	91020			
Anno 1493	Sept. 12	83310			
	Sept. 22	88867			
	Sept. 23	89460	53	8	28
	Octob. 14	101534			
	Nouemb. 18	115688			
Anno 1494	Ianuar. 5	115688			
	Ianuar. 15	112640			
	Febr. 13	99267			
	Iunij 12	44900			
	Iunij 13	44910			
	Sept. 11	82171			
	Decemb. 13	118800			
Anno	Iunij 11	44910			

Year	Month / Day	Chord	Dist. of Sun from zenith —		
			G.	—'	—"
1495	Sept. 11	81764			
	Sept. 30	93378			
	Decemb. 15	118788			
Anno 1496	Iunij 10	45025			
	Augusti 30	74800			
	Sept. 10	81612			
	Sept. 11	81490			
	Octob. 1	94400			
	Decemb. 11	118800			
Anno 1497	Mart. 28	73080			
	April. 24	57940			
	Majj 28	46240			
	Iunij 10	44925			
	Octob. 1	94300			
	Octob. 27	107900	65	17	58
Anno 1498	Iunij 11	44910			
	Iunij 12	44890			
	Iulij 23	53625	31	6	18
	Augusti 15	65900			
	Sept. 12	82566	48	45	58
	Octob. 11	99775	59	51	2
	Nouemb.	113225	68	57	35

Year	Month / Day	Chord	Dist. of Sun from zenith —		
			G.	—'	—"
	10				
	Nouemb. 23	116766	71	26	27
Anno 1499	Ianuar. 26	108550	65	36	20
	Febr. 11	100466			
	Mart. 11	90917			
	April. 21	59640			
	Maij 13	50875			
	Maij 29	46125			
	Iunij 12	44925			
	Iulij 11	49500	28	39	34
	Augusti 13	64350			

Year	Month / Day	Chord	Dist. of Sun from zenith —		
			G.	—'	—"
Anno 1500	Martij 8	85300			
	Mart. 29	72217			
	April. 24	57757	33	34	15
	Maij 19	48140			
	Maij 28	46183			
	Iunij 11	44890	25	56	39
	Iunij 12	44883			
	Iulij 28	56488			
	Decemb. 30	116950	71	34	13

Year	Month / Day	Chord	Dist. of Sun from zenith —		
			G.	—'	—"
Anno 1501	Ianuar. 17	111817			
	Mart. 10	84234			
	April. 14	63090	36	46	34
	Maij 2	55875			
	Iunij 6	45100			
	Sept. 13	83367			
	Sept. 28	92500			
	Decemb. 10	118775			
Anno 1503	Mart. 17	80080			
	Mart. 28	72340			
	April. 18	61100			
	April. 27	56636			
	Maij 11	50825	27	4	30
	Maij 25	46817			
	Maij 31	45790			
	Iunij 10	44900			
	Iulij 27	55634			
	Augusti 10	62613	36	29	25
Decemb. 12	118750	72	50	50	
Anno 1504	Ianu. 10	114140	69	44	11
	Febr. 9	101620	61	4	25
	Mart. 12	82750	48	52	51
	April. 20	59690			
	Maij 10	50910	29	29	38

Year	Month / Day	Chord	Dist. of Sun from zenith —		
			G.	—'	—"
	Maij 28	46090			
	Last solar [observat ion] [<i>Ultima Solarium</i>] June 3	45280			

Now follows the explanatory paragraph:

From the foregoing, I further select 24 observations covering the place of the Sun near the beginnings and middle portions of the zodiacal signs. For these I shall determine the Sun's distance from the equator, on the supposition that Nuremberg's distance from the equator is $49^{\circ} 26'$, and using our own parallax and the ancient *Almagest* refraction. For once the distance from the zenith has been corrected and converted into the true value, the Sun's true declination will be established; and from this declination, together with the maximum declination of $23^{\circ} 30' 20''$, the place of the Sun will at once come out by spherical triangle [*per Triangula Sphaerica*], rather than by a declination table. The places of the northern signs are, however, the more reliable, since they are not exposed to the uncertainty of refractions.

Table: From Walther's observations [*Ex Vualtheri observat.*] — true declination of the Sun [*Declinatio Solis vera*] and the Sun's place in the ecliptic [*Solis locus in Ecliptica*].

The declination column carries a suffix letter A or B (A = southern / *austrina*; B = northern / *borealis*).

Year / Month / Day	[<i>Ann. Mens. Dies</i>]	True Decl. — Gr.	—'	—"	(A/B)	Sun's place — S. (sign)	Gr.	'	"	1504
Januar. 10	20	22	56	A	□	(Scorpio)	29	14	30	1499
Januar. 26	16	12	40	A	□	(Aquarius)	15	34	30	1504
Februar. 9	13	16	39	A	□	(Aquarius)	29	33	2	1479
Febr. 21	7	12	25	A	□	(Pisces)	11	39	57	1504
Mart. 12	0	31	10	B	□	(Aries)	13	3	10	1488
Mart. 24	5	18	47	B	□	(Taurus)	13	4	56	1501
April. 14	12	39	35	B	□					

(Taurus) | 3 | 22 | 8 | | 1500 April. 24 | 15 | 51 | 53 | B | ♊ (Gemini) | 13 | 16 | 5
 | | 1504 Maij 10 | 19 | 56 | 28 | B | ♊ (Gemini) | 28 | 46 | 28 | | 1503 Maij 25 | 22
 | 21 | 36 | B | ♊ (Gemini) | 12 | 31 | 12 | | 1500 Iunij 11 | 23 | 29 | 26 | B | ♊
 (Gemini) | 27 | 59 | 48 | | 1490 Iunij 21 | 23 | 14 | 17 | B | ♋ (Cancer) | 8 | 24 | 9
 | | 1499 Iulij 11 | 20 | 47 | 32 | B | ♋ (Cancer) | 27 | 7 | 20 | | 1498 Iulij 23 | 18 |
 19 | 48 | B | ♌ (Leo) | 7 | 57 | 5 |

Parsing notes: The "Sun's place" column gives the zodiac sign as a symbol followed by degrees/minutes/seconds within the sign. The A/B suffix to the declination marks southern (A, *austrina*) versus northern (B, *borealis*) declination. The two leftmost columns (sub-headed *Ann. Mens. Dies*) compress year, month, and day; transcribed as printed.

Left column, upper table:

Residual of the preceding table [*Resid. Tabulae praeced.*] — continuing the same "true declination / Sun's place in ecliptic" listing.

Year / Month / Day [<i>Ann.</i> <i>Mens.</i> <i>Dies</i>]	True Decl. — Gr.	—'	—"	(A/B)	Sun's place — Sig. Gr.	'	"
1503 Augusti 10	12	56	43	B	♍ (Virgo)	49	40
1489 Augusti 24	7	52	30	B	♍ (Virgo)	54	0
1498 Septem- br. 12	0	40	15	B	♍ (Virgo)	55	5
1493 Septem- br. 23	3	42	46	A	♌ (Libra)	20	35
1498 Octob. 11	10	26	6	A	♏ (Scorp- io)	0	29

Year / Month / Day [Ann. Mens. Dies]	True Decl. — Gr.	— ‘	— ”	(A/B)	Sun's place — Sig. Gr.	’	”
1497 Octob. 27	15	54	20	A	♏ (Scorp io) 13	24	10
1498 Noue mb. 10	19	35	25	A	♐ (Sagitt arius) 17	12	35
1498 Noue mb. 23	22	5	35	A	♐ (Sagitt arius) 10	33	55
1503 Dece mb. 12	23	30	11	A	♑ (Capri corn) 9	23	45
1500 Dece mb. 12	23	22	12	A	♑ (Capri corn) 18	19	10

To these I append 20 places of the Sun drawn out from the observations of the most excellent Lansberge of Hesse [*Lamgravii Hassiae* — i.e. the Landgrave of Hesse], which Snellius [Willebrord Snel] published — places selected from observations made at Kassel [*Cassellis*] beginning in the year 1568, with rectified instruments and with the altitude of the equator repeated [as] 38° 40' 20". I have left these to a less certain refraction, so that I may use our own bare parallax and the obliquity of the ecliptic, discussed above.

Table: Years of Christ for meridian altitude observations [*Ann. Christi in Altit. Meridie.*] — true declination of the Sun and the Sun's place in the ecliptic.

Year / Mont h / Day [Ann. M. D.]	Visibl e alt. [Altit. visa] — Gr.	True Decl. — Gr.	'	"	(A/B)	Sun's place — Sig. Gr.	'	"
1658 Jun. 28	61 11	22	30	46	B	☐ (Canc er) 15	2	20
1658 Iulij 20	57 10	18	29	47	B	☐ (Leo) 6	38	50
1658 Aug. 24	46 10	7	29	50	B	☐ (Virg o) 10	54	15
1658 Sept. 13	38 30	0	10	26	A	☐ (Libr a) 0	26	8
1571 Mart. 15	39 30	0	29	28	B	☐ (Arie s) 1	13	55
1571 Sept. 13	38 46	0	5	54	B	☐ (Virg o) 29	45	10
1571 Octo b. 3	31 2½	7	39	0	A	☐ (Libr a) 19	29	50
1572 Mart. 11	39 3	0	22	38	B	☐ (Arie s) 1	1	47
1572 April. 30	56 7½	17	27	37	B	☐ (Taur us) 18	46	10
1572 Maij	60 59	22	18	46	B	☐ (Gem	9	50

Year / Month / Day	Visible alt. [<i>Ann.</i> <i>M.</i> <i>D.</i>] — Gr.	True Decl. — Gr.	'	"	(A/B)	Sun's place — Sig. Gr.	'	"
24						ini) 9		
1573 Mart. 11	38 56	0	15	38	B	□ (Arie s) 0	15	38
1573 April. 11	50 25	11	44	49	B	□ (Taur us) 0	41	25
1573 Iulij 20	57 24	18	43	47	B	□ (Leo) 6	22	44
1573 Mart. 12	38 58	0	37	38	B	□ (Arie s) 1	34	22
1593 Iun. 14	61 16¾	23	30	20		□ (Canc er) 28	58	30
1593 <i>stylo</i> Iun. 15	62 7½	23	27	26		□ (Canc er) 3	25	0
1593 <i>veteri</i> Sept. 12	38 55½	0	15	43		□ (Virg o) 29	20	35
1594 Iun. 10	61 10½	23	30	6		□ (Canc er) 28	58	30
1596 Mart. 23	43 48	5	7	52		□ (Taur us)	57	30

Year / Mont h / Day [Ann. M. D.]	Visibl e alt. [<i>Altit.</i> <i>visa</i>]	True Decl. — Gr.	'	"	(A/B)	Sun's place — Sig. Gr.	'	"
						12		
1596 Maij 7	58 8	19	27	46		□ (Taur us) 26	43	0

Below this table (left column, :

I selected the Tyconic meridian altitudes of the Sun observed at Uraniborg [*Vraniburgi*] — where the altitude of the equator is $34^{\circ} 5' 30''$ — from Longomontanus's *Astronomia Danica*, bk. 2, *Theoricorum* ch. 2, in the commentary *On the Sun*; and from Villebrord Snel [Snellius] among the observations made in Bohemia; and others, which Fr. Albert Curtius S.J. [*P. Albertus Curtius Soc. Iesu*] sent to me, taken from the manuscripts of Tycho — some of which had also been published at Vienna. But of the observations of the year 1601, some were made at Benátky castle [*in Arce Benatica*], where the altitude of the equator is $39^{\circ} 41' 30''$; some at Prague [*Pragae*], where the altitude of the equator is $39^{\circ} 55' 30''$, with a refraction found by Tycho greater by 2 minutes than in Denmark. From these I have used our own parallax and obliquity of the ecliptic to deduce the places of the Sun in the ecliptic.

Right column :

Years of Christ, by the old style [*Anni Christi stylis veteris*] — visible meridian altitude of the Sun [*Alt. merid. Solis visa*], true declination of the Sun [*Declinatio Solis vera*], and the Sun's place in the ecliptic [*Locus Solis in Ecliptica*]. Margin: drawn **from the manuscripts of Tycho** [*Ex M.S. Tychonis*]; some rows note the instrument used — "another instrument" [*alio instrum.*], "the Tyconic [system], old" [*Tychonico vet.*], "the Tyconic [system], new" [*Tychonico nou.*].

Year / Mont h / Day [An. Mens. Dies]	Alt. meri d. visa — G. ' "	True Decl. — Gr. ' "	' "	" "	(A/B)	Sun's place — S. G. ' "	' "	" "
1582 April. 27	50 52 0	16	46	39	B	☐ (Taur us) 16	21	55
1582 Majj 24	56 24 0	22	18	37		☐ (Gem ini) 11	44	10
1582 Augu sti 9	47 3 10	12	57	50		☐ (Leo) 26	13	5
1583 Mart. 14	35 23 30	1	16	30	B	☐ (Arie s) 3	11	55
1583 April. 26	50 30 45	15	40	25		☐ (Taur us) 12	13	18
1583 Sept. 13	34 13 20	0	7	25		☐ (Virg o) 29	48	35
1584 Mart. 11	34 29 55	0	23	55	B	☐ (Arie s) 0	59	59
1584 April. 30	51 48 30	17	43	10		☐ (Taur us) 19	44	20
1584 Iulij	50 31 50	16	27	30		☐ (Leo)	47	30

Year / Mont h / Day [An. Mens. Dies]	Alt. meri d. visa — G. ' "	True Decl. — Gr. ' "	'	"	(A/B)	Sun's place — S. G. ' "	'	"
28						14		
1584 Sept. 12	34 18 55	0	12	55		☐ (Virg o) 29	27	35
1585 Mart. 11	35 10 45	1	4	55	B	☐ (Arie s) 2	42	47
1585 April. 26	50 39 20	16	34	0		☐ (Taur us) 15	38	5
1585 Iulij 27	50 10 30	16	4	10		☐ (Leo) 16	13	5
1585 Sept. 10	35 11 40	1	5	50		☐ (Virg o) 27	14	54
1586 Mart. 11	34 18 30	0	12	30	B	☐ (Arie s) 0	31	0
1586 April. 27	50 52 30	16	47	10		☐ (Taur us) 16	23	40
1586 Iunij 12	57 35 36	23	30	12		☐ (Canc er) 0	45	53
1586 Sept. 13	34 7 0	0	2	0		☐ (Virg o) 29	55	0

Year / Mont h / Day [An. Mens. Dies]	Alt. meri d. visa — G. ' "	True Decl. — Gr. ' "	' "	" "	(A/B)	Sun's place — S. G. ' "	' "	" "
1587 Mart. 11	34 36 15	0	30	15	B	☐ (Arie s) 1	15	52
1587 April. 29	51 20 35	17	15	15		☐ (Taur us) 18	2	30
1587 Iunij 14	57 34 30	23	29	10		☐ (Gem ini) 2	15	44
1587 Iulij 27	50 1 50	16	55	30		☐ (Leo) 17	1	5
1587 Sept. 13	34 19 0	0	31	20		☐ (Virg o) 28	41	25
1588 Mart. 12	34 33 30	0	47	55	B	☐ (Arie s) 1	59	18
1588 April. 27	51 0 20	16	55	0		☐ (Taur us) 16	52	0
1588 Sept. 27	34 18 20	0	12	20		☐ (Virg o) 29	29	0
1589 Mart. 11	34 24 55	0	18	55	B	☐ (Arie s) 0	47	22
1589	57 35	23	30	7		☐	58	52

Year / Mont h / Day [An. Mens. Dies]	Alt. meri d. visa — G. ' "	True Decl. — Gr. ' "	'	"	(A/B)	Sun's place — S. G. ' "	'	"
Iunij 11	30					(Canc er) 0		
1589 <i>alio instr um.</i>	57 35 25	23	30	2		☐ 8 (Canc er) 1		50
1589 <i>alio instr.</i>	57 35 45	23	30	22		[—]		
1589 <i>Tych onico vet.</i>	57 35 50	23	30	27		[—]		
1589 <i>Tych onico nou.</i>	57 36 5	23	30	41		[—]		
1589 Iulij 31	50 18 13	16	12	53		☐ 33 (Leo) 15		40
1589 Sept. 9	35 55 5	1	29	5		☐ 39 (Virg o) 27		3
1589 Dec. 15	10 44 48	23	30	17	A	☐ 16 (Capr icorn) 19		40
1590 Mart. 11	34 18 30	0	12	35	B	☐ 31 (Arie s) 0		35

Year / Mont h / Day [An. Mens. Dies]	Alt. meri d. visa — G. ' "	True Decl. — Gr. ' "	'	"	(A/B)	Sun's place — S. G. ' "	'	"
1590 April. 26	50 45 30	16	40	10		☐ (Taur us) 16	37	2
1590 Sept. 10	34 30 15	0	24	10		☐ (Virg o) 28	59	24
1592 Sept. 10	35 5 5	0	59	15	B	☐ (Virg o) 27	31	27
1593 Mart. 10	34 1 30	0	4	30	A	☐ (Arie s) 0	45	48
1593 Iunij 11	57 35 0	23	29	40	B	☐ (Gem ini) 28	17	20
1594 Mart. 10	33 56 20	0	9	45	A	☐ (Arie s) 0	29	32
1594 Sept. 11	34 6 20	0	0	0		☐ (Virg o) 29	59	10
1594 <i>Susp.</i> Dec. [—]	10 41 10	23	33	55	A	[—]		
1596 Marti j 11	34 30 45	0	34	45	B	☐ (Arie s) 0	27	0

Year / Mont h / Day [An. Mens. Dies]	Alt. meri d. visa — G. ' "	True Decl. — Gr. ' "	'	"	(A/B)	Sun's place — S. G. ' "	'	"
1596 Sept. [—]	33 50 10	0	36	0	A	□ (Virg o) 29	21	50
1597 Mart. [—]	34 2 10	0	3	40	A	□ (Arie s) 0	50	48
1601 <i>Benat ica</i> Apr. 23	52 26 50	12	45	30	B	□ (Taur us) 13	57	20
1601 <i>Benat ica</i> Iun. 26	63 10 10	23	18	45		□ (Canc er) 2	21	48
1601 <i>Prag a</i> Aug. 6	56 50 40	16	42	47		□ (Leo) 13	53	33
1601 <i>st. nouo</i> Sept. 3	47 27 30	7	32	10		□ (Virg o) 10	48	8

[Margin: *Ex M.S. Tycho* — From the manuscripts of Tycho]

Bottom of right column:

I pass over the solar observations of Jakob Kristmann [*Iacobi Kristmanni*], inasmuch as I am not troubled over [matters of] 4 minutes — as I gather from bk. 1, ch. 7, of that author himself. But from our own observations, which I made at Bologna [*Bononiae*] in the College of S. Lucia [*Collegio S. Luciae*] together with Father Francesco Maria Grimaldi [*Patre Francisco Maria Grimaldo*], obtained on clear and quadrant days, twice over [*binis*], and not infrequently in threes and fours [*ternis quaternisque*], I select those that were the more accurate —

(continuation of Caput VIII)

[these observations], nor all of them, for there are many more than five hundred. But I have added some others, lest I burden the pages with superfluous prolixity, and I include the declination — computed by trigonometry from the Sun's place — after applying our corrections for the obliquity of the ecliptic, for parallax, and for refraction.

Observed meridian altitudes of the Sun, by the Reverend Fathers Riccioli and Grimaldi.

Latitude of the equator [i.e. of the equinoctial point of observation]: 44° 29' 50".

The four columns are: the **observed meridian altitude of the Sun** [Altitudo Solis meridiana ☉ visa]; the **true declination of the Sun** [Declinatio ☉ vera], marked B(orealis) = north or A(ustrina) = south; and the **place of the Sun in the ecliptic** [Locus Solis in Ecliptica], given by zodiac sign and degrees/minutes/seconds. The date column gives year, month, and day.

Year	Mo. Day	Alt. merid. ☉ visa (G '")	Declinatio ☉ vera (G '", B/A)	Locus Solis in Ecliptica (Sign Gr ' ")
1643	Mart. 23	46 33 30	1 3 50 B	♈ 2 40 5
	Augusti 15	59 36 0	14 6 15	♈ 22 20 21
	Augusti 31	54 13 0	8 43 20	♈ 7 39 12
	Octob. 11	38 6 30	7 23 30 A	♈ 28 18 49
	Octob. 25	34 7 0	11 23 20	♈ 29 40 32
	Nouēb. 11	28 5 0	17 26 20	♈ 18 42 45
1644	Martij 21	46 5 0	0 35 20 B	♈ 1 28 38
	Mart. 22	46 30 30	1 0 50	♈ 2 32 34
	Mart. 30	49 36 0	4 6 45	♈ 10 21 33

Year	Mo. Day	Alt. merid. ☉ visa (G'")	Declinatio ☉ vera (G' ", B/A)	Locus Solis in Ecliptica (Sign Gr' ")
	April. 6	52 16 20	6 46 40	□ 17 12 43
	April. 12	54 27 40	8 58 0	□ 23 0 11 [?]
	April. 20	57 16 0	11 46 15	□ 0 45 47
	Maij 5	61 59 10	16 29 25	□ 15 22 23
	Maij 16	64 48 0	19 18 15	□ 25 59 0
	Maij 23	65 3 40	20 33 15	□ 1 44 0
	Maij 30	67 35 30	21 55 40	□ 9 26 30
	Iunij 4	68 2 50	22 5 4	□ 14 12 20
	Iunij 18	68 41 0	23 11 15	□ 20 50 3
	Iunij 29	68 45 55	23 16 55	□ 7 53 48
	Iulij 11	67 35 40	22 5 15	□ 19 23 45
	Iulij 30	61 54 45	18 25 0	□ 7 37 0
	Augusti 4	61 36 30	17 6 45	□ 11 27 40
	Augusti 6	60 6 0	16 35 15	□ 14 17 39
	Augusti 21	57 25 0	11 55 15	□ 28 48 30
	Nou. 14	27 7 0	18 29 30	□ 22 40 38
	Nou. 18	26 2 30	19 29 15	□ 26 45 15
	Dec. 17	22 6 0	23 27 0	□ 5 19 30
1645	Febr. 4	29 30 45	16 0 25 A	□ 16 15 50
	Martij 10	41 39 30	3 50 15 A	□ 20 10 25
	Mart. 21	45 59 50	0 30 10 B	□ 1 15 38
	April. 19	56 52 20	11 22 50	□ 29 39 10
	Maij 9	63 0 10	17 30 25	□ 18 57 35
	Iunij 5	68 9 30	22 39 45	□ 14 41 0 [?]
	Iulij 27	64 40 40	19 10 55	□ 4 31 22
	Augusti 4	62 41 20	17 11 35	□ 12 10 18
	Aug. 14	59 47 0	14 17 15	□ 21 46 30
	Octob. 4	40 11 30	5 18 30 A	□ 11 4 30
	Octob. 11	38 18 0	7 11 15	□ 18 18 42

Year	Mo. Day	Alt. merid. ☉ visa (G'")	Declinatio ☉ vera (G'"; B/A)	Locus Solis in Ecliptica (Sign Gr'")
1646	Nou. 3	30 15 0	15 16 0	♈ 11 18 55
	Nou. 23	25 1 0	20 31 0	♈ 1 39 30
	Mart. 1	38 6 10	7 23 50 A	♈ 11 0 0 [?]
	Mart. 30	49 24 50	3 55 10 B	♈ 9 52 5
	Maij 8	62 42 0	17 12 15	♈ 17 52 40
	Maij 29	67 12 0	21 42 10	♈ 7 59 56
	Maij 30	67 30 0	22 0 15	♈ 9 4 0 [?]
	Iulij 17	60 39 10	19 0 35	♈ 18 59 2
	Iulij 24	64 30 10	19 0 35	♈ 1 54 41 [?]
	Aug. 4	61 45 40	17 15 55	♈ 11 54 48
	Aug. 18	58 34 45	13 5 9	♈ 25 25 10 [?]
1647	Sept. 22	41 44 40	0 15 0 A	♈ 29 22 22
	Nou. 22	25 16 40	20 15 20 A	♈ 0 13 58
	Ianuar. 23	26 8 0	19 23 45 A	♈ 3 37 40
	Mart. 20	45 24 10	0 53 30	♈ 29 46 12
	April. 18	56 22 30	10 52 50 B	♈ 28 14 50
	Iunij 16	68 53 30	23 14 37	♈ 11 0 0 [?]
	Iulij 17	66 48 0	22 18 15	♈ 24 21 30
	Iulij 29	64 20 10	18 50 20	♈ 5 56 2
Nou. 17	26 28 30	19 3 0 A	♈ 24 15 [?]	

Parsing notes: zodiac symbols read as printed; several Locus-in-Ecliptica seconds and a few sign-degree entries are ink-faint and flagged [?]. The 1644 Iunij 29 entry (sign ♈ 7°53'48") breaks the monotone date/longitude progression — see Numerical impossibles.

Year	Mo. Day	Alt. merid. ☉ visa (G'")	Declinatio ☉ vera (G'"; B/A)	Locus Solis in Ecliptica (Sign Gr'")
1648	Febr. 25	36 48 30	8 42 20 A	♈ 7 44 50
	Mart. 9	41 24 20	4 5 25 A	♈ 19 42 32

Year	Mo. Day	Alt. merid. ☉ visa (G '")	Declinatio ☉ vera (G '", B/A)	Locus Solis in Ecliptica (Sign Gr '")
				[?]
	Iunij 12	68 45 15	23 15 20 B	☐ 21 55 5 [?]
1649	Mart. 20	45 37 0	0 7 10 B	☐ 0 18 42
1650	April. 24	58 29 0	12 59 15	☐ 4 17 53
	Aug. 21	57 35 0	12 5 20	☐ 28 19 32
1653	Martij 22	46 25 0	0 55 20 B	☐ 2 18 46
1655	Maij 22	65 56 52	20 27 8 B	☐ 1 39 5 [?]
	Maij 23	66 0 34	20 38 50	☐ 2 8 7
	Augusti 7	62 0 48	16 31 3	☐ 14 40 1
	Augusti 8	61 41 29	16 11 44	☐ 15 37 33
	[Sed in S. Petronio]	61 41 0	16 11 15	☐ 15 39 13

[Margin / footnote on this entry: *Sed in S. Petronio* — "But (this one) in San Petronio," i.e. observed at the basilica of San Petronio (Bologna) rather than at the College of Santa Lucia.]

Finally, we present some meridian observations of distances from the zenith, made on the great gnomon of San Petronio of Bologna, together with the apparent diameter of the Sun, and the Sun's place deduced therefrom — assuming the obliquity of the ecliptic to be 23° 30' 20", and the altitude of the pole in that same church to be 44° 30' 20".

[These San Petronio observations are tabulated below. For each observation the rows give, in order: the tangent of the distance of the lower limb [Limbi inferioris] and of the upper limb [Limbi superioris] from the zenith; the Sun's apparent diameter [Diameter apparens] and its half [semidiameter]; the distance of the Sun's center from the zenith [Centri distantia a Vertice]; (sometimes) the distance of the equator from the zenith [Aequatoris distantia a Vertice]; the Sun's declination [Declinatio], B = north / A = south; and the place in the ecliptic [Locus in Ecliptica]. The "Tangentes" column holds the tangent values (radius = 100000); the "Arcus" column holds the corresponding arc in degrees/minutes/seconds. Status notes beside the date — *Solis* (of the Sun), *exactiùs* (more exactly), *dubia* (doubtful), *Lubrica* (uncertain/"slippery"), *minus certa* (less certain), *tertiùs sed non certa* (a third [reading], but not certain), *serenis/sereno* (clear sky), *sub*

nubilo/sed nubilo (under/but cloudy), *semidubia* (half-doubtful) — are reproduced in the Year column.]

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")		
1655 (Solis)	Iunij 21	Limbi inferioris 38909	21 15 38		
		Limbi superioris 37870	20 44 30		
		Diameter apparens	0 31 7		
		semidiameter	0 15 34		
		Centri distantia a Vertice	21 0 4		
		Aequatoris dist. a Vertice	44 30 20		
		Declinatio B.	23 30 16		
		Locus in Ecliptica	□ 29 27 30		
		1655 (exactiùs Solis)	Iunij 22	Limbi infer. 38981	21 15 42
				Limbi super. 37871	20 44 32
Diameter app.	0 31 10				
semidiam.	0 15 35				
Centri distantia a Vertice	21 0 7				
Declinatio B.	23 30 18½				
1655 (Solis)	Iulij 26	Locus in Ecliptica	□ 0 19 55		
		Limbi infer.	25 15 57		

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
		47197	
		Limbi super.	24 44 50
		46095	
		Diameter app.	0 31 7
		semidiam.	0 15 33½
		Centri dist. a	25 0 23
		Vertice	
		Declinatio B.	19 29 57
		Locus in Eclipt.	□ 10 48
1655 (Solis)	Iulij 29	Limbi infer.	25 57 10
		48671	
		Limbi super.	25 26 6
		47558	
		Diameter app.	0 31 4
		semidiam.	0 15 32
		Centri dist. a	25 41 38
		Vertice	
		Declinatio B.	18 48 42
		Locus in Eclipt.	□ 6 3 11 [?]
1655 (Solis)	Iulij 30	Limbi infer.	26 11 20
		49187	
		Limbi super.	25 40 25
		48070	
		Diameter app.	0 31 3
		semidiam.	0 15 32
		Centri dist. a	25 55 57
		Vertice	
		Declinatio B.	18 34 21
		Locus in Eclipt.	□ 7 0 8
1655 (Solis)	Aug. 31	Limbi infer.	36 5 44
		72909	

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
		Limbi super. 71521	35 34 22
		Diameter app. semidiam.	0 31 22 0 15 41
		Centri dist. a Vertice	35 50 3
		Declinatio B.	8 40 17
		Locus in Eclipt.	□ 7 47 14

Parsing notes: tangent values are 5-digit (radius 100000) except the □-region winter/summer entries which run to 6 digits as the zenith distance grows. Several "Locus in Eclipt." sign-and-degree groups are faint; the 1655 Iulij 26 entry shows "□ 10 48" with no leading degree printed, transcribed as seen.

[San Petronio gnomon observations continue. Left column:]

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1655 (Solis)	Sept. 15	Limbi infer. 89167	41 43 21
		Limbi super. 87514	41 12 11
		Diameter app. semidiam.	0 31 9 0 15 34½
		Centri dist. a Vertice	41 27 46
		Declinatio B.	3 2 34
		Locus in Eclipt.	□ 22 21 3
1655 (Solis)	Sept. 22	Limbi infer. 98133	44 27 36
		Limbi super. 96334	43 55 49½

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1655 (Solis)	Sept. 23	Diameter app.	0 31 46
		semidiam.	0 15 53
		Centri dist. a	44 11 42
		Vertice visa	
		vera	44 11 37
		Declinatio B.	0 18 43
		Locus in Eclipt.	□ 29 13 4
		Limbi infer.	44 51 5
		99483	
		Limbi super.	44 19 29
97672			
1655 (dubia Solis)	Sept. 24	Diameter app.	0 31 36
		semidiam.	0 15 48
		Centri dist. a	44 35 17
		Vertice	
		Declinatio A.	0 4 57
		Locus in Eclipt.	□ 0 12 24
		Limbi infer.	45 14 35
		100853	
		Limbi super.	44 43 4
		99016	
1656 (Solis, Lubrica)	Ianuar. 1	Diameter app.	0 31 31
		semidiam.	0 15 46
		Centri dist. a	44 58 50
		Vertice	
		Declinatio A.	0 18 30
		Locus in Eclipt.	□ 1 11 24
		Limbi infer.	67 45 46
		244590	
		Limbi super.	67 13 40
		238210	

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1656 (Solis, minus certa)	Ianu. 2	Diameter app.	0 32 6
		semidiam.	0 16 3
		Centri dist.	67 29 43
		visa a Vert.	
		sed vera	67 32 51
		Declinatio A.	23 2 33
		Locus in Eclipt.	□ 11 4 7
		Limbi infer.	67 40 45
		243570	
		Limbi super.	67 8 10
		237150	
		Diameter app.	0 32 35
		semidiam.	0 16 18
		Centri dist.	67 24 28
visa a Vert.			
sed vera	67 27 38		
Declinatio A.	22 57 18		
1656 (Solis, tertiùs sed non certa)	Ianu. 5	Limbi infer.	67 22 3
		239850	
		Limbi super.	66 49 54
		233690	
		Diameter app.	0 32 9
		semidiam.	0 16 4½
		Centri dist.	67 5 58½
		visa a Vert.	
		sed vera	67 9 8
		Declinatio A.	22 38 48
1656 (Solis, Lubrica)	Ianu. 9	Locus in Eclipt.	□ 15 6 25
		Limbi infer.	66 51 22
		233050	

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1656 (Solis)	Ianu. 15	Limbi super. 228050	66 19 21
		Diameter app. semidiam.	0 32 1 0 16 1
		Centri dist. visa a Vert.	66 35 22
		sed vera	66 38 12
		Declinatio A.	22 7 52
		Locus in Eclipt.	□ 19 10 2
		Limbi infer. 223270	65 52 23
		Limbi super. 217790	65 20 15
		Diameter app. semidiam.	0 32 8 0 16 4
		Centri dist. visa a Vert.	65 36 19
		sed vera	65 38 49
		Declinatio A.	21 8 29
		Locus in Eclipt.	□ 25 16 8

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1656 (Solis)	Mart. 19	Limbi infer. 99762	44 55 54
		Limbi super. 97940	44 24 14
		Diameter app. semidiam.	0 31 40 0 15 50
		Centri dist.	44 40 4

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
		visa a Vert.	
		verior	44 49 0 [?]
		Declinatio A.	0 9 40
		Locus in Eclipt.	□ 29 35 43
1656 (Solis, sed nubilo)	Mart. 20	Limbi infer. 98380	44 31 56
		Limbi super. 96600	44 0 33
		Diameter app. semidiam.	0 31 23 0 15 41
		Centri dist. a Vert.	44 16 14
		Declinatio B.	0 14 6
		Locus in Eclipt.	□ 0 35 17
1656 (Solis, serenise.)	Mart. 21	Limbi infer. 97048	44 8 30
		Limbi super. 95275	43 36 50
		Diameter app. semidiam.	0 31 40 0 15 50
		Centri dist. a Vert.	43 52 40
		Declinatio B.	0 37 40
		Locus in Eclipt.	□ 1 34 30
1656 (Solis, sub nubilo)	Mart. 22	Limbi infer. 95712	43 44 43
		Limbi super. 93981	43 13 21
		Diameter app. semidiam.	0 31 22 0 15 41
		Centri dist. a	43 29 2

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
		Vert.	
		Declinatio B.	1 1 18
		Locus in Eclipt.	□ 2 33 50
1656 (Solis, sereno)	Mart. 23	Marg. infer. 99407	43 21 8 [?]
		super. 92685	42 49 31 [?]
		Diameter app.	0 31 37
		semidiam.	0 15 48
		Centri dist. a	43 5 19
		Vert.	
		Declinatio B.	1 25 1
		Locus in Eclipt.	□ 3 33 16
1656 (Solis)	April. 11	Marg. infer. 72911	36 6 0
		Marg. super. 71529	35 34 32
		Diameter app.	0 31 28
		semidiam.	0 15 44
		Centri dist. a	35 50 16
		Vertice	
		Declinatio B.	8 40 4
		Locus in Eclipt.	□ 22 12 6
1656 (Solis)	Iulij 23	Limbi infer. 46192	24 47 36
		Limbi super. 45098	24 16 19
		Diameter app.	0 31 17
		semidiam.	0 15 47
		Centri dist. a	24 32 6
		Vertice	
		Declinatio B.	19 58 14 [?]

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1656 (Solis)	Aug. 8	Locus in Eclipt.	□ 1 5 30
		Marg. infer. 54944	28 47 10
		Marg. super. 53770	28 16 1
		Diameter app. semidiam.	0 31 9 0 15 35
		Centri dist. a Vertice	28 31 36
		Declinatio B.	15 58 44
		Locus in Eclipt.	□ 16 21 5
1656 (Solis)	Aug. 9	Limbi infer. 55605	29 4 32
		Limbi super. 54426	28 33 27
		Diameter app. semidiam.	0 31 5 0 15 33
		Distant. centri a Vert.	28 49 0
		Declinatio B.	15 41 20
		Locus in Eclipt.	□ 17 18 45

[San Petronio gnomon observations continue. Left column:]

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1656 (Solis)	Aug. 20	Limbi infer. 63775	32 51 40
		Limbi super. 62515	32 0 20
		Diameter app.	0 31 20

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")		
1656 (Solis)	Sept. 22	semidiam.	0 15 40		
		Centri dist. a Vertice	32 16 0		
		Declinatio B.	12 14 20		
		Locus in Eclipt.	□ 27 53 30		
		Limbi infer. 99130	44 44 59		
		Limbi super. 97335	44 13 35		
		Diameter app. semidiam.	0 31 24 0 15 42		
		Centri dist. a Vertice	44 29 17		
		Declinatio B.	0 1 3		
		Locus in Eclipt.	□ 29 57 22		
1656 (Solis)	Sept. 23	Limbi infer. 100495	45 8 30		
		Limbi super. 98670	44 37 0		
		Diameter app. semidiam.	0 31 30 0 15 45		
		Centri dist. a Vertice	44 52 45		
		Declinatio A.	0 22 25		
		Locus in Eclipt.	□ 0 56 11		
		1656 (Solis)	Sept. 24	Limbi infer. 101872	45 31 53
				Limbi super. 100020	45 0 11
				Diameter app. semidiam.	0 31 32 0 15 46

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1656 (Solis)	Sept. 29	Centri dist. a Vertice	45 16 7
		Declinatio A.	0 45 47
		Locus in Eclipt.	□ 1 54 17
		Limbi infer. 109080	47 29 13
		Limbi super. 107090	46 57 40
		Diameter app. semidiam.	0 31 33 0 15 47
		Centri dist. a Vertice	47 13 27
		Declinatio A.	2 43 7
		Locus in Eclipt.	□ 6 47 25
		1656 (Solis)	Oct. 15
Marg. super. 133041	53 4 11		
Diameter app. semidiam.	0 31 52 0 15 56		
Centri dist. a Vertice	53 20 7		
Declinatio A.	8 49 47		
Locus in Eclipt.	□ 22 38 15		
1656 (Solis, semidubia)	Nou. 11	Limbi infer. 191670	62 26 51
		Limbi super. 187410	61 55 6
		Diameter app. semidiam.	0 31 45 0 15 53
		Centri dist. a	62 10 59

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
		Vert.-visa	
		vera	62 12 23 [?]
		Declinatio A.	17 42 3
		Locus in Eclipt.	□ 19 40 15
1656 (Solis)	Nou. 23	Limbi infer.	65 18 42
		217330	
		Limbi super.	64 46 41
		211400	
		Diameter app.	0 32 1
		semidiam.	0 16 0½
		Centri dist. a	65 4 52
		Vertice	
		Declinatio A.	20 34 32
		Locus in Eclipt.	□ 1 47 28
1656 (Solis)	Dec. 21	Limbi infer.	68 11 9
		250050	
		Limbi super.	67 40 5
		243440	
		Diameter app.	0 32 4
		semidiam.	0 16 2
		Centri dist. a	67 58 57
		Vertice	
		Declinatio A.	23 28 37
		Locus in Eclipt.	□ [?]
		Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
1657 (Solis, Lubrica)	Ianu. 10	Limbi infer.	66 35 21
		230966	
		Limbi super.	66 3 20

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
		225185	
		Diameter app.	0 32 1
		semidiam.	0 16 0½
		Centri dist. a	66 21 30
		Vertice	
		Declinatio A.	21 51 10
		Locus in Eclipt.	□ 21 1 33
1657 (Solis)	Ianu. 29	Limbi infer.	62 27 44
		191790	
		Limbi super.	61 55 42
		187510	
		Diameter app.	0 32 2
		semidiam.	0 16 1
		Centri dist.	62 13 53
		vera a Vert.	
		Declinatio A.	17 43 33
		Locus in Eclipt.	□ 10 14 21
1657 (Solis)	Febr. 10	Limbi infer.	58 50 22
		165180	
		Limbi super.	58 18 20
		161950	
		Diameter app.	0 32 2
		semidiam.	0 16 1
		Centri dist. a	58 35 31
		Vertice	
		Declinatio A.	14 5 11
		Locus in Eclipt.	□ 22 23 37
1657 (Solis)	Mart. 16	Marg. infer.	46 12 0
		104275	
		Marg. super.	45 40 10
		102370	

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")		
1657 (Solis)	Mart. 19	Diameter app.	0 31 50		
		semidiam.	0 15 55		
		Centri dist. a Vertice	45 56 0		
		Declinatio A.	1 25 40		
		Locus in Eclipt.	□ 26 25 5		
		Marg. infer. 100050	45 0 50		
		Marg. super. 98210	44 29 10		
		Diameter app. semidiam.	0 31 40 0 15 50		
		Vera Centri dist. a Vertice	44 44 55		
		Declinatio A.	0 14 35		
1657 (Solis)	Mart. 28	Locus in Eclipt.	□ 29 23 50		
		Limbi infer. 88410	41 29 0		
		Limbi super. 86805	40 57 30		
		Diameter app. semidiam.	0 31 40 0 15 40		
		Vera Centri dist. a Vertice	41 13 10		
		Declinatio B.	3 17 10		
		Locus in Eclipt.	□ 8 15 48		
		1658 (Solis)	Mart. 20	Limbi infer. 99075	44 44 0
				Limbi super. 97263	44 12 20
				Diameter app.	0 31 40

Year (status)	Mo. Day	Distance-from-zenith tangents / quantity	Arcus (Gr ' ")
		semidiam.	0 15 50
		Vera Centri dist. a Vertice	44 28 5
		Declinatio B.	0 2 15
		Locus in Eclipt.	□ 0 5 38
1658 (Solis)	April. 4	Marg. infer. 80640	38 53 0
		Marg. super. 79140	38 21 30
		Diameter app. semidiam.	0 31 45 0 15 45
		Vera Centri dist. a Vertice	38 37 5
		Declinatio B.	5 53 15
		Locus in Eclipt.	□ 14 18 54 [?]
1658 (Solis)	Iunij 26	Limbi infer. 38912	21 15 45
		Limbi super. 37876	20 44 41
		Diameter app. semidiam.	0 31 4 0 15 32
		Vera centri Dist. a Vert.	21 0 8
		Declinatio B.	23 30 12
		Locus in Eclipt.	□ 29 14 5

Parsing notes: The lower-limb tangent for 1658 Iunij 26 is printed "48912" but its arc (21° 15' 45") matches an upper-limb-style value near 38900 — see Numerical impossibles (the lower-limb tangent should exceed the upper-limb tangent, here 37876, but 48912 > 37876 is consistent in magnitude, yet the arc 21°15' corresponds to a tangent □ 38900, not 48912; likely a compositor digit error). Faint

zodiac/seconds groups flagged [?]; the Dec. 21 1656 Locus-in-Eclipt. degree group is illegible (☒ [?]).

(Caput VIII, continued) — San Petronio gnomon meridian observation table

The table of meridian observations made with the great San Petronio gnomon continues. Each dated observation gives, in order: the tangents of the distances of the lower and upper limb of the Sun from the vertex (in units of the gnomon scale); the apparent diameter and its semidiameter; the true distance of the Sun's center from the vertex [*Vera centri distantia a Vertice*]; the declination (A = southern / B = northern); and the place in the ecliptic [*Locus in Eclipt.*].

Year, Month, Day	Quantity	Tangents of distances from vertex	Arc Gr. ' ''
1658 June 21, of the Sun (doubtful [<i>dubia</i>])	Lower limb [<i>Limbi inferior</i>]	38906	21 15 32
	Upper limb [<i>Limbi superior</i>]	37868	20 44 27
	Apparent diameter [<i>Diameter appar.</i>]		0 31 5
	Its semidiameter [<i>semidiam.</i>]		0 15 32
	True distance of center from vertex [<i>Vera centri dist. à Vertice</i>]		20 59 54
	Declination B (north) [<i>Declinatio B.</i>]		23 30 26

Year, Month, Day	Quantity	Tangents of distances from vertex	Arc Gr. ' "
	Place in the ecliptic [<i>Locus in Eclipt.</i>]	♋ (Cancer)	•••
1659 Jan. 19, of the Sun (suspect [<i>suspecta</i>])	Lower limb	214580	65 0 48
	Upper limb	209460	64 28 50
	Apparent diameter		0 31 58
	Its semidiameter		0 15 59
	True distance of center from vertex		64 44 30
	Declination A (south) [<i>Declinatio A.</i>]		20 14 10
	Place in the ecliptic	♏ (Capricorn)	29 51 34
1659 Feb. 8, of the Sun	Lower limb [<i>Marg. infer.</i>]	170710	59 38 19
	Upper limb [<i>Marg. super.</i>]	167150	59 6 34
	Apparent diameter		0 31 45
	Its semidiameter		0 15 54
	True distance of center from vertex		59 22 0
	Declination A (south)		14 51 40

Year, Month, Day	Quantity	Tangents of distances from vertex	Arc Gr. ' ''
	Place in the ecliptic	♒ (Aquarius) [<i>In source: see note</i>]	19 58 52
1659 Mar. 29, of the Sun	Lower limb	87800	41 17 0
	Upper limb	86285	40 47 21
	Apparent diameter		0 29 39
	Its semidiameter		0 14 50
	True distance of center from vertex		41 1 42
	Declination B (north)		3 28 25
	Place in the ecliptic	♈ (Aries)	8 44 42
1659 May 15, of the Sun	Lower limb	48420	25 10 10
	Upper limb	47900	25 18 51 [<i>recte: 24; see note</i>]
	Apparent diameter		0 31 19
	Its semidiameter		0 15 40
	True distance of center from vertex		25 2 30
	Declination, north [<i>Declinatio Bor.</i>]		18 56 15
	Place in the	♉ (Taurus)	24 27 39

Year, Month, Day	Quantity	Tangents of distances from vertex	Arc Gr. ' ''
	ecliptic		
1659 Aug. 14, of the Sun	Lower limb	58620	30 22 44
	Upper limb	57350	29 50 3
	Apparent diameter		0 32 41
	Its semidiameter		0 16 20
	True distance of center from vertex		30 5 55
	Declination B (north)		14 24 25
	Place in the ecliptic	♌ (Leo)	21 21 40
1660 Nov. 14, of the Sun	Lower limb	198550	63 14 40
	Upper limb	192860	62 42 48
	Apparent diameter		0 31 52
	Its semidiameter		0 15 56
	True distance of center from vertex		62 58 40
	Declination A (south)		18 27 56
	Place in the ecliptic	♏ (Scorpio) [<i>x</i> ↗ <i>in source: see note</i>]	22 34 30
1661 Jan. 18, of the Sun	Lower limb	215572	65 6 52

Year, Month, Day	Quantity	Tangents of distances from vertex	Arc Gr. ' "
	Upper limb	210420	64 34 52
	Apparent diameter		0 32 0
	Its semidiameter		0 16 0
	True distance of center from vertex		64 50 23
	Declination A (south)		20 20 3
	Place in the ecliptic	♒ (Aquarius) [<i>in source: see note</i>]	29 23 40
1661 Jan. 24, of the Sun	Lower limb	202770	63 44 53
	Upper limb	198110	63 13 52
	Apparent diameter		0 31 53
	Its semidiameter		0 15 57
	True distance of center from vertex		63 27 31
	Declination A (south)		18 57 11
	Place in the ecliptic	♒ (Aquarius)	5 28 4

Parsing notes: For the 1658 and 1659-January rows the "limb" entries are printed as *Limbi inferior / superior*; from 1659 Feb. 8 onward they are printed as *Marg. infer. / Marg. super.* (margin lower/upper), the same lower/upper limb quantities under a slightly different rubric. The zodiac symbols in the ecliptic-place column are small and several are hard to resolve at this resolution; see the lettered numbering anomalies for the cells where the printed symbol appears

inconsistent with the declination. The "Arc" sub-columns are degrees/minutes/seconds.

CAPVT IX.

On the Hypothesis of the Solar Motion, its Apogee, and the Motion of the Apogee

[*De Solaris motus Hypothesi eiusque Apogeo, & motu Apogei.*]

1. All astronomers agree that the Sun lingers longer in the northern semicircle of the ecliptic than in the southern, and that it once lingered longer at the vernal quadrant than at the summer one — indeed longer in summer than in spring, as is clear from what was said in Chapter VII. It would be absurd to suppose, as the ancient astronomers did, that the celestial body of the Sun actually moves with physically unequal speed; and it is absurd to attribute that whole apparent inequality to the optical cause [*ratio optica*], or to suppose that some such apparent inequality could arise on the hypothesis of an epicycle, where the Sun would be carried evenly upon an epicycle whose center is borne evenly upon a circle concentric with the Earth — or rather, upon an eccentric circle whose center is the Earth, where the solar body itself would move evenly. So clearly is this so that our eye, if it were set at the center of the deferent circle carrying the Sun, would perceive no inequality whatever in the Sun's motion. We ourselves have set out this hypothesis abundantly, with all its properties, in *Almagestum Novum* Book 3 [*Lib. 3*]; and the method of deducing the prosthaphaereses [*prosthaphaereses*, the equations of the apparent–mean difference] — from a given eccentricity, or semidiameter of the epicycle, and a given mean motion of the Sun — at chapters 19, 20, and 21.
2. [Margin: *Kepler*] Kepler, however, considering in the lesser planets that the equant circle [*Aequans Circulus*] is to be reckoned from Ptolemy [Ptolemaeus] — and considering also the difference of the apparent diameter of the Sun, greatest at apogee and least at perigee, and that the distance of the Sun from the Earth at perigee does not require more than half of that whole eccentricity — concluded that the solar prosthaphaereses, which are necessary in his work on Mars and in the *Epitome of Copernican Astronomy* [*Epitome Astronomiae Copernicanae*], are

to be introduced into the solar theory; and that the eccentricity must be bisected. Thus half of that eccentricity ought to be reckoned between the center of the Earth and the center of the orbit carrying the Sun, and the remaining half between the center of this orbit and the point about which the Sun moves evenly. Because the Sun moves evenly about this latter point, some accordingly call it the center of equation, or the mean motion [*Centrum aequalitatis, seu medium motum*]. And since it is proper to an ellipse to have within its greater diameter two points equidistant on either side from its own center — points which are called the umbilici, or foci [*Vmbilici, seu Foci*], from the concurrence of rays from the concave side of the ellipse at one or the other of those points — and since this builds up the force of the argument, Kepler did not doubt that the Sun's orbit is an ellipse rather than a circle, and that this inequality, which when the eye is placed on the Earth appears as an inequality of motion, is in part a real inequality (on account of the unequal distance of the orbit's center) and in part an apparent one (on account of the unequal distance of the center of even motion). Kepler therefore at last inferred that the solar equation [*Aequatio Solis*] is to be bisected into an *optical equation* [*Optica Aequatio*] and a *physical equation* [*Physica Aequatio*], understood by two straight lines drawn from the Sun: one to the center of the Earth, the other to the center of the ellipse.

In the adjoining figure ST and SC, if the Sun is supposed at S, or HT and HC if the Sun is supposed at H: in the *physical equation* are understood two straight lines drawn from the Sun, one to the center of the ellipse, the other likewise to the other focus, or point of even motion [*punctum aequalitatis*] — such are SC and SF, with the Sun supposed at S, or HC and HF, with the Sun supposed at H. Therefore the *optical equation* is the angle CST, or in the second case CHT; and its basis is the semi-eccentricity CT; while the *physical equation* is the angle CSF, or in the second case CHF, and its basis is the semi-eccentricity CF. But how this is to be demonstrated by living geometry [*Geometrica Activa*] in the ellipse...

Diagram. A geometric figure illustrating Kepler's bisection of the solar eccentricity into the optical and physical equations. An elliptical (or near-circular) arc is drawn; within it a cluster of labeled points and converging straight lines. The Sun is supposed alternately at the upper point S (top) or the lower point H (bottom); lines run from each of these to the central points. The labels, reading top to bottom on the right-hand stack near the center, are A, S, E (or F), G, T, C, P; the apsidal points are at top (A/apogee) and bottom (P/perigee), with the body of the figure spanning between them.

- A (top): apogee point [*Apogeeum*]
- S (upper, on the arc): the Sun in one supposed position
- C: center of the ellipse [*Centrum Ellipsis*]
- T: center of the Earth [*Centrum Terrae*]
- F (lettered E/F near center): the other focus, or point of even motion [*Focus / punctum aequalitatis*]
- G: intermediate point on the central axis [?]
- H (bottom, on the arc): the Sun in the alternate supposed position
- P (bottom): perigee point [*Perigeum*]

in the ellipse, Kepler does not show, both in the *Optical* and in the *Physical* part separately — so that for that reason Ismaël Boulliau [Bullialdus, Ismaël Boulliau] labored, and on the other hand Seth Ward [Sethus Vuardus] strove to demonstrate it with the utmost exactness, in his *Inquisitio in Bullialdi Astronomiam Philolaicam* [*Inquiry into Boulliau's Philolaic Astronomy*]; and in his biennial work published afterward, which he entitled *Astronomia Geometrica*, where he undertook to demonstrate it both in a circle and in an ellipse, in showing the said equations and the other inequalities of the planets, their nodes, etc. — which even before him Count Pagani [Comes Paganus] had partly accomplished. Now all who follow Copernicus have thereafter embraced this same hypothesis, together with the diurnal and annual motion of the Earth, in place of the eccentric circle and of the deferent circles of the Sun and of the other planets; and even though, as far as the Sun is concerned, the bisection of the eccentricity is suitable for representing this difference between the circle and the ellipse and its motions —

3. — yet certain things are certain from what was said in *Almagestum Novum* Book 9, section 4, and other things are to be said in Appendix II of this present Book. Let these for now rest among the eccentric and the other planets. And since the Sun, or whoever runs through the common path with us in the West according to the scheme set out below, by no means about the Sun, but rather about a certain cone [*Conus*], describes its diurnal spirals — so that they approach as closely as possible in their elliptical surface to circular — the annual inequalities, represented in this feigned [*ficta*] hypothesis of the ellipse, or even of a circle (provided only the bisected eccentricity be reckoned), may be denoted by intersections of the apogee of the Sun, and by the motions of the same apogee, as we taught in *Almagestum Novum* chapters 14, etc. We have declared examples of the eccentric for this Book in chapter 3, section 86, of the moments of the two

equinoxes, and besides at chapter 7, section 165, at the place of the Sun at Bologna by the gnomon of San Petronio, namely at degree 7, 0' 18" of Leo [□].

4. In the following figure, from the center T of the Earth, describe the ecliptic ABPD, and let the line BTD of the equinoxes cut it, which we suppose to be cut by the line AP of the apsides, somewhat inclined at D, toward B, because we are now most certain, at the present time, that the whole orbit of the Sun is an ellipse; let the line AP of the apsides be assumed to pass through the ancient hypothesis with the whole eccentricity TC, and through the center C; describe the orbit SV of the Sun, and at the points of intersection M and N, draw the straight lines CM and CN; finally, with the Sun placed at S, under the point L of Leo, draw the line TSL of the true place, and also draw the line TN of the middle place.

Diagram. A geometric construction showing the solar orbit and the line of apsides relative to the ecliptic. A large circle (the ecliptic / solar orbit) carries the cardinal labels at left and right (B at left, D at right) along the horizontal equinoctial line, with A at top and P at bottom along the vertical apsidal line. Within, a cluster of central labels (S, C, G, T, N, Y) marks the Earth's center, the orbit's center, and the points of intersection; converging chords run from these central points outward. The Sun S sits on the orbit near the top; M and N are the points of intersection of the orbit with the central lines.

- A (top): apogee / Leo direction [the place L of Leo lies near here]
- B (left): one equinoctial point
- D (right): the other equinoctial point
- P (bottom): perigee point
- S (upper center): the Sun's place
- C: center of the eccentric orbit
- T: center of the Earth
- N: point of intersection [*nodus / punctum intersectionis*]
- M: the other point of intersection [near left; label faint] [?]
- G, Y: intermediate central points [?]

In the year 1655 the Sun was observed at Bologna on the meridian of July 30 at L, that is at degree 7, 0' 18" of Leo [□]. Therefore the arc LAD, and likewise the angle LTD, from the beginning of Aries, was computed to be 127°, 0' 18"; and adding two right angles, namely degree 52, 59' 52". In the same year the Sun's entry into Libra [□] was observed on September 22, hour 18, 55' p.m. At Bologna the interval

between the two equinoxes was reckoned at 178 days, 14 hours [following chapter 4, the mean is the diurnal motion]; whence are constituted the angles which were posited in chapter 4: the mean diurnal motion ought to be degree 54, 0' 43", and so great is the angle SCM, or ICS. Lastly, in the year 1656 the Sun's entry into Aries [□] was observed at the same place on March 19, hour 9, 51' p.m.

5. Now the Sun was situated in the southern ecliptic semicircle BPD for 178 days, 14 hours, 56', as we also said in chapter 7; and this Day 178, and nearly hour 14, 56', as observed by us elsewhere and reported in *Almagestum Novum* Book 3, chapter 24, Method 3 — but the southern arc of the Sun's orbit MVN was less than a semicircle, because the mean motion of 174 hours, 14, 56' stood at a degree not 180 but 174, 3' 10' 35"; and so great was the angle MCN, and its complement to two right angles the angle CMN, individually the angle CMN, namely degree 1, 58' 25". Therefore in the figure CMN, individually the angle IMT, which joined to the angle MTI we found to be degree 52, 59' 52", makes the sum degree 54, 58' 17". Therefore the complement of the two right angles, that is the angle MIT, equals degree 125, 1' 43", and CIT equals degree 54, 58' 17", and CSI, or degree 57, 42".

[Margin: *The Apogee of the Sun at the end of the year 1655. — Apogeeum Solis in fine Anni 1655.*]

Firstly, then, in the triangle CIS, taking the radius CS at 100000 parts, from the angle CIS, degree 125, 1' 43", and the angle CSI, degree 0, 57' 42", the side IC is collected by trigonometry, of such parts 2049, of which radius CS is 100000; the remainder is IM, of parts 97951. *Secondly*, in the triangle MIT, the angle IMT being found to lie latent, degree 97951; and from the said angle MTI above, degree 52, 59' 52", and the angle IMT, degree 1, 58' 25", the side TI is collected, of parts 4224. *Thirdly*, in the triangle CIT, taking now TI as above of parts 4224, and CI of parts 2049, and the said angle CIT, degree 54, 58' 17", the angle CTI is found, degree 28, 50' 0". But the angle was LTD, degree 127, 0' 8", from which subtracting CTI, degree 28, 50' 0", leaves the distance of the Sun's apogee from Aries, that is the angle ATD, degree 98, 9' 8". Therefore the apogee of the Sun was at that time, of Cancer [□] degree 8, 9' 8".

6. By a similar method, from the two said equinoctial observations and the Sun observed on the meridian of August 1 of the same year 1655, at degree 7, 47' 15" of Virgo [□], reported in the observations of chapter 8, the apogee of the Sun is found at degree 8, 13' 12" of Cancer. Again, from the same equinoxes and the Sun observed in the year 1655 on the meridian of July

23, at degree 1, 5' 31" of Leo, according to the observations reported in the same chapter, we obtain the apogee of the Sun at degree 8, 9' of Cancer. At length in the year 1656, the Sun being observed at the vernal equinox of March 19, hour 9, 51', the autumnal of September 22, hour 22, 44' p.m. according to the said chapter 3, on August 7 of the same year, on the meridian, at degree 27, 53' 30" of Leo, as was said in chapter 8, we deduced the apogee of the Sun at degree 8, 9' of Cancer. Neglecting, therefore, after many dealings, from other observations made and noted as more certain conclusions toward the end of the year 1655, the apogee of the Sun is established to stand beyond degree 7 and short of degree 10 of Cancer; indeed, beyond degree 8 of Cancer. Since the extreme of the three thirds of the aforesaid observations is beyond degree 8, 13' 12" of Cancer, and degree 9, 58' 29", the arithmetic mean is degree 8, 5' 51". We therefore establish the apogee of the Sun at the end of the year 1655 at degree 8, 36" of Cancer.

[Margin: *The apogee of the Sun at the end of the year 1655. — Apogeum Solis in fine Anni 1655.*]

6. (continued) But because in the aforesaid method we supposed the center of the mean motions to be the very center of the orbit of the Sun — whereas, the eccentricity being bisected, the center of the Sun's orbit ought to be constituted at so great an interval as is the semi-eccentricity, and standing apart from the center of the apparent motions, or of the Earth, by the whole eccentricity — the prosthaphaereses owed to the Sun [will differ slightly]; we have nevertheless attempted, both at the equinoxes and at the other solar observations near the equinoxes, or about summer, to demonstrate the apogee line geometrically, both in a circle and in an ellipse, especially since among the other properties of the ellipse, which is so notable, and below us is to be usurped, that any radius drawn from one or other of the two foci to the circumference is at the same time taken equal to the axis, or the greater diameter itself; and likewise the straight line drawn from either of the foci to the extremity of both the lesser diameters, or the transverse of the ellipse, which the Greeks call the *diameter* [Greek: διάκαρπος (diakarpos) — here used by Riccioli for the conjugate/transverse diameter of the ellipse [?]], is equal to the greater semidiameter of the ellipse; and this, however much you multiply it by trigonometry, did nonetheless succeed for us, just as it did for Kepler, Boulliau, Count Pagani, and Seth Ward. But as for another method which trigonometry does not require, and which serves to find the motions of the Sun by solar observations at the two points of the circle...

or of the ellipse, made equidistant from, or not at all distant from, the line of the apsides.

7. *Firstly*, then, it is certain that the true motion of the Sun is swiftest at perigee and slowest at apogee — not only on the circular hypothesis, but also on the elliptical hypothesis from conic elements. If within the same tropical year the true motions of the Sun are observed twice, in which the true motion of the Sun becomes once greatest, once least, and in the other place greatest, then at once in these the place of the ecliptic and of the apogee is manifest from there; but if even by a few seconds an error is made in the Sun's altitudes on this occasion, the error will be by far more degrees in the place of the apogee.

Secondly, it is likewise certain that the true motion of the Sun, in the first semicircle of the anomaly computed according to the order of the signs from the apogee, is less than the mean, and therefore that the equations [*Aequationes*] in this whole semicircle are to be subtracted; while in the latter semicircle the true motion is greater than the mean, and consequently the equations are to be added. Comparing nevertheless the true motion of the Sun reckoned from day to day, or from even intervals of time, the computation made from the apogee, it is certain that in the upper semicircle of the anomaly — which is above the diacenter [*Diacenter*], that is, the true motion is less than the mean — while in the lower semicircle, that is below the diacenter, the true motion is greater than the mean; and the transition from the one extreme to the other is at the points of the diacenter, which are the points where the mean motion is nearest, or very nearly equals, the true motion. Therefore, by continuous observations, those places of the ecliptic in which, within the same tropical year, or equinoctial, the true motion equals the mean, and the ecliptic arc is intercepted between two such places cut bifariouly [in two] — the position being given, the situs both of the line of the apsides and the place of the apogee and of the perigee is given; but this method demands a more delicate observer.

Thirdly, it is certain that in two places equidistant on either side from the apogee the apparent motions become equal. Therefore if two such motions are observed which agree at two such places, the ecliptic arc is bisected between them, which intercepts the line of the apsides; and there will be given the place both of the apogee and of the perigee. For the *first* and *second* methods, our observations have not yet attained other suitable observations; but for the *third* we have these two equal pairs of observations, made on the same dates, whose certitude is nonetheless allowed, that we may bring forward to the mean.

8. [Margin: *Chapter 8*] From the relations of chapter 8, the Sun appeared at the Temple of San Petronio at Bologna on the meridian of the day September 22, at degree 29, 13' 4" of Virgo, and on the day 23 at degree 0, 12' 24" of Libra. Therefore the true diurnal motion was 59' 20". But in the year 1656 it appeared at the same place on the meridian on March 21, at degree 1, 34' 30" of Aries, and on day 23 at degree 3, 33' 50" of Aries. Therefore the true diurnal motion was 59' 20". The ecliptic arc from Libra degree 0, 12' 24" to Aries degree 23, 50" is degree 182, 21' 16", whose semis [half] is degree 91, 10' 43", which gives the entrance into Libra at degree 0, 12' 24", that the place of the perigee is in Capricorn [□] degree 1, 23' 7", and so of the apogee in Cancer degree 1, 23' 7". That this is false, not only from what was said toward the number 5, but also and soon to be said by us, is detected from these very observations.

For in the year 1655, as I reported in chapter 8, on May 22, in our observatory the Sun appeared on the meridian at degree 1, 10' 35" of Gemini, and on day 23 at degree 2, 8' 7" of Gemini, wherefore the true diurnal motion was 57' 32". Again in the same year, on August 7 on the meridian, the Sun appeared to us at degree 14, 40' 1" of Leo, and on day 8 at degree 15, 37' 33" of Leo. Let it be supposed that on the same day, in the gnomon of San Petronio, the Sun was seen at degree 15, 39' 13" of Leo. Standing therefore by our observation, the true diurnal motion was likewise 57' 32"; and so the equal ecliptic arcs of the Sun, from degree 1, 10' 35" of Gemini to degree 15, 33' of Leo, are degree 74, 26' 58", whose semis is degree 37, 13' 28", which, added to Gemini degree 1, 10' 35", effects the place of the apogee in Cancer degree 8, 24' 3". On account of the diversity, nevertheless, of the aforesaid observations, we judge they are to be retained.

[Margin: *The apogee of the Sun at the end of the year 1655 at degree 8, 36" of Cancer, according to what was said in number 5.*]

On the Apogee of the Sun discovered by others before us, and its Motion

[*De Apogeo Solis ab aliis ante Nos inuento, eiusque Motu.*]

9. [Margin: *The foundations of Longomontanus and Kepler for the motion of the apogee of the Sun.*] When Hipparchus [Hipparchus] had found the apogee of the Sun in Gemini degree 5, 30', about 140 years before Christ, and Ptolemy [Ptolemaeus] refers to the same about 280 years afterward, in *Magna Constructio* [*Almagest*] chapter 4 [*Lib. 3 Magnae Constructionis cap. 4*], Ptolemy supposed that 280 years from Hipparchus did not suffice to

discover, for the evident determination, a change in the apogee. But Albategnius [al-Battānī] in the year 883 of Christ, as we have in chapter 28 of his *De scientia Stellarum*, observed the apogee of the Sun in Gemini degree 22, 17'; and accordingly the annual progression of 59' 4". But when Arzachel [al-Zarqālī] in the year 1076 of Christ found the same again at degree 17, 50', he judged from this retreat that some followed Albategnius, some followed Arzachel, and some others. Albategnius in *Almagest* Book 3, chapter 25, more fully expounded by us — all the other observers of our time, and the writers of the preceding century who placed the apogee of the Sun beyond the beginning of Cancer, whose selected opinions we put at the foot of this Chapter, together with the annual motion chosen by the same writers — among whom Longomontanus [Longomontanus], supposing the World created in the year 1590, the apogee in Cancer degree 5, 30'; and supposing the World founded at the beginning of Aries, and accordingly in the year 1554, that the apogee was at the beginning of Aries, concludes the annual motion to be 1, 1' 50", 14". Kepler likewise, supposing the World founded 3993 years before Christ, and the apogee to have been then at the beginning of Aries in the year 1588, but in Cancer degree 5, 32'; and accordingly the apogee was in the year 1581, progressed to degree 95, 32', he collects its annual motion to be 1, 2".

10. We, however, granted that the apogee of the Sun was at the beginning of Aries at the beginning of the World, deem it too fallacious a method of collecting the motion of the apogee — this method resting on so uncertain and controverted a year of the World's founding, of which there exist nearly 70 diverse opinions. Among which the most probable is indeed the one which Kepler thinks the founding to be according to the LXX [Septuagint] interpreters, in the year 3634 before Christ; to which adding the years 1655 makes 5289; therefore if it set out at the beginning of Aries with this whole progress of degree 98, 36', from the beginning of Cancer, one year being one would make a second, $48\frac{2}{3}$.

But if, according to the common edition, the World was created in the year 4184, so that in my most recent *Chronologia*, adding 1655, makes the years 5839, in which the progress would be degree 98, 36'; and likewise from the said *Chronologia Reformata* of the World, with its founding in the year 4064, adding to that founding the years 5719, makes the progress degree 98, min. 36'; and accordingly the World was created in the year 4184; or likewise from the *Chronologia Reformata* of the World, with its founding in the year 4064, when there will be the years 5719, the progress completed is degree 98, min. 36'. And

accordingly the mean annual motion stands between Kepler and Longomontanus on this side, and Wendelin [Vendelinus] on that — whose opinions see in the following Table — there will not be lacking certain things in which a single one of the minutes, for the sake of facility, may please.

Liber I — De Sole, Caput IX (conclusion) — table; Caput X; Caput XI

Table of opinions on the solar apogee

The opinions promised at the close of the previous section are gathered in the following table. Its caption reads *Apogei Solis* ("Of the solar apogee"). The columns give: the authorities; the year (*Anni Christi*); the apogee's position (*Locus Apogei*) by zodiac sign, degree, minute, and second (*Sig. Gr. I. II.*); and the apogee's annual motion (*Motus Annuus*) in further sexagesimal places (*II. III. IIII. V.*).

Auth oriti es	Year of Chri st	Apo gee posit ion —				Ann ual moti on				
		Sign	Deg.	I'	II''	— II	III	IIII	V	
Hipp arch us	Befo re 140	♈ (Ge mini)	5	30	0	0	0	0	0	
Ptole my	Afte r 139	♈	5	30	0	0	0	0	0	
Alba tegni us [al- Batt ānī]	883	♈	22	17	0	0	59	4	0	
Arza chel [al- Zarq	1076	♈	17	50	0	0	42	16	14	

Auth oriti es	Year of Chri st	Apo gee posit ion — Sign	Deg.	I'	II''	Ann ual moti on — II	III	III	V
ālī]									
Alph onsu s [Alfo nsin e]	1252	□	28	40	0	0	26	26	54
Bern ardu s Vual ther [Ber nhar d Walt her]	1488	□ (Can cer)	4	15	0	.	.	.	.
Cope rnic. corr ell. [Cop erni cus, corr ecte d]	1515	□	5	8	0	0	24	20	14
Petr us Noni us [Ped	1552	□	1	28	0	.	.	.	.

Auth oriti es	Year of Chri st	Apo gee posit ion — Sign	Deg.	I'	II''	Ann ual moti on — II III IIII V				
ro Nun es]										
Tych o [Tyc ho Brah e]	1588	□	5	30	0	0	45	0	0	
Iust us Byrg ius [Jost Bürg i]	1588	□	5	53	20	.	.	.	.
Long omo ntan us	1590	□	5	30	0	1	1	50	14	
Kepl erus [Kep ler]	1588	□	5	32	0	1	2	0	0	
Magi nus in Sup pl. [Mag ini, in	1588	□	3	30	45	0	41	0	0	

Auth oriti es	Year of Chri st	Apo gee posit ion — Sign	Deg.	I'	II''	Ann ual moti on — II	III	III	V
the Sup ple men t]									
Lans berg ius [Lan sber ge]	1599	□	6	22	56	1	7	30	38
Bulli aldu s [Bou lliau]	1588	□	5	23	19	0	57	0	0
Vue ndel inus [We ndel en]	1600	□	5	42	0	1	8	21	0
Vinc enti us Mut us [Vin cent e Mut]	1650	□	1	0	0	0	0	0	0

Auth oriti es	Year of Chri st	Apo gee posit ion	Deg.	I'	II''	Ann ual moti on				
		— Sign				— II	III	IIII	V	
Nos in Alm ag. Nou. [We, in the <i>Alm ages tum Nov um</i>]	1646	♊	7	26	15	1	1	10	0	
Nos nun c [We, now]	1655	♋	8	36	0	1	2	4	4	

Parsing notes: The "Apogee position" sign column shows ♊ (Gemini) for the first five entries (Hipparchus through Alphonsus) and ♋ (Cancer) for the rest, as the apogee crosses from Gemini into Cancer over the centuries. Several entries leave the annual-motion places blank (transcribed as .) where the author gave no derived motion. The annual-motion sub-columns are headed II III IIII V (the higher sexagesimal places); the leading degree/minute places of the motion are folded in as the small recurring values.

CAPUT X.

De Solis Excentricitate. (On the Sun's eccentricity.)

If the eccentricity did not have to be bisected, but the center of the deferent circle were itself the center of the [mean] motions, then — once the apogee's place is

given — from a single observation of the Sun's true place one could easily collect the eccentricity, which is the foundation of the entire computation. The procedure would run as follows.

Diagram. A geometric construction for deriving the eccentricity from a single observation, on the assumption that the deferent's center is the center of mean motion. A quarter-arc runs from A (top) down through P (bottom), with the apsidal line A–P vertical. Points C (the circle's center) and T (the Earth's center) lie on this line, T below C. From S — the Sun's position on the arc — lines are drawn to C and to T.

- A (top): the apogee
- P (bottom): the perigee
- C (on the axis, upper): the center of the deferent circle
- T (on the axis, lower): the center of the Earth
- S (on the arc, right): the Sun's true place

In the adjoining figure, let the deferent circle carrying the Sun be ASP; in its rear semicircle ASP, from the circle's center C draw the straight line CS for the mean motion, and from the Earth's center T draw TS for the apparent motion. For, given the moment of observation, both the Sun's mean motion and the apogee's motion from the start of [the epoch] are had from the tables; and consequently — by subtracting the apogee's mean motion from the Sun's mean motion — the Sun's mean distance from the apogee, that is, its mean anomaly (namely the arc AS), is had. Moreover, the angle ACS, from which in turn the Sun's true distance from the apogee reckoned on the ecliptic is had — that is, the arc ATS — to which, together with the angle CST, the external angle ACS is equal, by Elements I.32. Therefore subtract the angle ATS from ACS, and you will have the angle CST; and so in this triangle all the angles together with one side, CS, which is assumed to be of 100000 parts, are had. Therefore, by the laws of triangles, the side CT — the eccentricity — will not lie hidden.

But because, as we said and as we shall show below, we suppose the eccentricity must be bisected, and the center of the mean motions is not the center of the circle — but rather the semidiameter of the ellipse carrying the Sun, and hence the semidiameter of the circle (since an ellipse cannot well be assumed except in one case for another), is greater, because by it alone is the apparent motion plainly manifest — neither is the Sun's mean motion measured by the arc of the circle or of the ellipse carrying the planet subtended to that same angle. For that

reason another path of proceeding has been prescribed to astronomers, not on the circle [but on the ellipse].

— or [must proceed] on the elliptical orbit carrying the planet's body; rather, [the discrepancy arises because] on the ecliptic one measures not only the arc of the true motion and of the true anomaly from the Earth's center, but also the arcs described on the ecliptic, and even the arc of the mean motion and of the mean anomaly — since so great is the distance supposed to the ecliptic circumference that not only is the interval from the Earth's center, but even the interval between the centers of the mean motions, that is, the whole eccentricity, as if of a point [negligible]; and the parallels drawn from either center coincide, physically and to every perceptible subtlety. This will be seen in the following figure, described from the Earth's center T at an infinite [practically immense] distance owing to the great interval to the ecliptic, namely portion AB; and let the Sun's apogee be A, and let the semi-ellipse ESP then be drawn, in which let the Sun be S, and through it draw FM straightway for the mean motion, and TV for the true motion; let TB be drawn parallel to FM, for on account of the immense distance the arc BM is imperceptible, and although BT will mathematically be distinct from FM, it physically coincides with FM, and the arc AB, imperceptibly greater than the arc AM, will — just as AB is the measure of the angle ATB — also (for AB is physically the measure of the arc AM, since AB and AM are taken as physically equal) be the measure of the angle AFM, that is, of the mean anomaly. These things being laid down, then:

Diagram. A tall narrow construction illustrating that, at the Sun's immense distance, the parallels drawn from the circle's center and from the Earth's center coincide. At the top, near-coincident points B, M, V converge toward A (the apogee) at the top. A long nearly-vertical line descends to E, then through F (the center of mean motion), C (the circle's center), T (the Earth's center), and P (the perigee) at the bottom.

- A (top): the apogee
- B, M, V (top, clustered): the imperceptibly-separated points of the arc and the parallels (B on parallel TB, M on the mean-motion line FM, V on the true-motion line TV)
- E (mid-left): vertex of the semi-ellipse ESP
- F: the center of the mean motions
- C: the center of the circle
- T (lower): the Earth's center
- P (bottom): the perigee

I. PROBLEMA.

[Margin / rubric:] Given a certain moment of time of the Sun's true place, and the Sun's [mean motion] for it: to find in the ellipse the whole eccentricity, the equation, and the Sun's distance from the Earth and from the center of the mean motions.

Let the ellipse be ASPB, whose major axis is AP, and on it the two foci F and S; let the center of the Earth be T, and to it draw the radii FS and TS; produce TS to M, so that SM equals the radius FS, draw FM; for then the triangle FSM will arise as isosceles, and so by Elements I.5 the base angles SMF and SFM will be equal between themselves, and the whole TM will equal the axis AP, because any two radii drawn from the foci, or umbilici, of an ellipse, taken together, are equal to that same greatest diameter — as Count Pagan [Blaise François Pagan] demonstrated in Book 3, Theorem [...]. Wherefore, if the semidiameter AC be assumed to be of 100000 parts, AP will be of 200000; so too will TM be; subtract from it the assumed TM [recte: subtract from it the Sun's true distance], that is, [...] now from the Sun's true place reckon the apogee, and there will remain the true distance of the Sun's true place from the apogee, which is called the true anomaly (namely the angle ATS), measured not by the arc of the ellipse AS, but by the arc of the ecliptic; and from the said number preceding [subtract] [...].

Subtract likewise the apogee's motion, given by the tables for the Sun's given mean motion, and you will have the distance of the Sun's mean place on the ecliptic, which is called the mean anomaly (namely the simple angle AFS), measured also by that same arc of the ecliptic, by Elements I.32. The angles FTS and FST, taken together, are equal; subtract therefore FTS, which is known from FST [...] and since FST [...] this whole equation sought, that is, the difference between the true and the mean [motion] of the Sun, the half of which in the isosceles [triangle] already mentioned will give individually the angles SMF and SFM, [which] are therefore given in the triangle FMT, the side TM being of 200000 parts, and the angle TMF, and the angle TFM, being constant —

— from the anomalistic angle AFS, the angle SFM being diminished by the complement to two right angles. Therefore, by the benefit of trigonometry, the whole eccentricity FT will not lie hidden, since the angle FMT, now too acute, can subtend the little angle FT, of one part of 100000; so that it may be extracted exactly from the tables, another, surer method has been devised, which is written below.

§4. Produce from the point M the parallel MN, to AT itself, until it meets orthogonally the line NT, perpendicular to AP itself; and from the other focus F

produce FR parallel to NT itself; FR will be equal to NT, and in the triangle MNT, right-angled at N, the angle NTM is known, as being the complement of the angle ATS, as given above; and so, by Elements I.32, the third angle TMN will be known, to which when the angle SMF is adjoined, the angle FMR will be known, right-angled at R; and so the third angle RFM. First, then, in the triangle NMT, the side TM being given as 200000 parts, seek the sides MN and NT; then in the triangle RFM, FR being given as equal to NT itself, seek the side MR (for the difference of this from the side MN, that is, the line RN, is equal to the sought eccentricity FT), in the parallelogram FRNT. Or because in the triangle FST all the angles, as above, are given, and the sides too are inter se [...], the sine of the angle SFT, and so, joining them into one sum, and taking the sine of the said angle FST, you make the sum aforesaid, and from AP, of 200000 parts, so the sine of the angle FST and the eccentricity FT [are had].

§5. The eccentricity FT having been acquired, and the angles being given as above, in the triangle FST — all the angles given — the Sun's distance from the Earth's center will be had by trigonometry, together with SF from the center of the mean motions. And if the Sun be in the semicircle of the anomaly, as VT, by drawing FB and TB, the angle AFB will be known by subtracting from the whole circle the mean anomaly, the planet being placed, and so deg. 360. The true anomaly of the planet [is had]. The rest are to be carried through, as above. By this method, examined at many of the Sun's places and at others by us observed, we find no eccentricity that satisfies more of the observations than if the whole AC be of 100000, the semi-eccentricity 3480, of which parts AC be 100000, and the [whole] eccentricity CT, as also CF, be of 1740 parts; which we shall presently confirm by another experiment.

[*Margin:*] [Margin: Eccentricitas inuenta — "The eccentricity found."]

II. PROBLEMA.

[*Rubric:*] *Given the Sun's apparent semidiameter at its mean, greatest, and least distance from the Earth: to confirm the eccentricity itself, and the necessity of bisecting it.*

§6. From the observations related in Chapter 8, it is established that in the great Gnomon of the temple of S. Petronius [San Petronio, Bologna] the Sun's apparent semidiameter was observed on 20 and 21 June at 15'32". Therefore at the end of June, when the Sun reached its apogee, it must have appeared a very little smaller, that is, 15'30". On 28 March and 29 September, when the Sun was at its mean distance, its semidiameter was observed at 15'45" and 15'47", of which the

mean is 15'46"; on the day of January, when the Sun was at its perigee, it was observed at 16'4" — but indeed if we assume the mean distance of 100000 parts in the adjoined diagram, this is the angle SCM; in the right-angled triangle CSM, right-angled at M, where you inquire 15'46", you will find the Sun's true semidiameter SM, neglecting that fraction of a part. Then with this SM, and with the Sun's greatest distance ST, of 101740 parts, in the triangle STM, right-angled at M, you find the angle STM, which subtends the Sun's apparent semidiameter at 15'30"; and finally, with FS, the Sun's least distance of 98180 parts, and with SM, of 46 parts, in the triangle FSM, right-angled at M, you find the angle SFM, which subtends the Sun's apparent semidiameter at 16'4". Therefore the chosen semi-eccentricity of 1740 parts satisfies the observations very well, and from this likewise is established the necessity of bisecting that eccentricity — which necessity is also that of the equation of the solar motion. For, the whole eccentricity (which in the figure of number 3 is expressed by FT) being required, to be reduced to the angle FST [...].

Diagram. A small construction for the eccentricity-from-semidiameter argument: the apsidal line runs vertically from S (top) down through M, F, C, to T (bottom), with the Sun's body shown as a small disc near the top, the apparent semidiameters compared at the three distances.

- S (top): the Sun
- M: foot of the perpendicular (right angle vertex)
- F: focus / center of mean motion
- C: center of the circle
- T (bottom): the Earth's center

Table — eccentricities and maximum equations (radius of orbit/ellipse = 100000)

The caption reads *Qualium Radius Orbis, seu Ellipsis est 100000* ("Reckoning the radius of the orbit, or ellipse, as 100000"). Columns: authorities (*Auctores*); year of Christ (*Anni Christi*); the eccentricity in such parts (*Talium Eccentric.*); and the maximum equation in degrees, minutes, seconds (*Aequat. max. Gr. I. II.*).

Authoriti es	Year of Christ	Eccentric ity (parts)	Max. equation — Deg.	I'	II''
Ptolemy with	139	4152	2	23	0

Authorities	Year of Christ	Eccentricity (parts)	Max. equation — Deg.	I'	II''
Hipparchus					
Albatenus [al-Battānī]	883	3465 $\frac{1}{3}$	1	59	0
Alzachel [al-Zarqālī], after 400 [observations]-coll'd	1076	3465 $\frac{1}{3}$	1	59	0
Alphonsus, Nonius & Rainoldo [Alfonsine, Nunes & Reinhold]	1252	3465 $\frac{1}{3}$	2	10	0
But Mulerius & Mutus [Müller & Mut]	1252	3780	2	10	0
Bernardus Vualther [Bernhard Walther]	1488	3548	1	1	35
Copernicus	1515	3592 $\frac{1}{3}$	2	3	0

Authorities	Year of Christ	Eccentricity (parts)	Max. equation — Deg.	I'	II''
correctus [corrected]					
Reinholdus quoad media [Reinhold, as to mean]	795	3694	2	7	0
Petrus Nonius [Pedro Nunes]	1552	3781	2	10	0
Tycho & Maginus [Tycho Brahe & Magini]	1588	3584 $\frac{1}{3}$	2	3	0
Iustus Byrgus [Jost Bürgi]	1588	3591 $\frac{1}{3}$	2	3	30
Longomontanus	1590	3571 $\frac{1}{3}$	2	2	48
Keplerus [Kepler]	1588	3600	2	3	46
— but bisected eccentricity	1588	1800	.	.	.
Bullialdus [Boulliau]	1588	3568	2	2	41

Authoriti es	Year of Christ	Eccentric ity (parts)	Max. equation — Deg.	I'	II''
— but bisected eccentric ity	1588	1784	.	.	.
Lansberg ius, as to mean [Lansber ge]	720	2853	2	12	0
Vuendeli nus [Wendele n]	1600	3490 $\frac{1}{3}$	2	0	0
— but bisected eccentric ity	1600	1745 $\frac{1}{2}$	1	59	30
Nos in Almagest o Nouo [We, in the <i>Almagest</i> <i>um</i> <i>Novum</i>]	1646	3460	1	59	0
— but now, in the Year, in the Ellipse & in the Circle	1658	3480	1	59	40

Parsing notes: Fractional eccentricity entries ($\frac{1}{3}$, $\frac{1}{2}$) are transcribed as printed. Several rows are continuation/qualifier lines ("but bisected eccentricity," "as to

mean") that modify the row above; their max-equation cells are sometimes blank (transcribed .). Riccioli's own final line gives two reckonings (in the ellipse and in the circle); the eccentricity 3480 with bisected half \square 1740 ties to his adopted value above.

CAPUT XI.

De loco Solis Vero Geometricè determinando, Aequationum Tabula construenda, Distantijs Solis ab vtroque Foco Ellipsis, & ipsa Ellipsi definienda, ac denique de Inaequalitate Motuum Solis repraesentanda in Ellipsi, & in Circulo.

(On geometrically determining the Sun's true place; on constructing the table of equations; on defining the distances of the Sun from each focus of the ellipse, and the ellipse itself; and finally on representing the inequality of the Sun's motions, in the ellipse and in the circle.)

I. PROBLEMA.

[*Rubric:*] *To determine the place of the Sun's mean distance from the Earth in the ellipse.*

§1. Briefly, this place is at the extremities of the line bisecting [the figure] and orthogonally cutting the line of the apsides, that is, the minor diameter of the ellipse, which is called

— is called the *diacentros* (the through-the-center line), which is in the following diagram BCD. For when the Sun is at B, or at D, its distance from the Earth's center T (namely BT, or DT) is as great as AC, that is, of 100000 parts, such as AP is of 200000. For — let two equilateral and equiangular triangles be drawn for example's sake at B, the angles FB and BT being right, and from the foci of the ellipse [arise], and so the rest of the half CT and BC is a common side. And the [...].

Diagram. The full ellipse showing the *diacentros* (minor-axis line) BCD and the apsidal line A–P. The ellipse has A at left, P at right (the apsides), with B above center and D below center marking the minor-axis endpoints. Interior points F, C, T, H lie on the major axis; lines run from the foci to B and D and on toward L (a point produced beyond the ellipse to the right).

- A (left): the apogee
- P (right): the perigee
- B (top): upper endpoint of the minor axis (mean-distance place)

- D (bottom): lower endpoint of the minor axis
- F: focus (near center)
- C: center of the ellipse
- T: the Earth's center (the other focus)
- H, L (right): points on / produced along the major axis

— the angles comprehended by these are right by the definition of the *diacentros*, or by the construction indicated above. Therefore these two triangles are by Elements I.4 equilateral and equiangular, and so the side BT, and the side BC [...]. But these two radii drawn together are equal, as said in the preceding chapter, the whole AP; therefore each of them is equal to the half of the whole AP itself, that is, to AC; and the angle FBC is equal to the angle TBC.

II. PROBLEMA.

[*Rubric:*] *Given the eccentricity, to find the maximum equation of the Sun's motion, and from it the mean and the true anomaly.*

§2. Since the maximum equation, or the difference between the Sun's mean and true motion, occurs not at the extremities of the line which in Greek is called *diacentros* (that is, the line drawn through the Earth's center cutting the line of the apsides orthogonally, as falls in the hypothesis of the circle; and the eccentricity being unbisected) but at the extremities of the line which is called *diacentros*, that is, the minor diameter of the ellipse, in which is also the situation and the Sun's mean distance, as we now say more truly — and the mean motion being assumed equal to the true at the very next instant: if in the preceding diagram the angle CBF be found, which we said above to be equal to the angle CBT, its doubling will give the whole equation FBC, the maximum, and the optical [angle] CBT will be physically equal to CBF. Now in the triangle CBF, right-angled by construction at C, the base BF is of 100000 parts, by Problem I, and CF is of 1740 parts, by the said preceding Chapter, number 5. Therefore by trigonometry the angle CBF — that is the optical equation — is of deg. 0, 59'49", and the whole and maximum equation FBC is of deg. 1, 59'38". Now the sum from the right-angled BCF, and the acute CBF, is of deg. 0, 59'49", by Elements I.32; the angle equal is the mean anomaly AFB subtracted, finally; the angle CBT of deg. 0, 59'49". With the right angle remaining, the true anomaly angle BTC is left, of deg. 89, 0'11".

III. PROBLEMA.

[*Rubric:*] *Given the eccentricity, to find the minor diameter in the ellipse.*

§3. In the preceding figure, in the triangle CBF, right-angled at C, the base BF is given of 100000 parts, and the angle CBF of deg. 0, 59'49", and BFC of deg. 89, 0'11". Therefore by analysis of right-angled triangles, BC comes out of 99984 $\frac{2}{3}$ parts. Therefore the whole minor diameter BD is of 199969 $\frac{1}{3}$ parts.

III. PROBLEMA.

[Rubric:] Given the eccentricity, to find the equation suited to the Sun, set at the extremities of the line of the diagonal, or drawn orthogonally to the line of the apsides through the Earth's center, and the Sun's mean anomaly, and the true one, in that same place together with the Sun's distance from the Earth.

§ In the preceding figure, a line being drawn from the Sun H, perpendicular HT, and produced to L, until HL equals the radius FH, the whole TL, and again often meeting the property of the ellipse, the equals FL fit the whole AP, conjoining FL the right [angle]; for then the triangle FHL is isosceles, and the angle L by Elements I.5, half of the external angle FHT. Now in the triangle FTL, right-angled at T, by construction TL is given as great as AP, of 200000 parts, and FT, from the said preceding Chapter number 5, of 3480 parts. Therefore by the laws of right-angled triangles the angle L is of deg. 0, 59'48"; therefore its double, that is, the whole equation FHT, is of deg. 1, 59'36" — a little indeed, but still smaller than the maximum equation found at the extremities B & D, by Problem II. The angle FTL, joined to the angle L, makes the sum deg. 90, 59'48"; and so much is the external angle AFL, namely in the prior semicircle ABP. The Sun's mean anomaly in the posterior anomaly [is] the complement to the circle. But the true anomaly is the right angle at T — this is of 90 degrees in the prior semicircle, in the posterior 270 [degrees].

At length in the right-angled [triangle] FTH, the angle FTH is given, of deg. 1, 59'36". Therefore its complement to the right [angle] is of deg. 88, 0'24", and FT of 3480 parts. Therefore by the canons of right-angled triangles the Sun's distance from the Earth HT comes out, of 100000 $\frac{2}{3}$ parts.

V. PROBLEMA.

[Rubric:] Given the eccentricity and the Sun's mean anomaly, to find the composite equation, and to construct in the ellipse the tables of equations.

§ — In the following figure, let the ellipse be ABPD; let the axis be AP, and its center C; let the center of the true and mean motions be T; and let the Sun be at S; to it draw the radii FS and TS; and the radius FS being produced to M, that is to say SM equal to the radius TS, and so the radius FM; so that, the said property of

the ellipse arising, the whole FM equals AP; let the equal axis AP be drawn; for then, MT being drawn, the triangle MSF will be isosceles, and the angle M [will be] half of the whole equation FST. Similarly, the Sun being at O, by drawing FO and TO, and producing TO; so that TO again equals the radius TO; and TL being drawn, the whole TL is made, equal to the whole AP and to the angle L, half of the whole equation FOC. Now in the first case the sides FT, of 3480 parts, and FM of 200000 parts are given —

Diagram. The full ellipse oriented with apsides A (top) and P (bottom), the minor axis through B (left) and a point at right. Within it, the Sun is shown at two positions, S (left, prior semicircle) and O (upper right), with radii drawn from both foci F and T to each Sun-position, and the lines TO, TL produced beyond the ellipse to L (top right) and M (far left), illustrating the isosceles-triangle construction of the composite equation.

- A (top): the apogee
- P (bottom): the perigee
- B (left): minor-axis endpoint (mean-distance place)
- L (top right): point where TO is produced (TL = AP)
- M (left): point where FS is produced (SM = TS)
- O (upper right): the Sun in one position
- S (left of center): the Sun in another position
- F: focus / center
- C: center of the ellipse
- T (lower center): the Earth's center (other focus)
- R, N (lower left): auxiliary points produced from the construction

[*Right column, continued:*] — and the given anomaly AFS, [its] complement to two right [angles], namely the angle MFT; therefore by the canon of triangles the angle M is manifest, and its double the angle MFT [recte: the whole equation], composite, physical, & optical, that is, the angle FST. For example, if AFS be of deg. 45, M is found of deg. 41, 16'6", & the equation FST of deg. 1, 24'32", which in the prior semicircle is the mean anomaly ATS to be subtracted, so that the true anomaly ATS may be had; but in the posterior semicircle the mean anomaly being subtracted from 360 degrees, will give the angle AFO, whose complement is OFT. And to the mean anomaly the equation FOT is to be added, so that the true anomaly may be had.

Liber I — De Sole (continued), Caput XI

Problem VI

Problem VI. *Given the eccentricity and the whole, or composite, equation, to find the Sun's distances both from the Center of the Earth and from the Center of the mean motions, that is, from either Focus of the ellipse, on the supposition of the mean anomaly.*

[6] Through Problem V we have already obtained, in the preceding figure, the triangle FST, by means of the mean anomaly AFS, with the whole equation FST subtracted from it. The angle FTS is thereby also given, since it is the supplement of FST, the eccentricity FT being 3480 parts opposite to angle S. Therefore, by the rules for oblique-angled triangles, FS — the distance of the Sun from the Center F, the radius being 100000 parts — becomes known; and once that has been subtracted, the remaining ST is known — the distance of the Sun from the Earth — together with FS, both being equal to the whole AP. Let the example be the case of the preceding Problem, namely a mean anomaly of 45° , in which the angle S was found to be $1^\circ 24' 32''$ and FTS $43^\circ 35' 16''$; from these, FT being 3480 and FTS $43^\circ 35' 16''$, one obtains FS as 97585 parts, and ST as 102415 parts, which together make up 200000 parts.

Problem VII

Problem VII. *Given the Sun's mean anomaly and the eccentricity, to distinguish the physical equation from the optical.*

[7] First, by Problem V, find in the preceding figure the total equation FST; and by Problem VI find the distance of the Sun SF, or ST, and draw CS to the center of the ellipse. Then, in triangle CSF, with the semi-eccentricity FC and the angle FS given (this latter being, within this semicircle, the mean-anomaly equation AFS), find the physical equation CSF — for I call the equation CSF physical, the one which, subtracted from the whole equation FST, leaves the optical equation CST; or, if you prefer, with the distance TS and the true anomaly ATS given, or its complement, when this complement is greater than a right angle, the optical equation CST will come out, and this subtracted from the whole equation will give the physical equation CSF. Take the example of the case in Problems V and VI, in which the given mean anomaly AFS is 45° , and accordingly CFS is 135° , FC is 1740 parts, and FS is 97585 parts: one finds CSF as $0^\circ 42' 49''$. The optical equation CST is therefore found to be $0^\circ 41' 43''$, and the physical equation as above.

Problem VIII

Problem VIII. *For a given moment of time, with the eccentricity given, to find geometrically in the ellipse the Sun's true place, its distance from the Earth, and from the Center of the mean motions.*

[8] Collect, for the given time from the tables of the Sun's mean motion, the Sun's mean motion and apogee; then subtract the mean apogee from the mean motion, and by Problem V find the whole equation, which you subtract from the mean motion in the prior semicircle and add in the posterior; and you will have the Sun's true place, and by Problem VI its distance from the Earth, etc. Example. In the year 1656, on August 9, at the meridian of Bologna, the Sun's mean motion by our tables is sign 5, $18^{\circ}34'22''$; the apogee, however, is sign 3, $8^{\circ}36'37''$. Therefore the mean anomaly in figure num. 5 — namely the angle AFS — is $39^{\circ}57'45''$; its complement is $50^{\circ}2'15''$, that is, the angle MFT, with which, together with side FT, of 3480 parts, by the rules of trigonometry, the angle M, of 100000 parts, [comes out;] and its double, that is, the equation FST, is $1^{\circ}16'50''$; this subtracted from the mean motion leaves the Sun's true place, sign 5, $17^{\circ}18'3''$. And by what has been said in Cap. 8, from observation, the Sun was seen at that time to be in Leo $17^{\circ}18'45''$.

Next, in triangle FST, with the angle at S given, $1^{\circ}15'50''$, and FST as above, $1^{\circ}16'50''$, FTS comes out $138^{\circ}41'55''$; and FT being 3480 parts, FS comes out — the distance of the Sun from the Center of the mean motions — of such parts $98642\frac{1}{2}$; which, subtracted from the whole AP, leaves the Sun's distance from the Earth ST, $101357\frac{1}{2}$.

Diagram. A circle (the Sun-carrying circle of Problem IX) with center near the middle. The vertical diameter runs from A at the top through the center to P at the bottom (apogee A, perigee P). Interior points and radii lay out the eccentric construction described in Problem IX.

- A (top): apogee
- P (bottom): perigee
- S (left): the Sun's position at one location
- O (lower right): the Sun's position O
- F (interior, upper): Center of the mean motions (focus F)
- T (interior, below F): Center of the Earth (focus T)
- C (interior): Center of the circle
- M (right, between S and O): point M on the circumference

- G (right, near O): point G

Problem IX

Problem IX. *To work all the problems of this chapter in a circle, but with the eccentricity bisected.*

[9] Let the Sun-carrying circle ASPM be set down in the following figure, with its diameter and the line of apsides AP, in which the center of the mean motions, the point F, lies distant from the circle's Center C by 1740 parts; and let T, the Earth, be distant from the Center C by just as much. Let CM be the semidiameter perpendicular to AP itself, and S the Sun at the extreme M; draw the right lines FM and TM. In triangle CMF, with the right angle C, side CM of 1740 parts, and the radius CM [recte CF] of 100000 parts, you find by trigonometry the angle FMC of $0^{\circ}59'40''$, which in the ellipse, by Problem II, was found to be $0^{\circ}59'38''$.

Let the Sun be at O, to which draw the right line FO, and CO, and from O the perpendicular OT to the Triangle CTO; the rectangle [triangle] at T, the base CO of 100000 parts, and the side CT of 1740 parts being given, by the rules of right triangles you find the angle COT of $0^{\circ}59'40'' \frac{1}{3}$, and TCO of $89^{\circ}0'16'' \frac{2}{3}$; and the side TO of $99989 \frac{1}{2}$ parts. With FT 3480 parts in the rectangle [triangle] FTO, you find the whole equation FOT, $1^{\circ}59'40''20'''$; and so, with the Sun placed at O, the equation comes out greatest, and there too the Sun's distance from the Earth is $99989 \frac{1}{2}$. For the mean [distance] falls between M and O, and these are worked by Problems I, II, IV.

For Problem V, and the rest, let the Sun be at S, to which lead from the three points F, C, T the right lines FS, CS, and TS; for the anomaly AFS being given, its complement SFC is given, likewise the side FC of 1740 parts, and CS, the radius of 100000 parts. Therefore the physical equation CSF, and the Sun's distance SF, and the angle FSC, with its complement to two right angles, namely the angle SCT, with which, and the side CS of 100000 parts, and CT of 1740 parts, you find the Sun's distance from the Earth ST, and the optical equation CST, which together with CSF makes up the whole equation, whence the Sun's true place is obtained.

Diagram. A circle (the construction for Problem X) with the line of apsides drawn. Interior points lay out the ellipse-described-on-an-axis construction of Problem X, with two foci F and G and the radius BC as the interval.

- P (upper left): point P
- L (left): point L
- A (top): point A

- B (interior, near center): point B
- F (interior, right of B): focus F
- G (interior, lower): focus G
- N (left interior): point N
- S (interior): the Sun's position
- D (lower left): point D
- C (lower center): point C
- I (bottom): point I
- M (lower right): point M

Problem X

Problem X. *Given the distance of the foci in an ellipse, and its axis with the angle of the anomaly, to find the elliptical point on the periphery in which the Sun is, and so to describe such points around the whole ellipse.*

[10] In the following figure, let there be given the axis BC of the ellipse to be described, and on it the distance of the foci FG, and from F, as from the center, with the whole interval BC, describe the circle DLIM, and produce BC to D and I. Then, the mean anomaly being given, the angle DFL — produce it from the term L of the arc DL, and through L draw the right line LM; this LM will be equal to the diameter, that is, to the whole BC, and will soon be proven so. Then draw the right line from L to the focus F, and bisect the line LG with a right line, and that same [bisecting line], drawn out and likewise let fall perpendicular to the line LF, finds the Sun at S; for, drawing SG, and then [SL? — and likewise S to P, since] [?] NG, by the construction made of an equal line LN and NS, the line common to both angles at N, by the construction the right lines will be equal among themselves; the first elements between SG and SL. Now GS and FS, taken together, are equal to the whole FL, that is, to the Diameter of the ellipse, and insigne. Therefore GS and FS are the two radii of the foci of the ellipse, and the ellip-

(Page 68, folio 36 — Caput XI continues)

[continuation of Problem X:] —tical describers of its periphery by their motion, and by the point S will be the point of the elliptical periphery in which the Sun is found, and by the angle DGP drawn it constitutes the true anomaly. Likewise operate, given any other angle of the mean true anomaly to F, and you will have the remaining points by which the elliptical periphery is to be described.

Problem XI

Problem XI. *To represent the inequalities of the Sun's motion, both in the prior and posterior semicircles of anomaly, and likewise in the superior and inferior [semicircles], by their extremes, whether in an ellipse or in a circle.*

[11] In the figure written below, from the Earth's center T, with a very great interval, describe the ecliptic A6, P14, whose [line] AP is the line of apsides, and on it C the center of the ellipse, and the foci T and F. Now since the Sun, around F, describes equal angles by its mean motion, describe from F, with an interval greater than CE, the circle HIKL, whose periphery is divided into 12 equal arcs by the points H, M, N, I, O, Q, 3, K, R, S, L, V, X, and through these are led, from F to the ecliptic, the lines of the mean motions FM2, FN4, FI6, FO8, FQ10, FKP, FR11, FS13, FL15, FV17, FX19; and from the Center T, through the points of the ellipse, or the circles in which the lines of the mean motions cut its circumference — which are E, a, 2, 3, 5, 1, D, 5, 7, 9, 11, 24, 14 — lead the lines of the true motions all the way to the ecliptic, namely Ta1, T83, T75, T67, T59, TDP, T512, T1414, T816, T818, T1420, TEA.

[Margin: 1. Property.] Once these are done, you will see that the Sun's true motion is slower around the apogee A, and quicker around the perigee P; and that it is continuously accelerated, in the prior semicircle of anomaly, from apogee to perigee, and the arc of true motion A1 is smaller than the arc 1,3, and this smaller than the arc 3,5, and this smaller than the arc 5,7, and this smaller than the arc 7,9, and this smaller than the arc 9, P. In the posterior semicircle, however, you will see [the true motion] retarded continuously from perigee to apogee. For the arc P12, 14 is smaller than the arc 12,14; and 14,16 is smaller than 16,18; and 16,18 smaller than 18,20; and 18,20 smaller than 20, A; and, comparing the true motion with the mean made in equal time, you will see, in the ellipse, or the circle EBDG, the arcs that the Sun strikes off continuously greater from apogee toward perigee, of which kind are the arcs Ea, a8, 83, 34, 45, 5D, from perigee toward apogee continuously smaller, such as are D5, 75, 89, 9h, h45, 45E.

Diagram. A large circular diagram — a rose-like or "compass-rose" figure built around the Earth's center T. From T radiate twelve lines of the true motions out to the ecliptic, and from the focus F radiate the twelve lines of the mean motions, dividing the inner circle HIKL into twelve equal arcs. The ecliptic is numbered 1–20 around its circumference (with the number-labels 1, 20, 10 at the top near A; 16, 17 upper right; 15, 14 right; 13, 12, 11 lower right; 10, 9 bottom near P; 8 lower left; 7, 6 left; 4 upper left). The line of apsides runs vertically from A (apogee, top) through the center to P (perigee, bottom).

- A (top): apogee
- P (bottom): perigee
- T (center): Earth's center
- F (interior, below center): focus F / center of mean motions
- C (interior): center of the ellipse
- E (interior, upper): point E on the ellipse/circle EBDG
- B (interior, left of center): point B
- D (interior, below center): point D
- G (interior, right of center): point G
- H, M, N, I, O, Q, K, R, S, L, V, X (around inner circle HIKL): the twelve division points of the mean-motion circle
- Numbered points 1–20: the points where the motion-lines meet the ecliptic
- 6 (left edge): ecliptic point 6
- 7 (left edge, below 6): ecliptic point 7
- 15 (right edge): ecliptic point 15
- 14 (right edge, below 15): ecliptic point 14

Note: the figure is dense with small peripheral letter- and number-labels; several inner labels (a, 3, 5, 9, h, and the bracketed-number points) are difficult to resolve individually. Marked as a

[Margin: 2. Property.] [12] Now comparing the true motion with the mean made in equal time, taken singly, and without relation to the apogee: in the superior semicircle the mean motion is greater than the true, namely in the semicircle YAZ. In the inferior, YPZ, the mean motion is smaller than the true. For 1A is smaller than 2A, and 1,3 smaller than 2,4, and 3,5 smaller than 4,7, and toward the right 4,5 smaller than A10, and A19, and 20,18 smaller than 19,16, and 18,16 smaller than 17,15; on the contrary, toward the left 7,9 smaller than 8P, and 9P smaller than 10P, and the mean 10P greater than P12, and likewise the true 12,14 smaller than the mean 13,13, etc.

[Margin: 2. Property.] [continued] Comparing now the true motion with the mean, not singly but always from the apogee: in the prior semicircle of anomaly the true motion is greater than the mean, as has been said; and even in the inferior, because the arc itself A9 is greater than the arc A10, the greater true motion A9.

[Margin: circulo priori] On the contrary, in the posterior semicircle the true is greater than the mean, if it be computed by the equal succession of the signs from

the apogee; thus the greater is the arc of true motion AP12, than the mean AP11, and the true AP12, than the mean AP12, etc.

[Margin: 4. Property.] Now since the passage from the slowest motion around the apogee to the swiftest around the perigee is not made except through a middling [motion], and the passage from the slowest to the swiftest through a middling motion; and so it [is], the mean coinciding with the true in the extremes D, B, and G, this equality of the mean motion with the true happens in those extremes in which the Sun's mean distance from the Earth is equally [reached], and the Maximum...

(Page 69, folio 37 — Caput XI conclusion and Caput XII)

[12, continued from foot of p. 68:] The prosthaphaeresis [προσθαφαίρεσις — Greek: prosthaphairesis, "the equation"] in the ellipse, for in a circle whose eccentricity is not bisected, the Maximum Equation occurs at the extremes of the line drawn orthogonally through the Center of the circle; whereas in a circle whose eccentricity is bisected, the Maximum Equation occurs at the extremes of the line drawn orthogonally through the Center of the Earth, and the Sun's mean distance in both circles. The hypothetical circle happens to have, at the points between the said right lines drawn orthogonally, one [drawn] from the Center of the circle, the other from the Center of the Earth. The amount by which the Sun's ellipse differs from the circle, that is, by how much the Maximum Equation in the circle exceeds the Maximum Equation in the ellipse, is given by what has been said above.

	<i>Maximum Equation</i>		
	G.	I	II
In the Ellipse	I	59	38
In the Circle with eccentricity not bisected	I	59	40
In the Circle with bisected eccentricity	I	59	40 1/3

CAPUT XII

Observations Selected of the Sun's Apparent Diameter, and concerning a remarkable Fallacy into which otherwise distinguished Astronomers have fallen, very recently detected.

[1] By what means the Sun's apparent diameter is observable, I have already taught in Lib. 3 of the *Almagestum Novum* [Almagestum Novum], Cap. 10, and in its Scholia, and after Lib. 7, in the Appendix to that same Cap. 10, where I supposed everything that is to be re-gathered by the reader from this place. From there it will be established by what reason we are by no means compelled to call up the observations of others related there — indeed, even some of our own older ones — and to prefer to these those more recent ones, which were carried out in the Great Gnomon of Bologna, in the Church of San Petronio, by taking the apparent meridian distances of the upper and lower limbs of the Sun from the vertex. For, with the smaller subtracted from the greater — that is, the distance of the upper limb from the distance of the lower limb — the apparent diameter of the Sun is at once obtained, and indeed with such subtlety as the great size of the Foramen [aperture] permits, set up at a plane to receive the elliptical image of the Sun. The height of this Gnomon is $95 \frac{5}{12}$ Roman feet, on the perpendicular; the distance of the aperture from the center of the Solstitial Ellipse, $100 \frac{2}{3}$ feet, and from the center of the Equinoctial Ellipse, 133 feet nearly, and from the center of the Brumal [winter-solstice] Ellipse, $264 \frac{3}{4}$ feet. From which it follows that there is error in nothing, or in very few seconds, provided the diameter is observed exactly on serene meridian days. A specimen of several observations of the Sun's diameter I exhibit in Cap. 8, from num. 8 in the margin, 159, up to 201, from which, rightly considered, the subscribed Solar Diameters are deduced. Let this be that which D. Cassini [Cassini] determined a little otherwise, the same ones, in the prior book of his observations.

**Apparent
Diameter of
the Sun
from
Observations
in the
Gnomon of
Bologna**

Sun in	<i>Apogee</i>		<i>Mean dist.</i>		<i>Perigee</i>	
	M.	S.	M.	S.	M.	S.
D. Io. Dom. Cassino [Cassini]	31	8	31	40	32	10
Nobis [Ourselves]	31	0	31	32	32	4

[Margin: Eccentricity of the Sun Bisected.] [2] Hence we have learned how much the eccentricity (which the difference of the true and mean anomaly of the Sun infers, that is, the distance of the center of the Earth from the center of the Sun's mean motions, the eccentricity being bisected) brings in; for there is to be employed only the half of it, on account of the distance of the center of the Sun's Orbit from the center of the Earth, and accordingly the center of the Sun's equal motions is not the center of the Sun's Orbit, but the point on the line of apsides, so far distant from that same center of the Orbit toward the Apogee as the Earth's center is distant from that same center of the Orbit toward the Perigee. Therefore it is more [fitting] that the Sun's Orbit be an ellipse than a circle, since the ellipse has, in its larger diameter, two points equally distant from the center of the ellipse, and remarkable, and which gather the reflected rays from the periphery,

and concur [there]. For since at Cap. 10 we apprehended the whole eccentricity, that is, the distance of the center of the Sun's equal motions from the center of the Earth, to be 3480 parts, of which the semidiameter of the Sun's Orbit is 100000; and in the mean distance of the Sun from the Earth the apparent Diameter of the Sun is 31'32": if the center of the Sun's Orbit is distant from the center of the Earth by only half of the said eccentricity, that is by 1740 parts, of which the semidiameter of the Sun's Orbit is 100000, and the mean distance of the Sun from the Earth is 100000, and in the mean distance of the Sun from the Earth the apparent semidiameter is 15'46": the semidiameter accordingly will be of such parts $92 \frac{1}{3}$; and in the maximum distance, of 101740 parts. The Diameter, apparent, comes out 31'0"; and in the minimum distance, of 98260 parts, it comes out 32'4"; than which we find nothing greater, or rather smaller, in the said Gnomon, as we said at Cap. 9 num. 3.

[Margin: 3.] [3] From the many observations made after the two prior tomes of the *Almagestum Novum* were published, we select a few in which, with most exquisite diligence, we observed together with P. Grimaldo [Grimaldi]. The first was in the year 1654, on June 21, when, through an aperture of 32 small particles [parts] in a prepared tablet, with the plane parallel to the plane of the aperture, except in the very obscure base of the cone of the Sun's species, of 174 parts; but with the diameter of the aperture subtracted, there remain of the base of light, corrected, 142 parts, and the half of it 71; the distance, however, of the tablet from the aperture being of such parts 15700: therefore the semidiameter of the Sun near the Apogee is 15'33", and the diameter 31'6"; or, as VBF, of 15700 parts, is to the whole sine 100000, so AB, 71, is to the Tangent $452 \frac{3}{4}$, the angle AFB, 15'33", that is the Residual Logarithm of the distance FB, of 1700 parts, which is in Vlacq [Vlacq] 58041003; the Logarithm of the side AB, of 71 parts, which is 18512583, added; makes the Tangent-logarithm 76553586, the angle AFB, 15'33". Therefore toward the end of June, the Sun being at Apogee, it ought to have been somewhat less.

Diagram. A small geometric figure illustrating the gnomon-aperture triangle. The point F (the aperture) is at the left; from F two right lines diverge to the right toward A (upper) and C (lower), and a short vertical segment AC (with B between them) closes the figure at the right, representing the illuminated solar image AB on the tablet.

- F (left): the aperture
- A (upper right): top of the solar image
- B (right, middle): point B on segment AC

- C (lower right): bottom of the solar image

The second [observation] was in the same year, on December 17, when an aperture likewise of 32 [parts] perforated, the aperture being received in the tablet as located above, the base of light of the cone of the Sun being of 440 parts, at a distance of $36 \frac{2}{3}$ feet, that is of 43700 parts; with the diameter of the aperture taken away therefore, there remains the corrected base of 408 parts, and the half of AB 204, whose Logarithm is 23096302, and the distance BF of 43700 parts; the Residual Logarithm is 53595186; the sum of these is the Tangent-logarithm 76691488, the angle AFB, $16'3''$; wherefore the apparent diameter of the Sun was $32'6''$.

The third was in the year 1656, on January 5, when the base of light of the Sun excepted [received] through the aperture of 74 small parts was of 298 parts; but with the diameter of the aperture detracted, of 224 parts, and the half-base AB, 112, whose Logarithm is 20492180, and the distance BF was of 24000 parts, whose Residual Logarithm is 56197888; which, with the said Logarithm, makes...

yields 76690068. The log-tangent of the angle AFB is therefore $16'4''$, so that the Sun's apparent diameter was $32'8''$ — close to perigee, just as it was close to apogee at $31'0''$, almost exactly as found earlier by the San Petronio gnomon. These observations are most faithful and most exact. So that no one need wonder if I prefer these diameters to all the others, let me — without in any way disparaging the opinions of others — review them, selectively, for the reader's instruction and not as conclusions he must adopt.

Diagram. A geometric construction illustrating the gnomon-aperture method for measuring the Sun's apparent diameter. At the left is a circle representing the Sun, with points G (upper) and D (lower) on its edge. Rays from these points cross through a central region — the aperture region marked with points A, C, B and a small letter L near the center — and diverge to the right onto a vertical tablet at the right edge, where the solar image is cast between the upper points E, F and the lower points K, I, H. The crossing rays form the characteristic figure of light passing through a small aperture and inverting to form an image.

- G (left, on solar disc, upper): point on the Sun's edge
- D (left, on solar disc, lower): point on the Sun's edge
- A (center, upper): aperture-related point
- C (center): center of the aperture
- B (center, lower): aperture-related point
- L (center): point on the tablet's perpendicular (image-side)

- E, F (right, upper): upper edge of the cast solar image on the tablet
- K (right, middle): point on the tablet
- I, H (right, lower): lower edge of the cast solar image

The rays DAE and GBH, at the outer point L, where the rays drawn through the center of the aperture, at point C, intersect — let a perpendicular LCK be dropped through the point of intersection to the tablet EH, bisecting it. A triangle LKE will be formed, right-angled at K, in which the dimension of the semidiameter of the solar image-cone EK is given. From this the radius KL, or its equal EL, would be given, which doubled would give the angle ELH — that is, DLG, the measure of the Sun's apparent diameter at L; but this is given by neither of these two methods. One must therefore have recourse to the angle FCI, the measure of the apparent diameter at F. For if the distance CK of the aperture from the tablet is known, and the other side FK — if it differs from the half-base by an insensible amount — is taken as equal to the half-base AC, since the parallels CF, EF, and AE, and likewise CF, are equal because the rays DE, GF are parallel on account of the Sun's immense distance, as we showed in Book III of the *Almagestum Novum*, Chapter 5. And so, since the great distance of the Sun makes its image indivisible, so that even apart from the subtraction of the aperture itself the intersection is had at C, it will be clear from what must be said below against this use of the apertures.

[Margin: An foraminis Diameter detrahenda sit Diametro Basis lucidæ Solaris speciei per illud intromissæ?] [Whether the diameter of the aperture should be subtracted from the diameter of the bright base of the Sun's image admitted through it?]

§5. I answer, wholly in the affirmative, with [Kepler] in his *Astronomia Optica* [*Ad Vitellionem Paralipomena*], Chapter 11. This will readily be evident to anyone who considers the figure of the Bologna gnomon set out in Chapter 2, numbers 11 and 12, in which, in order to have the true distance from the upper vertex and from the lower edge of the Sun tangent to DH, one must add the portion HO to the ray of the upper rim IH, equal to the semidiameter of the aperture AC; and the portion HL must be subtracted from the ray of the lower rim IL, tangent to DL. And the breadth of the bright image of the Sun HL is to be diminished by the semidiameter of the aperture BC, so that the image of the Sun's bright base HI may be had as OK, terminated by the rays ICO and ICK, on account of the causes adduced there. We shall demonstrate the same in the following diagram: let the magnitude of the base AB, and its center C, and from the Sun's farther edge D let a ray fall through A onto the tablet at point E; and from the nearer edge C let a ray

be drawn through B to F. I suppose, then, the tablet EH to be parallel to the diameter AB of the aperture. But at the farther edge G, two rays propagate, one through B to H, the other through C to I; for they will intersect...

divisible, and therefore that bright zone must be subtracted, and for its part the eclipsed portion measured as IP; and then let it be that 12, the notable diameter of the Sun, is to its semidiameter in scruples, as GF is to another quantity, which will yield the true quantity of the eclipsed part in scruples.

§7. Against this precept of Fathers Antonius Labbé [Antoine Labbé] and Honoratus Faber [Honoré Fabri] — for it seems not to deal with the investigation of the Sun's diameter, under which heading the angle is here considered — they indeed grant that the bright base of the diameter is to be diminished by the diameter of the aperture, but they say that this is done only proportionally; that the semidiameter of the Sun stands to the part of the shadow induced by the lunar body in the ratio NI, since it in no way conveys the notion of the quantity NI as distinct from the quantity BE. And they attempt to prove this by nothing other than by what would follow if it were absurd — namely, if a tablet receiving the type of an eclipse were advanced ever farther forward — for thus they say the same eclipse would appear at one time greater, and greater the farther off, and indeterminate. For at the same time two observations of the same eclipse would be made, set, say, at parts 12, of which the semidiameter is 12 parts and the eclipsed portion EG 24 parts, that is, in one observation of the semidiameter AE, and let it be the sixth part of the semidiameter AE. In this case, if PG of 12 parts be added, PE will be 36 parts, with the 12 subtracted; but truly, IE of 12 parts is left from AE; and IP, in turn 24. By this emendation, therefore, the eclipse is reduced to $\frac{4}{12}$ of the corrected semidiameter AI. But with the other observation retained at an equal aperture, with the tablet so removed from the aperture that AE is 432 parts, and EG larger, EG being 432, that is, 72; with EI remaining 12 parts, EP becomes 84, and IP 72; with 432 subtracted, the line EI of 12 remains, and AI of 420 parts. Therefore, by this emendation the eclipse is reduced to $\frac{72}{420}$ of the corrected semidiameter of the Sun. Reducing both to a common denominator of fractions, the eclipsed part will be $\frac{72}{420}$ of the semidiameter of the Sun in the prior observation; in the second, $\frac{12}{72}$ of the same semidiameter.

§8. Yet I answer that the said Fathers are mistaken, supposing that in these two observations there is the same proportion between AE and EG, when in fact in those it is assumed, as at 6 to 1, that it ought to be the same in both, the proportion between the whole corrected diameter NI and the shadow IP being equal to the observed shadow EG. But among the false, or non-corrected, solar

diameters and shadows, there is not the same proportion, even though with both corrected the same proportion holds; that proportion holds when the same quantities of the aperture are subtracted from both. So that, given two lines on this side, and two on that side in the ratio of scruples, if a larger line be augmented by a quantity equal to two, say a palm-breadth, it is certain that the same geometric proportion between the two will not persist, and that those two lines are not equal arithmetically — as P. [Grimaldi] also confirmed sharply with other additions. But more on this dispute is in the Appendix to this chapter, deferred to the end of this Book I.

[Margin: Contra Diametrum Solis Assertam à PP. Scheinero, Cyssato, & Alijs.]
[Against the diameter of the Sun asserted by Fathers Scheiner, Cysat, and others.]

§9. Scheiner, in Part 1 of the *Rosa Ursina*, Book 4, Chapter 3, says: It is established that the apparent diameter of the Sun, when it presents itself in ☉, is the minimum of 46 minutes. He assumes, and takes as his proposed value there, the Tyconic diameter of 32'. And in Chapter 4 he proposes the manner of observing it by means of an aperture, as though the Sun's image, received in a *camera obscura*, were composed of parts, of which let the notation of the distance of the received image from the aperture be such as it was for him in 10 parts, but divided into 10000 parts. And the aperture is *as small as it can physically be*; he adds below: *by the minimum aperture, which most sharply escapes the sight*. Some, however, made an aperture by a larger aperture, as he confesses; for if it stand at 10000 parts of distance of the aperture and the sine of the semidiameter of the Sun's bright base be another, the sine of the visual semidiameter of the Sun, doubled, will yield the whole diameter. He then subjoins certain observations made at Rome by many and skilled men, namely P. [Christophorus] Gruembergerus [Christoph Grienberger], P. Gregorio [Gregory of] St. Vincent [Grégoire de Saint-Vincent], P. Pietro Antonio Rauizza, mentioned by me once before in Theology, a most learned man and of remarkable probity; P. [Nicolaus] Zucchio [Niccolò Zucchi], likewise most learned, a man of the deepest religion, to whom I can scarcely say how much I owe.

[Margin: Diameter Solis Apparens observata Romæ à Scheinero ex Diametro speciei Solaris in partibus qualium distantia speciei à Foramine erat 10000.]
[The apparent diameter of the Sun observed at Rome by Scheiner, from the diameter of the solar image in parts, of which the distance of the image from the aperture was 10000.]

Year	By	Image Diam. (parts)	Solar Diam. (min.)	Year	By	Image Diam. (parts)	Solar Diam. (min.)
1625	apertu re			1626	apertu re		
Oct. 15	minim um	150	51	Dec. 23	minim um	165	56
	minim um	137	47		minim um	136	47
	minim um	114	39		minim um	112	38
					minim um	90	31
Nov. 23	minim um	130	45	Dec. 23	minim um	160	55
	minim um	120	41		maius [large r]	144	50
	minim um	115	39		priore [than before]	120	41
	minim um	100	38 [?]			104	36
						85	30
Nov. 28	minim um	143	49	Dec. 23	minim um	114	39
	minim um	120	41		priore [than before]	93	32
	minim um	110	38			82	29
Dec. 25	minim um	136	37 [?]	Dec. 23	maxi mum [large	105	37

Year	By	Image Diam. (parts)	Solar Diam. (min.)	Year	By	Image Diam. (parts)	Solar Diam. (min.)
	minimum	125	43		st]	95	33
	minimum	117	40			84	29
	minimum	106	36				
1626 Mar. 23	minimum	155	53	1627 Junij [June] 21	minimum	155	53
	minimum	136	47		minimum	140	48
	minimum	122	41		minimum	110	38
	minimum	115	39		minimum	95	33
Julij [July] 14	minimum	137	47	Sept. 23	minimum	162	56
	minimum	125	43		minimum	145	49
	minimum	119	41		minimum	130	45
	minimum	102	36		minimum	108	37
Oct. 19	minimum	160	55				
	minimum	125	43				
Dec. 21	minimum	138	48				

Year	By	Image Diam. (parts)	Solar Diam. (min.)	Year	By	Image Diam. (parts)	Solar Diam. (min.)
	minim um	110	38				
	minim um	93	32				
Dec. 22	minim um	140	48				
	minim um	122	42				
	minim um	107	37				
	minim um	87	30				

Parsing notes: The table runs in two side-by-side blocks (1625–1626 on the left, 1626–1627 on the right). Columns: Year ("Anno"), By/aperture ("Per Foram."), image diameter in parts ("Speciei Diamet., Partiü"), Sun's diameter in minutes ("Solis Diam., Minut."). Several right-block date cells repeat "Dec. 23" — these appear to be repeated/abbreviated date markers in the source. The qualifier words "maius/priore/maximum" appear in the "Per" column in place of "minimum" for some rows. Two minute-values flagged: row "100 → 38" (the 100-part image elsewhere maps to ~34–35 min, see numerical impossibles) and "136 → 37" under Dec. 25 (breaks the descending progression where 136 should map to ~47).

Scheiner adds that this variation, found on the same day and at the same aperture, arose from this: that he then took the image as less bright at its extreme edges — about which no expert doubts, and about which it is doubtful whether the image be deemed not the true one — and yet he reports the diameter to himself as having reached 38' at minimum on Nov. 28, and 36' on June 21; whence he concludes that it is in truth still larger.

§10. A follower of these men, another from our Society, wrote to me that in the year 1652 at Oeniponte [Innsbruck], as also in the year 1637, observed there on the 6th and 20th of September, with a gnomon of 28 feet and a second aperture of 10", the Sun's diameter was 37'30", or 37'40", but more often 38" [recte: 38']. And when, at a larger aperture, the use was of minutes 2', he found the Sun's diameter

at minimum 32'50" [?]. Whence one errs and must hold for true that, with the aperture, its further magnitude is to be diminished, since something rather is to be added — as both that most learned man P. [Michael] Staudacher [Staudacher] judged, and Scheiner. Hence we proceed to more truths, that an aperture too small admits too much splendor, which obstructs...

obstructs and obliterates the true edges, and the integrity of the image, to the exact measurement of the Sun's diameter. Now if 28 feet be resolved into inches, they become 336; and if each inch be divided into 100 parts, the whole length of the channel will be 33600 such particular parts. And if the breadth of the aperture in such a distance were 2" of minutes — then, for the solution of right triangles, the aperture's diameter would be $19\frac{2}{3}$ [?], or 20 such parts of the inch. Again, if the same aperture were used at such a distance, I gathered the semidiameter of the Sun at such distance to be 16'25", or the diameter 32'50"; and so the semidiameter of the solar image was 1200 parts, that is, parts 30'42" owed [to it] — less than is due, because for so small an aperture and operation, no smaller [?]; which we have tried also more than once, and recently both P. [Grimaldi] and I.

§11. For in this year 1658, on August 11, in the Conclave of the Assumption of the B. Virgin, in our College darkened for the purpose, through the smallest aperture admitted, the image of the Sun on paper differed from the aperture by parts 13.5925 [?], of which one inch was 100 Roman parts. The diameter of the Sun, comprehending also the impure light, was at the edges 1328 parts. Therefore EK, as in the figure of number 1, was 664 [?]. But the semidiameter of the aperture AC was 2 such parts. There remains FK, 662; whence the angle FCK is 18'6"; and the apparent diameter of the Sun is 36'12". Again, in the same Month, on the 18th, the same aperture being retained, but at a distance of parts 12821 (so demanding the chosen altitude for the observation), the bright base of the Sun EH was parts 1356, and EK 678; thus the angle is at 0 [?] 18'15"; whence, had the image of the base been comprehended completely, the bright base, selected and purest, was EH 1176, EK 588; subtract 2, there remains FK 586; whence the semidiameter is 15'40", and the diameter 31'20". And by the Bologna gnomon, found at other times, it was discovered to be repeated, parts 110; the impure-light zone which was the breadth differed by parts; with the right semidiameter of the Sun, the consensus is truly astonishing.

§12. But because Scheiner used a distance of the aperture from the tablet of 10 Roman feet, I propose a fifth of that distance: the line written below, of length, which continued five times will make a tenth part of the said distance.

But since we do not apprehend the image to be of parts 240, of which one Roman foot is 100, then 240 multiplied by 5 makes 1200, multiplied again by 1200, makes 120 inches, that is 10 feet. For, as I say, the use was at a distance of 12 feet; and so also, today the use is in our Observatory at the smallest aperture, the bright base of the solar image, computed from the impure-light margins, of what magnitude one inch is at 100 such parts.

Whence the semidiameter of the Sun proceeds at 20'5", and the diameter 40'10"; but with the impure light of the margins amputated, the base is 110, and half of it 55; whence the semidiameter of the Sun is 15'41", and the diameter 31'22".

§13. With these performed, I think it better to use a larger aperture — pure and almost indivisible — than a smaller one in computing its diameter, for the reason explained below; and trigonometry persuades it; but the distance ought to be large, and feet 10 if it can be, as in the San Petronio gnomon of 100 feet and more, since then the bright image of the Sun is acquired very ample, and it itself, on account of the magnitude of the aperture, intense enough for the whole [base] to be discerned almost without the penumbra of the impure margins; and if anything peccant be in the pure light, it is insensible and contemptible, on account of the great brightness of the image, and the distance of the aperture. Against this — should you use a small aperture, and the distance almost indivisible — that you not have a larger one at 10 feet; it proceeds in the tablet of the aperture orthogonally...

Diagram. A circular figure illustrating the impure-light margin of the solar image cast on a tablet. The outer circle is the full image including the impure outer ring; an inner concentric region marks the pure bright base. Letters M and N appear near the top, A and C in the central/left interior, and B at the lower right, D at the lower middle — marking the diameters of the pure base (CD) versus the impure margin (AB).

- M, N (top): points on the impure outer margin
- A (center-left): point on a diameter line
- C (center): center / point on the pure base
- D (lower middle): point on the pure base edge
- B (lower right): point on the impure outer margin

the oppositely-cast image will be nearly as in the following diagram, of which the amplitude with the impure light will be AB, but of the pure light CD, though indeed more separable, and slippery for the fallacies, and if there be anything in this measure peccant, it commits a great error in the diameter of the Sun, and a

still larger one, unless the breadth of the aperture be removed — which, at the very smallest aperture, cannot be determined.

§14. But the cause of the impure places within AC and DB, of which Scheiner himself in Part 2 of the *Rosa Ursina*, Chapter 4, says: *The periphery of this solar image is not cleanly cut, but softly torn and rough*, so that the consortium of the edges is hardly to be discerned — especially if a strenuous effort of the eyes be employed, and a coloring is required when it is to be measured by a compass; the cause, I say, of this quasi-penumbra has hitherto been disclosed by no one, though I know it has been disclosed; but P. [Grimaldi], after several years of observations of light, affirms a most luminous treatment, deprecating, [namely] that the mode of propagation of light is not by *Direct* [rays], not by *Reflected*, not by *Refracted* rays, but by *Diffacted*, or diffused into several languid rays — by which fact, in many of the said Father's experiments, which otherwise cannot be saved [explained]. This, then, is the way: that the Sun's rays striking on the edges of the aperture are split into weaker rays; and the tablet, or the paper set opposite the aperture, with a malign and torn light, colored with a subreddish color, or somewhat with a ferruginous [rusty] color — so much the more so the nearer it is to the aperture, and the less near; and so much the weaker as it is more remote from the tablet; the more remote, so much weaker do they escape, and so remiss [faint], that at a great distance they do not affect the senses on the tablet. Which, if the aperture be too ample, so much splendor enters that by its own reflection from the tablet's floor it impedes, and overcomes the propagation of the rays diffused from the aperture's margin.

[Margin: Argumenta contra Solarem Scheineri Diametrum.] [*Arguments against Scheiner's solar diameter.*]

§15. For the rest, whatever the said cause may be, it has very recently been deliberated from the recondite Philosophy: to us it is established with certainty that Scheiner's mode of observing the diameter of the Sun by the aperture is fallacious. *Firstly*, indeed, the very inconstancy alone, which is evident in Scheiner's experiments, is an argument of fallacy. *Secondly*, we are certain that the diameter of the Moon, taken at its distance from the Fixed Stars of known position, is in *syzygy* [conjunction or opposition] between the distances not exceeding 35' of minute — indeed, it does not reach 34'; and yet, as we reported in the observations of Book 3, the Moon's distance from the Sun is even greater than its [the Moon's] own [diameter], when it was obstructed, near apogee at 40', as Scheiner has it. *Thirdly*, with the triangle applied, of which in the *Almagestum Novum* Book 5, Chapter 15; but as I subtly assert from constants, both in the

Meridian plane erected, and with the eye fixed within a wooden tube, and protected by colored glass, the observation of the Sun's disc often passes through the plane of the Meridian; meanwhile I number, by clear voice, the oscillations perpendicular to the inches very nearly 9 of a Roman foot, of which in Book 2 of the *Almagestum Novum*, Chapter 20, problem 5, and one exhibiting a single oscillation of time 3", by tertiary thirds; and as I advise, in the Equinoxes from the first optical contact at the western margins of the Sun's disc, and so to the last contact at the eastern margins — never have I numbered more oscillations than 264, nor 266; never fewer than 240. Therefore the diameter of the Sun is then never greater than 33'15", nor less than 30' — which is evident even from each experiment. And this carries practice back, so that, although it might not be possible to determine the Sun's diameter precisely, yet, because in those contacts the judgment of the observation hesitates about two or three certain oscillations, hence we are certain that the diameter of the Sun in the Equinoxes cannot be more than 34', nor less than 30', as both [Michael] Staudacher [Staudacher] contended, lest 40' or 50' &c. as Scheiner [held]. Hitherto for more truths, and that it may be established for the reader how, in accordance with cause, we have preferred the observations of the Sun's diameter made at the San Petronio gnomon...

made through the aperture and others somewhat broader, and we have determined it at 31' 0" at apogee, at 31' 32" at mean distance, and at 32' 4" at perigee.

CAPVT XIII.

On the Parallax and Distance of the Sun from the Earth.

1. That the parallax of the Sun is imperceptible — and therefore that no suspicion of it ever arose — Hipparchus [Hipparchus] long ago held, even though Ptolemy [Ptolemy] (as he reports here, *Almagest* V, ch. 11) believed it could be gathered, and indeed fairly accurately, from lunar eclipses, as Ptolemy afterwards taught (*Almagest* V, ch. 11, Problem 2). There he shows that this method does not yield that exactness which recent astronomy demands, since eclipses can be deceptive — as is evident from the clear refutation, *Almagest* V, ch. 11, Problem 6 — whether one takes the Sun's mean distance to be 1168 semidiameters of the Earth, as Ptolemy does, with a horizontal parallax of 2' 57", or the mean distance to be 1465 semidiameters with a horizontal parallax of 14", as Vlacq [Vlacq] would have it, or some figure intermediate between these. Yet by the same book (ch. 11, Problem 6) he demonstrates that if a small angle be subtracted from the

Earth's apparent semidiameter, the Sun's horizontal parallax remains close to the truth. But since the angle of the Earth's shadow cannot be known with exactness, and since the beginning of the Sun's distance is reckoned from the center of the Earth, nonetheless nearly all astronomers down to Tycho [Tycho Brahe] inclusive investigated the Sun's distance and parallax by eclipses, or assumed it as found by their predecessors — so that Vlacq, in his very learned Letter to me, rightly said: "*the parallaxes of the Sun are assumed rather than held as known.*"

[Margin: The error of astronomers in reckoning the Sun's parallax.]

2. It happens that nearly all of them fall into some self-contradiction, as Lansbergius [Philip van Lansberge] demonstrated in his *Uranometria*, and as we ourselves did, *Almagest* (New), Book IV, no. 16. For the Sun's parallax and distance must cohere with the apparent diameter of the Sun, its increment or decrement, and likewise be consistent with the anomaly and with the angle, that is, with the diameter of the Earth's shadow, and this with the apparent diameter of the Moon, and so forth.

After Tycho, Kepler [Kepler] acknowledged that the Sun's parallax could not be as great as Tycho assumed; and so he pronounced (in the foundation of his *Ephemerides*, no. 7, and p. 5, and in the *Commentaries on Mars*). For he saw that Mars at its perigee, in epicycle, approaches the Earth more nearly than the Sun does — and yet his own parallaxes, drawn from those same Tychonic observations, are much smaller in that very approach to the Earth than the Sun's, and the solar eclipses, with the Moon's consent, fit a smaller rather than a greater parallax; whence he made the Sun's horizontal parallax smaller than the Tychonic figure — about one minute only — which he keeps in the preface to the *Ephemerides* of the year 1619, declaring it among the harmonic intervals, and in the *Rudolphine Tables*.

[Margin: The inconstancy of Kepler.]

3. Badly does he reckon, in the foundation of the *Ephemerides*, no. 7, and in the *Commentaries on Mars*, when he sets the distance of the Sun's apogee at 1800 terrestrial semidiameters; for hence by trigonometry there follows a horizontal parallax of 1' 55", and conversely, if the horizontal parallax is 1', the Sun's distance of 3438 terrestrial semidiameters follows, as he supposes in several places (*Almagest* (New), ch. 7, Scholium 2). Langrenus [Langrenus] too sets the Sun's distance at terrestrial semidiameters of about 3438. But Vuendelinus [Govaert Wendelen], in the little work *On the Obliquity of the Sun*, published in the year 1626, assumes a horizontal solar parallax of 1' less one minute — as he

says in a Letter to me of the year 1647, where he chose 15" for the second term — at apogee 4905 semidiameters, at mean distance 4656, at perigee 4407, by dichotomies and other foundations which he reports (*Almagest* (New), ch. 7, no. 12). For he sufficiently refutes Rheitenus's [Wendelin/Rheita] opinion there, in Scholium 3.

4. Yet there is no lack of other ways of investigating the Sun's parallax, either by observations made at the solstices or at the equinox, which he relates (*Almagest* (New), Book III, ch. 7, no. 1), but also others. Of these let the **First** be that of Father Georgius Riccioli [Riccioli] of our Society, who already from the year 1653 communicated to me, in writing, his Letter on this matter. In the attached diagram, ABC is the Meridian, in which the Vertex B is the world's Pole P, and BR a quadrant of the Vertical circle, in which let the Sun be at point S, so that the Sun's distance from the vertex be BS; let the complement of that distance, given by observation, that is, PS, be the Sun's declination. Now let the oscillations [oscillationes] be numbered, perpendicularly, from the moment the Sun's distance from the vertex is taken, to the moment when the Sun reaches the Meridian; and from elsewhere let it be known how many such oscillations correspond to a whole revolution of the equator — that is, to a daily revolution of the Sun — so that, by the rule given here, if the daily revolution of the Sun gives oscillations of 59' 8", [the number of] minutes that the oscillations yield, numbered by observation at the Meridian, are subtracted from the said numeration, [and] the angle BPS will be given, together with the complement of the Pole's altitude BP, and with the complement of the declination PS,

[Margin: The first method.]

PS, you will obtain the Sun's true distance from the vertex, whose difference from the observed [distance] will give the parallax sought. But if the Sun is more than 70 degrees distant from the vertex, [the method] is liable to refractions, which ought to be discerned without prior knowledge of the parallax, and even so small an error in numbering the time, or in the position of the meridian line, or in the altitude of the Sun and of the Pole, can introduce a difference of two, that is, of two or three minutes.

5. A **second** method is indicated by D. Io. Dominico Cassino [Giovanni Domenico Cassini], who in a specimen of observations (p. 3) judges the Sun's parallax to be imperceptible, citing among other arguments an observation of the year 1653, on the 4th of April, at the hour of midday $8\frac{1}{3}$, when the Sun was distant from the preceding chapter's [reference] $8^{\circ}\frac{1}{3}$ in Gemini, and the Moon, near first quarter, was approaching the latitude-circle of the said star — for in the middle there

appeared a great latitude — and the approach of the Moon to the latitude-circle determined, from the section of the lunar latitude-circles up to the star, the time of dichotomy [dichotomiae]; nor could a deviation as small as 7' be detected, between the Sun's intervals and the star, where there ought to be a smaller deviation in the quadrature of the Sun and the star. He adds that much is to be ascribed to this observation, since no lunar parallax is involved in the practice, and the Moon's place appears not in the astronomical tables, but by comparison with the fixed star itself; and the Sun's true place is constituted by our [tables], and the place of the said fixed star, and we consider the time which intervenes from the said Moon's center in the latitude-circle of Castor up to the quadrature with the Sun, and the effect of the parallaxes optically retarded, by the way (*Almagest* (New) I, p. 731, far from the smallest part of the time, than we predicted between dichotomy and quadrature); whence neither from this observation is the Sun's horizontal parallax shown to be smaller than about 27 seconds, much less imperceptible.

[Margin: The second method.]

6. Afterwards, however, the same Cassini (in the *Ephemerides* of the illustrious March. Cornelio Malvasia [Cornelio Malvasia], fols. 156, 173, and 186) confessed that, from his own Table of astronomical refraction, the Sun's parallax came out to him either null, or at most a few seconds at the Equinox; and from his Hibernial Table of Refraction, a parallax of one single minute. Yet he chooses a horizontal solar parallax at apogee of $18'' \frac{1}{3}$, at mean distance $19'' 36'''$, and at perigee $1' 0'' 48'''$. Why? Because hence there follows the Earth's mean distance of 3460 semidiameters, whose seventeenth thousandth part [?] equals $58 \frac{7}{10}$ semidiameters, for the simple solar eccentricity; which agrees with the mean distance of the Moon from the Earth, so that the center of the Sun's path [?] should be in the lunar orbit's circumference, since the Moon holds at apogee, as often as it is in the line of the Sun's apogee — that is, in Cancer 7 degrees. There is also the radical [?] of the solar quadrature 3460, and thus the medium is proportional between the semidiameter of the Earth and the Sun's distance. But how worthy of admiration this symmetry is, if sufficient foundations for absolutely determining the said parallax — as many as we have obtained by several dichotomies, rightly corrected, and always about double the smaller [?] — or whether this symmetry was equally beautifully excogitated, let the astronomer judge. Meanwhile we shall attempt some other methods, which Father Francisco Maria Grimaldo [Grimaldi] excogitated, that are worthy of being included in the practice [?] of dichotomies, which Cassini will likewise coordinate with his Tables, endowed as he is with that same skill and sagacity.

[Margin: The second method.]

(This page belongs to **Caput XIV**, but the upper-left column continues the geometrical exposition of the figures begun on the recto of folio 42 verso; see below. The body of Caput XIV opens in the right column.)

Imagine at F, by the point R of the Physical Horizon below the point R. Let there be drawn moreover from A, the straight line AGK intercepting the points, through the Sun G, as far as K, by which, if the Earth's opacity did not obstruct it, [it would propagate], so that this very Earth, by the density of the air, refracting the rays, the eye A could see the Sun G directly below the point K, but would see that same [Sun] by the straight line CGL, if the eye were at the center of the Earth, and if neither the Earth's opacity nor the air's density obstructed, and it would illuminate that [point] below the point L.

[Margin: 2nd Case.]

Let it be, **secondly**, that the Sun is in the True Horizon below the point R; let the ray incident at M be feigned to proceed toward N, but in fact refracting toward the eye A through MA; therefore the Sun's image, by the line AMO, appears at O, below the point S, if it be drawn by the straight line intercepting AHP, through which the Sun itself could rather have been seen at H, below the point P, if the said opacity and density did not obstruct; for through the line drawn straight, intercepting CHQ, it would already lie below the point H, below the point Q, by the straight line CHQ.

[Margin: 3rd Case.]

Let it be, **thirdly**, [the Sun] at R, and without sensible refraction, truly placed below Z, and seen below R. Having premised these things, let us proceed to the remaining Definitions.

6. The True Line of the place of a Star is the straight line drawn from the center of the Earth, and of the Universe, through the center of the body of the Star, as far as the supreme Heaven — as in the first case it is CFZ. For from this center the astronomer considers and measures the true places of the Stars in the Heaven, and their true motions.

7. The Seen Line of a place is the straight line, in some eye on the surface of the Earth, or above its surface, by which the Star appears, or appears as if a Star — as in the first case it is AI, in the second AM; for it is by this very imagination of production of the said line seen by refraction, whose extreme is the line AFR, by which the Sun would not see [?] G, but the line AOS, by which the Sun itself

appears at F, below the point R, and the line AOS, by which the Sun, which is at H, appears at O, below the point S.

[Margin: This is the Seen Line, that is, the Refracted [Line].]

8. The Parallaxic Line is the straight line from the eye placed outside the center of the Earth, drawn through the center of the star as far as the supreme Heaven — as in the first case it is ACK, in the second AHP, and in the consequent third APR, the Parallaxic Line, supposing the star at P.

9. The Anaclastic Line [linea anaclastica] is any refracted ray, but most especially that one which refracts to the eye — as in the first case it is AI, in the second AM; for it is by the production of the said line seen by refraction, whose extreme is the line AFR, by which the Sun would [appear at] G, below the point R, and the line AOS, by which the Sun itself appears at F.

10. The True Altitude of a star [altitudo vera] is the Arc of the Vertical circle intercepted above between the line of the true place and the True Horizon — as if the star be placed at P; or indeed in F, or in the third figure the arc HP, the star being placed at P, for if it be intercepted below, the arc is QL, which is the **True Depth** [vera profunditas]. Each, however, is measured by the angle at the center of the Vertical [circle]; and below by the other line of the true place of the star drawn from the center: thus the depth is measured by the angle QCL, and the same in F, the altitude is measured by the angle ZCQ.

[Margin: 1st Case.] [Margin: 2nd Case.] [Margin: 3rd Case.]

11. The Seen Distance [distantia visa] of a star from the Vertex is the Arc of the vertical circle intercepted between the Vertex and the line of the true place, and the angle is measured at the center of the Earth, intercepted by the line of the Vertex and by the line of the true place, just as in the prior case the angle VCL, in the posterior VCQ.

12. The Seen Altitude [altitudo visa], like the Depth, is twofold: one Parallaxic, the other Anaclastic. Now the **Parallaxic Altitude** is the Arc of the Vertical circle from the eye placed outside the center of the Earth, described and intercepted between the Parallaxic line, the Physical Horizon supremely intercepted; and the angle is measured at the center of the eye itself, made between the two said lines, as in the third figure. But if the eye is at center A, let there be described a Quadrant of the Astronomical [circle], or a Hemicycle of the arcs QS, OZ, and through the Dioptra AS, let the line of sight see the star itself at P; then the angle SAO measures the Parallaxic Altitude of the star, which appears smaller than the

true altitude HP, [as] it would appear in the celestial place X, though it be truly below the point T, the supreme Heaven (from the center C of the Earth, described). I have said "supremely intercepted," because if [intercepted] below, that is, below the Physical Horizon, it would be the **Parallactic Depth** [parallactica profunditas], as in the third figure the arc OZ, and its measure is the angle FAH, the star being placed at H, and in the second figure, in the prior case the angle OAK, in the posterior the angle OAP. On the Anaclastic Altitude I shall speak at no. 15.

[Margin: Of the Parallactic Altitude, Distance, and Depth — what?]

13. The **Seen Distance** of a star from the Vertex is likewise twofold: Parallactic and Anaclastic. The **Parallactic Distance** of a star from the Vertex is the complement of the Parallactic Altitude to the Quadrant, or its aggregate added to the Quadrant; and the **Parallactic Depth**, and the measure in each case is the angle made at the center of the eye by the Vertical line, and by the Anaclastic line, of which in the third figure is the angle VAP, the star being placed at P; in VAH, if it be in H; and in the second figure, in the prior case the angle VAK, in the posterior VAP.

14. The **Anaclastic Seen Distance** of a star from the Vertex is the arc of the circle from the center of the eye described, intercepted between the vertical line, and the Ray of the star refracted to that same eye; and its measure is the angle made at the center of the eye by the Vertical line and the Anaclastic line, that is, the Refracted Ray. Such in the prior case is the angle VAR, in the posterior VAS.

15. The **Anaclastic Seen Altitude** of a star is the complement of the Anaclastic Distance to the Quadrant, not exceeding the Quadrant; for if that distance exceed the Quadrant, that excess is the **Anaclastic Depth** [profunditas anaclastica], and its measure is the same. Now the example of Anaclastic Altitude in its own measure is, in the second figure, in the prior case, with the Anaclastic distance VAR, the angle VAR; the Quadrant AS, the Anaclastic Seen Altitude with the Anaclastic distance being null, as appears in the third figure; the Physical Horizon AFR. I shall give an example of Anaclastic Depth below, when there will be discourse of the Ray so refracted, that the Refractive, that is, the deeper [?].

16. The **Astronomical Parallax** [parallaxis astronomica] is the difference between the true place of a star, and the place of the same star, as visible through the Parallactic line. Therefore, if the Parallax be referred to the Altitude, it is called Parallax of Altitude, and it is the difference between the true altitude of the star, and the altitude of its Parallactic [place]; of what kind is it? In the first figure

the difference is between the Angle PCH and the Angle PAF. But if the Parallax be referred to the Distance, the Parallax of Distance, and the Difference between the True Distance, and the Parallaxic Distance, of what kind it is in the same [figures]; in the third figure the difference is between the Angle VCP and the Angle VAP; if, finally, it be referred to the depth, it is called **Parallax of Depth** [parallaxis profunditatis], and it is the difference between the True Depth of the star, and the Parallaxic Depth; of what kind it is in the first figure between the Angle QCK and the Angle RAK; when, however, the star is in the True Horizon, and there is no true depth, the Parallax of Depth is nothing, as in the third figure the angle FAH, and in the posterior case the angle 2. The figure is the angle RAP.

[Margin: Parallax of Altitude, of Distance, and of Depth — what?]

Tables and Diagrams

Solar distance and horizontal parallax table. A three-paired-column table of the Sun's distance (in Earth-semidiameters) and horizontal parallax (in minutes and seconds) at apogee, mean distance, and perigee. Riccioli notes the values are corrected to his new eccentricity, "now bisected" (*nunc bisectam*).

☉	Horiz.	☉	Horiz.	☉	Horiz.
Apogee	Parall. (')	Mean	Parall. (')	Perigee	Parall. (')
Distance	"	Distance	"	Distance	"
Semidia	0 27	Semidia	0 28½	Semidia	0 29
meters of		m. of		m. of	
Earth:		Earth:		Earth:	
7427		7300		7173	

Parsing notes: The three "distance" columns each carry the label "Semidiameter(s) of the Earth" (abbreviated *Semidiam. Terræ*) above the numeric value; the parallax columns are headed *Parall. Horiz.* with sub-columns for minutes (') and seconds ("). The mean-distance parallax reads 28½".

Diagram. A circle (the celestial sphere in meridian section) inscribed with a triangle, illustrating Riccioli's first method for the solar parallax. The center of the circle is marked S (the Sun's place on the vertical circle). Labels around and within:

- B (top of circle): the Vertex, identified in the text with the world's Pole P.
- P (upper right, on circumference near B): the Pole.
- A (left, on circumference): one terminus of the meridian ABC.

- C (lower right, on circumference): the other terminus of the meridian; also the world's Pole opposite.
- R (lower left, on circumference): foot of the vertical-circle quadrant BR.
- S (center): the Sun's position; BS is the Sun's distance from the vertex, PS its declination complement.

Chords/radii are drawn from B and P to S and to the circumference, forming the triangle BPS used in the parallax computation (angle BPS, side BP = colatitude, side PS = declination complement). No labels flagged.

Diagram. A semicircular (hemicycle) refraction diagram for Caput XIV's definitions. A horizontal base line AB rests on the diameter, with a semicircle above it (the celestial hemisphere). Labels:

- V (top of semicircle): the Vertex / Zenith.
- A (left end of base): the eye / left horizon point.
- B (right end of base): right horizon point.
- F (left, interior near base): horizon-related point.
- K (right, on or near circumference): point on the Physical Horizon line.
- O (interior, upper-middle): refraction point.
- G, H (interior, lower-middle, near base): refraction/ground points.
- I, L (interior near base): the word "LVCEM" (LIGHT) is engraved across the base between L and M; "DCE M" labels appear along the base — these are the horizon construction points D, C, E, M.
- The engraved word **LVCEM** ("LIGHT") spans the base line. Construction points along the base read (left to right): A, L, D, C, E, M, B; interior: F, O, G, H, N, K.

Parsing note: this small figure has densely packed lower-middle labels; the cluster G/N/H and the points D/C/E/M along the base are partly obscured. Two labels uncertain.

Diagram. A quadrant-and-base refraction diagram (larger, the second figure of the refraction definitions). A vertical line VTN... descends from the Vertex V at top, with a quarter-arc to the right and a long base line at the bottom. Labels read approximately:

- V (top): Vertex.
- T, S, O (upper interior, descending): points on the vertical and on rays.
- N, D, M, A (left side, descending to base): vertical-line and horizon points.

- F, R (right interior): refraction/horizon points.
- C, B, E, G (along the lower base, left to right): horizon and center points (C = center of Earth).
- P, L, K (lower right, on base and arc): terminal points of rays.
- Q (interior): construction point.

Rays AI, AM, AMO, AHP, CHQ, CGL, AGK described in the text radiate from A (eye) and C (center) through the interior points. Two interior labels in the dense lower-left cluster are uncertain.

Diagram. A small quadrant diagram (inset, right column) for the parallactic/anaclastic altitude definitions. A vertical line from V at top, a quarter-arc, and a short base. Labels:

- V (top): Vertex.
- T, P, X (upper right interior / on arc): the star's true place T, parallactic place P, apparent celestial place X.
- O, S (interior): the eye-center O and the Sun/star point S.
- A (lower left): the eye.
- C (lower middle, base): center of the Earth.
- Z, Q (lower interior): depth/quadrant points.

Rays AS, OS, SAO described in text; angle SAO measures the parallactic altitude. No labels flagged beyond general inset density.

Now, by §32 of the first set of Elements, the external angle is equal to the two internal and opposite angles taken together; and since each of the internal angles taken on either side is equal, the difference between the external angle and the other opposite angle measures the parallax of distance from the vertex. Indeed, since in this case the line itself has come into being—that is, the parallactic line—through the equating of the line of true place with the parallactic line, by this very fact that angle is called the parallax of distance from the vertex. Therefore in the first figure the parallax of distance is the angle AGC; in the second figure it is the angle APC, if the star is at P, or AHC if it is at H. Hence, however much stars at the same distance from the vertex differ among themselves in true altitude, by just so much do they differ in parallactic altitude—true altitude and parallactic depth, that is. For this reason the very same angle, even if not formally, yet at least equivalently, is the parallax of distance from the vertex, and equally is the parallax of altitude or of depth.

§17. The horizontal parallax [Parallaxis Horizontalis], simply so called, is that which belongs to a star situated in the true horizon. Hence it can be neither the parallax of depth nor the parallax of distance from the vertex. Such it is in the second and third figures: the angle AHC, if we may use the terminology of the learned, and which the common run of astronomers call the **horizontal altitude-parallax** [Parallaxis Altitudinis], even though I would call it the parallax in the horizontal circle.

§18. The physico-horizontal parallax [Parallaxis Physicohorizontalis] is that which belongs to a star apparent in the physical horizon, as in the second figure of the earlier case it is the angle FAG—the Sun, that is, being at G—where the refraction is apparent; but it can more properly be called a parallax not of altitude but rather of depth or of distance from the vertex. Yet they can be conjoined, and the horizontal parallax coincides with the physico-horizontal into one, so far as concerns the parallax itself.

§19. The optical parallax of a star [Refractio Sideris Optica] is the angle made at the point of incidence between the refracted ray and the unrefracted ray, or the line of incidence through the point of incidence continued straight, which some call the angle of refraction. Such it is in the second figure: the angle AMN, in the latter case. This I have chosen to call **the optical refraction** [Refractio Opticam], because the optical writers consider it under this name and express it in their tables of refractions in air, in water, in glass, in crystal; for astronomers do not consider it in the same way they do, since they do not attend to the difference of place at the point of refraction—that is, the angle N—but consider the difference of the place of the refracted ray as seen through the line of true place, or the refracted ray as visible through the parallactic line; in either case the certain measure is, and the difference between the place seen through the line of anaclastics, or the parallactic place, whence the places of the stars are reckoned, namely the center of the Earth, and the center of the eye in the place of the observations is constituted. Yet astronomers can consider the optical refraction, that is the astronomical, which differs little from the other; but, lest the properties of one be confounded with those of another (for the properties of one grow confused with another, as happened to Tycho [Tycho Brahe]), I have chosen to call the refraction through the line of true place the astronomical refraction, and have expressed it in tables in larger type, as being more proper to astronomy, and the optical refraction of a star, which is more remote, as being false—so far below as I shall show.

§20. The astronomical refraction [Refractio Astronomica] is simply thus defined: it is the difference of the place of a star seen in the heavens through the line of anaclastics and the line of true place, reckoned to the anaclastic altitude. If it be referred to the anaclastic altitude compared with the true altitude, it is called **the refraction of altitude** [Refractio Altitudinis]; if to the depth, **of depth** [Profunditatis]; if to the distance, **of distance** [Distantiae]. For since refraction adapts the distance to such a case of altitude as is easier for the eyes per the schemata set out below. By this alone we shall henceforth make use. Therefore it [the astronomical refraction] is simple. The difference between the true place of a star at its distance from the vertex and the seen place by the refracted ray is, in the former case the difference between the angles VCL and VAR, in the latter the difference between the angles VCQ and VAS. But when the stars are external to the horizon,

beyond the horizon, [it arises] not from any horizontal lines, but from the line to be led by the eye, that straight parallel line to the line of true place. For the angle, indeed, as that parallel, and the refracted radius will make the measure of the astronomical refraction.

§21. The composite astronomical refraction [Refractio Astronomica Composita], namely from simple refraction and from the parallax for the diminished refraction, equated, or exceeded; as some pretend, [is] none in reality. For if the refraction be as great as the simple refraction, it is not composite with parallax; but to this on the contrary. If indeed the refraction be greater than the parallax would be, it does not produce two effects, but rather one effect alone of an optically-seen star, in which place beyond the meanwhile linear parallax, until the place from the center of the Earth is reckoned; and so elevating the star above the true place. Nor does elevating it optically above the line of true place, but if it produces in reality the sole effect; nor by elevating it optically above the star, more or less, or equally, than the parallax would have been depressed had it not been refracted; in this case the parallactic line does not obtrude itself upon the eye, nor for that reason does it pertain to the star in reality, nor that radius which afterward is refracted; and so the parallax in this case is not actual. Whence in the first figure the Sun being at G, it would be seen through the parallactic line AGK, under K; such a radius penetrates to A, the eye obstructing it, the opaque body of the Earth; refracted nonetheless at I, to the eye A; hence the Sun appears in line AIFR. Nor is the refraction elevated optically at K, in L, and at L in R, but rather at K, that is in R, or in line CL, to line AR, hence it is not composed from refraction and parallax previously corrected; and thereupon from simple refraction and from converting the distance of a star seen from the vertex into

true place, it suffices for the seen place to be added to the seen refraction, nor is the parallax inserted per the subtraction, as Astronomy through Tycho [Tycho Brahe] deceived itself. And if the refraction be less than the parallax would be, partly potential, partly actual; then to subtract the simple refraction and the residual parallax, by subtracting the seen place from the distance of the star from the vertex; but in this case the parallax itself is rather potentially seen, than actually parallax; and from the potential mere [refraction], inasmuch as the refraction is impeded.

§22. The horizontal refraction [Refractio Horizontalis] is thus defined: it is that which belongs to a star constituted in the true horizon, of which kind in the second figure is the parallax OAF, the Sun being at H.

§23. The physico-horizontal refraction [Refractio Physicohorizontalis] is that which belongs to a star apparent in the physical horizon, as in the latter case of the second figure, where the measure of the refraction contains the angle HCG. This nevertheless Tycho [Tycho Brahe] calls horizontal, and that one rather observes, because it is easier and because the moment is given immediately of that observation; nay rather it is the first apparition of the star in the physical horizon: but at the moment in which a star is in the true horizon, none is given by foreknown reckoning, because the demonstration is such that it itself does exact observations to institute. Thus in Tome 1, Prognosis, p. 102, I use the refractions and the seen altitudes of the observations, and earlier on p. 79 in the Table set out, nor is it doubtful both Lunar p. 124, and Fixed p. 280, the seen altitudes to estimate.

§24. The remaining Definitions, that we may pass over hereto as superfluous, namely of parallaxes, and of the refractions of right ascension, of declinations, of longitude, of latitude; since in this place we treat only of parallaxes, and of refractions in the vertical circle; nay rather the parallax soberly, and seldom in favor of refractions. The parallax also, and the subhorizontal refraction, or the superhorizontal—what indeed easily flows from these—if the situation of a star below the true horizon, or above.

Art. II. Some Propositions on Parallaxes in the Vertical Circle.

I. PROPOSITION. *Of a more remote star the parallax is smaller than of a nearer; conversely, of a more remote star from the vertex the parallax is greater than of a nearer—the rest being equal.*

§25. Since the angle measuring the parallax, namely that made at the center of the star, and having for its base the semidiameter of the Earth—

—of the Earth, which is also wont to be equal to the parallax, at an equal distance of stars from the vertex, is greater in the center of a nearer star than in the center of a more remote one, as being the external angle of the internal and opposite rectilinear triangle. But at an equal distance of the same stars from the vertex, the angle of the nearer is more parallactic to the vertex, until at the vertex itself it altogether vanishes; it suffices to describe a congruent figure, and forthwith the demonstration presents itself.

II. PROPOSITION. *For an eye elevated in the vertical line, the parallax is greater, the rest being equal, than for one less elevated.*

§26. Namely, the base of the parallax being opposite, it is greater, if it consist of a semidiameter of the Earth and of a greater height of the eye, than if of a lesser.

III. PROPOSITION. *The parallax of true altitude through the parallactic line, and the seen [parallax] of given equal altitude, are not equal—the rest being equal.*

§27. For at the same instant of time the same star cannot have the parallactic distance from the vertex seen, which would be equal to the true, since the seen is less than the true—as in the fourth figure the angle VAR is less than the angle VCR—and therefore the seen altitude is equal to the true. And in order that the seen altitude come out equal to the true distance from the vertex, it is necessary that the star be raised up so long until it becomes parallel to the line of the true prior distance, as in this figure the star, from R, ought in reality to ascend in S, and the parallactic line AS, parallel to the preceding true CR, so that the seen VCR, from the vertex distance VAS, comes out equal to the pristine true VCR, per §29 of the first set of Elements. But in such a situation the parallax ASC, per the first Proposition of this [series], will be less, and the parallax ARC greater; therefore the seen altitudes belonging to the equal true altitude are not equal to the parallax of the true altitude, but smaller, and so of the rest.

COROLLARY.

§28. The Table, therefore, of parallaxes serving for a given true altitude, does not serve exactly, nor in geometrical rigor, for the seen altitude—as to the quantity, equal as it lies; it serves nonetheless mediately by the artifice following, and immediately.

IV. PROBLEMATIC PROPOSITION. *From the Table of parallaxes of true altitude, to extract the parallax belonging to an equal seen altitude.*

§29. Seek in the aforesaid Table the parallax answering to the given seen altitude, just as if it were the true [altitude], and to it add the given altitude; and with the

aggregate produced by this addition seek in the same Table another parallax: that one will be the true altitude of the prior given seen one. For example: let the Moon be distant from the center of the Earth 52 terrestrial semidiameters, and let its seen altitude be 15 degrees; the parallax in the Table of parallaxes of the Moon answers to 15 degrees of seen altitude as 64'10". To this is added 15 degrees, which makes a true altitude of 16°4'10"; to this, however, in the same Table answers a parallax of 63'51". This, therefore, will agree with the seen altitude of 15 degrees; you will work the more subtly, however, by the Analysis of the triangle ACS. Given then CS, the distance of the star from the Earth, in parts of which the terrestrial semidiameter is AC; given also CAS, the complement of the seen distance VAS, to two right angles, the parallax ASC will easily be obtained, belonging to the seen distance.

[Center-column figure between §27 and §28; see metadata header below.]

Diagram. A quadrant figure illustrating the third proposition on parallaxes of true versus seen altitude. At lower left is the apex C (center of the Earth); a vertical line rises to the vertex/zenith V at top. From C a horizontal base runs to H at lower right, where the curved arc of the quadrant springs upward to V. The eye is at A, on the vertical line above C. Rays run from A and from C through the points R and S on the arc; AS is drawn parallel to CR. The interior point labels include S (upper, the raised position), R (lower position on the arc), and the triangle ACR / ACS construction.

- V (top): vertex (zenith)
- 4.fig. (label, upper right): figure number 4
- S (upper arc): raised seen position
- R (mid arc): position on arc
- A (on vertical line): the eye
- C (lower left apex): center of the Earth
- H (lower right): foot of the quadrant on the horizon

V. PROPOSITION. *The horizontal parallax is smaller indeed than the arc intercepted between the true and the sensible horizon; but in the Sun it is insensibly smaller, in the Moon scarcely sensibly, and almost negligibly smaller.*

§30. In this fifth figure the horizontal parallax is the angle AHC, per §17 of the Definitions; and FH, per the definition of sines, is the sine of the arc FH—that is, the sine of the arc intercepted between the true horizon CH and the sensible horizon; while the angle FCH, with the diagonal AI drawn, [is] between the equal parallels AF and CI, and the other CF; there is born the isosceles triangle COI;

therefore per §15 of the first set of Elements the angle OCI—that is FCI—is equal to the angle OIC, that is to angle AIC, but to the angle AIC, external per §32 of the first set of Elements, [it is] greater by the two internal and opposite [angles]; therefore the angle AHC is greater than the angle FCH, and the arc FH is greater than the horizontal parallax, that is smaller than that one.

Now, in order to compare at the same time the horizontal parallax and the arc FH, that is the angle FCI, by resolving first the triangle right-angled ACH, in which is given the side CH, that is the distance of the luminaries in semidiameters of the Earth, and AC, one semidiameter; wherefore the parallactic angle AHC will not lie hidden, deinde in the triangle FCI, given CF, but as the base, namely the distance of the luminaries from the center of the Earth, and FI equal to the terrestrial semidiameter AC; therefore the angle FCI will not lie hidden, measuring the arc FH. So that we may bestow upon Us the most subtle Logarithms, having assumed the minimum distance of the Moon from the Earth at 52 terrestrial semidiameters; that of the Sun, at the mean Tyconic [distance], 1142; and our terrestrial 7373: from which, the data being given, the horizontal parallaxes come forth, and the arc FH, as in the following Table.

Diagram. A quadrant figure for the fifth proposition on the horizontal parallax. The apex C is at lower left (center of the Earth); a vertical line rises to V at the top. From C a base runs rightward through B to H at lower right, with the quadrant arc curving up from H to V. The point F lies on the arc at upper right; A is on the vertical line; the diagonal AI and the parallels AF and CI are drawn, generating the isosceles triangle COI near the center. Labels B, I, H sit along the lower base.

- V (top): vertex (zenith)
- 5.fig. (label, upper right): figure number 5
- F (upper-right arc): point on the arc (sensible horizon)
- A (on vertical line, left): the eye
- C (lower left apex): center of the Earth
- B (mid lower base): point on base
- I (lower base, right of B): foot of diagonal
- H (lower right): foot of the quadrant on the true horizon

	Semid. of Earth	Parall. horiz. (I. II. III. IV)	Arc FH (I. II. III. IV)
☾ (Moon) at distance	52	66 6 39 0	66 15 8 0

	Semid. of Earth	Parall. horiz. (I. II. III. IV)	Arc FH (I. II. III. IV)
☾ (Moon) at distance	1142	3 0 22 0	3 0 22 5
☉ (Earth/Sun)	7373	0 28 18 0	0 28 18 5

Parsing notes: The table is in the right-hand column beneath the fifth figure. Three rows give the distance in terrestrial semidiameters (52 = Moon nearest, 1142 = Sun's mean Tyconic, 7373 = a third value), with the horizontal parallax and the arc FH each broken into four sub-columns (I/II/III/IV, presumably degrees/minutes/seconds and a further fraction). The leftmost two body-glyph rows are marked "in distantia." Values for parallax and arc FH agree closely in each row, confirming the proposition that the difference is insensible. Several fine digit-readings are uncertain at this resolution.

Therefore it is plain that the horizontal parallax is smaller than the arc FH intercepted between the true and physical horizon by an insensible amount in the Sun, and in the Moon to the utmost smaller by 9' for the most part; negligible.

VI. PROPOSITION. *Given the horizontal parallax, the true altitude of stars is forthwith given, when they are in the physical horizon; and therefore by the same the horizontal altitudes, apart from a discriminating sensible [quantity]; if nevertheless to the Lunar parallax the utmost nine seconds-fraction be added.*

§31. For the arc between the true and physical horizon is the true altitude of the physical horizon, which stars existing there have; but here it is given equal to the horizontal parallax of the Sun per the preceding Proposition, nay rather of the Moon increased by 9'; in equals indeed there is none, but in the stars themselves [is] a smaller parallax than they have at the same place, as is plain a fortiori. In Mars, however, in Venus, or in Mercury, although they have at perigee a greater solar parallax in reality, nevertheless the supposed distance of our Sun from the Earth, never have they a parallax of 3'; minutes, that is. Which nevertheless if they should have, as Tycho [Tycho Brahe] supposes of the Sun, it is plain from what has been said of the Tyconic [system], that they would be sensibly equal to the arc FH. Therefore no Planet, the Sun excepted, when it is in the physical horizon, is higher above the true horizon by more than one minute, and in the mean

—distance from the Earth, not to mention at apogee by more than 18 seconds, in whole seconds; the Moon however never there [is] higher than $60^{\circ}15'8''$. That maximum horizontal [parallax], which belongs to a star existing in the true horizon, since it is the maximum which is in the physical horizon, even though the discrimination in the Sun is insensible, and in the Moon does not exceed 9' seconds, as I said in Proposition 5: yet one could be used for the other.

VII. PROPOSITION. *The parallax of a star truly existing in the physical horizon is greater than the horizontal parallax; therefore it deserves, and is itself properly to be called, the horizontal parallax.*

§32. In the fifth figure of a Star existing at F, the parallax is the angle AFC, which is alternate to the angle FCI, [and] is equal, and this greater parallax AHC; therefore AFC, greater than AHC, see the preceding Demonstration. Nor is it inconvenient in a Star truly above the horizon to come out a greater parallax than not elevated, because in the physical horizon there is a parallax not of altitude but of depth, and truly it more depresses a star than the parallax of a star less elevated; that parallax in the sensible horizon does not depress more truly, that is below the true [horizon], but depresses more below the apparent horizon, and the horizontal parallax there depresses, that is below the horizon. But on account of the aforesaid greater [magnitude], it is nevertheless not unworthy of the name of the horizontal parallax, that the Tables of parallaxes use the true horizon, especially since it will presently be demonstrated to be the maximum of all parallaxes.

VIII. PROPOSITION. *The parallax of a star truly existing in the physical horizon is the maximum of all [parallaxes] of the same star elsewhere, but at the same distance from the Earth existing; and from the physical horizon both upward and downward the parallaxes continually decrease.*

§33. While I was attempting to demonstrate this otherwise, P. Francesco Maria Grimaldi [Grimaldi] suggested to me another proof, which is of this [matter]: In the vertical circle BVHP let there be the vertical line VP, and the astronomical horizon BCH, and the physical EAF, in which the eye is at A, if from the center of the Earth C, the straight lines CE, CF are drawn, which are equal to the semidiameters of this circle, there will be made the isosceles triangle CEF, and by §15 of the first set of Elements, with equal base, there will be equal parallaxes congruent to a Star placed at the extreme of the physical horizon E, or F, namely the angle AEC, and AFC, sit deinde [let there next be] a Star here in K, below the physical horizon, hence in F, above the physical horizon, [as far] as is the arc FK, so that through the eye A, led, it can fall to point K, and from there straight KI;

nam if to the same point K from the center of the Earth straight CK, and CI are led, there is born another isosceles triangle CIK, of which the parallactic angle at the base between equal will be AKC, and AIC; the rays at the chord KI are led, and to the chord EF, perpendicular CL, in the triangle indeed proper ACI, right-angled at L, base AC, per §18 of the first set of Elements, the maximum is the side CL; therefore the chord EF, [is] more distant from the center of the circle C, than the chord IK; therefore per §15 of the third [book of] Euclid the chord EF, [is] greater than IK; therefore the angle ECF, [is] smaller than the angle ICK, and therefore per §32 and §5 of the first set of Elements, the angles at the base EF are greater than the angles at the base IK; greater therefore the parallax F, and E, singularly, than the greater parallax at the inferior K. By how much, however, the point K below the point I, [is] superior, the point I, from the chord per chord EF, led to the point K is nearer the center C, and by so much the chord per chord ducta is nearer the center C, and so much greater, than EF, and that itself EF, of all [chords] which come from point C, led maximally to the center C, [being] distant, and so the parallax E, and F, of all the maximum, and the rest all always toward the vertex V, or toward the lowest point P, decrease continually.

NOTABLE COROLLARY.

§34. Falsely, therefore, has it hitherto been thought to be of all parallaxes the maximum, that horizontal one which belongs to a Star existing in the true horizon, since the maximum is that which is in the physical horizon, although the discrimination in the Sun is insensible, and in the Moon not exceeding 9' seconds, but I said in Proposition 5, one could be used for the other.

Diagram. A full-circle diagram for the eighth proposition (Grimaldi's proof) showing the vertical circle BVHP. The vertex V is at top, the lowest point P at bottom, on a vertical diameter through the center C. The astronomical (true) horizon BCH runs horizontally through C, with B at left and H at right. The physical horizon EAF is a chord above and parallel to it, with the eye A near its midpoint, E at left and F at right. The point K lies on the circle below the physical horizon (right side), with I a related point, and the perpendicular CL dropped to the chord EF. Rays radiate from A and from C through the labeled circumference points.

- V (top): vertex (zenith)
- 6.fig. (label, upper right): figure number 6
- E (upper left, on circle): left end of physical horizon
- A (center-upper): the eye, on the physical horizon

- L (near center): foot of perpendicular CL on chord EF
- F (upper right, on circle): right end of physical horizon
- B (left, on circle): left end of astronomical horizon
- C (center): center of the Earth
- K (right, below physical horizon): star position below physical horizon
- H (right, on circle): right end of astronomical horizon
- P (bottom): lowest point (nadir)

[Margin, beside §33: "Linea CH, serviat pro EAF, & omissa ab inesse." — The line CH may serve for EAF, and [is] omitted from being inserted. (marginal note, partly abbreviated; reading uncertain)]

—that maximum horizontal [parallax], which belongs to a Star existing in the true horizon, since it is the maximum, which is in the physical horizon, even though the discrimination in the Sun is insensible, and in the Moon does not exceed 9' seconds, as I said in Proposition 5: yet one could be used for the other.

IX. PROPOSITION. *The parallax of depth is smaller than the parallax of altitude equal in depth.*

§35. Let there be in this seventh figure a Star at K, [seen] from A; and therefore the parallax of altitude AKC, if indeed there be another star, or the same at another time in L, below the horizon toward BCH; given then the altitude-arc HK, there will be a parallax of depth ALC, per the definitions premised. Let CL be continued in M, and from A, to M, let the straight line AM be drawn; there will be made the triangle AML, in which the angle M is equal to the parallactic angle of altitude K, opposed to the same side AC; and the triangles ACK, and ACM, are similar, because besides the common side AC, the sides CK, and CM are equal, as being radii of the same circle; and comprehending under the side AC, equal angles VCK, and VCM, that is equal to the complements of equal altitudes, if indeed the angles MCB, and HCL, [are] equal at the vertex among themselves. And so in the greater triangle AML, the angle M, is opposed to the greater side AL, the angle however L, to the smaller AM. Therefore the angle M, and so that one which is equal K, which is the parallax of altitude, [is] greater than the angle L, that is the parallax of depth.

X. PROPOSITION. *The parallax of depth, [as compared with] the parallax of equal altitude in the Moon, is not smaller by more than 10" seconds-fraction.*

§36. For the maximum parallax of altitudes is that which belongs to a Star existing in the physical horizon, per Proposition 8; this, however, in the Moon is

as great as the vertical arc described through the center of the Moon between the astronomical and physical horizons; therefore the arc in the Moon proximate to it, per the said Proposition 5, [is the] minimum 66'. Of minutes 60' I now add to that—if so much be below the true horizon—added to this by 90 degrees: there will be made a triangle of which the angle, comprehended by the semidiameter of the Earth, and at the distance of the Moon from the Earth at the minimum, that is 52 terrestrial semidiameters, will be $91^{\circ}6'15''8''$. Therefore by the Logarithmic canons there will come forth the parallax of depth in such a minimum $65^{\circ}55''10''$; and therefore the minimum parallax of altitude [is the] maximum, not more than 66'. So that the same difference will scarcely be a single second, as will be plain by calculation. Wherefore in the Sun it can be held for insensible, and in the Moon scarcely and barely sensible.

Diagram. A full-circle diagram for the ninth and tenth propositions comparing the parallax of depth with the parallax of altitude. The vertex V is at top, on a vertical diameter through center C. The point M is at upper left, K at upper right (the star above the horizon), with A (the eye) just inside near the top. The astronomical horizon line runs through C to B (left) and H (right). The point L lies below the horizon (the depth position), with rays AM, AK, CL, CK, CM drawn from the center and the eye. The triangles ACK, ACM, and AML are formed.

- V (top): vertex (zenith)
- 7.fig. (label, upper right): figure number 7
- M (upper left, on circle): continuation point of CL
- A (center-upper): the eye
- K (upper right, on circle): star above horizon (altitude position)
- C (center): center of the Earth
- B (left, on circle): left horizon point
- L (lower, below horizon): star below horizon (depth position)
- H (right, on circle): right horizon point

Art. III. Propositions on Refractions.

XI. PROPOSITION. *A ray which falls more obliquely, or at a greater angle of inclination, is refracted at a greater angle, and equally if equally oblique.*

§37. Thus Vitellio [Witelo] Book 10, ch. 14, and Kepler in the *Paralipomena* to Witelo Book 1, ch. 4, Proposition 1, from the latter first by experiment, demonstrate; deinde a priori, and so received in Optics, let it have place as Axiom 2. The Axioms of Kepler in the *Dioptrice* [Kepler, *Dioptrice*]. Hence the refraction of an obliquely incident ray is greater than the optical refraction.

XII. PROPOSITION. *A ray returning from a denser medium, through the same point through which it entered, the refraction at the perpendicular [is] equal to the refraction at the perpendicular in the entry.*

§38. This is demonstrated by Alhazen [Ibn al-Haytham] Book 7, Proposition 34.

[Margin: Witelo [Witelo], Bk 10, Prop. 9; *Dioptrice* no. 10; Herigone in *Dioptr.* Prop. 1, etc.; likewise in [Kepler]'s *Dioptrice*.]

XIII. PROPOSITIO.

For a star, whether distant or near, the optical refraction is the same along the same line of incidence into the same point of the same dense medium.

[§39] Kepler expresses this same point in other words in his *Paralipomena* [*Paralipomena ad Vitellionem*], ch. 4, Prop. 4, when he says: "Between a thin light and a dense light there is no difference of refraction, other things being equal." And in this sense he adds in the appended note: "A greater quantity of light does not increase the refraction." For even though the ray from a more distant star is uniformly weakened in the course of its travel — being fainter, while the denser ray of a nearer medium resists more, with the result that it is more intensified — nevertheless this does not amount to more as regards the figure or the bending of the ray. The reason is that this quantity arises from the greater or fainter obliquity of incidence; and for a more distant star, and for a nearer one, the bending of the ray is supposed to occur along the same line of incidence, and hence at an equal angle of inclination. Therefore, by Prop. XI, the optical refraction of each is equal.

XIV. PROPOSITIO.

At the true vertex [zenith] the visible star is at a smaller distance, by force of refraction, when it is more distant than when the Earth is nearer — other things being equal.

[§40] With the other features remaining as described in Figure 2, let it now be so in this eighth figure that the Sun is at H and the Moon at G.

Diagram. A quadrant-shaped figure: a quarter-circle arc with a horizontal base line and a vertical line at the left, representing the celestial vault above the horizon. The vertical line at upper left carries V (the true vertex/zenith) at top, with S marked as a star near the top of the arc. Radii and refracted rays are drawn from points on the arc down toward the eye at the lower left. The base line runs along the bottom.

- V (top of vertical): the true vertex (zenith)
- S (near top of arc, with asterisk): a star
- M, L (on or near the arc): points on the celestial vault
- P, O, K (left region): intermediate points along the refracted rays
- A (lower left): the observer's eye (true position)
- F (lower left, near base): point on the base line
- C, G (along the base): G is the position of the Moon
- H (lower right, end of base): the position of the Sun

[The labels are small and several are crowded near the eye; readings P, O, K, L, M as best resolved.]

at the true vertex-distance VCGH, which is the same one, let a line parallel to it be drawn from the eye AF. The Sun's ray, refracted at the point K, then passing through HK, and entering at P, but truly refracted along KA toward the eye A — for from the produced line AK the Sun appears optically at the celestial vault in S, and so its distance from its visible vertex is the angle VAS. Now the Moon's ray at G cannot radiate toward K, because by Prop. XI its radiation occurs at a greater angle of inclination, and therefore the refraction is greater; thus the Moon's ray is refracted at AK, and likewise the Moon's incident line is the Solar line. The Moon will then be at N, where it is seen to be at a vertex-distance smaller than VCH — that is, the distance of the Sun. Then finally, since just as the Moon's ray, tangent to the sphere of the airy refraction, touches at the lower point because the Solar ray is higher: thus in this case the Moon's ray, tangent to the sphere of the airy refraction at the eye A, first enters the air; whereas the Solar ray first enters at the eye, striking it — therefore the Moon's ray and ray at the eye A, refracted at the lower point, say at L, and by that same refraction AL, the Moon appears at L; and so its visible distance from the vertex is VAL, greater than the Sun's VAS; and so for similar cases, the other features being equal, that is with the densities of the air the same, etc.

XV. PROPOSITIO.

At the same vertex-distance, the visible star, by force of refraction, is greater when the star is more distant than when the Earth is nearer — other things being equal.

[§41] In the eighth figure it will be apparent if they are not in the same vertical line; ...

at least diversely, by the same, or by an unequal refraction. The ray AK, with the Moon at M and the Sun at S, then by Prop. XII this same chapter falls in the same

line KH, where the equal and equally inclined refraction will occur, and the Sun will be at H and the Moon at N, and by the same force of each, the ray falls at K; therefore drawing the line CN, the Sun will be at S, true at its vertex-distance VCH, which is the Moon's nearer distance VCN.

XVI. PROPOSITIO.

The simple astronomical refraction of a star more distant from the Earth is greater in all other respects equal, than of a nearer one — provided the optical refraction is smaller.

[§42] For supposing the air to be of equal density, and the situation the same, if each is of equal force, the star's distance from the true vertex, as posited in Prop. 14, is smaller than the distance of the more distant star by the same Prop. 14. Therefore the greater difference between the visible and the true distance of the more distant star, and the visible and true of the nearer one — but in such a case the simple astronomical refraction consists in the difference, by Definition 20. Thus, as in Figure 8, with the stars positioned on the line CGH, the more distant luminary at VAF, the nearer luminary VAS, while the distance VAS falls short of the angle VAF (which is the true vertex-distance of the more distant star by the angle VCH) than the angle LAF (by which the visible Moon-distance VAL falls short of the angle VAF), the optical refraction AIO is greater for the Moon than AKP; and the Sun, on account of the greater Lunar ray.

But if the visible distance of each is the same, it is greater by Prop. 15. The true distance of the more distant star: therefore the greater difference between the visible and the true, the more distant than between the visible and the true, by Def. 20, the greater the simple astronomical refraction.

COROLL. I. AGAINST TYCHO.

[§43] [Tycho Brahe] is therefore wrong in his Tables of Astronomical Refractions, *Progymnasmata* Tome 1, pp. 79, 114, & 280. He exhibits the refractions of the Fixed stars as smaller than the Solar ones, and the Solar smaller than the Lunar, but from an altitude of 6 degrees not greater than the Lunar — when he ought to have exhibited them greater, as he did from the beginning of the quadrant up to an altitude of 6 degrees. Indeed because he confused the Optical Refraction with the Astronomical, he reckoned (doubtfully fearing) the more distant star's refraction to be greater than the Astronomical refraction. [Margin: Tycho's opinion false. 1, 2.] For thus they ring out on p. 280, where these are the words: "I judge that these refractions of the Fixed stars can be applied to the Planets too without inconvenience, since the difference is hardly perceptible, except that the

Moon, which we expose around the Sun, or some of these things somewhat greater, is liable to observation." He speaks of the refractions by that method he handed down on p. 91 — namely, by observing the difference between the true and the visible, the distance from the vertex; nor are they sufficiently coherent with parallax. And the refraction, simply compounded, since the method is openly to be applied as set out on p. 92, & that visible in practice p. 102. The Moon, being a simple star — if it had been composed of Lunar refraction out of the Horizontal Parallax, which is once around 23 degrees greater, the refraction would have made greater by one degree, which nevertheless he made not greater than 33 minutes.

COROLL. II. AGAINST KEPLER.

[§44] It follows moreover from Prop. 15 that Kepler's reasoning in his *Astronomiae Pars Optica* ch. 4, Prop. 4 is a paralogism [a faulty inference]. For in that Proposition, which he rightly stated: "Between a thin light and a dense light there is no difference of refraction, other things being equal," he deduced in the appended note: "A greater quantity of light does not increase the refraction." But when the rest are required to be equal, the distance from the vertex is greater, the astronomical refraction of more distant stars greater than of nearer ones to the Earth, by Prop. 14. And although he had earlier spoken of the Optical refraction, in the same proposition he applies the teaching to the astronomical, when observation repeats it; for it is in the air [that] Tycho Brahe handed down the refractions of the same stars of the Sun and the Moon, of which that lofty cupola has none.

[Margin: Kepler's error.]

which the perpendicular fell upon, for the Fixed stars and Planets, some of which are nearer to the Sun [than] others — Tycho ascribes the same to them, & soon: "In vain therefore is Rothmann, who supposes it to be the case, that diverse Fixed stars near the Sun, & Planets, would touch refractions: & however much Brahe in the *Progymnasmata* folio 280." The Moon's refractions are suspected to be greater, on account of its nearness; nevertheless folio 124 (which he afterwards wrote) the refractions, as I said, he found to be the same with the Solar. Therefore Kepler reckoned the refractions of stars to be equal in any whatsoever, at a distance from the Earth, which is true indeed if they are at the same distance from the true vertex, & in the same sense he says about the Optical refraction; but at the astronomical [refraction] it is false, since they are not at the same nor the true visible. Hence in the *Rudolphine* precept he said lastly about Tycho: "If perhaps (which he nevertheless suspected falsely) the altitude of the star from

the center of the Earth varies the cause, varieties would appear. I judge the refractions to be greater for that reason, because in computing them Tycho still applied the parallax too small. And indeed without the parallax the refractions ought to have been greater." Hence at last badly in the appended note of the same Prop. 4, Bk 1, *Optics*, ch. 4, he adds: "Nor does the refraction represent the Moon conjoined to a star, if it appears beyond a refraction-distance." And that this is false we shall show at once.

XVII. PROPOSITIO.

Two stars equally distant from the center of the Earth can, by force of Refraction, be represented as conjoined or nearly bodily, which, refraction set aside, appeared widely disjoined.

[§45] It is, as I said against Kepler, Bk 1, *Astron. Opt.*, ch. 4, Prop. 4, in the appended note. Let them be in Figure 8, the Sun at H, the Moon at N, in the same plane vertical, in which lie the rays of the Sun in the vicinity, but truly equal at vertical & at a smaller distance; whence if the aggregation of the semidiameters of both visual bodies, equal, radiating along an equally high line at the same point — equal, or very near, & equally high at the surface of the Air refractive, at the same point, or along an equally high refracted ray KA, will appear to the eye A, in the same line AKMS, equal, or higher, the Moon at M, & the Sun at S, & as to the visible Altitude conjoined, but as to azimuth or true latitude the Moon's image differs partly to the eye A, & nevertheless, if to the eye A, the line is drawn parallactically AN, & verum at the lower point, the distance is AH, where truly the distances are smaller, & per equal as if without refraction they were seen, & both, the Moon at a higher distance than the Sun. Hence one easily recognizes that two stars unequally distant from the Earth could appear conjoined, & conversely two stars unequally distant from the Earth, & conjoined, would appear, if without refraction seen, seen as disjoined by force of refractions.

XVIII. PROPOSITIO.

The eye on the Earth not at all raised, the Refracted Ray never represents the stars below the Physical Horizon, but only above it.

[§46] Because the Refracted Ray of this kind of place, either coincides with the Physical Horizon, or is above this horizon, & so represents the stars, or it is in this Horizon, or above, as it falls below this horizon, it does not penetrate the opacity of the Earth, nor does it reach the eye on the surface itself lying low.

XIX. PROPOSITIO.

The eye raised above the Earth, the stars can appear below the Horizon by force of Refraction.

[§47] It is proved by frequent experiment; for we have, from our Observatory, not from the eminent place, seen from the peak of the Paternal mountain [Monte Paterno] the Moon, & other objects below the horizontal line, instruments collocated for levelling appearing, nor do we doubt that, since their rays, as the air is denser, are inflected, refracted, & reach us, & this does the Moon move, that it is higher in the true horizon, since it can have a greater Refraction with a great parallax of its own; nor is it represented in the Physical Horizon, but above it. Let an example of this be in Figure 9, the Moon existing at H, ...

Diagram. A quadrant figure similar to the eighth: a quarter-circle arc bounded by a vertical line at the left (carrying V at top, O, A, C downward) and a horizontal base line at the bottom (running to F, L, H at the right). Internal lines show K and I as intermediate points; refracted rays run from points on the arc toward the eye region at lower left, illustrating how the Moon at H is represented below the physical horizon when the eye is elevated.

- V (top of vertical): the true vertex
- O, A, C (down the vertical, left side): points on the vertical / eye positions
- K (interior, upper): point on a refracted ray
- I (interior, lower): point on a refracted ray
- F, L (along the base): points on the base line
- H (right end of base): the position of the Moon

which, radiating into the point K, can be seen at L, by the refracted ray KO, verging downward: For the refracted Ray always represents the stars less distant from the vertex, than if without refraction they were beheld. And in this sense it always raises the eye, however much it verges downward.

By this occasion it is sufficiently advised that the eye below the surface of the Earth depressed — say in the bottom of a pit, a hollow, a ditch, a valley — by force of refraction some stars can appear there which without refraction could not appear.

XX. PROPOSITIO.

All the Fixed stars & Planets, the Moon excepted, when they appear in the Physical Horizon, are really below the true Horizon, by as great a depth as is the difference between their Parallax & their Horizontal Astronomical Refraction.

[§47, cont.] For from one part the Arc between the Astronomical & Physical Horizon of the Fixed stars is null to the sense, because they lack a sensible parallax; in the Planets, the Moon excepted, [it is] insensibly represented, because they lack a sensible parallax from their own Horizontal, by what is said in Propositions 5 & 6, nor does it exceed 1 minute, or the other [parallax], supposing the truer Solar distance from the Earth, of which we [treated] in the *Almagestum Novum* Bk 3. From the other part the Horizontal Astronomical Refraction of the stars, by Tycho's experiments and ours, does not exceed 1 minute 27 [minutes]; when therefore both are in the Physical Horizon, the distance from the vertex of the visible adds the horizontal Refraction of 27 minutes, & thence the Arc between the Horizons is so much, which is the residue from the subtracted parallax, since it itself is below the horizon. But if the Arc between the Horizons exceeds 2 minutes, the star will be below the horizon by as many remaining minutes as the residue is, when the parallax is subtracted horizontally.

XXI. PROPOSITIO.

When the Moon appears in the Physical Horizon, it is really between that & the Astronomical Horizon.

[§48] The reason is that the Lunar Refraction in that position is much smaller than the sensible Horizontal Parallax, not to mention the Arc between the Astronomical & Physical [horizons], the Horizon being intercepted. Therefore if then the refraction is added to the visible distance from the vertex, the true [distance] will become its distance from the vertex, larger than if the Moon were in the true horizon; but [it is] below, if it ought to be in itself, the distance of the visible adds so much as the arc by which its Horizon differs, which differs from the horizontal Lunar parallax 9' at its highest, by 2 seconds, by what is said in Prop. 5 & 6.

XXII. PROPOSITIO.

The visible distance from the vertex by force of refraction is not only smaller for the Moon, but for some others of the Planets, it can be greater than the True; yet it is always smaller, Visible, or Visible, by the parallactic line alone.

[§49] For the Moon in the apparent Physical Horizon, it is evident from the preceding Proposition; for the other Planets it is proved, because the eye can be elevated so far from the Earth that, the rays refracted, verging downward, may see the stars, as said in Prop. 19; yet nothing can be brought repugnant to it, on account of which the star at that moment could not be in the true Horizon, ...

[in the true Horizon], or above, in any case, the True distance from the vertex does not exceed 90 degrees; & nevertheless the Visible distance, by force of the refracted ray verging downward, will be greater than 90 degrees; otherwise it would not verge downward. As if, as in Figure 9, by the Refracted ray KO, the star which is really at H, appears at O, the Angle VOL is greater, than the angle VCH, smaller than the angle VOF, which is parallactic; & so as said in Prop. 19, the Refraction always raises: understand not the True visible [distance], but above the parallactic [distance], the Visible or beholdable distance from the vertex.

XXIII. PROPOSITIO.

To find the simple Astronomical Refraction of any given star by observing, the star's Declination & the Altitude of the Pole [latitude] being given.

[§50] This can be carried out in several ways, but the easiest & most exact is the one which, taking the Azimuth observed together with the distance of the star from the vertex at that very moment, by which the star's center appears in the determined Azimuth — which is evidently described by our Filar Triangle [triangulum filare], *Almagestum Novum* ch. 15, Prob. 8; & if it is located in the determined Azimuth, & is expected to be, ...

Diagram. A full circle (the celestial meridian/sphere) crossed by a horizontal diameter (the horizon line, with B, A at the left end and G, H at the right end) and a vertical diameter (with V at top and N at bottom). Near the center are points I, L, C, D, K marking the true and visible positions of a star and the triangle used in the construction. A curved line F at upper right and arcs descend toward the lower right, representing the refracted ray path.

- V (top of vertical): the true vertex (zenith)
- N (bottom of vertical): the nadir
- B, A (left end of horizontal diameter): points on the horizon
- G, H (right end of horizontal diameter): points on the horizon
- F (upper right): point on the arc / refracted ray
- I, L, C, D, K (central cluster): points of the construction — the true and visible star positions and the triangle vertices

and that the center of the star may arrive at its rising, or setting, & at the same moment another observer with the instrument may seize, splendidly to the minute, & some second of subdivision, the star's visible distance from the vertex. Furthermore in the Fixed stars there is no need to know the moment of time, since it suffices to know the day, because within one day their declination is not sensibly varied. But in the Sun it is expedient to make the observations on the days of the Solstices, in which the Sun's declination is insensibly varied — or at least in the Sun, & in the other Planets to be observed, either by clockwork [horologia], or by the Fixed stars, the more precise moment of time, so that the star's declination may be exactly computed.

These things accomplished, let it be so in the tenth Figure that the star first appears at K, but truly by force of Refraction it appeared at C, or wherever in the Physical Horizon BF, or wherever to the true place K, from the Mundane Pole P, let the arc PK be drawn, a portion of the circle of declinations; & from the Vertex V through K, [let] the semicircle vertical VN [be drawn], which gives rise to the spherical triangle VPK, in which the Azimuth observed is the Angle VPK, & the side PV the complement of the Altitude of the Pole [co-latitude], & the side PK the complement of the declinations Boreal, or the aggregate out of the declination Austral & Quadrant, if the declination be Austral, or Quadrant, if there be no declination: Therefore, three of these being given, by the Canons of Triangles, the side of the star's distance from the Vertex VK will become known, from which subtracting the visible VC, the simple Refraction CK will remain known.

But secondly, if the star at D appears by force of refraction below the horizon at L, drawing through it the vertical semicircle VN, & at the arc of declinations PD, the triangle VPD will be born, in which the Azimuth is known, the angle PV, & PD, the complement of the declination Boreal, or the aggregate out of the declination Austral & Quadrant, or Quadrant, from which the true distance from the vertex VD will become known, from which subtracting the observed, or visible VL, the Refraction DL will remain. Let it be on the contrary, the star at L, but it appears at C, ...

(for it is supposed to be seen as a greater distance from the vertex, than the true distance from the vertex is established from what is said above) then in the Triangle VLP, from these three given data commemorated, & applied to this case, the true distance VL will be given; from which subtracting it from the Visible VC, the Refraction CL will remain.

Nor does it stand in the way that the arc VLC, through which in this Figure the visible distance of the star from the vertex is represented, is the arc of a great

circle described from the center of the Earth; & nevertheless the visible distance from the vertex is captured by the surface of the air, where, however, since we do not indicate by such an arc, with the angle made in the center of the instrument, which in the highest Heaven we measure the visible [distance] from the vertex, we use a line from the center of the eye drawn by the instrument, & a parallel line as the True distance from the vertex. It suffices for us separately to find the true [distance], & without an arc vertical through the star drawn, to consider the visible place, or the image of the star, however far, from the eye into the infinite remote. Thus in Lunar parallaxes we use an angle made in the center of the eye & in a parallactic line, which we compare to a perpendicular line, & to a vertical line; & we compare an angle made in the center to a vertical line, & to a line of the true place. Thus in the Planetary Propositions where they use an anomalistic angle around their center in true motion — indeed in the form of the Equant, beyond the center of the Planetary orbit — because such an angle is not measured by the arc of the orbit, but by benefit of parallels, it is measured by the distance from the Apogee, in the highest Ecliptic infinitely, or however much, considered remote.

XXIV. PROPOSITIO.

Although the simple Astronomical Refraction of the Moon can be known without Parallax; & whether the Visible can be exchanged into the True, the True nevertheless cannot be exchanged into the Visible by force of one [refraction], any more than the Visible by force of one [can be exchanged] into the Visible by force of the other.

[§51] The first part of the Proposition is proved, because by Definition 20, the notion & usage of Astronomers received, this Refraction is nothing else than the difference between the true distance of the star from the vertex, & the visible by force of the refracted ray; but this, by Prop. 23, that is, by such praxis as is handed down there, can be known without parallax; therefore the praxis assigned to it does not need the notion of parallaxes. It is confirmed, first, because in this case the comparison is made between the true distance of the star from the vertex, & the true, or visible by force of the refracted ray; but between the true, & the visible by force of the refracted ray; & at the same moment at which the sensible Refraction occurs, the sensible Lunar parallax also occurs, greater than the refraction; the eye being in a suitable distance from the Earth or from the sensible parallaxes, it nevertheless does not raise the parallactic line, nor is it referred to in our case, but only made.

It is confirmed, 2, by example, & by the authority of Tycho, who in Tome 1 of the *Progymnasmata*, p. 124, exhibits a little table of Lunar Refractions, without including parallax; otherwise it would have had to exhibit the refractions not smaller than 85 [seconds]: established at 33 [minutes], namely, of pure Refraction, & of Parallax horizontal Lunar, which is once smaller, than 52', but it could be at most 33': & so of the others, & it likewise made the simple second part by these Propositions.

The third, & the fourth part, on the Commutation of the True into the Visible, or of the Visible by force of the refracted ray into the Visible by force of the parallactic line, is proved because then in the comparison there is not only the True with the Visible refracted; but the True into the Visible absolute, when however the Refraction is not greater than the parallax, or equal, as happens in the Moon; the Refraction does not raise the optical Visible so much, as the parallax depresses; turned therefore from the true distance into the Visible by force of Refractions, the star is seen higher indeed than in the absolutely depressed, it will be seen, since it is less by force of the residual parallax, but with the excess, since the Parallax as a whole conquers the Refraction, & by what excesses, the depressed effect operates. Therefore in order that the True may be turned into the Visible adequately, & absolutely, parallax will be needed, & much more if the visible is to be compared with the other Visible. Repeat here, what I said in Prop. 21.

Proposition XXV

For the remaining planets, which have a smaller refraction than parallax, not only can the simple distance from the vertex be known apart from refraction, but it can even be known apart from parallax — and the true distance can be converted into the visible distance, and the visible into the true (yet not into the visible anaclastic) by parallactic refraction alone.

§52. The first part is established as above, from what was set down in practice at Proposition 23. The second part is proved, and this second part follows from it: because in both cases — whether refraction acts alone, owing to a single refracted ray, without any regard for the parallactic line; or whether it acts together with parallax — the thing that has a smaller refraction holds simply, by the very fact that it is smaller than the refraction. But this is the simple true distance, and meanwhile it posits nothing in being, nor does it bring it about that the eye sees the stars truly parallactically, but only refractedly — yet merely refractedly. And although the eye placed beyond the center of the Earth — that is, above the horizon — sees the true [place], since the parallax of the stars, when

the distance of the star from the Earth is so great, is null or scarcely greater than the refraction, the parallactic line is so situated that it does not exist in the nature of things; rather it truly is not, nor does it furnish anything physically or optically, as I shall also show under number 21. Nor can it be conceived that there is here some conflict of contraries, in which refraction raises something upward by eight while parallax draws it downward by two, so that one should follow the elevation by only six. Rather, the refracted ray directs the visible star, and at that time the visible parallactic line, considered apart from this, is determined from the place of the star itself, when the refraction raises the ray; nor does it elevate the object more than it ought, so that it might be seen apart from parallax; and still it leaves a place for parallax, because this is the refracted distance. [The optical argument of this paragraph is densely compressed and partly conjectural in the reading. [?]]

Our discourse is confirmed when we descend to practice. Suppose, by Proposition 23, that the Sun's true distance from the vertex is found to be $84^{\circ} 30'$, but that it is observed by instruments as $84^{\circ} 50'$, and the refracted ray is certainly something not less than the elevation by some minutes, say $20'$; and it is not parallax, since [the deviation] from the vertex is some [?] $20'$; therefore the refraction will be $30'$. If, then, the minute of absolute true distance has been $84^{\circ} 30'$, and conversely, if 85° be taken, subtract $30'$ from it and the true distance of 85° will be left; and conversely, if 85° be given, subtract $30'$ and the visible distance of $84^{\circ} 30'$ will remain. [?] Most certainly, then, the visible refracted distance, when $30'$ is taken away, leaves the visible distance for the future. Nor does it matter for this comparison that there be a mutual conversion: the parallax does the work. [?]

But truly, if the refraction added $30'$ — for example, of one minute of parallax — the refraction would evade by $31'$, if the whole distance had been added to the visible; the true distance evades by $84^{\circ} 29'$, contrary to the supposition made. Nor would the comparison occur of the visible refracted distance, but of the visible-by-refraction (or the visible anaclastic) with the visible parallactic — in which sole comparison we grant the use of parallax. For then the visible refracted distance of $84^{\circ} 30'$, with $31'$ added, joined to refraction and parallax, results in the visible parallactic distance of $85^{\circ} 1'$. Most certainly, indeed, if the visible distance be diminished by $31'$, the visible anaclastic distance of $84^{\circ} 30'$ results. But the comparison declares nothing in astronomy, since, once that refraction is supposed known from here, parallax is no different than is usual, when it is the visible absolute distance that lies in the true distance from the vertex, and conversely the true distance is converted into the visible, or the absolute into the thing to be seen. [?]

We grant, moreover, that if anyone should cast into a Table that the refractions are composed of simple refraction and of a lesser parallax, and then proceed to convert the visible into the true and the true into the visible distance by subtracting the former refractions [and] that lesser parallax — I assert that that composition will be made in vain, since in practice it is to be dissolved, and simple refraction suffices.

Corollary

Against Tycho [Tycho Brahe], and the rest who were deceived in this — some of whom were even among us.

§53. It follows from the preceding proposition, rightly considered, that Tycho [Tycho Brahe] erred in the method of inquiring into Solar Refractions, in that, while he knew the parallax to be greater than he handed down (*Progymnasmata* I, p. 92), he said, when he treated of the Sun's elevation by a given observation: *It must be added — that is, that the Sun would incline more toward the horizon — and that Refraction emends nothing.* And at once he subjoins: *Thus we recognize the apparent elevation of the Sun, if it be wholly freed from parallax; but these [elevations], when the true altitude has been subtracted by computation in the same Azimuth, will give the sought Refraction.* These are trifles — nay, mere trifles, and the work of a depraved imagination. For refraction will be the difference between the True and the Visible distance from the vertex; that is, the greater between the true and the visible, which now acquires what is to be subtracted in withdrawing the visible from the true distance. Hence its composition out of parallax — either before the subtraction is made, since this can be had at once, or [out of] the addition of parallax. But let Tycho subjoin his method in the same place: *It does not escape notice — he says — that the third side represents Refraction in the circle of the verticals, to which nevertheless the addition of parallax comes; on which account the Sun appears lower [than it would] without this — for by Refraction it would appear higher, and on that account the Refraction is greater.* See in what manner Tycho estimated Refraction and Parallax to intervene, in reality, by a kind of quasi-conflict: so that, had Parallax not opposed, refraction in its working would have made a much greater [display] than is the image of the Sun, however large the latter appeared in reality. But this falls flat. For if there had been no parallax, on that account the Sun would have been in the center of the Earth, nor would there have been any Refraction in any place; but if, the Earth remaining, the eye [were] on the surface of the Earth, and the Sun were seen as high as $1^{\circ} 30'$, for example, while in reality it was as high as only 1° . And, by feigning the visible Sun seen by two eyes — by one a refracted ray, by the

other a parallactic ray that is wondrously not refracted — this would so move the eye that the Sun appeared less by one whole degree, namely 59'; by that much less is the refracted object, [yet] not because the prior eye sees the Sun higher. Whence it follows that there is no greater Refraction. For if there had been no parallax, on that account the Sun would have fallen [short]; nor would the Refraction have been greater than the $1^{\circ} 30'$ at which it had been seen as refracted and elevated, since in the first case it had been refracted and elevated. On that account, in the very thing Tycho already recognizes Refraction while the parallax is added — when you say, *it does not escape notice that the third side represents Refraction*; otherwise, if it were not refraction but part of refraction, it ought to have been named, for collecting the equation, not *Refraction* but a *part of Refraction*. Nor is that refraction of yours composed of an elevating refraction together with parallactic refractions partly, by one elevating so much as parallax had depressed; rather it would be from the other elevating above the true place of the Star, as I imagine.

Consequently, however, Tycho — after he had given, on p. 79, the Table of Solar Refractions composed of pure Refraction and parallax, and afterwards on p. 102 [given] both — is not consistent with it. But for the future, since our Tables of Astronomical Refractions are simpler, let us use the Rules set down above. Reread what I said under number 21.

Proposition XXVI

If the refracted ray be parallel to the line of the true place, the distance of the star from the vertex visible will be equal to the true distance from the vertex, and the difference between the visible-by-refraction and the visible parallactic will be equal to the parallax itself, the refraction ceasing; and then for the first time the refraction is astronomical.

§54. In Figure 11, let the star be at L, and the line of the true place CL, but the refracted ray AK; let the visible ray AB be equidistant from the line CL. Let the ray, on its refraction, fall along the line KL, and with the eye at O, let the parallactic line AL be drawn to L. I say that the visible distance VAB is equal to the true distance VCL, because the external angle [equals] the internal one by the opposite, on which account the straight line VC falls upon the two parallels CL and AB by the same angle ALC — that is, that the parallax is equal to the alternate angle BAL, by which

Diagram. A quadrant-shaped figure in the upper-left of the column. A vertical line rises at left from a corner; a horizontal base runs from that corner to the

right to point H. A quarter-circle arc connects the top of the vertical (V) to H. Within the quadrant, rays and chords are drawn from the lower-left corner (the eye/observer position) outward to points on the arc and to interior labeled points, illustrating the relation between the true place, the refracted ray, the visible ray, and the parallactic line.

- V (top of the vertical): the vertex / zenith point
- B (upper interior): point on the visible ray
- K (interior, left of center): point where the ray is refracted
- L (interior, right): the star's position
- C (lower-left corner): center of the Earth / observer base
- H (lower-right end of the base): horizon point

(angle) the visible distance VAB differs from the true distance VCL — that is, VAB differs from the visible distance, or visible parallactic, that is VAL. Lastly, if there is no difference between the true distance and the visible-by-refraction distance, by the definitions of number 20, all refraction will cease at that point, when first the parallactic line touches such a [point]. Yet there is no conversion; and so, if visible refraction cease, the visible distance evades equal to the true, as we shall say at Proposition 30, concerning the Moon. Hence the Table of the refraction of the visible altitude is not sufficient; one must proceed further, and a Table of Refractions must be constructed from the altitudes of the true distance from the vertex, congruent, or it teaches in what manner from the constructed visible Table others can be elicited; and then one must discuss when, [given] some star, the visible distance ought to be greater than the true, whether the refracted ray be in the physical horizon, or directed downward, or upward — and indeed it has hitherto not been demonstrated that, by the upward-directed refracted ray, the visible distance is always less than the true. These, then, are the matters.

Proposition XXVII

Of the Moon appearing in the Physical Horizon, the Visible Distance from the Vertex is greater than the True.

§55. For by Proposition 21, the Moon is then truly between the True and Physical horizons; therefore the True distance from the Vertex is less than a Quadrant, but the Visible is a Quadrant; therefore the latter is greater than the True.

Proposition XXVIII

Of all the planets (the Moon excepted) and of the fixed stars, in the Physical Horizon, the Apparent Visible Distance from the Vertex is less than the True.

§56. For by Proposition 20, the rest of the planets and the fixed stars are, in the Physical Horizon, truly below the True Horizon; therefore the True distance from the Vertex is greater than a Quadrant, but the Visible is equal to a Quadrant; therefore the latter is less than the True.

Proposition XXIX

Of the Moon above the Apparent Physical Horizon, the Visible Distance from the Vertex is greater than the True.

§57. For the Moon's visible distance is greater than the true, when it appears in the physical horizon by Proposition 27. Thereafter, if the Moon raises itself, [the distance] continually decreases until the Astronomical Refraction ceases (I speak of the perceptible sense), before which the Moon's Parallax in this case vanishes, and the visible has thus far persevered greater throughout the whole preceding and lower altitude, greater [than the true] with sensible Refraction. The sensible Refraction ceasing, the Moon is no longer seen by us through the Refracted Ray, which is diverse from the parallactic; rather it is seen through the Physical Ray, which is the visible parallactic Ray; but the eye, with the Vertical line, makes the angle of the visible distance, greater than the internal one, and by the opposite of the Triangle, the parallactic angle makes the true distance to be measured by the angle internal and opposite to the one mentioned. And so it comes about, until the Moon occupies the vertex [and] all parallax ceases.

Proposition XXX

Of the Moon existing in the True Horizon, with the eye elevated below the Apparent Horizon, the Visible Distance from the Vertex is greater than the True.

§58. For the True [distance] in this case is a Quadrant, [yet] the visible [distance] greater than a Quadrant, because it is seen by the downward-tending Refracted Ray, since it is not seen by the refracted ray coinciding with the physical horizon, unless it has ascended above the true horizon by Proposition 21. I said that this Proposition follows in this place, [namely] that, if no Refraction be supposed here, the Parallax thence will be something other than is usual, since the Visible [distance] is greater than the Visible absolute into the True from the Vertex; and conversely the True into the Visible, or what is absolutely to be seen, is converted.

Proposition XXXI

Of the Moon existing below the True Horizon, with the eye elevated below the Apparent Horizon, the Distance from the Vertex is greater than the True.

§59. The reason is, that in the ascent of the Moon to the True Horizon, the Astronomical Refractions are very great, nor do they cease altogether before the approach to the True Horizon; but if the visible distance of the Moon from the Vertex could be less, and afterwards, when the Moon is in the Horizon, the visible would evade greater, [and] could be made equal to the true, then, if the equal should evade the true, the Astronomical Refraction would cease — which is impossible.

Proposition XXXII

Of the planets (the Moon excepted) above the Apparent Physical Horizon, the Distance from the Vertex visible is greater than the True, so long as the Astronomical Refraction lasts as a sensible [quantity]; but the first sensible Refraction ceasing, the Visible is equal to the True, and thereafter [becomes] greater than the True, so long as the parallax lasts as a sensible [quantity]; yet it is always equal to the True when they lack a sensible parallax.

§60. Since indeed from the moment at which, in the physical horizon, the [planet] appears — in which the Visible is less than the True — before it become equal it always perseveres greater, when it cannot pass continually to a lesser and equal, unless it leap beyond the equal at the same time and in the same kind; and so it does not evade equal except when the first [moment of] the most parallel refracted ray, when the line of the true place ceases, and the visible distance evades equal by force of the refracted ray. And the refracted ray of Optical Refraction can indeed be remarkable, yet Astronomical [Refraction] can be so slight as to be insensible. Thence, the Star ascending, it is not seen by an ample [angle] through the refracted ray, which is sensibly diverse from the parallactic; rather there persists [a refraction], so long as the parallax lasts as a sensible [quantity], when the parallactic line with the Vertical line makes the angle external, greater, internal, and by the opposite of the parallactic Triangle, [it makes] the distance from the Vertex seen parallactically greater than the true distance, since that one measures the internal angle external; and the opposite as foretold. But in the Fixed stars, which lack sensible parallax, the Refraction ceasing, the Visible Distance is equal to the True.

Proposition XXXIII

Of all the planets (the Moon excepted) and of the fixed stars appearing below the Physical horizon, the Distance from the vertex visible is less than the True.

§61. For when they appear in the physical horizon, the visible is less than the true by Proposition 26; but it could before this have been greater than the true, [and] could before have been equal to the True; yet it could not be equal to the True except by the Astronomical Refraction ceasing, since it consists, by Definition 20, in the difference between the True distance and the refracted visible; because the refractions about the horizon, and in the ascent of the [planet] itself, never cease; nay, they persevere greater, until the parallax is external — neither is there obstruction to the elevated eye, which sees the Stars below the horizon, through the refracted ray below the horizon tending upward, and making with the vertical line a greater right angle; for never, however high it be elevated, will the distance of the refracted ray from the vertex be greater than the true — that is, that which we shall be about to teach of Mars at Perigee, of all [the planets], the Moon excepted, nearest to the Earth, in the following Problem.

Proposition XXXIV

Given the Distance of a Star from the center of the Earth, and the altitude of the refractive Air (in the parts of which the semidiameter of the Earth is known), and also the depth of the Star below the Horizon: to investigate the maximum distance of the [star] itself from the vertex from an eye placed within that Air, [the star being] visible at the highest by the Refracted Ray.

§62. Let it be: in Figure 12, A is the center of the Earth and of the circumscribed Air, the vertical terrestrial quadrant is BIC, whose semidiameter, or radius, is AI, and the Air's Refractive quadrant is OKD, whose Altitude is IK, the Vertical line is AV, and the Horizon is that in which Mars is at M, depressed by 1° , and therefore, the line AM being drawn to it, the

Diagram. A figure showing two concentric quarter-circle arcs in the upper-left of the column. From a lower-left corner (A) rise a vertical line and extend a horizontal base. The inner arc represents the terrestrial quadrant and the outer arc the refractive-Air quadrant. Straight rays are drawn from A across the figure to points on the arcs and to interior points, with a long oblique line reaching the lower-right (M, the position of Mars below the horizon).

- V (top of the vertical): the vertex / zenith
- O (upper-left, on the outer arc near V): point on the Air quadrant

- T (interior): intermediate point on a ray
- B (interior, near V): point on the terrestrial quadrant (BIC)
- K (interior): point on the refractive-Air arc (Altitude IK)
- L (interior, right): point on a ray
- A (lower-left corner): center of the Earth and of the Air
- C, D (along the lower portion / base): points where the arcs meet the base (terrestrial quadrant BIC; Air quadrant OKD)
- I (on the base, between A and the arcs): point on the terrestrial radius AI
- H (lower-right of the base): horizon point
- M (far lower-right): the position of Mars, depressed 1° below the horizon

angle of the true depth HAM is the degree of one [degree]; but Mars's ray, touching the Air at K in the Vertical KM, does not stand beyond the highest in the Air-elevated [region], because the altitude of the rising is the least IK, let it be BO, let it be admitted at the point of contact, which is OK, since AK and AO are equal, the Triangle AOK will be isosceles, and the angle at the base OK [will be] equal by Proposition 15, Book I of the Elements. Now if the ray be drawn down a little below the point of contact K, the air, [when] refracted, must be at the contact K, so near, that the more the refraction will be sensible, [the more] another OK, or how much lower it enters, by so much less highly will it be refracted, on account of the greater inclination of the incident ray, nor will the refractions pertaining to that contact O reach the eye, but they will fall there on the side toward B. The proposed thing now is to investigate the Angle VOK, the distance of the visible Star from the eye, that we may know which is greater or less than the angle VAM, the True Distance from the vertex, when we have assumed it as $91'$. And indeed at Mars's Perigee, since here, the Moon excepted, the planet at maximum accedes to the Earth, and hence judgment is taken concerning the more remote Stars.

Now indeed (as Book 7 of the *Almagestum Novum* [*Almagestum Novum*], Section 6, Chapter 1, [shows]), Mars's distance at Perigee from the Earth is the terrestrial semidiameters 247, and by our *Geographia Reformata*, the terrestrial semidiameter AI is 3690 Bolognese miles. Therefore Mars's distance at Perigee from the center of the Earth — that is, AM — is 871,630 miles of those, the Altitude IK, or the Air's refractive [height], at the most that it can be, being 50 miles; and so the whole AK is 3740 miles. In the triangle AKM therefore, having the rectangle at the point of contact K, Mars's Parallax AMK will be $1^\circ 28' 8''$; but let it be by abundance $1^\circ 30'$; therefore by 32, the angle of the first elements KAM is $89^\circ 48' 26''$; the angle KAH being removed, $88^\circ 18' 30''$; therefore the residue OAD, the complement of the angle OAK, [is] $1^\circ 30'$; and by the first elements of the

distance VOK, $90^{\circ} 10' 45''$, less than the angle VAM by $91'$, and the Astronomical Refraction by $18' 15''$, by which distance from O is less, if the [angle] be 50, [or] AK less by 50, if the Star be at M, and from the Earth greater; so therefore it is less, if these all concur, as in all the other Stars it comes about, the Moon excepted. By the same method, moreover, the same will be shown, if the Star be set below the True Horizon by several degrees.

For the Moon

§63. Let us now experiment in the Moon by the same method, and so: the distance of the Moon at Apogee AM, of the terrestrial semidiameters from the highest 70, the rest as above; so that, as above of Mars, the parallax AMK will be 50, approximately, and finally VOK $90^{\circ} 55'$, less than VAM, less by $5'$, as by Proposition 32; let it be of the Moon's distance from the Vertex $84^{\circ} 30'$; let there be added to it $11'$; the refraction is established at the Vertex $11'$. But from observations of Refractions about the horizon, the Moon's distance at Perigee being of the terrestrial semidiameters $11'$; let the parallax AMK be $66'$; and finally VOK $91^{\circ} 6'$, greater than the angle VAM, but by minutes more nearly $6'$; therefore the Moon's depth below the horizon is less than an integer degree, since

[Top of right column, continuing §63:] when first it appears refracted to the eye O, let us experiment what may happen in both cases of the Moon, namely at Apogee and Perigee, when it is in the True Horizon, in which we feign the Moon to be at A, the Moon's least parallax at Apogee AMK, let it be 50. The angle therefore KAO, [is] $89^{\circ} 10'$; and OAK [is] 50, the angle AOK [is] $89^{\circ} 35'$, and VOK [is] $90^{\circ} 25'$. But at the Moon's Perigee the maximum Parallax AMK, [if] it be $1^{\circ} 6'$, will be OAK, [a] degree $1^{\circ} 6'$, and AOK [is] $89^{\circ} 27'$, and VOK [is] $90^{\circ} 33'$. Wherefore, that the excess be safe by $30'$, [the] visible distance is greater than the true from the Vertex by some minutes; the Moon cannot exist below the true horizon unless [its] parallax be less, [and] the Moon's Apogee be refracted; but it appears refracted to the eye O, when, however, the Apogee [is] rather to be above that [horizon] by a few minutes. One must beware, lest these be feigned out of impossible cases of certain [stars]. It is enough that we have tried it, because perhaps it could happen at the eye O, since indeed out of so great an altitude of the eye we cannot observe, [and so] we cannot render these things more certain. Certainly, in the meantime, we presume that we can have the depth of the more remote stars [greater] than the Moon's, when first it appears to the elevated eye, unless [from] the thickness and density of vapors a horizontal [refraction] obstruct, [and] as much the refracted rays retard; nay, they do not appear, unless elevated above the horizon, which often [happens].

§64. Let us absolve, in the meantime, the Rules of conversion, which we began at Proposition 27.

Proposition XXXV

To resolve the conversion of the Distance of the Stars from the Vertex, both Visible into True and True into Visible from the vertex, and likewise of the Altitude absolutely.

I. Rule. Of the Moon, you will convert the Visible Distance from the Vertex into the True by first subtracting the Refraction [and] Parallax, and adding the residue to the Visible distance.

II. Rule. Of the Moon, you will convert the True Distance from the Vertex into the Visible by first subtracting the Refraction [and] Parallax, and adding the residue to the True Distance.

III. Rule. Of the Moon, you will convert the Altitude into the True by first subtracting the Refraction [and] Parallax, and adding the residue to the Visible Altitude.

IV. Rule. Of the Moon, you will convert the True Altitude into the Visible by first subtracting the Refraction [and] Parallax, and adding the residue to the Visible Altitude.

V. Rule. You will convert the Visible Altitude of the Fixed stars into the True by subtracting the Refraction from the Visible Altitude.

VI. Rule. You will convert the True Altitude of the Fixed stars into the Visible by adding the Refraction to the Visible Altitude.

The contrary must be done for obtaining the Distance of the Fixed stars from the vertex: for the Visible is to be added, and the True subtracted.

VII. Rule. You will convert the Visible Altitude of the other Planets into the True by subtracting the simple Refraction from the Visible Altitude. But if the Refraction be composed of Parallax, and that as in Tycho's [Tycho Brahe's] Solar [Table], subtract the greater Solar Parallax, and subtract the residue from the Visible Altitude; on the contrary, if the Parallax be greater, add this Refraction to it, and subtract the residue from the Visible Altitude.

VIII. Rule. You will convert the True Altitude of the other Planets into the Visible by adding the simple Refraction to the True Altitude. But if the Refraction be composed of Parallax, and that as in Tycho's [Tycho Brahe's] Solar [Table],

subtract the Solar Parallax from the Refraction, and add it to the True Altitude; but when the Parallax exceeds the Refraction, subtract this [Refraction] from the Parallax, and subtract the residue from the True Altitude.

It would be necessary, moreover, to have Tables of Refractions for the True Altitude, since they are wont to be made only for the Visible; and yet, by an artifice similar to that one which I have handed down at Proposition 4, the Refraction agreeing with the True Altitude can be elicited.

Proposition XXXVI

To investigate the Distance of a Planet from the center of the Earth, and hence its Parallax, supposing the altitude of the refractive Air (in the parts of which the semidiameter of the Earth is given) and the given true [place] of the Planet

A Supposition

[Margin: 65]

Let it be supposed here that the Fixed Stars stand so far distant from the Earth that they suffer no perceptible parallax, whether viewed from the center of the Earth or from its surface—and indeed not even from the surface of the refractive Air, since that Air is not raised more than about 50 Italian miles, indeed scarcely 20, above the dictated points. (On these matters see *Almagestum Novum* [Almagestum Novum] Vol. 2, Book 10, Sect. 6, Prob. 51.) Consequently the two straight lines drawn from any Fixed Star—one to the center of the Earth, the other to the surface of the refractive Air—are to be considered perceptibly parallel.

This being granted, in the following figure (which is part of the preceding figure, already set out), let the Sun stand, for example, at G, and the Fixed Star at F, as was said in num. 41. Let the visible incident ray be FGI, and so the two visible objects must lie at the same apparent distance from the vertex, that is, at the same angle VBI, since both are now brought to the Sun G along the straight line AG from the center of the Earth.

Diagram. A refraction construction repeating part of the larger figure from the previous chapter. A roughly horizontal baseline runs from A (lower left) to F (lower right), with intermediate points G and E along it. Above A rises a short vertical sequence of points K, V, B, H, O, I, with a curved arc sweeping from the upper-left points down toward F. The numeral "15" labels the figure at upper right.

- A (lower left): center of the Earth
- F (lower right): position of the Fixed Star
- G (on baseline): position of the Sun
- K, V, B (upper left, vertical): vertex / zenith line points
- H, O, I (upper left): intermediate refraction points on the incident ray
- "15": figure number

These things prepared: since in triangle ABI the refraction of the Air is given, together with the semidiameter of the Earth, the altitude AI, and the parts in which the semidiameter of the Earth AB is given, and since the apparent distance from the vertex VBI is given by observation, the angle ABI then becomes known, and by trigonometry its complement BAI is also found. By the same operation, since the refraction BIK has a known relation to the equal refraction of the Fixed Star, the angle AIK becomes manifest, and from its two right-angle complement we get AIG.

Next, since the observed distance of the visible Sun from the vertex is given at that moment, the true place of the Sun is given from the Astronomical Tables, together with its true declination, and from that, with the time before or after midday and the altitude of the Pole, the true distance of the Sun from the vertex VAG is found by trigonometry. Subtracting this from BAI gives the angle IAG; and in triangle IAG, in which the side AI is also known from the semidiameter of the Earth and the altitude OI, the distance AG—that is, the distance of the Sun from the center of the Earth—does not lie hidden. So if the refraction of the Fixed Star observable by Astronomers from the center of the Earth were the Optical Refraction... But these same Astronomers observe only the simple Astronomical refraction, namely the bare difference between the visible and true altitude of some Fixed Star, recognized through the altitude of the Pole, the declination of the Star, its azimuth, and the data; and in the Fixed Stars this is greater than in the Sun, as is plain from Prop. 15 and 16.

By another method we have no need, since this method supposes the true distance of the Fixed Star from the vertex to be already known, and yet it obtains the same visible distance of the Sun from the vertex; given which, first collect the angle ABI in triangle ABI, as above.

Next: since from the declination of the Sun and its azimuth, or from the time and the altitude of the Pole, the true distance of the Sun from the vertex VAG is given, and likewise the true distance of the Fixed Star VAF (if both are computed), the angle BAI becomes known, and likewise IAF. But since the Parallax of the Fixed

Stars is imperceptible, and the angle AIF is perceptibly nil, then IF and AF lie at the same parallel by the premised supposition; and therefore in triangle AIF the angle AIF, the complement of the known angle IAF to two right angles, and consequently the side AOI, without perceptible error, are given. Therefore in triangle AIG the two angles AIG and IAG are given, and the side AOI, whence the distance AG does not lie hidden. Finally in triangle ABG, since AB, AG, and the angle BAG are known, the parallax AGB becomes known.

[Margin: 66]

Proposition XXXVII

[Margin: 66]

To investigate the Distance of a Planet from the center of the Earth, and hence its Parallax, given the visible and true altitude of the Planet, as well as a Fixed Star which at the same moment, and at the same visible altitude as the Planet has or will have, and given the Altitude of the Air—provided that we first take the multiple refraction in the parts in which the semidiameter of the Earth is known, since not from a single but from a multiple Refraction the rays of the same Star reach the Air before they come to the eye of the observer.

This proposition is set down on account of the opinion that the Air around the Earth is suited for perceptible Refractions, not being of uniform density but of varying density and greater density near the Earth, yet not so much, nor uniformly throughout, except over some short span—for which the following diagram is given.

Diagram. A refraction construction. A horizontal baseline runs from A (lower left) through points C, E, N to F (lower right). At the left a vertical column of points rises from B up through D, P, O, M, V, H. Slanting lines and a sweeping arc connect the upper-left points to F and to the points along the baseline. The numeral "14" labels the figure at right of center.

- A (lower left): center of the Earth
- B, D, P, O, M, V, H (vertical at left): successive surfaces / refraction points of the Air rising toward the vertex
- C, E, N (on baseline): intermediate points
- F (lower right): position of the Fixed Star
- "14": figure number

With the Vertical line AV drawn from the center A of the Earth to the vertex V, let there be described from A the portions of the Earth's circles BOC, and of the Air the last refractive arc DIE, and the first refractive arc HMN—as great as the true distance of the Fixed Star from the Vertex requires, that is, the angle VAF, which is given. Then let the whole perceptible refraction—both of the Planet, suppose the Sun, and of the Fixed Star F—be at the same altitude of the Air, and at the same temper of the Air (as we required, if they are to retain the same distance from the vertex), incident at the same point, and through many intervening refractions of the Air: let the first ray FG, at M, where it first refracts toward the perpendicular AI, at P, where it concurs with the radius incident to the center EG, MK, which would necessarily make it fall toward EG (for if it touched only at the point of non-refraction, then IP would be shorter than DK). These things accomplished:

First, in triangle APG, AG and AI are given, consisting of the semidiameter of the Earth AO, and the altitude of the Air at the last refraction at I; and the distance of the visible Planet, and the angle VBI, the complement of ABI. Investigate therefore by the Trigonometry of Angles the angle BAI, from which subtract the true distance of the Fixed Star from the vertex VAF, and you will have the angle PAF, whose two-right-angle complement is the angle APF; and since the whole semidiameter of the Earth AB is not subtended at F by a perceptible angle, lest there be added an even greater quantity OP—of a thousand-some smaller fraction, scarcely 50 Italian miles, which makes the angle far smaller than 50 Italian miles—the angle augments F, if the angle is small.

Secondly: in triangle APG, if BAI, we subtract the true distance of the Planet from the vertex VAG, the known angle PAG; with which, since AP and APG, and the latter VAF, are assumed, the true distance of the Planet from the center AG is found; and from the difference, which is greater than AK, we investigate the distance of the Planet G; this AG, most close to the truth, with what difference is contemptible, as will appear if only you assume AI, in this manner AP, so great—as great as AK requires; the trouble, however, of this limited measure knows the true distance from the Earth, since it is certain that the difference does not reach the integral semidiameter of the Earth.

Method of observing for Propositions 36 and 37 in the Sun

[Margin: 67]

If an evening observation is made, await the Sun very near to setting, and with the instrument permanently set up, and showing each single second, take the visible altitude of the Sun's center...

[Margin: 68]

and at the same moment let another observe its Azimuth, and let him begin to number the time through the perpendicular oscillations until the moment of the noted altitude is reached, so that through the time of motion acquired by that movement, when subtracted, the time numbered may remain; the time at which the noted altitude of the Sun was observed will then be known. For from the declination of the Sun, agreeing at that moment, and from the known altitude of the Pole, the true distance of the Sun from the vertex for that very moment, when its visible distance from the vertex was taken, becomes known. Then await the following night, and for some of the noted declinations of the Fixed Stars, and to that selected by inspection of the Star-bearing Globe, the same visible altitude which the Sun obtained will be reached, whether in the same or in a different Azimuth; and at once at the same Azimuth take the time numbered as above, or acquire it.

[Margin: cum declinatione, & altitudine Poli visam Fixae distantiam à vertice — i.e. "with the declination, and altitude of the Pole, the visible distance of the Fixed Star from the vertex"] We, together with P. Grimaldi [Grimaldi], for taking the visible altitude of the Stars more subtly, made use of a water-level [libella aquatica], and with threads similarly parallel to the Horizon; and where we used it for taking the altitude of the Pole more exactly, in investigating the Azimuth of the Sun we made use of a thread-triangle set to the horizon at a right angle, expecting some noted Fixed Star at the same vertical plane—but the example may perhaps become clearer if the whole foregoing practice is observed; the highest utility requires it, nor a smaller utility in the calculations to be deduced from it. Moreover, the foregoing observation of the star appearing in the Horizon itself, since the Fixed Stars scarcely appear in it unless elevated above it.

Diagram. A schematic of the observing apparatus drawn horizontally across the page. At the left is a cluster of points labeled H, G, C, I, with O, R, S below and F, A at the foot, joined by short verticals to a long horizontal beam (the trabecula). At the right end is a second cluster M, D, Z (upper), K, S, P, R, N, T, B, L (lower), forming the eyepiece/pinnule assembly. Below the beam at the left a vertical drops to V, E, X, Y. A small auxiliary triangle with points a, g, h, b appears below the right portion. The figure illustrates the beam-and-pinnule (trabecula) instrument described in the adjacent text.

- AB (long horizontal): the beam (*trabecula*), 25 feet long
- H, G, C, I, O, R, S, F (left cluster): the pinnule and thread assembly at the head A
- FGHI, KLMN: the forked supports for stretching the threads
- OY, AC: perpendicular lines through the pinnule cylinder
- M, D, Z, K, P, R, N, T, B, L (right cluster): the eyepiece pinnule assembly
- V, E, X, Y (below left): plumb-line points
- a, g, h, b (auxiliary triangle below right): the thread-triangle for the Star

In the year 1656, October 10, upon the beam AB, 25 feet long, P. Grimaldi [Grimaldi] and I placed it nearly: a metal tube, whose convex lens was AC, & BD, of crystal, the same tube fixed beneath with iron screws, or orthogonally inserted into a red tube, or supported on the beam, so that water could not stand in either tube—continuous; upon the same beam were two forks FGHI, & KLMN, from which the threads could be stretched at once into the altitude of the water infused in the tubes, the crystalline water resting in its own equilibrium. At the head A of the beam was affixed a little cylinder OV, in which the perpendicular line OY ran, in which tube AC, through which the little cylinder of pinnules X could be moved up and down, so that it might stand at once in any position. These things prepared, by hand we frequently filled both tubes AB per both, until the water stood level in O & C, conserving the beam in a horizontal position, whence we knew the Sun to rise: soon, and the rising of the Sun extends us toward the thread QR, & ST, so that it was parallel to the horizon, and at once by its drawing it converges those forks in O, & in P, & is now in equilibrium at rest. Meanwhile the Sun ascended some degrees above the Horizon, & at the same situation, so that it might stand, P. Grimaldi observed the discus through the thread ST cutting the visible Sun bifariously, observing the impressions of the altitudes with the eye and the upper rib of the costume of the pinnules X, in V, collected; & the pinnules moving downward, until its upper edge with the thread ST concurred, beneath the Sun Z, situate at the same point V, in the extreme pinnules, P, in the thread ST, & Z, the center of the Solar discus. I however observed at the same moment by the sign given to me by P. Grimaldi: in triangle SVP, of whose latitude *ab* is the angle perpendicular, & cut at right angles at the horizon, converting toward the Sun thus, with the truth; thread *ab* would coincide in the plane of the horizon at the very narrow Iron Rule, *he*, which since about the center *a* it moves, & the thread *ac* affirmed superimposed at the head of the Iron Rule, the points below; & afterward most accurately we obtained the Azimuth of the Sun through some Fixed Star.

[Margin: The line RK, however, is produced from this V, so that it goes to P. —
Linea RK, inselligitur producta hinc visa, ac vt inde visa ad P.]

[Margin: 69]

But on the following night we awaited until the Lucida of the Aries reached from the center to the Azimuth designated through the thread-triangle *abe*, in which the Sun had stood in the morning, when namely in the same straight line stood the eye *b*, & two threads *ab*, & *ac*, & the center of the Star *g*; at once its distance from the vertex was taken, which is gr. 44. 24. beyond the perceptible distance of refraction. Therefore in the spherical triangle APV, with three known sides, namely AV, the distance of the Lucida from the vertex gr. 44. 24. & its Tycho[nic] [Tycho Brahe] declination boreal, which was then gr. 21. 49. 40. complement AP, gr. 68. 10. 20. & of the altitude of the Pole in our observatory the complement VP, gr. 45. 29. 50. Wherefore through Trigonometry it is examined; from this azimuthal triangle there comes out the azimuthal angle to this Star *g*, & the Sun in that situation remains, observed common AVP, gr. 104. 58. 50.

[Margin: 70]

From our and P. Grimaldi's [Grimaldi] Table constructed for the whole Year, under the altitude of the Sun gr. 4. 6. 13. below which the Sun was observed, it is given for hour 5. 6. 13. before midday on October 11, that is hour 18. 53. 47. after midday on October 10, & the Sun was very near it at gr. 18 ½. the time equated Tycho[nically] [Tycho Brahe] would then be 18.48. & since the moment of the observation in our Solar Tables above is settled, the true place is given gr. 18. 30. ½. & for that the mean Anomaly Sign. 3. gr. 11. 50. 29. but the true Sign. 3. grad. 9. 13. 17. for that place both of the Sun, & of the obliquity of the Ecliptic settled above gr. 23. 30. 20. it follows the declination of the Sun austral gr. 7. 16. 15. Therefore in triangle SVP, VP is given, & as above gr. 45. 29. 50. & PS constant from the quadrant, & the declination of the Sun, namely gr. 97. 16. 15. & the Azimuthal Angle AVP, num. 27. is found gr. 16. 0. whence per the laws of Triangles it is gathered the true distance of the Sun from the vertex VS, gr. 85. 19. 6. but at the visible it was gr. 85. 9. 47. therefore the Refraction of the Sun is Astronomical, & simple, gr. 0. 9. 19.

[Margin: 71]

The following night between the 12 & 13 of October, with the same serenity persevering, & with the temper of the air which had been on the preceding days, with the same instrument, of which num. 68, the little torches moved away, into the eyes however not running, but illustrating them, was awaited Aldebaran,

until it came to the same visible altitude in which the Sun had been, the Sun obscured by the Pinnule in its pristine situation at V, & a little after the trabecula was converted toward this altitude opposed in the same equal water; at once Aldebaran Z, was in a straight line VP, onto, whence it is Perpendicular oscillating numbered the time, until the distance of the Lucida of the Aries from the vertex was caught, which was gr. 54. very precise, & the time was found between the lapse of a minute...

of minutes 6'. 45". of which to the Equator are owed gr. 1. 41'. 15". which are to be referred. Meanwhile in triangle APV, with VP given, & as above gr. 45. 29. 50. & VA, gr. 54. & the complement of the declination of the Lucida of Aries, as above gr. 68. 10. 20. it gathers the angle to the Pole of the World APV, gr. 60. 23. 13". but the difference of right Ascension of the Lucida of Aries, & Aldebaran Tyconic [Tycho Brahe] gr. 37. 3. 44". and to this time, which added to the gr. 60. 23. 13". & the interval of time gives gr. 1. 41'. 15". makes for the distance of Aldebaran from the vertex example gr. 74. 13. 38". & VP, gr. 45. 29. 50". it gathers the True Aldebaran distance from the Vertex VS, gr. 85. 19. 22". for which moment, when found at the distance from the vertex seen so great, as much as of the Sun namely gr. 85. 9. 47". therefore of these the difference, that is the Refraction Astronomical simple of Aldebaran was gr. 9. 35". which is Tyconic [Tycho Brahe] gr. 10. 10".

[Margin: Refraction of Aldebaran — *Refractio Aldebarae.*]

[Margin: 72]

Let us now return to Figure 13, set out above, in which is given of the Sun the distance from the Vertex visible & true observed VBI, gr. 85. 9. 47". & its complement to two right angles ABI, gr. 94. 50. 13". & since the semidiameter of the Earth is taken for now AB, of German miles 1000. & AI, for the summit 1010. as much, however, as no one of expert Astronomers admitted, with *Almagestum Novum* [Almagestum Novum] Book 10, Almag. Nov. sect. 6. Prob. 51. we shall show the altitude of the refractive air not to be greater than 50 Italic miles, & about 20. to consist of this German 5. Nor is it needful that this be very true, & a small proportion between AB & AI; this being given, by Trigonometry we investigate the angle BAI, grad. 7. 30. 8". which subtracted from the distance of the Sun from the vertex gr. 85. 19. 6". leaves the angle IAG, gr. 77. 48. 58". the same with BAI, subtracted the true distance of Aldebaran, which num. 29. having got we were gr. 85. 19. 22". leaves IAF gr. 77. 49. 14". & therefore the angle FGS, will be 16". Since however from the very great distance of the Fixed Stars from the Earth the assumption of their parallax AFI, not to mention AFB, is imperceptible, & therefore AF, & AI, & at the same parallax, the parallax AGI

follows, in this final place 16". but in geometric rigor the third part of a scruple very small was the parallax of the Fixed Stars AFI, & even still smaller the parallax AGB, by example terrestrial estimated.

[Margin: 73]

But since it is certain there is not so great an altitude of the Air or first, until the last refractive, assumed the same AI, of German miles 1010. of which AB; 1000. for from this angle BAI, gr. 4. 30. 13". it follows the angle BAI, gr. 4. 30. 13". which subtracted as above grad. 85. 19. 6". & VAF, gr. 80. 45. 14". it relinquishes the angle VAG, grad. 80. 45. 1". & IAF, grad. 80. 45. 34". Wherefore the difference of these GAF, will be as above 16". & since only the Sun's parallax AG, by physical rectilinear parallelism AF, & IF, supposing, will rather be the same external angle AGI, so much greater than GAF, by however much you suppose in the third or fourth scruple of the parallax of the Fixed Stars AFI, & since it always happens, however much, you assume AI, if the Sun's Parallax within a second we neglect Thirds we choose, the distance of the Sun from the surface AG, nothing however will vary, with how much variation of the angle laterals AI, then of the variation of the angle IAG, & AIG. main in itself caused IAG, is gr. 4. 30. 13". in the second case IAG, is gr. 80. 45. 18". & IAF grad. 80. 45. 34". then AIF, or AIG gr. 99. 14. 26". from which it follows the interval of the Sun AG, of German miles 1259487. of which AI, is 1010. Finally if we assume AI, of German miles 1005. of which AB. for 1000. & the angle, ut supra ABI, grad. 4. 53. 13". varies, easily from the preceding method BAI, grad. 2. 38. 49. 24". so IAG, grad. 80. 40. 16". 36". & IAF gr. 12. 40. 32". 16". & AIG grad. 97. 19. 48. 24". always; AGI, 16". & AG, miles 11245. of which AI, 1005. of which AB, is one. Whence in triangle ABC, with AB, 1000. & AG, ut supra, & BAG gr. 85. 19. 6".

[Margin: 74]

it follows the parallax AGB, 15. 59". & horizontal 16". Hitherto we have hunted the parallax of the Sun together with the difference of it from the Earth distant, supposing the altitude of the refractive air, & at the same time the Refraction simply both of the Sun, & of the Fixed Star, but if we hunt only the parallax of the Sun, but of another Planet we inquire, the expedition will be in practice and below.

Proposition XXXVIII

[Margin: 74]

Given a Planet, & some Fixed Star obtaining the same Visible altitude, although unknown, & at the same diverse time obtaining it, the True altitude, for some moment of time, which they singly have at equal altitude visible; the same; the density of the refractive air remaining, there is straightway given the Parallax of the Planet, although the Parallax is imperceptible or unobservable, or observable, & given the data.

For the difference of the True altitudes of the Planet, & of the Fixed Star itself is the Parallax, which we inquire, if the Fixed Stars' parallax is indubitably nil; but at the same time it is supposed that, if at the same time it is observed, & its aggregate parallax, of the same difference, it constitutes the Parallax of the Planet, besides another calculus Geometric. Which that it become clear to the soul of the Reader, examine the figure 13. in which let be feigned to be in the same plane Vertical of the Planet G, & of the Fixed Star F, when both obtain the same Visible from the vertex distance VBI, & along the laws Anaclasticas; & in the same incident line FGI, there will be of the true distances from the Vertex differing the angle GAF, or therefore the parallax of the Fixed Star AFI, & the same surface, of the surface estimated, supposing imperceptible, & then the true angle AF, & IF, sole at the same surface AGI, in this very place 16". & since however the semidiameter of the Earth OI, ex dictis lib. 10. Almag. Nov. sect. 6. Probl. 51. not at the very greater miles 40. but at the very thousandth part of the whole AB, & Distance AG, & BG, & SG, are at the same equals; therefore the excess at the angle AGI, & therefore vel imperceptible, vel by example, vel more notable for AGB.

[Margin: 75]

We suppose however the observation of the Planet, & the Fixed Star to be made at the same night, or if the Planet at the Sun, made within at the same Distance of the refraction; & since that condition is judged not in itself in things estimated. Nor obstructs in any practice; that the Planet, when observed, has been in different vertical at the eo, in which it was; or shall be the Fixed Star, when the same, or perceptibly visible at the same altitude obtains, vel observed; & therefore it is, as if it were transferred to the same Vertical; but in this, two we suppose nil Astronomical, & Anaclastica to be denied known. First it is that all the Fixed Stars created are by God, vel credible at the same Vertical, & at the same center of terrestrial radiance; & at the same vertical at the points superficial of the air refractive at some equal, inclination at perpendicular; having at the same refraction posited at the same surface of the air density, & the same not only visible, but also true distance at the vertex. For in the foregoing num. 13. figure, if so you conceive the Triangle AFG, double to be, & one in one, the other in another

truly Vertical; if at the same Distance AF, on both; equal it is, & at the point I, equally high from the Horizon, equally as the arc EI, namely the angle IAE, & the radius FI, incident inclined at perpendicular AH, equally angle HIF, would have impressed at the same angle, the same at the truly; angle AIF, the complements of angles HIF, & at two right angles will be equal among themselves, & likewise; IAF, twins among themselves, & therefore the Angle F, among themselves, & not only F, the twins among themselves, but at the same sphere of the air at the terrestrial semidiameters AI, among themselves; therefore added an equal angle VAI, evades the distance from the vertex VAF, on both, equal. **Secondly we suppose**

at the moment at which some planet has been observed — as the Sun was in our example — that it could either be found in the same vertical circle (or one created by God in some way to be a fixed star), and direct from the center of the Earth, where it is sought, and shine to the same point; such a star would then have the same refraction and the same observed distance from the vertex. And since it would shine to a point higher than itself, namely to that point in whose vertical the other fixed star lies — when it would obtain a visible distance from the center of the Earth equal to the visible distance of the planet from the vertex — it would have an equal visible distance, and therefore would exhibit an equal parallax of the planet. For this reason, even if the two observations were not made at the same instant formally, they were nonetheless made equivalently, and so as if they had been made at the same instant.

Method of Observing for Proposition 38, in the Case of the Sun

[Margin: 76]

First, so that the error in the Sun's declination may be as small as possible, make the observation either at the solstice or as near to it as possible — because around the solstice the Sun's declination changes imperceptibly — taking the Sun's altitude with the kind of instrument we described above, or another, and observing the Sun's visible altitude. Note its astronomical (not optical) situation as to quantity; and let an assistant direct the cross-thread of the triangle of threads toward the center of the Sun, and hold it fixed there immovably. **Second**, on the night following, [observe] the chosen fixed star — a star whose transit falls at an altitude at least 20 or 25 degrees high, so that it reaches the same vertical above the refraction still sensible at that altitude — and at the very moment it arrives at the vertical plane marked out by the two threads of the same triangle, [measure] how great its greatest distance from the vertex can be obtained, with

all the subtlety attainable; for that is the complement of its declination. Then by trigonometry the azimuth in which the Sun stood will be obtained: this is the **common azimuth** — the one shared vertical, the sightline linking the Sun and the star — in which the Sun was. Therefore, since on the solstitial days the declination can be regarded as scarcely changing, and since by the clocks you will know the time when the Sun was observed, you have its declination free of error as to position; and from the complement of the declination just stated, together with the distance of the Pole from the vertex, trigonometry will yield the Sun's true distance from the vertex sought for that moment — namely the distance the Sun had before sunset, when it was observed. And so let the assistant observe at that prior moment, fixing the triangle of threads at the Sun's very center, but always holding it motionless, for the azimuth to be sought. **Third**, on the same night, the air remaining at the same temperature, let one wait until some fixed star — by inspection of the chosen globe and of its declination — comes to an altitude beyond sensible refraction, that is, at 20 or 25 degrees, and at the moment it reaches that plane [marked by the threads], let the most exquisite measurement of its distance from the vertex be taken. For from that, and from its declination — or from the complement of the declination, the distance of the Pole from the vertex being obtained — you obtain the common azimuth in which the fixed star itself stood; and, taking the declination of the prior fixed star as equal in altitude, with the adjacent side and the distance of the Pole from the vertex obtained, you will have the Sun's true distance from the vertex. This **ought to be greater** — the Sun's true zenith distance must come out greater than the apparent comparison derived from the unrefracted star, because refraction makes the Sun appear higher (with a smaller apparent zenith distance) by Proposition 9 [?] — and this difference will be the solar refraction to be applied as a correction (the source here prints "Parallax Solis corrigenda," "the Sun's parallax to be corrected," where the logic of the chapter requires *Refractio*, "refraction" — see anomaly), somewhat as said above.

[Margin: 77]

Proposition 39

Given the astronomical refraction of fixed stars lacking sensible parallax, the observed altitude of those same stars being agreed, and of the Sun, or of any planet, at the same observed altitude, and in the same density of air, azimuth, or declination, and at the same moment of time, together with the altitude of the Pole: the simple astronomical parallax of the Sun, or of that planet, is given — provided its simple astronomical refraction [is also given].

For the refraction having been subtracted from the observed altitude of the fixed stars...

their true altitude is had; and from the remaining data of the other planets, the true distance of the same from the vertex corresponding to the observed [distance] is had; and so the simple astronomical refraction, and the true altitude [are had]: finally, the difference of the true altitudes of the planet and of the fixed star is the parallax of the planet, by the preceding Proposition 38 — provided the true altitude of the planet comes out greater than that of the fixed star. From this it follows that, if at sunset, or at sunrise, the physical azimuth of the Sun, and above all the azimuth of the fixed stars, were observed, that observation could not have been made unless the difference of its distance from the vertex were known; and supposing the horizontal refraction, or the parallax, if the horizontal refraction of the fixed star is supposed to be that which suits it, the horizontal refraction of the fixed star would be that, which suits it — which is agreed upon in the very sensible point itself. The only doubt that can remain is whether the density of air was the same in place and time as that under which the refraction of the fixed stars was observed, and when the Sun is observed.

Probable Conclusions Concerning the Parallax of the Sun, for the Time Being

[Margin: 78]

First Conclusion. Through the preceding practice the parallax cannot be known with certainty, with that subtlety which more recent astronomy requires — so much so that this conclusion now requires the exclusion of an error of the very fewest seconds. For now indeed, from the lunar dichotomies, and the parallaxes of Mars, and others, by arguments we have come to know that the horizontal parallax of the Sun is much less than one whole minute. Although an instrument can be made so large, and the semidiameter of the divided circle could exhibit individual seconds — as the more learned teach (chapter 1, number 3 [?]) — yet so great are the errors in the division, and in the subdivision of the degree and minute, and in the placement, and in the use of the dioptra, and so on, and in the collimation toward the center of the star, and in the placement of the instrument itself, [even with] the most correct rectification and horizon-setting, that one can err by several seconds, or at the very least by single seconds in individual observations. Moreover, the said practice requires six points of astronomical elementary data, namely: the altitude of the Pole, the declination of the Sun, the observed distance of the same, the azimuth, or the observed declination, or the

moment of time of observation, and of these two the observed declination, or the observed azimuth; and so all things computed, however subtle the observation, can be collected from the errors, or from the errorlets, by more than 1 minute, more than 5 seconds. Furthermore, from the said data the same density of air is required, when the refraction of the fixed stars is observed at the altitude at which the Sun was observed, and so the fixed star with the Sun, neither the fixed star with the Sun, [whether] at once or just before, or just after, can be glimpsed; but by day, here by night perhaps it is visible; always the night is ambiguous, [as to] whether the air was denser by night than by day. Hence with such uncertainty it will be confirmed [in what is] to be said in the chapter following on the refractions of the Sun, and of the fixed stars observed by [Tycho Brahe], number 8.

[Margin: 79]

Second Conclusion. Since, however, through the preceding practices we have always found the horizontal parallax of the Sun less than 30 seconds, and have apprehended the same through several dichotomies, we therefore decided that it is not greater; and, as the more probable position, we have adopted and still hold it to be $19''\ 8'''$ (nineteen seconds, eight thirds) at Perigee, and $27''\ 8'''$ (twenty-seven seconds, eight thirds) at Apogee. (The source prints these as "19". 8"." and "27". 8".", with a double-prime on each figure; the leading double-prime on 19/27 is a compositor's reuse of the " sort for the thirds order — both values fall under the "less than 30"" ceiling the same sentence asserts. Note, however, that the apogee value ($27''$) is printed *larger* than the perigee value ($19''$), which is physically backwards — the Sun's horizontal parallax should be larger at perigee, when it is nearer; the Perigee/Apogee labels appear transposed. See anomaly.) We incline rather to the opinion of those who think it even smaller; but we do not acquiesce in those who contend that it is altogether insensible, so that the system of the Sun and its planets, together with the fixed stars, could be raised to infinity around it; but see the end of Chapter 13.

[Margin: 80]

Third Conclusion. However great the parallax of the Sun may be (at the same observed distance from the vertex, and of the fixed star, the same, the air being constituted), so much greater is the astronomical refraction of the fixed stars than the astronomical and simple refraction of the Sun, as is the parallax of the Sun. This is clear from Propositions 16, 38, and 39 together.

CAPVT XV.

On the Refractions of the Sun [De Refractionibus Solis]

[Margin: 1]

[Tycho Brahe] taught us the manner of observing the refractions of the stars in the preceding chapter, supplying what he himself omitted; but I am speaking of non-optical refraction, that is, astronomical and simple, which is the difference between the true and the observed altitude of a star, when the observed is greater than the true; and then the composite [refraction], out of this simple [refraction] and the parallax. Now indeed Tycho, in Tome I, *Progymnasmata* page 79, exhibits a Table of Solar Refractions from his own observation in the Danish Horizon; yet he confesses that these same [refractions] vary there in a less serene sky, and in different horizons, on account of the different temper of the air; and on page 94 [?] he affirms that the difference between them can be true; and on page 95, that the Solar refractions are observed on the day of the solstice, when the declination varies insensibly, and he exhorts that the visible altitude of the Sun be converted into the true, by the subtraction of the integral refraction; and on page 102, by example he teaches [this], and by the addition of the parallaxes. Afterward, on page 124, he exhibits a Table of Lunar Refractions in the circle of altitude, constructed by frequent experiment. Finally, on page 280, he produces a Table of the Refractions of the Fixed stars in the circle of altitude from his own observation, where he adds these words worthy to be noted, for the things to be said below: *"If, however, that mathematician [Rothmann] of Landgrave [William IV] in his Cassel [observations] should be shown to hold rightly, the refractions which he admits there for fixed stars are nearly double those [admitted] here — concerning which matter [see] in the volume of letters of our collection, [as he] indicates: But I should nonetheless believe that those observations attenuated the refractions of the fixed stars too much by some carelessness of his own. For Rothmann had written, as is had in the Letters of Tycho, page 29, that he had found by himself the refraction of the Fixed stars to be 5' 0" [?] at the altitude of 5° 18', and 2' 1" [?] at the altitude of 9° 42'. But Tycho's [refractions] of the Sun for the most part horizontal, 15', or at most 20', to which Tycho on page 65 responds, that he finds the refractions observed by himself to be nearly double in Denmark, than [those of] Rothmann at Cassel; and this rather [is to be] attributed to the incorrect observations at Cassel, than to the diversity of horizon. Again Rothmann there, page 81, says that the refractions of the Sun near the winter solstice [Bruma] are far greater than at other times of the year. And at last Tycho there, page 159, notes the refractions of Rothmann to be too small, and the twilights too great, [and that]*

these do not agree among themselves; for from the one it follows that the air is rarefied, but from the other that it is more turbid. But it would have been proper to inquire whether the refractions were observed at the same temper of the air, or rather at the same temper of day, [which is] very diverse around the rising of the Sun from that [air] around its setting." So far, summarily, concerning the general foundations of the Tyconic Refractions.

[Margin: 2]

Before we discuss these things, the triple Table of Tyconic Refractions, taken from the said places, must be set before our eyes, which stands as follows.

The right column of folio 57 carries the refraction table proper. Transcribed below as a pipe-table.

Refractions in the Danish Air, deduced by [Tycho Brahe] from his own observations.

Visible Altitude (Gr.)	Sun Refrac. ' "	Sun Refrac. ' "	Moon Refrac. ' "	Moon Refrac. ' "	Fixed- Star Refrac. ' "	Fixed- Star Refrac. ' "
0	34	0	33	0	30	0
1	26	0	25	0	21	30
2	20	0	20	0	15	30
3	17	0	17	0	12	30
4	15	30	15	0	11	0
5	14	0	14	0	10	0
6	13	30	13	50	9	0
7	12	45	12	45	8	15
8	11	15	12	0	6	45
9	10	30	11	0	6	0
10	10	0	10	45	5	30
11	9	30	10	10	5	0
12	9	0	9	35	4	30
13	8	30	9	0	4	0
14	8	0	8	30	3	30
15	7	30	8	0	3	0

Visible Altitude (Gr.)	Sun		Moon		Fixed- Star	
	Refrac. '	"	Refrac. '	"	Refrac. '	"
16	7	0	7	30	2	30
17	6	30	7	0	2	0
18	5	45	6	30	1	0
19	5	0	6	0	0	0
20	4	30	5	30	—	—
21	4	0	5	0	—	—
22	3	30	4	25	—	—
23	3	10	4	0	—	—
24	2	50	3	45	—	—
25	2	30	3	20	—	—
26	2	15	3	0	—	—
27	2	0	2	40	—	—
28	1	45	2	20	—	—
29	1	35	2	0	—	—
30	1	25	1	40	—	—
31	1	15	1	30	—	—
32	1	5	1	20	—	—
33	0	55	1	10	—	—
34	0	45	1	0	—	—
35	0	35	0	50	—	—
36	0	30	0	45	—	—
37	0	25	0	40	—	—
38	0	20	0	35	—	—
39	0	15	0	25	—	—
40	0	10	0	25 [?]	—	—
41	0	9	0	20	—	—
42	0	8	0	15	—	—
43	0	7	0	10	—	—
44	0	6	0	5	—	—

Visible Altitude (Gr.)	Sun Refrac. ' "	Sun Refrac. ' "	Moon Refrac. ' "	Moon Refrac. ' "	Fixed- Star Refrac. ' "	Fixed- Star Refrac. ' "
45	0	5	0	0	—	—

Note on the Fixed-Star column: against altitude 22 the source carries the note "*Cessant hic Refract. Fixati, quia Tycho, vt fatetur pagin. 280. supra quartam viam refractiones ad sensum minores 4' ½ [?] insensibiles censet*" — "The refractions of the fixed stars cease here, because Tycho, as he confesses on page 280, reckons the refractions above the fourth course [i.e. above ~22° visible altitude] sensibly smaller, [and below] 4' ½ [?] insensible." A second marginal note opposite altitude 25–27 reads "*Ex repertis Solarib. minores 4' ½ [?]: Ideoq; ex Solis altitudinibus elicuit Fixarum Refractiones*" — "From the solar [refractions] found smaller [than] 4' ½ [?]: and therefore he elicited the refractions of the fixed stars from the altitudes of the Sun."

Parsing notes: the table has five paired (minutes/seconds) columns under three headings (Sun, Moon, Fixed star). Visible altitude runs 0–45° by single degrees. Several seconds-values in the lower altitudes are faint; the Moon-refraction at 40° (printed "25") breaks the otherwise smooth descent (39°→0'25", 40°→0'25", then 41°→0'20") and is flagged. The Fixed-star column terminates at 19° visible altitude (value 0'0"); cells at 20°+ are blank, consistent with the marginal note that Tycho deems fixed-star refraction insensible above the "fourth course."

[Margin: 3]

Not acquiescing, however, in these just causes, I wrote to Father Albert Curtius [Albert Curtz], to whom — by order of the Emperor — the manuscript of the Tychonic observations was delivered, that he might be the supervisor of their typographical edition, that he might not refuse to transmit to me those observations, by which (inasmuch as they were made in the summer solstice) Tycho had most especially, with great confidence, investigated the Solar Refractions — which he most liberally and most diligently provided, a most humane man, and of me most deserving, perfectly well: And these [observations], to be examined by the Reader by trigonometric calculation, if I have ever freely [erred] through carelessness, in good faith transcribed from his copy, I share.

Observed by [Tycho Brahe] at Uraniborg in the Year 1589, on the 11th day of June, [Old Style].

Measurement	Gr.	'	"
Meridian Altitude of the Sun			
Per quadrantem volubilem (by the revolving quadrant)	57	35	45
Per Chalybeum maiores (by the larger steel [instrument])	57	35	30
— or —			25 [vel]
Per Tychonicum (by the Tychonic [instrument])	57	35	45
Et per alterum (and by another)	57	35	50
Declinatio Solis per Armillas (declination of the Sun by the armillaries)	23	29	50
Subterraneas maiores (the larger underground [armillaries])	23	29	50
<i>Erat satis serenum</i> (the sky was sufficiently serene)			

On the same 11th [day], after noon, the following were observed for the Refraction of the Sun in the summer Solstice:

Declination of Sun by larger Armillaries (Gr. ' ")	Altitude of Sun by revolving Quadrant, or larger Steel [instr.] (Gr. ' ")	Azimuth of Sun from Meridian, in the West (Gr. ' ")
23 29 45 / 23 29 50 (<i>altero pinnac.</i> — by the other sight)	35 2 30 (<i>Volub.</i>)	80 40
23 29 45 / 23 29 40	33 22 30 (<i>Volub.</i>)	83 10
23 29 45 / 23 29 50	30 13 45 (<i>Volub.</i>)	87 50
23 29 45 / 23 29 45	29 13 0 (<i>Volub.</i>)	89 38
23 29 45 (<i>vtroq;</i> — by both)	27 10 30 (<i>Volub.</i>)	92 37
23 29 45 / 23 29 50	20 50 0 (<i>per vtrumq;</i> <i>minim. quadr.</i> — by each, smallest quadrant)	—
23 30 30 / 23 30 0	18 45 0 (<i>Chalib.</i>)	—
23 30 15 / 23 30 0	15 54 0 (<i>Chalib.</i>)	—
23 30 40 / 23 30 20	13 44 30 (<i>Chalib.</i>)	—
23 31 0 / 23 31 50	10 17 0 (<i>Chalib.</i>)	—
23 31 20 / 23 31 0	9 47 0 (<i>Chalib.</i>)	—
23 33 0 / 23 32 0	7 45 0	—
23 33 45 / 23 34 0	7 0 0	—
23 34 15 / 23 34 0	6 30 0	—
23 34 20 / 23 34 0	6 15 0	—
23 34 45 [?] / 23 34 45	5 30 0	—
23 35 40 / 23 36 15	4 30 0	—

(Right-hand continuation of the same 11 June observation, lower visible altitudes:)

Declination / Altitude of Sun (Gr. '")	Visible Altitude (Gr. '")	Note
23 36 30 / 23 35 45	4 5 0	<i>ob nubeculas Horiz. obscur.</i> (on account of little clouds, the horizon was obscured)
23 37 40 / 23 38 0	3 40 0	—
23 38 0 / 23 38 30	3 10 0	—
23 40 0 / 23 39 45	2 45 0	—
23 40 30 / 23 40 10	2 20 0	—
23 41 30 / 23 42 0	1 50 0	<i>per æstimationem</i> (by estimation)
23 42 50	1 30 0	<i>per æstimationem, vnico pinnacid.</i> (by estimation, with a single sight)

[Margin: 23 44] Then the Sun, on account of the Horizon of the observatory, could not be observed, nor could it be raised above the middle of its part beyond the horizon. It was around the horizon of medium thickness of vapors. [i.e.: at altitude 23°44' the Sun, owing to the observatory's local horizon, could no longer be observed and could not be elevated above the middle of its disk above the horizon; the horizon held vapors of medium density.]

On the 12th day of June, in the Morning:

Declination of Sun by Armillaries (Gr. '")	Visible Altitude of Sun (Gr. '")	Azimuth of Sun between rising and meridian (Gr. '")
23 40 30 / 23 40 0	2 43 30	—
23 40 0 (<i>altero nó potuit</i> — by the other [it] could not [be done])	3 17 40	129 8 0
23 37 0 / 23 36 30	4 42 0	126 25 0
23 35 0 / 23 35 10	5 4 0	125 50 0

Declination of Sun by Armillaries (Gr. ' ''")	Visible Altitude of Sun (Gr. ' ''")	Azimuth of Sun between rising and meridian (Gr. ' ''")
23 34 50 / 23 35 0	5 25 0	125 15 0
23 34 0 / 23 32 0	6 54 0	122 32 [0]
23 33 20 / 23 32 50	8 33 30	119 55 0
23 31 40 / 23 32 10	10 4 0	116 20 0
23 31 0 / 23 32 0	11 17 0	115 15 0
23 30 56 / 23 30 56	11 50 0	114 35 0
23 30 45	13 48 0	111 40 0
23 30 30 / 23 30 45	16 27 30	107 45 0
23 29 5 / 23 30 15	19 57 0	102 40 0
23 30 20 / 23 29 50	22 44 0	99 3 0
23 30 30 / 23 30 50	25 36 0	94 35 0
23 30 15 / 23 29 30	32 10 0	84 50 0

Parsing notes: The 11–12 June observation tables present the Sun's declination as paired armillary readings (two sights / two instruments, transcribed here as "first / second"); these tables continue beyond this batch's page boundary. The left-hand 11-June table and the right-hand continuation are part of one descending series of solar altitudes (from ~35° down to ~1°30'); the 12-June morning table is a separate ascending series. Several seconds-values in the cramped gutter-side columns are faint and are flagged [?]; the declination second-readings cluster tightly around 23°29'–23°36' as expected for the solstice. Tables continue (catchword "Eodem" — "On the same [day]" — at foot of folio 58).

Liber I — De Sole (continued)

Caput XV — De Refractionibus Solis (continued)

[Tycho's solstice observations, continued — page 91 / folio 59]

On the same 12 June: meridian altitude of the Sun.

	Method	Gr.	I	II
As yesterday,	By the Chalybs	57	35	30 / or 25

	Method	Gr.	I	II
on 11 June, the weather was sufficiently clear	[steel quadrant]			
	By the Volubilis [revolving instrument]	57	35	45
	By the new Tychonic [instrumen t]	57	36	5
	the old	57	35	50
Declination of the Sun by		23	29	50
the larger armillaries		23	30	0

Parsing notes: the first altitude row shows a corrected reading "30, or 25" in the second-minutes column, transcribed as printed.

On the same 12 June, after noon. (Descending series: declination of the Sun by the armillaries; visible altitude of the Sun by the quadrant; azimuth of the Sun from the meridian toward the west.)

Declination ☉ per Armillaries — Gr.	I	II	Altitude ☉ Visa per Quadrant. — Gr.	I	II	Azimuth ☉ à Meridian ad Occ. — Gr.	I	II
23	29	30	28	1	45	91	5	

(Volu

Declination ☉ per Armillas — Gr.			Altitudo ☉ Visa per Quadrant. — Gr.			Azimuth ☉ à Merid. ad Occ. — Gr.		
	I	II		I	II		I	II
23	29	20						
23	29	30	26	57	10	92	45	
23	29	20						
23	29	30	20	45 (Q. <i>mini</i> <i>m.</i>)				
23	29	20						
23	29	40	20	5 (Q. <i>mini</i> <i>m.</i>)				
23	29	50						
23	30	0	17	0 (Q. <i>mini</i> <i>m.</i>)		"Today the air was clear er than yesterday"		
23	30	10						
23	30	10	15	10	0			
23	30	15	14	0 (Chal <i>yb.</i>)				

Declination ☉ per Armillas — Gr.			Altitudo ☉ Visa per Quadrant. — Gr.			Azimuth ☉ à Merid. ad Occ. — Gr.			
	I	II	I	II	I	II	I	II	
23	30	10							
23	30	15	13	20	0				
23	30	20							
23	30	50	11	40					
23	30	40	11	10					
23	31	20							
23	32	0	9	15					
23	31	20							
23	32	0	8	0 (<i>Q. minim.</i>)					
23	32	30							
23	32	20	6	45					
23	33	0							
23	33	30	6	10					
23	33	40							
23	34	15	5	40					
23	34	50	5	15					
23	34	15							
23	35	10	4	50					
23	35	0							
23	35	50	4	30					

Parsing notes: the marginal notes in the azimuth column ("Today the air was clearer than yesterday") are interspersed comments rather than azimuth values; transcribed in place. The declination column gives paired readings for some altitude entries (the instrument was read twice). The instrument abbreviations — *Volub.* (Volubilis, the revolving instrument), *Q. minim.* (Quadrans minimus, the

smallest quadrant), *Chalyb.* (Chalybs, the steel quadrant) — are reproduced as printed beside their altitudes.

[Riccioli's analysis — right column, page 91]

[Margin: 4] From these data I selected the azimuths of the 12th, and the morning ones, because at that time the air was clearer, and because the solstice had occurred shortly after the middle of the preceding night. For this reason the morning declination of the Sun differed scarcely perceptibly from our maximum declination of $23^{\circ}30'20''$. I therefore chose the altitude of the pole at Uraniborg as $55^{\circ}54'40''$, the value I determined in my *Geographia Reformata*, Book 7, Chapter 21 (Proposition 23, Figure, and Triangle VPL). The complement of the polar altitude PVL is thus $34^{\circ}5'20''$, and the complement of the maximum declination LVP is $66^{\circ}29'40''$. From these, together with the azimuths, I derived trigonometrically the true distance of the Sun from the zenith, VL; and by comparing it with the observed (visible) distance, I obtained the refraction. But this often fails, because the computed true distance frequently comes out smaller than the visible distance, as can be seen in the following table.

[Margin: Tabula Cassini, etc.]

Azim uth		Dista ntia		Dista ntia		Refra ctio		
meri diona lis		⊙ à Verti ce		⊙ à Verti ce		⊙ simpl ex —		
Gr.	— Gr.	I	II	— Gr.	I	II	I	II
50 52	86	42	20	86	50	20	8	0
53 35	85	18	0	85	20	45	2	45
54 10	84	56	0	85	1	0	5	0
57 28	83	6	0	83	5	30	•	10
60 5	81	26	30	81	30	22	3	52
63 40	79	56	0	79	14	54		
64 35	78	43	0	78	39	0		
65 25	78	10	0	78	6	30		
68 20	76	12	0	76	10	33		

Azimuth		Distantia		Distantia		Refraction	
meridionalis complementi		Distantia		Distantia		Refraction	
lis		⊙ à		⊙ à		ctio	
complementi —		Vertice		Vertice		⊙ simpl	
Gr.		Visa		Vera		ex —	
— Gr.	I	II	— Gr.	I	II	I	II
72 15	73	32	30	73	30	37	
77 20	70	3	0	69	59	30	
80 57	67	16	0	67	10	10	
85 25	64	24	0	64	21	35	

Parsing notes: the "Azimuth meridionalis complementi" column gives degrees and minutes paired in a single cell as printed. Several refraction-column cells are blank in the source (the computed true distance exceeded the visible distance, so no simple refraction could be entered); the fourth row's whole-degree cell shows a bullet/dot rather than a digit, transcribed as "•". See numerical impossibles below: row 6 (azimuth 63°40') shows a true distance (79°14'54") that breaks the smooth descending progression of its column.

From this it is apparent how unreliable this method by azimuths is, unless at the very same instant in which the center of the star reaches the vertical plane of the determined azimuth, the star's distance from the zenith is taken, with the instrument divided and positioned exactly. For it is more credible that the discrepancy arose from a fault in the observation or from an interval of delay that elapsed — though it is now neglected, as if not perceptibly obstructive — or from the trigonometric calculation, or from a sudden change in the air, or from a false polar altitude or maximum declination of the Sun, or from a scribe's errors in recording the figures. Perhaps several other observations of the many years that Tycho indicates in Tome 1 of the *Progymnasmata*, p. 79, will come to light, from which a fuller examination may be instituted.

[Margin: 5] Don Giovanni Domenico Cassini [Cassini] communicated to me the above-mentioned observations, having selected those of 12 June (the morning ones taken with the Chalybs quadrant), together with the declinations of each set of armillaries, and from them he collected the refractions written below — in each case smaller than those in the Tyconic refraction table. This agrees not

only with Rothmann [Rothmann] but also with Don Vincenzo Muto [Vincenzo Mutio], who observed in Hesse; for the latter observed much smaller refractions in Majorca than Tycho exhibits in his table.

[Cassini's refraction table — page 92 / folio 60]

Anno 1589, Iunij die 12, ex D. Cassini calculis. (In the year 1589, on 12 June, from Don Cassini's calculations.)

Altit. ☉ obser vata — Gr.	Refra ctio ex prior i decli natio ne Armil lari		Refra ctio ex poste riori Decl n. —		Refra ction um differ entia		
	I	II	— I	II	— I	II	
18	45		0	56	0	19	
15	54		0	37	1	7	30
13	44½		1	7	0	41	30
9	47		3	0	2	35	25
7	45		3	55	1	21	34
4	48		5	6	4	48	18
6	30		5	24	5	6	18
6	15		5	30	5	6	24
5	30		5	42	5	30	12
4	50		6	0	5	48	12
4	30		8	6	7	12	54
4	9		9	11	9	55	44
3	45		9	55	10	31	36
2	26		12	6	11	54	12
1	50		12	55	12	36	19
1	50		14	9	14	42	33

Altit. ☉ obser vata — Gr.	Refra ctio ex prior i decli natio ne Armil lari		Refra ctio ex poste riori Decl n. —		Refra ction um differ entia	
	I	II	I	II	I	II
1	30		15	42		
0	0		17	15		

Parsing notes: the table has four field-groups — observed solar altitude; refraction from the prior armillary declination; refraction from the later declination; and the difference of the refractions. The second-minutes column of the observed altitude is mostly blank (whole minutes only); the fraction "44½" is printed in row 3. Several lower rows leave the "posterior declination" and "difference" cells blank. See numerical impossibles below: row 14 (altitude 2°26') and several adjacent rows do not maintain a strictly smooth monotone increase in the refraction columns.

[Margin: Contra Gassendus, etc.] Against this, Pierre Gassendi [Gassendi], at the close of the year 1632 and the beginning of 1633, having undertaken at Digne an investigation of the winter refractions, set it out in his *Commentaries on Celestial Matters* contained in Tome 4 of his Works — a specimen of which is in the small table here, and whose use is great parallax [*usus est Parallaxi multa magna* — i.e. the use of these is in matters of large parallax], and therefore the refractions of this kind are smaller.

Altit. ☉ Visa — Gr.	I	Refractio — I	II
22	16	7	6
27	22	9	0
30	28	3	0
35	11	1	0
40	9	0	0

Altit. ☉ Visa —

Gr.	I	Refractio — I	II
42	48		30

Parsing notes: the refraction values in this small table are erratic (e.g. $22^{\circ}16' \rightarrow 7'6''$, but $30^{\circ}28' \rightarrow 3'0''$ then $35^{\circ}11' \rightarrow 1'0''$), reflecting Gassendi's winter measurements as Riccioli reproduces them; transcribed as printed. See numerical impossibles below.

[Riccioli on Kepler and refraction theory — page 92, lower]

[Margin: 6] Kepler [Kepler], following the precept of the *Rudolphine Tables*, relates that he had observed nearly the same refractions in Bohemia as in Denmark; and he adds that the diversity of refractions can arise from different times — for at full moons, and on a day with abundant light, the air is rarefied for the most part, whereas at new moons, and in the depth of night, with the sky serene and clear, [it is denser]. Kepler, then (in Tome 1 of the *Progymnasmata*, p. 280), acknowledged that the lunar refractions ought to be corrected to make them larger; yet the solar ones he exhibits as larger in the same horizon on account of the excessive solar parallax added to the simple refraction. And nevertheless Kepler says the same thing in the *Astronomia Optica*, p. 123. Rothmann, from the secants of the Tyconic solar refractions, employs a minute of parallax for each [*utitur parallaxi minutorum 5'* — uses a parallax of 5 minutes]. He reformed Tycho's table at the end of Book X of the *Almagestum Novum*, prefacing it with many remarks worthy of note and with problems, both theorems concerning refractions and a calculation at the end of the same book. We added our own tables of refractions for the Sun, Moon, and Fixed stars from the solstice and equinox observations.

I confess, nonetheless, that I once acknowledged together with us nearly to consent in many points; afterward, however, having gained greater constancy both in his observations and in ours, I recognized how slippery this matter is — whether through the air's varying density around the Earth, arising not only from the ordinary causes of the year and the temperaments of the days (since the matutinal and vespertine refractions are greater than the equinoctial, and these in turn greater than the hibernal refractions, and the morning and evening ones greater because the air is then not parched by daytime heat but rather, beyond the ordinary, both at full moons and at the other lunar phases [is denser]).

[Margin: 7] *First, on the refractive altitude of the air* — how great it is, and whether it is perpetually the same in the same horizon — concerning which we

said a little in *Almagestum Novum*, sect. 1, lib. 10, at Problem 43. *Second*, on the shape of that same air, whether it is spherical or rather convex, and hence apt for varying the refractions along an elliptical [path] or otherwise. *Third*, whether the density of the more humid air conduces to augmenting the refractions more than the colder air, and whether on rainy nights, the sky being clear, [it is] denser than on less clear but more tepid nights. *Fourth*, whether the density of the refractive air is uniform or non-uniform and multiplex, causing refractions at the same moment. For it can happen that, although the individual refractions are smaller in less dense air than in very dense air, nevertheless because of the multitude of them arising from the non-uniformity of density, the rays that reach our eyes are refracted higher than we suppose. And so it is certain, or at least probable, that on the days when both we and Tycho and others recorded so great an inconstancy of refraction in their observations — apart from what could have been due to a fault of the observer or of the instruments — we obtained a greater refraction at one time, when we were expecting a smaller one.

For example, in the year 1656, on 19 August, when through a great level [*libella*] we had observed the Sun's vespertine altitude as $8^{\circ}23'16''$, from the time of meridian — 6 hours $23'47''$ — we derived the true distance as $8^{\circ}38'29''$. Hence the simple refraction was $15'3''$. But in the same year, on 11 October, in the morning, when from a double cause — that is, of the matutinal and autumnal seasons — a greater refraction would seem to be in prospect, nevertheless a smaller one was found, since the observed distance of the Sun from our zenith was $8^{\circ}45'47''$, and by the azimuth of the Sun verified against Lucida Arietis [α Arietis], the true distance of the Sun was found to be $8^{\circ}19'5''$; and therefore the refraction was $9'18''$. And so likewise on other days and at other times.

[Margin: 8] It is therefore best to abstain as much as possible from observations at the horizon, or those very near the horizon — or at least one still needs, in the same horizon, very exact observations of altitudes for an astronomy. For if there were none at all, the astronomical refraction tables of nearly all astronomers, ours and others', and especially Tycho's, would be useless in this kind of observation of many years, which he indicates were made [in] Tome 1 of the *Progymnasmata*, pp. 79 and 280. By the double method we use, *first*, in selecting the Tychonic refractions of the Fixed stars, and by subtracting the solar parallax, each person reckons the refraction to be as great as he would judge from Propositions 15 and 38. We there show, in equal visible altitude, the rest being equal, that the astronomical refraction of that star is greater, because the star's parallax is greater [than] from the Earth, and hence greater toward the Earth — inasmuch as the parallax of its own star is greater, [whereas] the Fixed stars lack

a sensible parallax, just as the Fixed stars [are] received [as being so far] removed from astronomers. But because Tycho, p. 280, indicates that from certain observations he had noticed the refractions of the Fixed stars to be about $4\frac{1}{2}'$ smaller than the solar ones, he therefore elicits the table of the Fixed stars from the solar one, subtracting $4\frac{1}{2}'$. Therefore by the surer method we elicit the Tychonic refractions of the Fixed stars from the solar ones, but corrected by subtracting the Tychonic parallaxes — in the middle distance from the Earth — and then by the simple refractions of the Sun, adding the solar parallax, [drawn] from the Tychonic [values], in order that we may have the truer refractions of the Fixed stars. We use our own solar parallax for the Sun; but for the Moon the astronomical refractions are stated to be somewhat smaller than the solar ones. Let the optical refractions be as in Propositions 14, 15, 16, etc.; for so it will appear that the refractions in clear and serene air cease around 30° of altitude, which is the middle opinion between Tycho and Rothmann. For Tycho, in the epistle on p. 108, and Tome 1 of the *Progymnasmata*, p. 91, judged that vapors around the horizon, which make the air thicker, are the chief cause of refraction; [these vapors] render the air denser, but not a proper and natural diversity between our air and the aether; and therefore [the refraction] ceases around 45° of [continued on next page]

altitude. Rothmann, however, conceded that it ceases around 20° , which Tycho granted for the Fixed stars. When, then, neither the air is so serene nor so still, there will be an inconstancy of refractions; no fixed law applies. And these things proceed to better [understanding]. Yet all the summer refractions are found to be smaller, and the winter ones larger, and on the same day the morning ones greater than the evening ones. See, therefore, the refractions [in] our tables.

[Margin: 9] After the foregoing, I found in the celebrated *Ephemerides* of Cornelius Malvasia [Marchese Cornelio Malvasia] — namely in the proem, fols. 155, 172, 173, and 186 — the new doctrine of refractions of Don Giovanni Domenico Cassini, who asserts from experience, certain in all transparent objects he has examined (both solid and liquid), that the refractions of the stars proceed by the same law of variety in different inclinations, although diverse in diverse bodies in the measure of [their] density; and from certain observations he derived, according to that law, a distinct table; and these he separated out into a horizontal solar parallax, the rest being refractions; and the visible solar parallax of horizontal vision he reduced to the first minutes, and to its refractions; and he corrected the polar altitude, even from the circumpolar stars formerly taken, and from certain solstitial observations he similarly corrected, compensating for parallax and refraction, [and] recognized that the same polar altitudes resulted,

and the solstitial ones that proceeded from the circumpolar stars. Hence he did not hesitate to say, fol. 175: "Wherever in a place by those solstitial altitudes I correct, it proceeds from the same elevation of the pole, which the Pole star's altitude furnishes; similarly corrected, it is deduced, the discrepancy never being any greater than in the observations themselves, which inevitably proceed by a discrepancy. For this reason he laid down that his refractions, wherever and at whatever time they are deduced under a clear sky, and from all those stars, the same altitude above the horizon possessing a visible [altitude], agree." *For neither* (so he says, fol. 172) *does any sufficient reason seem to support those who think, on account of the diversity of distances, that in the same altitude the refractions vary.* He asserts, moreover, that the refractions persevere up to the vertex, and finally, fol. 186, affirms: *that the ray of any [body], incident obliquely in the surface of the air at distances from the Earth, descends by refraction along its parallels.* And a little after: *that the altitude of the air is $\frac{6085}{10000}$ of the Earth's semidiameter.* These propositions he proves by no experiment, nor by an established foundation — I believe a proof of them [belongs] to an astronomical work, which he is contemplating; and therefore I have not yet departed from that refractive altitude of the air, of which I treated in lib. 10 of *Almagestum Novum*, sect. 6, at Problems 43 and 51.

[Margin: 10] Furthermore, I am not the only one at Bologna, but [also] Don Vincenzo Muto in Majorca and Rothmann in Hesse and Tycho in Denmark, who detected refractions even up to 45° of altitude; nor are these sensible refractions to be deduced from the Tyconic refractions of the Sun itself, if it is to be shown as above, by subtracting the very solar parallax. For at 14° of visible altitude the Tyconic solar parallax is at perigee 2'50", and the Tyconic solar refraction at the same point 2'50"; therefore at that place the simple refraction of the Sun ought to cease. But whatever may be the case from other observations, with the just cautions meanwhile I cannot — what I most desire — acquiesce, by the advice of friends and most illustrious men who say these things.

[Margin: Primo, etc.] *First*, given that the refractions which we experience in crystal, glass, water, wine, etc., we could distinguish [from] the refractions made in air — not the ray, for example, of the Sun entering glass would first have been refracted at the entry into our denser and thicker air; nevertheless these refractions are not those which astronomy requires, and the optical [refractions] are to be distinguished from the astronomical, as I taught at lib. 10, num. 19 and 20. *Second*, in Propositions 14, 15, 16, etc., we show that in the same altitude, whether visible or true, of stars more remote from the center of the Earth, the rest being equal, the astronomical refractions are greater — this is contrary to the

optical effects of Tycho and others, who confound [these]; for the optical [refractions], at fixed stars, rather than astronomical, assign refractions. *Third*, we show that the simple refractions of the Sun can be obtained without parallax, although these are smaller, as we show at Proposition 25; and therefore we refute Tycho at numbers 21 and 53.

Now indeed Cassini, in all examples, in order to obtain the true altitude of the Sun, adds the visible parallax, and subtracts the residual refraction; and if in his composition the refraction is simple [together with] the parallax, the same cannot be fitted to the Fixed stars, which lack parallax, as the visible parallax was [computed] above, said num. 21.

[Margin: 11] *Fourth*, near the horizon, in the Cassinian table, I do not see that headlong increment of refraction, in due proportion. For example, in his summer table, the refractions stand thus, where the greater is the difference of refraction degree 2 and 1; and the altitude, than degree 1 and 0; with this nevertheless requiring the opposite, the astronomical refractions [being] thus, and likewise in some others in the table — unless an error of the typography.

Alt. — Gr.	Refractio.		Differentia.	
	— I	II	— I	II
2	10	12	4	24
1	0	27	36	6
0	21	4		

Parsing notes: this small Cassinian summer-table excerpt is poorly aligned in the source; the columns (altitude; refraction; difference) overlap. The refraction value "27'36"" at altitude 1° is much larger than at altitude 0° or 2°, which is the inversion Riccioli is criticizing. Transcribed as printed; see numerical impossibles below.

The same equinoctial and winter [table], unless there be an error of the typography.

[Margin: 11] As for the retained solar parallax and the refraction of the stars in the Cassinian [table], and these being applied, in a few cases the same polar elevations result, [arising] not from a prejudged certainty (since we have the case of an insensible refraction of the Fixed stars beyond a degree of altitude), nor from prejudged certainty, [arising] from astronomical refractions of the Fixed stars taken in the polar altitude, the refraction of the Fixed stars exceeding 25° of altitude. And where the polar altitude or solstitial observations are deduced,

[their] refraction is ascribed only to the Sun, whether ordinary, or — as not rarely happens — extraordinary, or by a fault of some particular observation.

Caput XVI — De Constituendis Epochis Motus Solis

(On Establishing the Epochs of the Sun's Motion.)

[Margin: 1] Now in Chapter IV we had the true equinox of the year 1655 of Christ, at Bologna, on 12 September [in] the Gregorian style, at the hour after noon $18^{\text{h}}55'25''$. Hence the midday of 20 [September] [is at] hour $18^{\text{h}}55'25''$. From here, then, to the year 1600 completed in the meridian — the last [day] of December preceding — there are 54 Julian years and 263 days, [reckoned at] hour $18^{\text{h}}55'25''$, or thereabouts. By these [we have], from our tables, the mean motion of the Sun (after whole revolutions) of Signs 8, degrees 19, $4'25''$, by which the radix at the beginning of the year 1600 completed remains, as below:

Sign.	Gr.	I	II
9	10	4	25

[Margin: 2] If to this we add the mean motion of 10 days, which is $9^{\circ}51'23''$, the radix of the year 1600 completed becomes [as below]; but in the style of the old Julian form it will be:

Signa	Gr.	I	II
9	19	55	58

Then, if from this same [value] we subtract the mean motion of Julian years 1600 — that is, our whole 6 Zodiac [revolutions], Sign. 6, degrees 12, $15'47''$ — the radix at the beginning of the years of the epoch of the common [era] of Christ becomes:

Sign.	Gr.	I	II
9	7	40	1

[Margin: 3] In the same way, if we wish to have the radices for the years before Christ, we shall have them sufficiently exact up to the year [1000?] — [continued on next page]

(continued from §3)...within which all the Observations of the Ancients are recorded. As for going still further back, however, one may suspect some error of a few minutes from the year 5000 before Christ; with respect to thirty [minutes] we are not entirely secure, because the motion of the year 5000 turns out for us to

be greater than [it is] in the Rudolphine Tables. But let our own motion stand as the surer foundation, as we plainly demonstrate by examples.

§4. From what was said in Caput IV, no. 9, the Hipparchan equinox in the year 158 before Christ — at Alexandria, September 26, at very nearly the 20th hour after noon, corrected, that is, for the time of refraction — therefore, according to my *Geography Reformed* [*Geographia Reformata*], occurred at Bologna at 18^h27'20", and at Uraniborg [Vraniburgum] at 18^h32'56". At that moment, then, from our own Tables for Bologna and from the Rudolphine Tables for Uraniborg, the Sun's reckoning stands as follows:

From Our					
Tables	Sign.	Gr.	I	II	
Mean	6	1	51	35	
Motion of the Sun					
Anomaly of the Sun	3	24	30	34	
Equation to be subtracted	0	1	48	50	
True place of the Sun	6	0	2	45	
From the					
Rudolphine [Tables]	Sign.	Gr.	I	II	
Mean	6	2	3	51	
Motion of the Sun					
Anomaly of the Sun	3	28	7	22	
Equation to be subtracted	0	1	49	44	
True place of the Sun	6	0	14	47	

The Rudolphine [Tables] therefore differ from my observation by 14'47" in longitude — that is, by 6^h in time — and they differ by 2'45" from the uncorrected [observation], which was made on the meridian at hour 18. But my Tables differ by only 2'45" in [time], which depends solely on the hour's discrepancy of 1.17'. They include no implausible deviation arising either from observation (because of the deflection of the armilla from the plane of the equator, amounting to a minute or 1'17") or from a fault avoided by observation. Hence we detect the error of one whole day in Ptolemy's equinox.

§5. For Ptolemy, in *Almagest* book 3, chapter 8, reports the autumnal equinox as the very foundation upon which, as if upon a foundation, he builds his tables, in these words: "Of the equinoxes observed [by us], one [was found] most exact among all the others, in the autumn of the year 3 of Adrian, in the month Athyr, on day 7 after midnight by the two nearest equal hours." Bullialdus [Ismaël Boulliau], however, in *Astronomia Philolaica* book 3, and Longomontanus in his *Commentary on the Sun*, with good reason judge that not only on account of autumnal refraction did this Ptolemaic observation anticipate his [true] observation by several hours, but also that Ptolemy accommodated his observations to those of Hipparchus, both because the days [the difference of 365 hours] in the Hipparchan cycle could be made commensurable with a whole Lunar Cycle, and because the opinion of the Apogee of the Sun being immobile was rendered surer. As to what may be certain about the autumnal equinoxes of Hipparchus, [whether they came] earlier on account of refraction wearing away [the time], than they themselves [Ptolemy's] turned out, consequently [the question] is whether Ptolemy, in reconciling [his data] with theirs, did come out earlier. Bullialdus, however, shows in the same place from the observations that the horizon increased the northern declination by 7' minutes, and 43" seconds, supposing the parallax to be 2'19". But that this parallax is false from what was said above, and [is] scarcely 10" — therefore the Refractions vary, and [are] diminished by at least 8' minutes, which is of moment. Therefore, if Ptolemy [observed] between meridian and evening, he saw the armilla illuminated equally on both sides, [and] was easily deceived [as to whether it was] at hour 4 or 5, especially if the armilla [was] in its placement [off] by one or another minute, deviated, as I noted above.

Therefore, in this regard, I have reduced both my Tables and the Rudolphine to the meridian of Bologna and of Uraniborg, having corrected the time. For it would have been, if we adhere to Ptolemy's observation not yet corrected, hour 0.27'.20" after noon on September 26; at Uraniborg, hour 0.42'.56". In the year of Christ 132. So stands the computation.

The Sun's reckoning by the same observation, computed for the same moment, both from our Tables and from the Rudolphine:

From Our Tables	Sign.	Gr.	I	II
Mean Motion of the Sun	6	3	3	10
Anomaly of the Sun	3	20	43	19
Equation to be subtracted	0	1	52	2
True place of the Sun	6	1	11	18
From the Rudolphine , however	Sign.	Gr.	I	II
Mean Motion of the Sun	6	3	19	9
Anomaly of the Sun	3	21	39	44
Equation to be subtracted	0	1	55	10
True place of the Sun	6	1	23	59

Since, therefore, both my Tables and the Rudolphine Tables exhibit the Hipparchan equinox in fairly close agreement — but do not exhibit the Ptolemaic [equinox], showing instead the Sun at one degree and more beyond the autumnal section [equinoctial point] — it must be said that either Ptolemy erred in observing the autumnal equinox, or that he was led astray by his false hypotheses (about the apogee being roughly immobile), and the truth came out somewhat differently; or that the equinox actually occurred several hours before

noon on September 24, concerning which matter [see] again in the following Book, Caput V.

§6. It will nevertheless be worth the effort to examine the Tables not against any and every equinox, but against those closest to the equinox — and indeed against those which we know to have been accurately made among the choice ones in the Grand Gnomon of S. Petronio [San Petronio], selected from those [discussed] in Caput VIII, computed at the very moment of [transit across] the meridian. Behold, then, the place of the Sun as then observed, and as computed from our Tables:

Year of Christ	Place of the	Place of the	Deficit / Excess
	Sun Observed	Sun Computed	
	— Sig. Gr. I II	— Gr. I II	— I II
1655 Sept. 22	☐ 29 13 4	29 13 0	d 0 4
1655 Sept. 22	0 24 4	0 11 51	d 0 33
1656 Mart. 19	☐ 29 35 43	29 34 58	d 0 45
1656 Mart. 21	☐ 1 34 30	1 33 56	d 0 34
1656 Mart. 23	3 33 16	3 33 49	e 0 33
1656 Sept. 21	☐ 29 57 22	29 57 37	e 0 15
1656 Sept. 23	0 36 11	0 56 32	e 0 21
1656 Sept. 25	0 16 17	1 15 29	e 0 32
1657 Mart. 28	☐ 8 15 48	8 14 55	d 0 53
1658 Mart. 10	☐ 0 5 38	0 5 41	e 0 3

Parsing notes: This table (the "Locus Solis" comparison from the San Petronio gnomon observations) is faint and ink-degraded; the zodiac sign symbols (☐ Virgo, ☐ Pisces, ☐ Aries) and many of the minute/second figures are hard to resolve. The "Deficit/Excess" column heads each entry with a single letter, "d" (*defectus*, deficit/shortfall) or "e" (*excessus*, excess); several of these letters and adjoining digits are uncertain. Multiple cells flagged as a degraded / — see report.

It is therefore established that our Tables do not differ from these choicest observations by a whole minute; and that if they differ from others by more, the surer reason is on our side, that the fault lies in the observations, since these Tables are bound to the equinoctial observations by a Geometrical and Arithmetical bond cohering with itself, [and] could not [otherwise] exhibit themselves so closely in agreement with the equinoctial observations, and [would] err more grossly in others. But let those skilled in these matters note that

observations made on days other [than the equinoxes], far from the equinoctial [days], commit a greater error in equality [evenness] than those committed at the equinoxes; and to that extent they induce [error] into the place of the Sun, and so the equinoctial [observations] are rather to be weighed against the Lydian-stone [touchstone] of the Tables. The Rudolphine [Tables], however, differ from the aforesaid observations by somewhat more minutes, so that at the first [observation] [the discrepancy is] 4'.51", and so of the rest.

CAPVT XVII.

A New Theory of the Sun's Motions is Set Forth.

§1. Up to now we have been content to approve the Theory of the Sun proposed by Kepler in [terms of] an Ellipse, [and] refined by Bullialdus [Boulliau], Count Pagan [Blaise François Pagan], Seth Ward [Sethus Vuardus], and many others; [a theory] as if among the most recent [authors], [and] as the simplest...

(continued, §1)...the simplest way of representing the Sun's Motion, and [a theory] coherent with the very nature of the Ellipse, whose two Foci, or Umbilics, are equally distant from the center [of the ellipse], rendering the ratio by which the Sun's eccentricity is bisected. Nevertheless, for two reasons, it seems to labor under some imperfection.

§2. The first is that in the Keplerian Ellipse, just as the Earth is assigned to one Focus — the Earth, for whose illumination the Sun is destined chiefly by divine [decree], as is established from Holy Scripture — so to the other Focus there ought to be assigned some [other] body in the World, or [else] the Sun itself ought to be referred to the center of the ellipse in its uniform motion about the other Focus, and to be moved with semi-uniform motion about the center of the ellipse; or some [other] region in the World ought to be determined, whence it might come about, with the parts [of the ellipse] understood, that the Sun should be moved uniformly, or semi-uniformly, or [moved] as the Earth itself [is], in some opinion, moved unequally about the center, but really uniformly about a certain eccentric — so much the more [unequally], by how much greater or less the Sun's Distance prove to be, as established by God.

§3. The other [reason], and by far the greater, is that the appearance of the diurnal motions in the Sun, [appearing to go] from East to West, cannot be reconciled by an Ellipse — indeed not even by a simple eccentric orb — with their own proper [motion] from West to East. Yet the Copernican concern is not [a thing] to fall back upon here, since it makes the motion of the Primum Mobile

pervade the celestial bodies, and is contrary to Holy Scripture, and to physical and physico-mathematical demonstrations [given] in book 9 of the *Almagestum Novum*, sections 4, chapters 19 and 21, and to be discussed in the 11th Appendix. It is certain that the Sun's Motion is not only Annual but also diurnal, from rising in the East to setting in the West; and on the other hand [it is certain that there is] a rest of the Earth; and [that] on the part of the heavens the Planetary fluids really [exist], the distinct falsities of which I have nearly made certain; nor does it seem that these two motions can be better reconciled than [as] a continuous motion, [and] not [as] contrary [motions] one to another, unless [we posit] for the motion of the Planets a spiral motion of all the Planets.

[Margin: The Spiral Motion of the Planets.]

§4. And indeed, if a Fixed Star, by one revolution from the same [point] to the same Meridian, exhibits to us that diurnal motion which we imagine [to be] of the Primum Mobile — [the Star] having no other slow proper motion from West to East — then the Sun alone will be that which is celebrated [as marking] the equinoxes in others [years], and at other points of the Equator [will appear] westward; nor is it necessary to feign another abstract Primum Mobile [removed] from the senses. Rather the [true] Primum Mobile sensible will be the motion of the Sphere of the Fixed Stars.

§5. Which granted, if we conceive the Sun as [moving] around divine Cones, so [arranged] that it describe spirals now wider, now narrower — as much in altitude [depth] as it is described in breadth — at the same moment at which a Fixed Star is borne westward, [the Sun] returns to the same Meridian, [and] returns to the same Meridian, [though] not [exactly], but somewhat more slowly; safe [from objection] will be all the Appearances in the Sun's motion. In the Planets, indeed, when they are seen Stationary, or Retrograde, [or] Direct, the reason of this appearance is easily assigned. For when they return to the same Meridian more slowly than a Fixed Star, they are seen Direct, that is, [moving] toward the East; when they are detained at the East, [so that] at the same moment a Fixed Star returns, which [moment] the Planet [reaches] more sluggishly, they are seen Stationary; when finally, [reaching] the Meridian more swiftly, they cross [it] before a Fixed Star, [moving] toward the West, they are seen Retrograde. But this is nothing to the Sun, which is always slower than the Fixed [Stars], nor [does] the Fixed [Star] return to the same Meridian, and therefore [the Sun] never appears Stationary, let alone Retrograde.

§6. Therefore, since two Theories of the Sun present themselves to us with this difficulty, we have thought out a [Theory] suited to our own measure [*pro nostro modulo*]; but some Foundations [Fundamenta] must be premised.

I. Foundation, concerning the Sun's Apparent Semidiameter and Eccentricity.

§7. The Sun's Apogee apparent semidiameter is 15' minutes and 30" seconds; the Perigee, however, is 16'14"; and at the mean distance, 15'46". Hence, moreover, and from the Equations, the better Eccentricity of the Sun's whole motion is found [to be] 3480, [or] bisected indeed 1740, of such [parts] as the semidiameter, or the orbital Radius of the Sun [is] 100000 [parts], as is clear from what was said in Caput XI and XII.

II. Foundation, concerning the Axis of the Earth's Greatest Shadow.

Diagram. A geometric construction in the right margin illustrating the axis of the Earth's maximum shadow cone, with the Sun's apogee distance and apparent semidiameter. The figure shows a near-vertical line at the top descending to a small circle (the Sun) marked **S**, with lines radiating from it; below, the construction continues to a point **C** at the bottom. The labels visible (several are faint):

- A: upper terminus of the principal vertical axis line
- D, F: two points near the top, flanking S (forming the small upper construction triangle)
- S: the Sun's center (the small circle near top)
- T: a point on the axis below S (the Earth, or its tangent point)
- B: a point along the line near T
- E: a point in the mid-region of the axis
- L: a point on the descending oblique line toward the bottom
- C: the lower terminus / apex of the shadow cone

(2 labels flagged uncertain in positioning — see report.)

§7 (continued). The Sun's Apogee distance being set at 6666 semidiameters of the Earth from the center of the Earth, and the apparent semidiameter being 15'30": the axis of the Earth's shadow is 229 [terrestrial] semidiameters. For let it be, in the present figure, that S [is] the Sun's center, and T the center of the Earth; and that the Sun be seen from T under an angle ATS of 15'30", by the Radius AT touching the Sun in A, and making there a right angle by Euclid's 18th [proposition] of book 3; ST [being] 6666 of the terrestrial semidiameters. By the

rule of right [angled] triangles the angle AS [is found], of the true terrestrial semidiameters 30; therefore [the angle] AS will turn out [to be] the sole semidiameter [angle], the rest [being] FS of [the] terrestrial semidiameters — that is, when, and since ST [is] 6666 semidiameters, the angle FTS is found [to be] 14'56"; and so much is the Angle CD, or parallel to AS, the rest [being] FS of [the] terrestrial semidiameters. Since DF [is] equal to one semidiameter of the Earth BT [which is] taken away, therefore the sole semidiameter remains, and since [the angle] from D [equal] to S of so much, [namely] as much as the [angle] AS, the rest [being] FS of [the] terrestrial semidiameters — 29 of such [parts], and with ST [of] 6666 semidiameters, the angle FTS is found [to be] 14'56". And so much is the Angle FTS of the [terrestrial] semidiameters, [namely] of the linear [parts] CD and TF. Therefore by so great an Angle CD, or by the side BT, comes about one semidiameter of the Earth, that is, the Earth's shadow CT, of the terrestrial semidiameters 229.

III. Foundation, concerning the Moon's Distance and Shadow.

§8. The Sun's Apogee apparent semidiameter being set at 15'30", and the terrestrial distance [being] 6666 semidiameters; and the least [distance], at oppositions, in conjunctions [being] distant 100 [?] from the center of the Earth; the apex of the Lunar Shadow at the Moon's oppositions [is] distant from the center of the Earth 114½ terrestrial semidiameters. For, from our observations, the Moon's Perigee distance at syzygies is of the [terrestrial] semidiameters 58; or as we shall show in the following Book, then indeed, the Moon being set in opposition, the apex of the Moon's Shadow is of the [terrestrial] semidiameters 56½: wherefore the apex [is] as aforesaid [at] the distance of the Earth, [being] distant a semidiameter 114½. From what was said in *Almagest* book 4, Caput 17, the true semidiameter of the Moon's [distance] at perigee is of the [terrestrial] semidiameters 16; of such [parts] the terrestrial semidiameter [is] 100; at apogee [as] above, [it has been] found [to be] of the [terrestrial] semidiameters [such that] the apparent semidiameter of the Sun [is] 30 [terrestrial] semidiameters. Therefore the apparent semidiameter of the Sun's [shadow] exceeds [that] of the Moon by 19[?] [terrestrial semidiameters] — let it be assumed [that] in the preceding figure the Moon's semidiameter [is] BT, the residue SF, [and] the true semidiameter of the Moon [is] 29[?]; and the Moon's perigee distance being added [as] 58, [we have] the Sun's distance at apogee 6666: let ST [be] 6724; the angle FTS [is found, and] thus the axis of the Moon's Shadow TC [is] of the [terrestrial] semidiameters 226: of such [parts] as the apparent semidiameter of the Moon [is] BT, and one [semidiameter], that is, of the terrestrial semidiameters 114½.

IV. Foundation, concerning the Proportion of the Distances of the Earth's Shadow, and the Moon's, with the Sun's Eccentricity.

§9. From the conclusions, and from what was set down in the three preceding foundations, it follows that the maximum distance of the apex of the Earth's Shadow from the center of the Earth [is] as great as the whole Eccentricity of the Sun; and that the Distance of the apex of the Moon's [Shadow], tending in the same direction [*in eandem plagam*] — in which the Earth's Shadow [tends] — but [the] least, the Sun nevertheless [being] at apogee, [is] as great as the whole Eccentricity of the Sun bisected. For the whole Eccentricity of the Sun, from Foundation I, [is] of the distance at the Sun's apogee 10174, and the partition [is] 1480: of such [parts] as the distance at the apogee [is] 10174[?], and 3480 to 6666; the partition [is] 229. [It is] nearest to 229; of which the half is the distance of the apex of the Moon's shadow $114\frac{1}{2}$, just as the whole Eccentricity of the Sun bisected [is] 1740, [which is] half of the whole 3480. Hence furthermore it follows that the Distance of the Sun from the center of the Earth, [its] mean, ought in such a [case] to be in the Hypo-

(continued, §9)...Hypothesis to be of the terrestrial semidiameters 6552, and the least [to be] 6438: which, although they be less than [the values] formerly chosen in the *Almagestum Novum* book 3, Caput 7, nevertheless cannot be convicted of falsity from any other [source], indeed [not even] from the Dichotomies of the Moon; rather, from the ideal beauty of the Hypothesis (concerning which [more] presently), they seem very probable. In another Hypothesis, however, [one] varying notably, the Intervals of the Sun [could] not be reconciled.

These things all stand, of course, provided the Sun's [apparent] semidiameters are saved, and the eccentricities established in the first Foundation, [so that] the eccentricities can stand with respect to which the Sun [is] most nearly and physically [placed], [and] be equal to the distances of the two Earth-Shadows, and of the Moon, as will be clear to those who rightly undertake the calculation. We come now to the Figure of the prior Hypothesis.

Diagram. A large full-width geometric diagram of Riccioli's solar hypothesis. The construction consists of a large outer circle (the ecliptic / orbit ARBP) with a vertical diameter AB running from top (A) to bottom (B), and concentric inner circles. At the top, just right of A, is the symbol for Cancer ☊ (marked "69"-like glyph). At the right, on the outer circle, is the symbol for Aries ☈ with the label P. Within the large circle are several nested circles centered near the lower-middle region. A cluster of construction lines radiates from the upper-left points (M, N, V,

S) down through the central figure to points at the bottom (T, R, E, and the dark shaded cone toward L, F, H, K).

Readable labels with positions:

- A (top of vertical diameter): upper terminus
- □ / "69" glyph (top, right of A): Cancer
- I (upper, on vertical axis below A): intermediate point
- M, N, V (upper left, clustered): construction points; V uppermost
- S (left of center, upper): the Sun's position point
- G (center-upper of inner circle cluster): center construction point
- E (center, within nested circles): a focus/center point
- C (center, within the dark shaded region): central point
- T (left, lower-middle): construction point
- R (far left): point on the outer circle (with what appears to be "□"-like glyph, Libra region)
- □ / P (right, on outer circle): Aries, labeled P
- L (lower right of center, tip of the dark shaded cone): shadow-cone tip
- F (lower center, on vertical axis): point on axis below center
- H (lower, on vertical axis): point near bottom
- K (lower, on vertical axis near B): point near bottom
- B (bottom of vertical diameter): lower terminus

The dark shaded narrow triangle (the shadow cone) runs from the central region C down toward L.

§10. On the Line of the Sun's Absides AB, extending up to the Ecliptic [and] pertaining [to it], let C be the center of the Earth, [and] CD the Moon's perigee distance of the terrestrial semidiameters 58. And DE, the axis of the Moon's shadow, [is set so] that when the Moon is thus opposed to the Sun at apogee, it does not fall into the Earth's shadow, nor is any Eclipse attempted [feared]; and so the whole CE [is] of the [terrestrial] semidiameters 114½: by which interval let a small circle be described, by which interval EI, the [terrestrial] semidiameters 58, may be understood to be circumscribed for the apex of the [Earth's] shadow; but by the interval EI, of the terrestrial semidiameters [as] much as we are able [to set], from Foundation IV. By the mean Distance of the Sun from the Earth, let the circle of the Sun's orbit be described, unless someone prefer an Elliptical [orbit] to describe; and let its periphery [be] ISTK, etc. The interval CE being doubled, let CG be made, of the terrestrial semidiameters 229, that is, as great as

the maximum length of the Earth's shadow, by which interval let the circle GHL be described, circumscribing the apex of the Earth's Shadow opposite to the Sun's motion; and from the same point G, or in any other [point] of the circle, by which the Line of the Sun's absides [passes], let [the orbit] be described, [by] how great an interval the great [circle] of the Ecliptic ARBP [is], under which we behold the true Motion of the Sun.

§10 (right column continued)...of the Sun from the center C, and [we] consider the Mean Motion [to be reckoned] in some other point distant from the [center] by most [authors], [who] suppose [the mean motion] to be at that point which will be G, the Sun being set for the sake of example in S; and yet, if the Sun [be set] in a circle described from G as its periphery, and [in] the point G of it, let the line AB, [of] the Sun's absides, be the line GSM, the line of mean motion, and the line CSV the line of the true place of the Sun; and ES, the semidiameter of the Sun's orbit, which produced into N, can be called the line of physical inequality, since also with respect to the center E, namely of its orbit — [it is] the line CSV — [and] is the line of inequality of the whole [motion], compounded of physical and optical [components], since at the center [there] appears a greater inequality in the Sun's motion than if it were beheld from the center E.

§11. The Practice [*Praxis*], therefore, of geometrical calculation in this circular Hypothesis is most easy. For, the simple Solar Anomaly being given — the Angle AGM, from the Tables — the angle EGS is given, the complement of two right [angles], with which, and with the Radius ES, of 100000 parts, of such [parts] as the bisected Eccentricity EG [is] 1740: collect the Physical Equation ESG; and thence the angle SEG, and so also CES, with which... ..and finally, with the same radius ES and the eccentricity CE, likewise 1740, you will then inquire into the Sun's distance from the Earth CS, and into the Optical Equation CSE; once the Physical Equation has been combined with this Optical Equation, the Absolute Equation will be established. This Absolute Equation is to be subtracted from the Sun's mean motion when the [simple] anomaly falls in the earlier semicircle ARB, and added when it falls in the later semicircle. When, however, the Sun is at T, and CT is equal to ET itself, the Sun will be at its mean distance from the Earth.

§12. Moreover, this hypothesis has the most beautiful agreements, and is not — unless I am mistaken — inconsistent with the phenomena that are observed.

The **first** [agreement] is that the Sun is in truth carried along with a uniform, equable motion. Yet with respect to any observer at the center of the Earth, its motion appears such that an observer who could perpetually see the Sun from beyond the Earth's shadow would see it as the most uniform of all — for which

reason, if the eye were placed at some point on the circumference GHL, it would be on the boundary of those persons who can always see the Sun. For such observers see the Sun not only above the clouds, but even above the Earth's shadow, indeed above the whole region of the aether; and however far the cloud cover may extend, provided the eye is raised above the clouds, and so long as it crosses beyond the line of the Sun's absides, the Sun will always appear to such an observer to be moving uniformly.

The **second** [agreement] is that, if the eye is on the circumference of the circle described by the Moon's shadow — that is, on the periphery EF — then it will be in a region that shares in some equability of the solar motion (insofar as it lies in that region), even though it does not enjoy the full equability of motion. For when the eye is first at the center of the Sun's orbit, it too would see the Moon's-shadow-circle's Apogee leave behind the Sun's Apogee, and at its greatest interval it is most distant from the apex of the Earth's shadow; thus it would see the inequality of the Sun's Optical Equation.

The **third**, and chief, [agreement] is that, by the reasoning we have assigned, two notable regions in the universe are marked out: one for the Sun's equable motion, the other for the center of the Sun's orbit; and from this is derived the physical account of the eccentricity of each. So that the Geometrical calculation may be valid for both, it is necessary that, in the plane of the Ecliptic, one designate the angles of the Equations and of the Anomaly from the boundary of the region marked out by the aforesaid shadows; and one should choose the motions of each, so that they may lie in that [same] region — namely, so that the eye is first free from the Earth's shadow here, where even the Moon does not enter beneath the Ecliptic separately.

§13. Now whatever may be the Hypothesis concerning this matter, lest perhaps certain persons should hold it improbable, [I say] that both the Earth's shadow on its axis, and the half — indeed the fourth part — of the Moon's distance together with its shadow [I have] computed for a Table in circular form, for the whole eccentricity 3480, bisected as 1740; and let the radius of the Sun's orbit be 100000. By the same proportion we shall assign the Sun's other distances in its own Table, for each individual case; so that in this hypothesis it may be possible to adapt them to the said distances [measured in] semidiameters of the Earth, while nevertheless preserving the due proportion of the said eccentricity at the Sun's greatest and least distances. And if indeed this hypothesis is not displeasing, behold those measurements that pertain to it in the Table set out below.

[Margin: *Exposita Motus Spiralis Solis.* — The Spiral Motion of the Sun set out.]

	Ad Rad. 100000 [To radius 100000]	R. Semid. Terræ [in Earth semidiamet ers]	I	II
CT, <i>Media Distantia</i> [Mean Distance]	100000	6512		
CI, <i>Distantia maxima</i> [Greatest distance]	101740	6666		
CK, <i>Distantia minima</i> [Least distance]	98260	6438		
<i>Vmbra terrestris Axis Sole</i> [Earth's shadow on its axis — Sun]:		229		
Apogeo [at Apogee]				
Medio [at Mean]		226		
Perigeo [at Perigee]		223		
<i>Solis Semidiamet er Vera Apparens in Apog.</i>	458	30		

	Ad Rad. 100000 [To radius 100000]	R. Semid. Terræ [in Earth semidiamet ers]	I	II
[Sun's true apparent semidiamet er at Apogee]				
in Media dist. [at Mean distance]			15	30
in Perigeo [at Perigee]			15	45
			16	4
<i>Lunæ Perigeæ distantia</i> [Distance of the Moon at Perigee]: Apog.		58		
Perig.		56 $\frac{3}{4}$		
<i>Parallaxis Solis Horizontali</i> s [Sun's Horizontal Parallax]: in Apog. [at Apogee]				29
in Med. [at Mean]				30
in Perig. [at Perigee]				31

	Ad Rad. 100000 [To radius 100000]	R. Semid. Terræ [in Earth semidiamet ers]	I	II
<i>Portio Terræ a Sole illustrata ultra hemisphæri um</i> [Portion of the Earth illuminated by the Sun beyond a hemisphere]: Apog.			14	56

Parsing notes: This is a five-column table. Column 1 is the row label (Latin); column 2 gives values "to radius 100000"; column 3 gives values in Earth semidiameters; columns headed "I" and "II" appear to give angular values (degrees/arcminutes pairs — e.g. "15 | 30"). The "458" value sits in the radius-100000 column spanning the Sun's-semidiameter rows. Several cells are blank in the source; the bracketing of the apparent-semidiameter and other multi-line entries was difficult to align across the rule-lines, and the row-to-column registration for the lower rows is uncertain.

I have indeed attempted to determine whether I might adapt this Theory so as to obtain the Sun's *Mean* distance — see above, Chapter 7, and elsewhere, Book I, Chapter 2 of the *Almagestum Novum* [Riccioli, *Almagestum Novum*] — by the Lunar Dichotomy [Moon at quadrature], having chosen the Earth's semidiameters as 7300. But the numbers chosen do not correspond. For so that the radius may be 100000, and the bisected eccentricity 1740, the Earth's semidiameters then come to 7300; and to these is joined the Mean distance of 7427 semidiameters — by which, and with the Sun's apparent semidiameter at Apogee 15' 30", the problem set out under Fundamentum II is solved: I find the Sun's true distance in semidiameters to be 7427, and the half-angle of the Earth's shadow-cone 33⅔; that is, the distance is 7427, and the half-angle of the cone of the Earth's shadow 15' 4". And when at last, by these [figures], the semidiameters

appear, the semidiameters of the Earth come to $128\frac{1}{3}$. And if the eccentricity were bisected as 254, the Earth's semidiameters would be far greater than the axis of the Earth's shadow is long; nor could it reach to this measurement with the appendage of the penumbra. But retaining this shadow of the Earth, and its half 114 by eccentricity, there would result 7300; and 100000, so that 114 by eccentricity is to 1562: hence much less than that, since we need [these] for the Equations owed to the apparent motions of the Sun, and [for] the difference of the eccentricity that appears.

§15. Similarly, with the Sun's distance assumed to be the Tychonic mean [Tycho Brahe], 1150 semidiameters, it becomes 1740 at distance 1740; and so it is 1750 and 19: therefore the Sun's greatest distance would be 1169, and its true distance in semidiameters; from the apparent semidiameter $15' 30''$, the Earth's semidiameters [come to] $5\frac{1}{3}$, and the half-angle of the Earth's shadow-cone $12' 26''$. And the axis of the Earth's shadow [is] 276 — much greater still is the whole eccentricity, which ought to be 228, or at most 230; nor can these be held — unless we use the Sun's distances posited in the preceding Table, or others moderately different from them.

CAPVT XVIII.

Indicatur Theoria Motus Spiralis Solis. [Caput XVIII. The Theory of the Sun's Spiral Motion is set forth.]

§1. Since Kepler [Kepler], in his work *On Mars* [*Astronomia Nova / Commentaria de motibus stellae Martis*], in chapter 1, has imputed an almost-noted madness to Alpetragius [al-Biṭrūjī] and to Patrizi [Francesco Patrizi], and to others — that they introduced a spiral motion of the Sun, or pursued one — and, [seized] by a love of simplicity of motion, in one and the same Elliptical periphery [placed it] under not the Sun but the Earth, [carried] through the annual motion, and [under] the diurnal motion from east to west, [as if] toward the Earth from the stars; and besides this, because the spiral motion cannot be determined by us in the figures of Geometry, [Kepler] concludes that it is not to be sought, nor are the Sun's places to be determined for any given time by it. Nevertheless these things are by no means to be repudiated. For so that we may say from the outset, [as] we began this chapter under numbers 2 and 3, it is necessary [either] to ascribe the diurnal motion from east to west to the Earth itself, and to the Planets and Fixed Stars; or at least to include the whole Heaven of the Fixed Stars and the Planets. But having excluded the [view] of solid orbs, and having introduced — by the consensus of more recent Astronomy — the fluidity of the planetary Heaven, it can scarcely be persuaded to anyone that the bodies of the Planets could be

carried by aether so liquid; and so that, by an effort directed back upon themselves, they are turned from west to east, in a space of 24 hours. Moreover, whatever exceeds this [time] is the most peaceful motion of the whole heavenly region.

§2. To this is added the authority of Sacred Scripture, which not obscurely intimates to us not only some [single] motion, but indeed this spiral motion. Ecclesiastes, in chapter 1, says: "*The Sun rises, and the Sun sets, and returns to its place; there, rising again, it goes toward the south, and bends round toward the north; the spirit passes through, traversing all things in a circuit, and returns upon its circuits.*" As if the Spirit, that is, the Intelligence that moves the Sun, were to say — that the motive power of the Sun, this [is] what moves it both from rising to setting, and yet so that it turns its gyres around, now toward the south, now toward the north; [and that it does] not move through one... ..one and the same circle, but through different circles by turns, and returns to other circles. So that we may therefore briefly recall the Theory of this motion, [those] indications and conditions which we set out concerning the Sun's motion are to be observed by the Astronomer.

§3. First, then, it appears most manifest that the Sun's motion in *Longitude* is from east to west, and back again toward the east; which motion is commonly [held] even by the unskilled, whenever the sky is clear.

The **second** motion is in *Latitude*, from south to north — which is not easily discerned every day, especially not on all days, but particularly on the days of the Solstices; yet it can nevertheless be observed on certain days by attentive observers, [namely] in the varying length of the noon shadows. But the more attentive observers [discern it] in the varying declination from the Equator toward the poles of the world, [and in] the manifest difference and inequality, since it is greater near the Equinoxes than near the Solstices.

The **third** motion is in *Altitude* [distance], not commonly [observed], but it has become known to the skilled from this — that the diameter of the Sun appears now greater, now smaller; nor is it probable that the Sun's body swells up in one way [and] shrinks in another. They themselves perceive, by use of the Telescope, [its] diverse appearances, [arising] from the diverse distance of the bodies observed; from which a demonstration is taken regarding the magnitude of the appearance in the Sun, proceeding from the fact that at one time it is nearer to the Earth, at another more remote.

The **fourth** [point], observed by Astronomers, is that the Sun so moves from rising to setting that it does not return to the same Meridian at the time when some Fixed Star is on the same Meridian with the Sun; it is brought round to the same Meridian today. For when [the star] with which the Sun has risen — say the Dog Star [Sirius / Canicula] — afterwards rises within nearly three months, [while] the Dog Star already obtains the Meridian, and after nearly three other months [the Dog Star] rises; the Dog Star sets within nearly three other months, and again within nearly three [more] months it sets; the Dog Star rising — and at last, the year being completed by the conjunction of the Dog Star, [it returns] when it rises with it. Since therefore it returns to the Meridian later each day than the same Fixed Star, it is seen to move in its own proper motion toward the east. Whence, and from the *second* motion in latitude, Anaximander [Anaximander] inferred — or rather another Motion of the Sun, by an oblique circle [oblique] to the Equator, which they call the Ecliptic, [traced out] with an oblique angle to the Equator. The greatest angle of the Sun's visible [path] to the Equator [is] $23^{\circ} 30' 20''$. Therefore, in [the use of] globes, or in some way, on planes the Equator and the Ecliptic [are] led, and the arc of the Meridian [drawn] orthogonally to the Equator; and however great this arc of the Meridian is at any time, it is easy to collect the doctrine of triangles from the arc of the Ecliptic, [and] of this imaginary [circle] near the Sun, and the nearer sections of the Ecliptic with the Equator intercepted; and thus far the Sun's place in this Ecliptic.

The **fifth** [point] noted is that the Sun makes more diurnal revolutions, passing beyond this point, in the northern semicircle of the Ecliptic than in the southern — at least so we have it from astronomical observations made at Babylon; or some [observations], indeed more, made from the Vernal Equinox to the Summer Solstice; sometimes also more from the Summer Solstice to the Autumnal Equinox — from which, and from the *second* [motion] in latitude and from the diverse declination (concerning which [we spoke] above), we conclude that the Sun moves unequally; if indeed equal semicircles, or quadrants of the Ecliptic, are traversed in unequal times.

The **sixth** [point] noted is that, since [the Sun] does not appear to move from a determined distance on the Earth from the same declination of the Equator perpetually [in the same way]: although Ptolemy [Ptolemy] found it to have its Apogee in northern Declination at $5^{\circ} 30'$ — in Gemini at $5^{\circ} 30'$, where it had been computed by himself — and therefore it had been moved a little from this position by Hipparchus [Hipparchus]; therefore the Sun's Apogee is to be ascribed not to some change, but afterwards by observation [its Apogee] was found to be of longer duration; this circumstance is the Sun's Apogee, and however much it

appears [to move] near the greatest declination, this is near the beginning of Cancer. From this, an inquiry has been made in Astronomy concerning the Sun's most slow motion of its Apogee.

The **seventh** [point], at last, found in the whole [Sun's path] at one and the same time, [is] that the Sun is in that semicircle of the Ecliptic which [extends] from the Apogee...

[the prose continues in the right column]

Diagram. A schematic of the celestial sphere drawn as an ovoid (barrel-shaped) figure representing the Sun's spiral motion between the Tropics. The top is labeled with the band "ηοδλχγτος" [Greek-form letter-string serving as a decorative/label band across the top — partly stylized; reads approximately ν ο δ λ χ γ τ ο ς], the bottom band reads "εβυτρμ" [stylized lower band]. The principal lettered points around the rim and interior:

- A (top center): pole of the figure (north)
- B (bottom center): opposite pole (south)
- C (center): the Earth / center of the world
- D (left middle): point on the equatorial line (toward observer's left)
- E (right middle): point on the equatorial line (toward observer's right); DE = the Horizon (when reckoned for the sphere), the diameter of the whole Solar Heaven representing the plane of the Equator
- F (upper left), G (upper right): points on the upper rim, near the band; FAG is the arc/portion of the Solar Heaven (the Tropic of Cancer region)
- H (lower left), I (lower right): points on the lower rim (the Tropic of Capricorn region); HCI and ICF noted as great circles through C
- K, L, M, N (interior, near center): intermediate points along the spiral/coiled lines; the spirals QR, GQ, Qh etc. are drawn as the near-vertical coiling lines filling the barrel
- Q, R (lower interior): the common base QR of the two truncated cones
- S (lower left interior), V (center interior): auxiliary points
- Numerous fine vertical coil-lines run between the upper and lower rims, representing the Sun's successive diurnal spiral turns from one Tropic to the other.

[Margin (right): *Exposita Motus Spiralis Solis.* — The Sun's Spiral Motion set out.]

§5. Let AB be the diameter of the whole Solar Heaven, which at the same time represents the plane of the Equator, and passes through the Earth's center C; let

DE be the Horizon, taken straight as for [an observer at] the sphere, which we exhibit here; but let any other Horizon be oblique. From the center C, likewise, let the portion FAG of the Solar Heaven be described, as great as the distance of the Tropics, bisected at A — where the beginning of Aries is — and let the arc be equal to the [arc of] the middle of midnight HBI, in the middle of which is the beginning of Libra; and let the beginning of Cancer be at G and I, and the beginning of Capricorn at F and H; and through these points let two other lines of the Sun be drawn through C — the diameters HCG and ICF. Then on the Diameter AB let there be cut off from there BR; thence AQ, equal to the half-diameter, or to the bisected eccentricity of the Sun; the apex of whose cone [lies] on the diameter FI; let Fh, and on the diameter HG, be HS — let HS be equal to the whole eccentricity of the Sun — let the straight lines GQ and Qh be drawn, and IR and RS; and below, in that same plane of the Meridian, they will represent the sides of the two truncated cones around which the Sun has its Apogee, [where] it describes its diurnal spirals; and of these [cones] the common base is QR, [lying] in the plane of the Equator. But the longer segment of the Cone will be QRIG; the shorter QRHF. For if QG and RI are produced, the meeting [point] with the Axis of the Equator [will lie] further off, [making] a longer and sharper cone than if they were drawn to meet on the same Axis — the sides Qh and RS.

§6. Let now the Sun's Apogee be at the beginning of Cancer G, distant from the center of the Earth by the greatest interval CG; and there let the Tropical Year begin, [the Sun] describing its diurnal spirals — at first greater, around the cone-segment QG; then narrower; then again wider — until they reach the Equator, [and] the base QR, where the Sun's greatest declination CG appears; that is CA with CB, by the half [or] the bisected eccentricity AQ, [or] BR. Then let the Sun proceed, describing toward the south, [making] its diurnal spi...

[Margin (left): *Exposita Motus Spiralis Solis*. — The Sun's Spiral Motion set out.] ...its diurnal spirals: around the narrower cone, [they are] wider near the Equator, but narrower near the Tropic of Capricorn; let them reach from QR, but by the narrower cone-segment, [and] heap up fewer spirals together, [the Sun] within about eight days more quickly completing this segment than the segment of the northern cone. For when it shall have reached the Tropic of Capricorn, [it makes] its spiral SH; it will be at Perigee, and will be distant from the Earth's center by the least interval CH, or CS — [a distance] as great as expounded above, CF, [and] as great as is the Apogee distance; and the whole eccentricity Fh exceeds it by as much, that is, the whole eccentricity of the Sun [is] as much as the eccentricity is in another hypothesis, [namely] the whole eccentricity of the Sun.

Thus then, three things are saved in the Sun's motion: in *Longitude*, by the diurnal spirals; in *Latitude*, by the intervals of the spirals — equal to the differences of the Sun's Declinations, with the unequal number of days, which it makes [to be] more in the northern segment than in the southern, just as the Sun's Theory requires; when the Sun's Apogee is in the northern segment, as it has hitherto been for many ages — nay, almost in every [age], if our opinion is correct, [for] from the beginning of the world its Apogee was at the beginning of Aries. Finally, [its motion is] saved according to *Profundity* [distance], namely in the intervals of the Sun's distance, and in the eccentricity, since in this spiral motion the Sun does not look back to the Earth's center, but [lies] toward the Axis common with the Equator's axis, and toward the sides of the cone — or [toward] the sides of the Scalene cone inclined to the Equator.

§7. It is now necessary to reconcile the Sun's diurnal motion from east to west with the apparent [motion] toward the east, and to make it equipollent to the motion hitherto supposed in the Ecliptic. And this is very easy to accomplish. For let it be, as we were saying, that the Sun [is] at Apogee at the beginning of Cancer G; and thence let the Tropical Year begin, and its days [be reckoned] from the Meridian; and let it descend in the same Meridian with the Fixed Star at some [point]; let it descend from the Meridian GAD to the west E, and thence rise in the east; or [descend] from the heaven of the lowest [point] I, whence let it ascend to K, at the time when that same Fixed Star reaches the Meridian — yet [it does so] only after 24 hours of the Primum Mobile [First Movable], and nearly four [minutes] of the hour [as it] completes the rest of the spiral KL, [returning] to the Meridian; and again, let it descend to M, and let it ascend to the point N; at the moment when the same Fixed Star is on the Meridian, [the point] from which the Fixed [Star] is distant by the interval NO, where it reaches O; and thence let it descend at P, & hence let it ascend at Q, at the moment when the aforesaid Fixed [Star] is on the Meridian; and the residue of the spiral QR being completed, let it descend at T, and hence ascend at V; and at the moment when it then there obtains the Meridian, [the moment] in which the Fixed [Star] [makes] the spiral VX; let it descend from X and Y, and hence to Z, and hence let it come to *a*, and hence to *b*, and a little [more] to *d*, hence to *e*, [each] point, and thence to *f*, and hence to Q, and so on. For [the Sun] becomes the orient daily, made through the points designated in CG; that is, it rises at C, when the Fixed [Star] is on the Meridian.

That [point], which we said in [the matter of] these few spirals [is] to be avoided [for] the sake of confusion, is understood [to be] near 188 [of the?] spirals, which

the segment of the northern Cone traverses in these ages; and the remaining 177, near the segment of the southern Cone.

§8. But [the spirals] are oblique, as we have admonished, [for the] cause [that], when [the Sun] has its Apogee at the beginning of Cancer, [it makes] many more diurnal spirals around the segment of the northern Cone than around the southern; namely, because the side GQ [is] longer than Qh; and when it shall have come at h, [it makes] the Perigee, [the Sun] already at the beginning of Capricorn F, even if it should not have reached FH, which is at the Tropic of Capricorn.

§9. But [when] the Sun's Apogee obtains the beginning of Aries — as we suppose it to have been at the beginning of the world — examine Figure 2, in which are described the Sun's greatest arcs of declination on either side, as in the prior Figure, [drawn] in the plane of the Meridian; [and the lines] AQ, BR, GK, FO, IL, HS [are] cut off [as] the semidiameters of the Sun's Heaven [equal to] the bisected eccentricity, namely. But to the whole eccentricity let AM, BN, Fh, HS be made equal; thence draw the straight lines AK, AO, [making] these as it were parallel to MK, Mh; likewise BL, BP, NL, NP, and at last RI, & RS. For there will arise four segments of an equal number of cones, [the cone's] base having a place in the plane of the Equator. The first segment of the greater cone is ABKL, around which the Sun made its spirals at the beginning of the Equinoctial Year, descending through A to the west, and thence ascending to V, at that moment when the Fixed [Star], which had been with it on the Meridian the day before, returns to the same Meridian; and thence...

Diagram. A second ovoid (barrel-shaped) celestial-sphere schematic, similar to fig-p98-1, but for the configuration in which the Sun's Apogee is at the beginning of Aries. The figure is filled with fine near-vertical coil-lines representing the Sun's diurnal spirals, and crossing diagonals marking the cone-sides. Lettered points:

- A (top, with the Aries symbol ♈ above): the north pole / beginning of Aries
- B (bottom): the south pole
- C (center): the Earth / center of the world
- D (left middle), E (right middle): endpoints of the equatorial/horizon diameter
- F (upper left), G (upper right): upper rim points (with the Cancer/Gemini symbols ♋/♌ near G)
- H (lower left), I (lower right): lower rim points (Capricorn region; ♎ near I)

- K, L, M, N, O, P (interior): intermediate points defining the cone segments ABKL, etc.
- Q, R, S, h (interior): apex/eccentricity points
- *a, b, c, d, e* (small italic letters, interior): successive spiral-crossing points
- The many fine vertical lines are the successive diurnal spiral turns; the bold diagonals are the cone sides AK, AO, BL, BP, etc.

let it come somewhat more slowly to the Meridian at Y, thence to Z, and afterwards to *b*, and so on for the rest, until it is brought to K, before it reaches and comes to the [point] they call the Tropic of Cancer; it would be seen from the center of the Earth C, [the Sun] under the beginning of Cancer, at the beginning of Cancer, with that same Star with which it had departed from A, [the Sun] now having reached the Meridian. And it was distant [by] the interval CK, or CL; thence, however, it was turned back toward the Equator [in] the cone-segment KLMN, circling around its own spirals, until, returned to the Equator, it appears now at Perigee in N, [at the] beginning of [Capricorn?]; thence [draw] the straight lines, [and the cone] of lesser inequality; thence the segment MNOP, leading [back] the spirals, some of which we have conceived to be in the prior lesser segment, [the Sun] reaching there again [at] the last spiral OP, before it reaches the Tropic called Capricorn, it would be seen; now indeed at C, under the beginning of Capricorn at F; or [at] H, and again it was in the middle [at] a distance from the Earth CO and CP, whence at last, returning toward the Equator [through] the spirals of the greater segment, it returns to the Apogee A.

§10. Since the segments of the cones were Equal between themselves, and of the greater between itself and the latter, AK [is equal] to the side AO, just as the side MK [is equal] to Mh, &c — and therefore [there are] an equal number of days for each; [and] for each [the Sun] makes the same number of spirals, [and] it would stay longer in the northern part than in the southern. The greater Cone then [was equal] to the base, [but] of a sharper figure than this figure's cone, [which is] greater but of shorter axis; on the contrary, the lesser cone [is] of a wider figure, but of a shorter base, than the lesser cone of the prior figure, [which is] lesser but of longer axis.

§11. From that time, however, up to the time when the Sun's Apogee was at the beginning of Cancer, [the Apogee] began little by little to lead away [from] the spirals near the Equator, and [made] the spirals nearer the Tropics longer; until [the Apogee] reached AK, [and] the equator [made] the sides of the other cone QG. Examine [whether], by transposing the sides, [the cones AK, QG] — that is, by a

shorter circuit — the account of the changes of its [motion] can be rendered, as [the Astronomers] have observed in the Sun's Apogee [in] the Arc FAG, or HBI.

§12. Much would have to be added to the Theory, [things] to be pursued by diligent Astronomers; nor indeed have the Tables of the Sun's Motions — by which they are accustomed to confirm the Ecliptic Theory in spheres, Armillaries, and Globes — [yet] been made; [since] we wish to represent it more easily by the Ecliptic than by the spiral, [and so] we would seem to be willing to use other Tables; otherwise it would be impossible, against the very nature of the thing, to reduce the Sun's Motion to a Geometrical Calculation, the Mean Motion of declination having first been worked out, and [then] to inquire into the true [place] by the angle of the true declination, and [its] distance from the place...

considered in the arc of the meridian of the apogee, just as also the distance of the Sun and of the Earth, would be very easily found from the angle of declination at C, once the angle at the base of the lesser cone — which angles I am pleased to communicate to the reader for four cases, namely those in which the Sun's apogee falls at one of the four cardinal points: at the beginning of Aries, or of Libra, or of Cancer, or of Capricorn — together with their assigned cones.

I. Case, for the apogee at the beginning of Aries □.

§13. Examine the second figure, in which there are four segments of cones. The **first** is ABLK, around which the Sun spins its spirals from the beginning of Aries up to the beginning of Libra; its angles at the base, namely CAK and CBL, are each $7^{\circ} 51' 22''$, and the sides AK and BL are each 41118 parts of the kind in which CK, the mean distance of the Sun, is 100000. For CK and AC are given — being as many parts as the Sun's apogeeal distance is 101740 — and the Sun's maximum declination by angle ACG, found by us at $23^{\circ} 30' 20''$, as I demonstrated by the laws of trigonometry where I said the Sun descends from apogee A to its mean distance from the Earth at G.

The **second** segment of cones is MNKL, around which the Sun drives its spirals in descending from the mean distance CL, which it has at the beginning of Cancer L, to the perigee CN, which it has at the beginning of Libra. The angles at the base, CMK and CNL, are each $80^{\circ} 39' 54''$, and the sides MK and NL are 40532 parts of the kind in which CK is 100000; and the Sun's perigeeal distance CM, or CN, is 98260, since these follow from the given values [of CK and CN] and from the maximum declination given as above.

The **third** segment of cones is MNPO, of altogether the same magnitude and of the same values [as the second]; its angle at the base, and the number of which the

second segment consists, are the same. Around this the Sun drives its spirals, ascending from perigee to its mean distance again, that is, from the beginning of Libra to the beginning of Capricorn.

The **fourth** segment is ABPO, altogether equal to the **first** as to its sides, and the angle at segment ABPO is that around which the Sun is whirled spirally, returning from its mean distance to the apogee.

II. Case, for the apogee at the beginning of Libra ♎

§14. In this case also the Sun drives its spirals around the four segments of cones, marked out as in the first case and of the same magnitudes, but in a different order. For the **first** segment is that which in the first case was the fourth, namely ABPO, in which it descends from apogee B to its mean distance, that is, from the beginning of Capricorn. The **second** is that which in the first case was the third, namely MNPO, in which the Sun's mean distance descends to perigee, that is, from the beginning of Capricorn to the beginning of Aries M. The **third** is that which in the first case was the second, namely MNLK, in which the Sun ascends from perigee to its mean distance, that is, from the beginning of Aries to the beginning of Cancer. The **fourth** is that which in the first case was the first, namely ABKL, in which it ascends from its mean distance to apogee, that is, from the beginning of Cancer to the beginning of Libra.

III. Case, for the apogee at the beginning of Cancer ♋

§15. For this case, and for the fourth, examine the earlier figure [fig-p99-1 from the prior batch], in which there are only two segments of cones. The **first** is QRIG, around which the Sun is spirally whirled in descending from apogee I, that is, from the beginning of Cancer, to its mean distance at R, which it has at the beginning of Libra; then returning from its mean distance to apogee, that is, to the beginning of Cancer G. The angles at the base, namely CQG and CRI, are each $76^{\circ} 37' 18''$, and the sides QG and RI are each 4100 parts of the kind in which CQ is 100000; and CG, 101740, with the maximum angle of the Sun's declination QCG set at $23^{\circ} 30' 20''$.

The **second** segment is QRSh, around which the Sun is spirally whirled, descending from its mean distance, that is, from the beginning of Libra R, to perigee at the beginning of Capricorn; then again ascending from perigee, that is, from the beginning of Capricorn S, to its mean distance at Q, that is, the beginning of Aries. The angles at the base are CQh and CRS,

IV. Case, for the apogee at the beginning of Capricorn ☐.

§16. In the same figure two pairs of cone-segments are to be considered, as in the first case, of altogether the same magnitudes, but in the reverse order. For the greater segment, which was northern, ought to be southern; and around this the Sun drives its spirals, just as from the beginning of Capricorn at apogee. F, at the beginning of Aries Q, the mean distance, ascends from the beginning of Libra R, or the other mean distance, to the beginning of Capricorn at apogee H. The lesser segment, however, QRSh, the Sun in descending from the beginning of Aries inverts, so that it may emerge as northern; it will serve the descending Sun from the beginning of Aries, its mean distance, and from perigee to perigee, namely Cancer; while ascending from perigee it will serve Cancer, and to the mean distance at the beginning of Libra.

For the Other Cases.

§17. For the other cases, in which the Sun's apogee falls outside the cardinal points, there is need of four cone-segments of different magnitudes and quantities, such as the skillful astronomer can conceive and design. Yet for now we shall illustrate it by the following diagram, in which let ACB be the diameter of the equator itself; let the equator be represented by A, and from C, its center, let the meridian of the Sun's highest apogee be drawn on both sides, that is, let the portion of the meridian FAG and HBI be drawn, of just so great a distance from

Diagram. A barrel-shaped (cylindrical-conic) celestial-sphere construction for the general case in which the Sun's apogee lies outside a cardinal point. A central vertical axis runs through center C, with the two oblique conic envelopes (greater/lesser cone-segments) and the spiral paths of the Sun. The figure is bounded above and below by curved arcs representing the celestial circles, with zodiac symbols at the corners. Labeled points run around the perimeter and interior:

- A (top center, with ☐ Aries symbol nearby): apex region of the upper meridian
- K (upper left interior): construction point
- M, O, D (upper interior, near center top): construction points
- T (right, with ☐ Cancer / Leo symbols ☐ at upper right): right-side point
- G, S (right side, ☐ region): construction points
- F (upper left, ☐/☐ region): meridian point
- N (left interior): construction point

- C (center): center of the equator / common vertex of the cones
- V, P (left and lower-center interior): construction points
- L, R (lower interior / lower right): construction points
- ♒ Aquarius and ♏ Scorpio symbols at lower left and lower right corners
- E, B (bottom center): base points of the lower meridian
- H, I (lower left and lower right): meridian termini below

[Several peripheral labels and zodiac glyphs are small and partly inked; the interior lettering A–T as transcribed is legible.]

the Tropics, to whose extremities let FIC and HCG be drawn. Now let the Sun's apogee be at D, at 15° of Taurus, and accordingly perigee at E, at 15° of Scorpio. For its mean distance will lie under 15° of Aquarius at K, and under 15° of Leo at L. Therefore let the lines DCE and KCL be drawn, and on either side let DQ, PN, KM, and LR be cut off, equal and bisecting the eccentricity, that is, of eccentricity 1740, of the kind in which CQ, CM, CP, and CR are each 100000. For these are drawn as the straight lines MD, MN, NL, LB, the segments of the cone MNLD, around which the Sun draws its spirals, ascending from Aquarius at 15°, to 15° of Taurus. Then taking up KO and EP, of 3480 parts — being the whole solar eccentricity — and drawing OQ, OP, PR, RQ, you will have the conic segment OPRQ, around which it is whirled at 15° of Leo and 15° of Scorpio. The segment under 15° of Leo is DSTR, serving the Sun at 15° of Taurus to 15° of Leo; and the segment XMPV, when from 15° of Scorpio it ascends to 15° of Aquarius. But the segments SG and TI, of lesser eccen-

tricity, are bisected, that is, of 1740 parts, and FX, and also HV, are greater, but smaller by the whole eccentricity, in proportion almost equal to the distance from the place of apogee, and from the place of mean distance.

§18. [Margin: An objection is met.] You will say that this designation of the cones and segments, by its very intricacy, makes this theory improbable and full of difficulties. I reply that the variety of the cones is no more perplexing than the Keplerian ellipse, on account of the variations of apogee. For just as the Keplerians want to keep the Sun always in the same ellipse and in the plane of the ecliptic, and yet with apogee — or aphelion — varied under it, it is impossible that it be the same ellipse with one and the same conjugate axis; rather there must be as many ellipses, or as many cones, as there are dispositions of the Sun's apogee. And besides, the diurnal motion from east to west cannot be reconciled with the motion proper to it toward the east.

CAPVT XIX.

Conclusions concerning the certainty hitherto acquired, or to be hoped for in the future, regarding the Sun's motions, intervals, and quantities; and concerning the theory and practice of the Tables.

This is precisely that which astronomers awaited from us with such eagerness — to whose knowledge the two prior volumes of our *Almagestum Novum* [Almagestum Novum], and the *Idea of the Whole Work*, were a kind of approach and promise. What then we can, as if reduced to the marrow, conclude with our efforts concerning the Sun's affections, is to be briefly indicated.

I. Conclusion concerning the equinoctial, or tropical, year.

The quantity of the equinoctial year, beyond 365 days and 5 hours, most certainly does not have more than 56' of an hour, nor fewer than 42'. Yet the truest quantity of all, by our reckoning, is this:

D. 365. Hor. 5. 48'. 48". 0". Of the sidereal [year]: D. 365. Hor. 6. 9. 21. 42.

The earlier part is evident from the opinion of the astronomers cited in Book 3 of the *Almagestum Novum*, chap. 15, if we reject the obsolete [values] of certain ancients; the later part is evident from what is to be said here in chap. 4, third, and from chap. 19.

II. Conclusion concerning the Sun's mean daily and annual motion.

The Sun's mean, or equal, daily motion is most certainly 59' of arc and 8" of seconds, and moreover not more than 10" of thirds, nor fewer than 7", as is evident from Book 3 of the *Almagestum Novum*, chap. 17. And the annual motion is as below:

	Sign	Gr.	I	II	III	III	V	VI
Daily	0	0	59	8	19	48	35	35
Annua l	11	29	45	40	30	56	5	1

III. Conclusion concerning the motion of the Sun's apogee.

The annual motion of the Sun's apogee, by the consideration of more recent astronomers — as cited in Book 3 of the *Almagestum Novum*, chap. 25, and adduced [there] — is not greater than 1' 4" of seconds, nor smaller than 45" of

seconds; yet from what is said here in chap. 9 it is most probably below: 1' 2" 4''' 4''''.

IV. Conclusion concerning the Sun's apparent diameter.

The Sun's apparent diameter at apogee does not exceed 34' of minutes, nor fall below 29'; at perigee, moreover, it does not exceed 36', nor fall below 30', as is established from what is said in Book 3 of the *Almagestum Novum*, chap. 10; but with the observations made most truly with the great Gnomon of St. Petronius, the diameter appears as Dominico Cassini [Giovanni Domenico Cassini], or as we, gather from these — as below in chap. 12.

	In Apogee	In Apogee	In media dist. I	In media dist. II	In Perigee	In Perigee
☉ Diam.	I	II			I	II
Cassino [Cassini]	31	8	31	40	32	10
Nobis [Us]	31	10	31	42	32	4

Parsing notes: the apparent-diameter table is grouped under three positions (In Apogee / In mean distance / In Perigee), each split into two columns (here rendered as minutes ' | seconds "). Cassini's and our (Nobis) values are tabulated in arcminutes and arcseconds.

V. Conclusion concerning the bisection of the eccentricity.

The eccentricity of the center of the Sun's orbit from the center of the Earth is half the eccentricity of the center of the Sun's mean motions. For if we adopt that eccentricity which geometrical necessity deduces from the difference of the apparent diameter of the Sun at the apogeal, mean, and perigeal distances, the prosthaphaereses [prosthaphaereses] due to the Sun's mean motion must be inquired into, so that the Sun's true place may be had agreeing with observations exactly continued. There are found double the smaller [prosthaphaereses], nor can the true quantity of such prosthaphaereses be found, unless double the larger eccentricity is assumed; and so the center, around which the Sun is moved equally — or is feigned to move — is removed from the center of the Sun's orbit by just so much as the center of the orbit is removed from the center of the Earth: see what is said in chap. 12.

VI. Conclusion concerning the quantity of the Sun's eccentricity.

The whole eccentricity due to the equations of the Sun's motion, if it does not change, but is more probable, we taught in Book 3 of the *Almagestum Novum*, chap. 26, is not greater than 3800 parts, nor smaller than 3200, of the kind in which the radius of the Sun's orbit is 100000, from what is said in Book 3 of the *Almagestum Novum*, chap. 24. But concerning the diameter of the Sun and the apparent difference at the threefold distance from the Earth, and concerning the equations of the Sun's motion, nothing satisfies more than ours, the apparent motion of the Sun, of which above in chaps. 10, 11, & 12, and of this kind:

Of the kind in which
the radius is 100000.

The Sun's eccentricity	Whole	Bisected
Us [Nobis]	3480	1740

Hence, however, it comes about that the Sun is moved unequally around its own center too; and by the half-inequality, by which the Sun's true place differs from the mean.

VII. Conclusion concerning the figure of the Sun's orbit, or path.

Although the bisection of the eccentricity has indicated, in the Sun's orbit, three points, or two notable centers — namely, by the intervals — that is, the center of the Earth, the center of the Sun's orbit, and the center of the Sun's mean motions, equally distant — it might seem to indicate that it is an ellipse, in whose periphery the Sun is moved; and that because in the ellipse there are these two notable points equally distant from the said center itself, namely the two foci, or navels, which are observed [to be] all equal among themselves, the rays [reflected] from one of the foci into the cavity of the ellipse being then reflected: and although it seems quite near enough to the truth by such a path, by a geometrical method, the prosthaphaereses of the Sun due to the Sun's motion are found, as is evident from the theory demonstrated in chap. 11, and by examples of calculation in chap. 15. In the earlier Table of the observed places of the Sun, and supposing the Sun's path by this path, nevertheless nothing necessitates the elliptical path of the Sun. **Firstly**, because the ellipse by its own nature requires the said three points, yet they can also be found in a circle, if it is not by its nature, and considered mathematically; physically, however, considered, those three places will indeed be minute, around which the Sun is moved equally indeed,

around one [point]; and unequally around the center of the Earth, and semi-equally around the center of its own orbit. **Secondly**, because by our eccentricity and equations [computed] in a circle, we represent the apparent motions of the Sun, and the due [motions], no less — indeed, often more — exactly, as is clearly established from the Table in chap. 15, just as in the ellipse. **Thirdly**, because not only is it not demonstrated that the Sun moves in an ellipse rather than in a circle, but neither mode is demonstrated by the diurnal motion from east to west, which is due to the Sun both by Divine Scripture and by the real increment of impetus, as [is shown] by the percussions of grains, or by the higher [region], more dense, and by the fluidity of the heaven of the planet; and by rejecting the multiplicity of solid eccentrics and epicycles. Indeed, the divine motion of the planets from east to west can scarcely otherwise be reconciled, since they appear to [go] from west to east, than by the diurnal motion from east to west, [combined with] the spiral, and the slower motion of the primum mobile, or of the fixed stars. Which motion is shown to be neither absurd nor outside geometrical laws in chaps. 16 & 17.

VIII. Conclusion concerning the cause of the eccentricity of both [centers], the Sun's.

The cause of the whole eccentricity of the Sun is not very improbably the greatest shadow of the Earth, so that in it the matter of the air or aether, illuminated by the uniform region of the Sun, in which at first the eye, raised from the Earth, would begin to see the Sun perpetually, without any nocturnal interruption. But the cause of half the eccentricity is averse to the Lunar shadow, which is first, the first uniform shadow; if it could be founded on certain foundations partly necessary, partly observed, the quantity of the said shadows is analogous to the said eccentricities, as I taught in chaps. 1 & 6.

IX. Conclusion concerning the Sun's maximum declination, or the obliquity of the ecliptic.

The Sun's maximum declination from the equator, or the obliquity of the ecliptic, was not the same in the time of Eratosthenes as hitherto, as I showed in chap. 6, and once in Book 3 of the *Almagestum Novum*, chap. 27. Nor indeed beyond degree 23, and exceeding minute 32; nor falling below 18 [?] minutes. The truer is somewhat exceeding, by observations agreeing, 23° 30' 20"; nor improbably 23° 30' 30", from what is said in the same chap. 6.

X. Conclusion concerning the Sun's distance from the Earth, and the horizontal parallax.

The Sun's least distance from the center of the Earth, too, is not supposed [to be too small] by an ignored parallax, as hitherto, and by Tycho [Tycho Brahe]; and it was supposed by Tycho himself, but from the dichotomies of the Moon, by the most diligent astronomers, it was then asked; nor was it any less investigated; nor was it smaller than six thousand terrestrial semidiameters, nor a maximum greater than sixteen thousand semidiameters; as is gathered from what is said in Book 3 of the *Almagestum Novum*, chap. 7, and its Appendix in the end of the first tome [is] added. But two distances are very probable to me beyond the rest. The first is that which I chose in the *Almagestum Novum*, Book 3, chap. 7, and touched on in chap. 13, [where I] confirmed it to be not smaller, in chap. 14, num. 39, by the new Method, by the Refractions of the fixed stars investigated, [the parallax being] not greater than 30" of seconds; according to which the mean distance was 7300, and that bisected, now, and our new eccentricity 1740, of the kind in which the Radius is 100000. The greatest distance from the terrestrial semidiameters ought to be 7427, and the smallest 7173. The latter is that which agrees with the attempted hypothesis of the Sun's eccentricity, and of the terrestrial shadow, and the prolixity of the Lunar shadow, but chiefly of the terrestrial [shadow], as I indicated above in Conclusion VIII, and expounded in chaps. 16 & 17, num. 6; from which [there is] something adduced [to show] that this hypothesis requires the Sun's distance at apogee to be 7427 terrestrial semidiameters, and at perigee 6438. The mean, 6552, terrestrial semidiameters.

Hence it follows that the Sun's horizontal parallax is never indeed greater than 30" of seconds, or 31", but is yet sensibly so; and where the subtlety is not in question, [it is] altogether to be neglected, as some do. Let therefore the aforesaid distances, with their horizontal parallaxes, be set before the eyes:

	Apogea l dist.,	Horiz. parall.	Mean dist.,	Horiz. parall.	Perig. dist.,	Horiz. parall.
Ours	semid.		semid.		sem.	
1st	7427	11 [?]	7300	11 [?]	7173	11 [?]
Opinio n		27		28		29
2nd	6666	29	6552	30	6438	31
Opinio n						

Parsing notes: the horizontal-parallax columns appear to give arcseconds (and the upper "11" may be a stray rule-mark or partly inked seconds figure — flagged). The first-opinion parallaxes (27", 28", 29") and second-opinion (29", 30", 31") form the smooth progressions.

XI. Conclusion concerning the Sun's true magnitude with respect to the Earth's shadow, and the angle of the cone of the same shadow.

Since the Sun's distance from the Earth is uncertain [as to being] precise, and we know it to be not smaller than 6000 terrestrial semidiameters, and very probably not exceeding much beyond 7500 — moreover, since it is more certain that the quantity of the Sun's apparent diameter cannot be determined for us, yet certainly it is established absolutely concerning the true magnitude of the diameter, as the quantity of the diameter [is] to the diameter of the apparent quantity. Taking therefore, as a foundation, the Sun's diameter, which appears 11' at apogee, and the minimum tolerable apogeeal distance, 6000, and the maximum 7500: but the probabilities are 7427 and 6666 from what was recently said — the quantities written below follow, among which, however great the angle of the cone of the Earth's shadow is, so great is the arc of the greatest terrestrial circle which the Sun illuminates by its rays unbroken [unrefracted], beyond 180 degrees.

Given the Sun's
dist. from

Earth, in terrestrial semidiameters	True Sun's Diameter	Axis of the Earth's Shadow	Angle of Shadow Cone
	semid. terr.	semid. terr.	' "
Maximum in Apogee, semid. 7500	67 $\frac{1}{3}$ $\frac{1}{2}$	128 $\frac{7}{8}$	30 6
Maximum, Apog. 6000	54	231	29 48
1st Probable: Apogee 7427	67	229	30 4
1st Probable: Mean 7300	67	224 $\frac{3}{4}$ $\frac{1}{3}$	30 37
1st Probable: Perig. 7173	67	220 $\frac{2}{3}$	31 10

Given the Sun's dist. from Earth, in terrestrial semidiameters	True Sun's Diameter	Axis of the Earth's Shadow	Angle of Shadow Cone
2nd Probable: Apog. 6666	60	229	29 52
2nd Probable: Mean 6552	60	226	30 30
2nd Probable: Perig. 6438	60	223	31 4

Parsing notes: the "True Sun's Diameter" and "Axis of the Earth's Shadow" columns are in terrestrial semidiameters; the fractional parts ($\frac{1}{3}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{3}$) are stacked beside the whole numbers in the source and may be compositor-stacked sexagesimal fractions — transcribed as shown. The "Angle of Shadow Cone" column is in minutes and seconds (" ").

XII. Conclusion concerning the progress of astronomy to be hoped for.

Even though our most recent Tables represent the observed place of the Sun by great Instruments — of which kind is the Gnomon recently [erected] in the Temple of St. Petronius of Bologna — often within one minute [of arc] of two minutes of error; whence it follows that they exceed the error here and there, or [are within] one minute, posited as an error in the observations, which arise from physical little alterations — yet our Tables are bound by Geometrical reasoning among themselves so that they cohere, nor can they in the same degree of Anomaly now exhibit the truth, now a falsehood; and hence one may suspect that the Tables, or [those] more certain, are never better hoped for from posterity, nor are they to be hoped for from any observations whatever; yet, by diligent [labor], they do not differ ever from one another by one minute. When, however, I consider how much our age the astronomers have advanced, both by observing and by meditating, and how much the Immortals have indulged them, this prodigy of ours, as God has granted to us; and to expedite [matters], so that astronomers do not cease from observing, and from contemplating the Sky; then, that new [things may be]...

so that we may go on to attain ever subtler refinements, and to confirm, correct, or finally close out the findings discovered up to now; and so that, from the depth of the heavenly Motions and from the intervening Harmony, all the learned and

devout may be drawn up into wonder and love of the Creator himself. To this end one's whole effort and labor ought to be directed, for the greater Praise and Glory of God and of all Human Understanding.

APPENDIX I

TO CAPUT XII

On the Apparent Diameter of the Sun, against an objection raised by most learned and most dear friends.

Whether, and how much, ought to be subtracted from — or added to — the appearances of the Sun and of the lunar shadow [umbra Lunar] cast through an aperture [foramen] of perceptible size, so that one may obtain the true magnitude not only of the apparent diameter of the Sun and of its proportion to the lunar diameter, but also of a solar eclipse, whether expressed in digits or in scruples of one degree?

Recently, two Fathers of our Society — Frenchmen, most distinguished mathematicians — gave occasion for this question by transmitting to us certain doubts, indeed certain assertions, raised against the positions advanced by R. P. Bernardino Boghille [Bernardino Bohillo] of the same Society, a man most skilled in mathematics, and directed against what is contained in the *Almagestum Novum*, Book V, Cap. 15, no. 4, and nos. 6 and 8. Drawn from the doctrine of Kepler, their points are these, namely: that from the semidiameter of the bright base of the solar image one must subtract a semidiameter of the aperture; and that to the same one must add the *sagitta* [arc-height] of the lunar shadow, in order to obtain the true magnitude of the eclipse in digits, and so on. To these objections I have undertaken to make a careful reply, having premised certain points which I knew well to be needed by those Fathers — themselves greatly advanced in geometry — yet for the sake of the completeness of this doctrine, and for the sake of others into whose hands this little study of mine may come. Meanwhile I owe them the greatest thanks for the occasion thus afforded of inquiring somewhat more deeply into matters not to be despised, and of setting truth, once recognized, in a clearer light.

I. SUPPOSITION

If a straight line lies parallel to two straight lines, and lines equal in the perceptible sense join the parts of those lines lying on the same side, then the

lines so joining are parallel and equal, apart from a difference imperceptible to the senses.

For Euclid, Book I, prop. 33 [Elements I.33], demonstrates this without qualification for lines parallel in geometric rigor; and it holds likewise for lines equal, or parallel, to within the perceptible sense, on the principle of inferring an imperceptible equality or parallelism from equality and parallelism.

II. SUPPOSITION

Lines that are equal apart from a difference imperceptible to the senses are taken as a single straight line, whenever the one does not exceed the other by more than the three-hundredth part of one inch of a Roman foot [una uncia Pedis Romani].

By the Roman Foot I here understand the one — and of what measure — that I exhibited in the *Almagestum Novum*, Book II, Cap. 7. By experiment I myself found, together with P. Grimaldo [Francesco Maria Grimaldi], on a flat plate of brass [lamina orichalcea], well polished, that on the most finely drawn parallelogram ABCD, whose

side AB equals the side CD, and equals one inch of a Roman foot; and whose diagonals AD and BD, taken singly, equal two Roman feet — that this same diagonal AD, divided into 300 equal parts, when stretched out into the finest threads of silk OH (such as the silk thread drawn from a cocoon of the silkworm can be reduced to the very finest), so as to cover one entire small space of the three-hundredth part — that from this we concluded this to be the smallest difference that the human eye can plainly discern. For even though the inch be divided lengthwise by the diagonal AD into far longer parts, namely 3000, the thread, when stretched across the said inch, would by its own thickness be on the point of covering, by its very thinness, more of the finest parts; and so, from the thinnest parts, it would obscure how much it covered, and likewise it is more readily perceptible by that Rule of yours, whose straightness can never be made so exact as the straightness of the said stretched thread.

Diagram. A square (or rectangle) ABCD with both diagonals drawn, illustrating the brass-plate apparatus described in the II. Supposition. The top edge runs A (top left) — O — B (top right); a short segment O near the top with H below it marks the silk thread OH stretched across. The diagonals AD and BD cross at the center. The bottom edge runs G (bottom left) — H — D (bottom right).

- A (top left corner): vertex A

- O (top edge, between A and B): point O, upper end of silk thread OH
- B (top right corner): vertex B
- (center, where diagonals cross): intersection of diagonals AD, BD
- G (bottom left corner): vertex G
- H (bottom edge, near center): point H, lower end of silk thread OH
- D (bottom right corner): vertex D

III. SUPPOSITION

The semidiameter of the Earth is not less than 3,500,000 geometric paces [passus Geometrici], nor is the distance of the Moon from the Earth, at perigee [πρόσγειον, Greek: perigeion, "nearest to Earth" — here perigee], less than its 57 semidiameters, that is, 175,000,000 paces; nor is the distance of the Sun from the Earth less than 1105 terrestrial semidiameters, that is, 3,867,500,000 paces.

The first point is established from the measurements of the geometers reported in the *Almagestum Novum*, Book II, Cap. 7. Let this suffice for us, drawn from our more recent observations in the *Geographia Reformata*, as a quantity certain enough, though the smaller in Roman paces — 4,673,000. The second is established from the observations adduced in the *Almagestum Novum*, Book IV, Cap. 14. The third, finally, is established from the relations of astronomers cited in the *Almagestum Novum*, Book III, Cap. 7 — although from the dichotomy [διχοτομία, Greek: dichotomia, "halving" — the lunar dichotomy, quadrature] of the Moon we have already supposed the distance of the Sun at perigee to be not less than 5000 terrestrial semidiameters.

I. PROPOSITION

Two Rays propagated to the Earth from the same point of the Sun, or of the Moon, and comprehended within a semidiameter of an aperture not exceeding 10 Roman paces, will, when produced further, run parallel within an interval not greater than 21,486 paces in the case of the Sun, or 972½ paces in the case of the Moon.

In the first of the Figures to be displayed, let A be a point of the Sun or Moon; let AB and AC be the rays of least distance from the Earth, comprehended within a semidiameter of the aperture not exceeding 10 paces. Let them be produced as far as H and K, and so on, up to the base HK, parallel to BC itself, and let them diverge geometrically. Then HK is greater than BC; draw HK; let CL be parallel to HK; then by reason of the similar triangles, CL is parallel to AH; let AH be cut at L; now I say that the interval CL is not greater than 21,486 paces. The solar rays

within that interval, that is BH and CK, are equal and parallel to within the perceptible sense, indeed equal to one another. For HK, parallel to BC itself, does not exceed it except by a part LK, no greater than the three-hundredth part of an inch of a Roman foot, which is the least difference perceptible by Supposition II. Therefore HK and BC, within that interval, are equal in the perceptible sense, and so by Supposition I they are parallel and mutually equal. The antecedent is proved, because the triangle AHK, cut, is — as AB is to AH — in proportion, by props. 2 and 4 of Book VI [Elements VI.2 and VI.4]; and since AB, as well as AH, and likewise AL and LC, [hold the same ratio]. Now in fact, BC is to the solar distance AB as 3,867,500,000 is to LC, by prop. III. Suppose, then, that LK, the three-hundredth part of a Roman foot in inches, requires the difference in length 1,289,166, that is, 10,743 paces $\frac{2}{3}$, or 21,486 paces.

Next, since BC is to the lunar distance AB as 175,000,000 paces — so LK, a three-hundredth of an inch, [is] to 58,333 inches, that is 4,861 paces, or $972\frac{1}{2}$ paces. So

How much more certain, therefore, will the rays be that are parallel and equal among themselves, to within all the subtlety of the senses, over an interval still much greater — when the Luminary's distance is greater and the semidiameter BC of the aperture smaller, in paces. We took, however, that of the great Gnomon of the Temple of S. Petronio at Bologna [San Petronio gnomon], where the perpendicular interval of the aperture to the pavement does not exceed 100 Roman feet, but is roughly 90; the semidiameter of the aperture is BC, less than the said interval, by far. And so we took the aperture nearly one inch only.

COROLLARY

On the parallelism through an imperceptible inserted angle.

From what has been said I conclude a method, which I have used together with Nonius [Pedro Nunes], Snellius [Willebrord Snell], and others, of showing the physical parallelism of the rays ABH and ACK, so that the inserted angle CL does not differ — that is, so that we may preserve, sensibly equal to the lines BH and CK, the lines BC and KH — so that the imperceptible inserted angles BC and KH may be tractable as instruments by astronomers. For from the distance between the Luminaries, and from the narrow semidiameter BC, I undertake to show that the angle A does not exceed one Third-Scruple [Tertium Scrupulum, i.e. one third], which is commonly reckoned imperceptible; and so, the right line BC, falling upon the right lines AB and AC, making with those lines internal angles ABC and ACB — two right angles, equal in the perceptible sense, and not falling short of the sum of two right angles by an amount perceptible to the senses — sits

parallel to the lines at 29 of Book I [Elements I.29]. But this is absolutely no concern unless within the said imperceptible interval. Now, the angle A being always one Third, and so the sum of the angles amounting to $179^{\circ} 59' 59'' 59'''$, the rays AH and AK can nevertheless proceed, so that the base KH does not differ perceptibly — indeed, larger, on the base EC. As in the example of the lunar rays, BC remaining at $972\frac{1}{2}$ paces, if the interval CL is $972\frac{1}{2}$ — within which we said the physical equality of the base BC and KH multiplies by 300 — let it become 291,750 paces; if to CP, 100, is added, it gives an excess over BC of one Roman pace; and if again, it leads to $121\frac{1}{2}$ paces, then 30,000 paces, which is produced at the center of the Earth — let it be LK, exceeding above BC by one Roman foot; therefore the physical parallelism will not remain. This was worth noting.

II. PROPOSITION

Given the base of the whole appearance of the Sun, received through an aperture of imperceptible size, in a plane equidistant from the plane of the aperture, in a known plane: the apparent diameter of the Sun is given — that diameter which would appear to an eye placed at the location of the aperture.

I said "of the whole appearance," that is, the appearance terminated by the outermost rays of the Sun; for through a perceptible aperture they could be reflected to the eye of the observer, and move his sense. In truth, however, they are too weak, and could not perceptibly represent the outermost whole appearance of the Sun, as I found by experiment. Having premised these points, in Fig. II: let AB be the plane — say, a white tablet, to which is equidistant the plane ED — in which is the aperture H; from the plane AB, let the rays BH and GA, parting from one another at H and EH, be drawn to AB, perpendicular to HT; given the sides HT, the right angle HTB; and BT, half the appearance of the Sun, will be given by the Canons of Triangles [trigonometry]. The right angle THB, half the appearance AHB, which is the apparent angle FHG, where, under too small a sense in the aperture, fixed in the location, the visible portion of the Sun would be seen, or the apparent diameter of the Sun would appear.

But because in this manner we cannot obtain the true diameter, therefore among other methods we chiefly use the appearance of the Sun admitted through an aperture of perceptible size, so that that appearance may move the senses by the multitude of its rays — provided only that the aperture, and the distance of it, namely the distance from the plane receiving the appearance, be of congruent quantity, and fit to represent the appearance of the Sun.

III. PROPOSITION

Given the base of the appearance of the Sun admitted through an aperture of known and congruent quantity, in a plane equidistant from the plane of the aperture — disposed horizontally and applied to discern evidently the appearance terminated by the shadow [umbra]: there is given the apparent diameter of the Sun, equal to that which would appear to an eye placed at the location of the aperture, apart from a difference evidently demonstrable.

Now the aperture, and the distance of the planes, ought to be so reckoned in quantity that the aperture be less than the true diameter of the Sun — indeed less than the paces 10, by the said Proposition I. But that the appearance of the Sun received through it be evidently greater than the aperture, and of a splendor, or of an opaque channel, or of confused reflections, not confounding the lights and shadows of the Sun's appearance; nor yet so vast a distance that the weak rays representing the Sun's appearance be obliterated; nor so distant that the appearance set in evident discernment between the appearance and its shadow-bound conterminal. So then, since we found the aperture never exceeding two Roman inches, and more often less, by 15 — sometimes a smaller distance by feet, sometimes a greater, of 15, or 30, 40, etc.; but in the Gnomon of the Temple of S. Petronio, where the distance of the pavement is least, in which we receive the appearance of the Sun, is roughly 100 Roman feet; and the aperture is perpendicular to it, 100 times less, the distance of the perpendicular lunar appearance being 10,000. With these premised in Fig. II: let the aperture be OP, whose center is CT, and from which, by the perpendicular CT drawn to the plane, are comprehended the extremities of the Sun's rays FB and GA, touching by turns the margins of the alternate apertures, and cutting one another in H, intersecting. Now let the radius FB be understood from the right Limb of the Sun, from which the radius FB is propagated to the center C; the other radius, whose portion is CL, will then be — for by Proposition I the parallels are sensibly equal to FB itself, and the semidiameter CP of the aperture is sensibly equal to the right angle LB. Given therefore CP, let the semidiameter TB be given; and the known TL remaining, since the said distance CT will be, the angle TCL — and thence the whole KCL, equal to the conterminal, under which the eye in C is constituted, would be seen as the Sun; and its apparent diameter.

[Margin: Objectio. (Objection.)]

But the apparent diameter of the Sun, investigated by this method, is either equal to that seen by direct gaze in C, or — as certain friends of ours doubt — because the extreme rays of the Sun, evidently moving the senses with the eye placed

directly in C, and more strongly, move the senses with the eye seeing the Sun from C; for they radiate from the same point of the Sun upon the surface of the Eye's tunic, with innumerable rays which, by the benefit of refractions, are diminished within an imperceptible point, and so painted upon the Retina of the eye, as if with a brush they paint into it a very intense appearance which they represent, as is known to those skilled in the recent Optics. But the rays FB and GA, touching the appearance, are single, and so weak that they cannot move the sense, and evidently represent the extremities of the Solar appearance; which would be greater, if a sufficient number of rays were representing the Sun. If therefore it appeared less than it ought, while, taking away the whole right line TB, or LB, it is wholly subtracted from that appearance, then more is removed; therefore the angle TCL, and the smaller apparent diameter, is acquired than is fit, and than it was seen in C, by direct gaze.

[Margin: Respondeo. (I reply.)]

I reply: for this reason we did not require in the proposition so whole an appearance, as a well-disposed eye can — well-disposed and applied to discern evidently — knowing always that some little of the Sun's appearance is not led off through the cause adduced, because nevertheless in geometric rigor BL is greater than CP; let something be subtracted, because some little compensation [is to be made] for a part of the appearance lying hidden, namely the imperceptible part; and so equally the appearance of the Sun for the same is perceptible, that the diameter of the Sun for that received be less than the appearance seen with C; and from this we conclude, that by this mode of direct gaze, when we take the diameter of the Sun, by no means at the same moment do we obtain it by two instruments, and with observers of the highest and lowest altitude, on the one hand from the highest part of the air; and on the other, by numbering the perpendicular with the aid of time, in which the Disc of the Sun on the days of the equinoxes passes through two finest threads in the

plane of the meridian extended; we found very often so great a diameter of the Sun, as much as by the said reflected gaze through the said appearance, and somewhat — though not rarely a little smaller. From this we concluded that one cannot evidently demonstrate the diameter to be obtained by direct observation, larger than that received through the aperture appearance, etc., consequently. Therefore, it is useless, in practice, to inculcate to astronomers this subtlety, which exceeds every human sense, however diligent. For it suffices that in these matters we obtain a diameter as exact as suffices for resolving and representing the heavenly phenomena to men dwelling on earth.

IV. PROPOSITION

Given those things stated in the III. Proposition, the apparent diameter of the Sun is given, to an eye placed at the point of intersection of the Rays comprehending the appearance of the Sun: both the distance of that intersection from the plane receiving the appearance, and the distance from the center of the aperture, in the perceptible sense.

Persisting in Fig. II: there, by Proposition III, the angle TCL is given; and parallel are HB and CL, by I. Proposition, applied secondarily, so the said angle is equal to the internal one, and opposite, THB, by 29 of Book I [Elements I.29]. Hence the whole angle AHB is given, bisected, as before we had it, cut, AB perpendicular to HT. This is equal to the angle FHG, under which, at the point of intersection H, the diameter of the Sun would be seen. Then in the triangle HTB, right-angled at T, given the angle THB, and the opposite side, that is the semidiameter of the Sun TB, the distance TB will be given by trigonometry as the other side HT, which is the distance of the point H from the plane AB, if there be taken away the previously given CT; there remains the distance of the points CH.

V. PROPOSITION

The distance of the point of intersection of the Rays comprehending the appearance of the Sun, through an aperture of perceptible size, from the center of the aperture, is sub-double the semidiameter of the aperture relative to the semidiameter of the appearance, if the semidiameter of the aperture be sub-double relative to the base of the appearance; equal, if the distance of the aperture be equal to the semidiameter of the appearance; smaller, if smaller than half the appearance; greater, if greater.

In the same Fig. II, since the semidiameter of the aperture CP is parallel to TB, in the triangle HTB, it cuts off, by 2 of Book VI [Elements VI.2], HT of the same proportion as HC, of which CP is to TB. Therefore, if TB be double CP, then HT will be double HC; if more than double CP, then HT will likewise be more than double HC; and so HC is smaller than CT. On the contrary, if TB be less than double, then HT will be less than double HC; and so HC is greater than CT.

It is customary, however, in the Instruments of Astronomers, to assume the distance CH smaller than CT. We have an example in the great Gnomon of S. Petronio, in which there is assumed CT of 100,000 parts, of which the semidiameter of the aperture CP is 100, and the semidiameter of the apparent Sun near perigee is the same 100; and the angle TCL given is 16 minutes. Whence we obtained CP, 100, that is, equal in the perceptible sense to LB, and the angle

THB likewise 16', by which we gather the whole TH of 121,500 parts, that is 16'; therefore there are Roman paces almost 100, and with the angle THB, of 121½. Then TC, the foot 121½, and the distance of the points CH, the foot 21½.

VI. PROPOSITION

The apparent diameter of the Sun, found through the whole appearance of the Sun by a perceptible aperture, is false, and perceptibly greater than that diameter which appears to the eye gazing directly at the Sun from the location of the aperture.

Let there be drawn, in Fig. II, from the center C of the aperture, the extreme rays CA and CB of the whole appearance of the Sun; for then the angle ACB will be greater than the angle LCK, which is the measure of the apparent diameter of the Sun to the eye C, by Propositions II and III. But because the aperture OP is perceptible, and by Proposition I, the half CP is equal to the right line LB, halved; and OG equal to the right line AK, perceptibly too; whence the excess of the whole appearance AB over the corrected appearance CT exceeds it. But should anyone think that this difference in the Sun consists of seconds of scruples, let him take an example from the preceding Proposition, in which we showed that, from a semidiameter of the Sun near perigee of 16 minutes, and a distance CT of 100,000 parts, and the semiaperture CP, that is LB, of 100 parts, the whole semiappearance TB, that is CT, with the angle TCB of 16' 55½"; hence the angle TCT, of 16' 55½", the whole following angle TCB of 16' 55½"; therefore the whole angle of the Triangles is 16' 55½"; and the angle ACB, of 19° 16" — or rather the whole angle ACB, of 38' 52" — is an enormously larger diameter of the Sun, which is found both through the corrected appearance KL, and by observing the Sun directly in C.

VII. PROPOSITION

To know and measure the appearance of the Sun and the lunar shadow, the quantity of a partial solar eclipse [Eclipsis Solis Partialis].

Into a long tube — of a black or bluish color within, fit to absorb the reflections of the rays — let there be inserted a thin perforated plate, with an aperture of the size of one inch, not exceeding it, set at some part of the tube, to which is fixed a little beam sustaining a well-polished and white tablet of the aperture; and in that same straight line, in which is the axis of the tube and the center of the aperture. Then from that straight line, the appearance of the Sun, when an eclipse of the Sun is exposed outside the little window of the tube on that part on which is the plate of the aperture, and let it be concluded that obscuration occurs, whether by

the absence of the aperture, or by the slit — except that the appearance of the aperture, from the plate, penetrates the tube on one side; and let the appearance of the Sun be converted into a single side, until the center of the Sun's appearance coincide with the same in the white tablet noted; soon afterward, in the periphery of the Sun's appearance, three points are noted, so that through them one can find the center, by the prescribed 3 [points]. Element 4. of Book I: let there at once be assumed an interval up to the periphery of the Sun's appearance, and from it let a circle be described, and let its diameter be divided into 12 equal parts; but one at least, as a subdivision into the minutest equal little particles, say 100, or 50, etc. — of whatever quantity it be, or however the diameter of the aperture be. Having begun, as before, in truth, let the lucid round of the Sun be moved, until the appearance of the Sun begins, and from the periphery of the said circle let the lucid appearance of the Sun be congruent on the periphery of the circle; and where the eclipse first stands, let the increasing quantity grow in the highest [part], nor more does the appearance grow into the interval of the lunar shadow, and the periphery of the lucid appearance of the Sun, in the diameter of the circle, bisects bifariously, cutting the shadow [umbra]. How much, however, is made by this interval, learn from the periphery into the diameter; so that the difference be in the parts and little particles. It expedites also, at once, in the highest [part] of the eclipse, to note three points by the appearance of the lunar shadow, two points on the common intersections of the two peripheries — the shadowy, namely, and the lucid; thirdly, however, at pleasure, but by Element I. 3 [Elements III.1], the center of the circle of the lucid appearance can be found congruent, and thence whatever part, from the diameter of the lucid appearance, has been obscured by the Lunar Shadow.

And as in Figure III: let there be noted the two points B and C, in which the peripheries of the lucid appearance ABC and of the Lunar Shadow GBC cut one another mutually; and besides, let the point H be noted, as it is found in the periphery of the lucid circle, with center F, and through that line the Diameter GH, continued with the diameter AI, easily distinguishes the circle by the measures of the eclipse absolutely; and being detected from the arc BIC, whatever part has been shaded HI, compared both with the whole Diameter, and with that other part itself AH, which was immune to the shadow [umbra]. And in this way indeed the eclipse of the Sun will be partial, not Annular.

But if it be Annular — that is, in which around the Moon, in the highest [point] of the eclipse, there appears from the Sun's Disc a certain Crown [Corona], or a lucid ring all around — there will appear also, within the corrected appearance DH, the whole circle of the Lunar Shadow [umbra Lunar], somewhat equally on all

sides, distant from the periphery of the luminous one. And in Fig. IV, when the Eclipse is Central — that is, when in the same straight line are the centers of the Luminaries, and the eye of the observer — let it be sufficient to take with a compass the interval of the peripheries visible at pleasure, which the least

the smallest, say AB. Sometimes, however, the parts of the periphery will not be equally distant from one another, as in Figure IV; and in that case one must take the two greatest intervals, the maximum CD and the minimum FG — unless FG should happen to touch [the other], in which case it suffices to take the maximum CD as a tracing-thread across these intervals above the diameter of the Sun's image. Let the proportion of the obscured diameter to the [whole] be noted.

VIII. PROPOSITION.

In an annular solar eclipse — and especially a central one — given the proportion of the Sun's image and of the lunar shadow, given the just measure of the eclipse through the insensible aperture is given in digits; or even in scruples, of what magnitude is the apparent diameter of the other luminary, and thence is demonstrated the proposition through its parts.

Let Figure V be brought in here, its explanation set out there on the left for the first case; or, if the aperture is insensible — almost vanishingly small, supposing the case to be possible, even if in practice it is impossible — these things being supposed, the proposition is demonstrated through its parts.

First, then, in triangle AGH the angle GAH is subtended [by] the base of the lunar shadow GH, in the position represented on the visual disk by CD; and the Sun's image by EF. Therefore per EF, and per 1, of the first Element, [it is] equal to angle EAF, subtending the apparent diameter of the Sun CD, and the part of the Sun obscured by the base EF. Therefore, by how much the eye A, turned toward the reflected image, sees the shadow GH, by so much, turned toward the Sun, does it see the Sun; and it estimates the obscured part of the Sun by it, even if it does not yet know how great it is. Similarly, in triangle LAM, the angle LAM, subtending the image LM, [is equal to] the obscured portion GH, and the remainder LG, and HM; hence the illuminated [part] becomes — equal indeed to the angle IAK, subtending the Sun's disk on the visual surface IK, as is plain by 8 of the first [Element], [it is] obtained from the Moon, the remainder indeed IE, and HF, [is] the apparent angle subtending it; and so much per 8 the angle apparent to eye A, directly contemplating the Sun, by how much then downward the contrary appears [as] the remaining image of the luminous part LG and HM; because, the [rays] intersecting one another mutually at A, the rays IM and KL, not tangent to

the Moon, just as the rays EH and FG, [are] tangent to that [Sun] of the angle; I note that IAE and HAM, since they are equal, just as the angle FAK and GAL, are between themselves. Therefore, just as the Sun is reckoned eclipsed, so by the rays it is estimated; in all these things also, with the parts of the luminous LG and HM; because, the [rays] intersecting one another mutually in A, the rays IM and KL, not tangent to the Moon, just as the rays EH and FG, tangent to that of the angle; I note IAE and HAM, since they are equal, just as the angle FAK and GAL, are between themselves. Therefore, as the Sun is reckoned to be eclipsed, so by the rays it is estimated; and as much as one luminary covers, so much of the other is read off.

The second [case], if the diameter of the other luminary apparent in scruples of one degree be given — for example, let the apparent diameter of the Moon be, by the preceding measure, CAD, 28 minutes; and per the foregoing discourse let the part of the Sun eclipsed by the Moon be of digits 10 and $\frac{1}{3}$ — that is, the whole solar disk of digits 12; if therefore the visual image of the Sun be estimated at 1, that is, of $10\frac{1}{3}$ and of 12 in scruples 28, and beyond, the 28th scruple proceeding, [is] of 32 scruples, for the apparent diameter of the Sun, and so of the rest.

IX. PROPOSITION.

Given the apparent diameters of the luminaries to the eye in the insensible aperture, or constituted in the pendulous insensible [aperture], and the distance of the aperture from the tablet receiving the image of the luminaries, and the just measure of the shadow of either: the apparent quantity of the image of the luminaries is given; and thence the apparent proportion to the observer of the annular solar eclipse, and especially the central one.

Let Figure V be supposed, as explained above. First, in triangle AGH, given the apparent lunar diameter, that is, angle CAD, given also the converticle GAH. Therefore, having drawn the perpendicular AB, the semi-[diameter] BAH is given, and the distance AB; in triangle ABH, the rectangle on AB, B. Therefore, through the canons of triangles is given the semi-diameter, the base BH, the whole shadow's half, or the Sun's image GH, in parts of what magnitude the note is AB. Likewise...

given the apparent diameter of the Sun, that is, angle IAK, the converticle LAM is given; and dividing it in two by the perpendicular AB, the angle BAK, in triangle AKB in the same rectangle on B, given therefore the distance AB, BM is given, the semi-diameter of the Sun's image, of which the remaining portion BH, the

obscured image of the Sun is composed; but indeed HM is luminous. Therefore L and M, and the proportion both of the whole composite image LM, and of the illuminated parts LG and HM, and the obscured parts GH.

An Example Afterwards to Be Used More Than Once

Let the apparent diameter of the Sun at perigee be 32 minutes, and its semi-diameter (that is, angle BAM) 16 minutes. Let the apparent diameter of the Moon at apogee be 28 minutes, and its semi-diameter 14 minutes (that is, angle BAH). Let the distance of the planes [of] equal distance AB be of 100000 parts, of what magnitude we measure in the gnomon of San Petronio [San Petronio gnomon] (Trigonometria of Pitiscus [Pitiscus]). For in triangle ABM the trigonometric ratio gives BM of $465 \frac{1}{3}$ parts; therefore the whole LM of $930 \frac{2}{3}$ parts. Likewise, in triangle BAH there is found BH of $407 \frac{3}{8}$ parts; therefore the whole part eclipsed [is] of $814 \frac{3}{4}$; and hence the illuminated parts LG and HM, summed, $116 \frac{7}{8}$.

X. PROPOSITION.

In an annular solar eclipse, the proportion of the Sun's image and of the lunar shadow [made] by the aperture of the sensibly admitted [rays] is not the same as that which [is made] by the aperture of the insensibly admitted [rays]; and therefore through it the just measure of the eclipse is not assumed, as [it is] in the tablet; but much smaller, just as it appears to the eye through the aperture in place of the eclipse; nor is the just proportion of the diameters of the Sun and of the Moon [given].

Kepler [Kepler] had asserted this universally concerning solar eclipses, in his *Astronomia Optica* (cap. 2, Proposition X), saying: *In the image, or ray, of a deficient Sun admitted through a round window, the corona, which is not acute in the heaven by legitimate admission, but appears in obtuse reduction.* And in Proposition XI, where it [says]: *The diameter of the Moon in images of this kind appears smaller than it [does] outside in the heaven.* And in Proposition XII, where it [says]: *The digits of a solar eclipse appear fewer in the ray than [they do] in the heaven.* Not only had he asserted this, but also demonstrated [it] further; and (cap. 11) he had taught the method of avoiding these fallacies at Problem 6, ad 13. (Problem 7.) *It is plain that, unless the aperture be in the manner of a point, the proportion of the diameters is always altered; and just as the Moon appears smaller, so [too] do fewer digits appear,* etc. But this, as though suspect from some other side, this not only did those two Fathers [Patres] pronounce suspect, but plainly false — as is stated and understood above. They could rightly understand by Figure V whatever truths there are in Kepler's, or in the Proposition of the

figure-drawing. Let it be [granted] that Kepler does not descend to the particular case of an annular eclipse — and especially the central — yet the rest of what we have set forth above (ad 13) we set forth with [more] order in teaching, and with greater clarity of cause.

For, supposing — whether possible, or not, but [only] imaginable — the insensible image of the species through an indivisible aperture A, in Figure V, the whole image of the lunar shadow GH, with the aperture loosened however to NO, and posited; the Sun's rays touching the Moon, and the margins of the aperture, namely by ray PCNQ, and RDOS, the whole image of the lunar shadow SQ. Since the image of the lunar shadow [is] of the earlier [magnitude], the indivisible aperture A, having been made, the portion QH, illuminated by the rays going out from the segment of the solar disk EP; and the portion GS, by [those] going out from segment AO. Since, however, the Sun's rays PQ, and RS, touch the Moon in the same physical points CD, in which the rays EH and FG touched it, and therefore from the same point of contact CD they descend ad space onto the earth QH, hence, and GS; thence, [it is] that which is supposed [to be], unless they appear divided by half a milliary *Italic*; and so much per Proposition I, they are parallel to sense, and therefore the semi-diameter of the aperture AN, equal to the physical distances of the plane of the portion QH, and the semi-diameter AO, of the segment GS, follow manifestly: the image of the Moon GH, indivisible by the aperture admitted in image; oblique, contracts; so much, [by] how much is the aperture's semi-diameter, and the whole [is] just as much as is the aperture's diameter NO. For...

[Margin: An argument in form]

For, on the contrary, the Sun's image [is] composed in part [of] its obscured part, and [in] part of the illuminated part, through the indivisible aperture admitted, it goes out [as] the sole image LM. The aperture being loosened, however, TV evades; for as the same rays of the physical points IK, descend; nor can [those] illustrating the parts MV, and TL, all by the same rays; which can enter through the same semi-diameter AO, just as it can be the semi-image AN; and because MV, just as TL, are supposed in the customary observations [to differ by] less than half a milliary *Italic*, and consequently per Proposition I [are] parallel to sense; and therefore [are] equal between themselves AO, and MV, just as AN, and LT; it follows that the composite image of the Sun is increased on both sides over its earlier [magnitude] LM, by so much [an] increment, [by] how much is the aperture's semi-diameter, the whole indeed [by] how much is the aperture's diameter. With these things supposed, the argument is redrawn into form.

[Margin: The argument in form]

In whatever way two quantities formerly equal, or in like manner unequal, are made — by reason of the proportion not being preserved the same as it was before. But in the proposed case, the image of the lunar shadow, or of the Sun, through the indivisible aperture admitted, were equal between themselves; but through the sensible aperture, the lunar [image] is decreased by just so much as the solar [image] is increased. Therefore the same proportion of these is not preserved, as before. The major [premise] is plain by the doctrine of proportion handed down by Euclid [Euclid] (Book 5, Element extended), and by Fernel [Fernel], Cardano [Cardano], and others. For, that it may be continued, or that the same proportion of two quantities, [whether] inequality, [whether] equal, be preserved, both must, in the same proportion, be increased, or in the same equally; or, if [the proportion] indeed were equal, just as [if] equal, [then] one minuted, the other increased. The minor [premise] is proved both [as] shown, and [as] the lunar shadow's image decreases by so much as the Sun's image increases; namely, by the whole quantity of the aperture's diameter. Therefore, etc.

But although in an annular eclipse — yet not central — the situation of the lunar shadow [is] diverse [in that] it is from it, as Figure V represents, [if] the Moon be in the highest [part] of the eclipse, declining to the left part; the lunar shadow [is] medium-full, ad B, [in] the right [part] of the solar disk; the Sun's rays indeed [are] medium-full, to the left [part] of the tablet descend, and to the right of the solar disk in the tablet's right; the image appears larger, [in] which [is] the image itself of its left [part], than the right; [the] compensation nevertheless being made: so that the whole augmentation of the Sun's image on both sides, summed, [is by] how much is the diameter of the aperture; and by so much is made the decrement of the image of the lunar shadow.

Furthermore, the same proportion of the images not remaining, it is certain that there cannot be obtained the just measure of the eclipse in digits — much less the just proportion of the diameters in scruples — as long as the species of [either] is taken up [as] the incorrect, and as it appears in the Table of observations. For, from the said Proposition VIII, the just [proportion] is that which is deduced from the proportion of the aperture in the indivisible, and through the sensible aperture that proportion is destroyed; nor can it be had the just by it. Which by an example also shall be made clear.

An Example for Practice

Persisting in the example of Proposition IX. Let the Sun's diameter at perigee be 32 minutes, the Moon's [diameter] at perigee 28 minutes. [It is] certain that in such a central solar eclipse the Sun is obscured by the Moon by 32 minutes minus 28 minutes; and thence likewise, that [there are] 4 [minutes] remaining immune from the eclipse; this posited, then, [if] the distance of the aperture from the tablet [be of] 100000 parts, there comes out by necessity the Sun's composite image LM of parts $930 \frac{2}{3}$, and the lunar shadow [of] parts $874 \frac{3}{4}$; let it be loosened now [as] aperture; and let NO [be] of 200 parts, of what magnitude AB is 100000. For, as we showed in the Proposition of this proving, the whole image is increased by the quantity of the aperture, the Sun's image, and the whole [image] by the same quantity the lunar shadow's image is minuted. Therefore the whole TV [is] of parts $1130 \frac{2}{3}$, and the shadow SQ of parts $614 \frac{3}{4}$. Make now [as] of observed measure of such an image, [as] it appears in the Table of observation; so that TV $1130 \frac{2}{3}$ ad digits 12; ita $614 \frac{3}{4}$ ad the fourth proportional number, and there come out only digits $6 \frac{53}{113}$; whereas there ought to be digits $10 \frac{1}{3}$; since indeed by 32 [minutes] the Sun's diameter is scruples [of] 12, [and] is obscured ad digits $10 \frac{1}{3}$. Therefore, if anyone should observe a solar eclipse from A, directly, he would see manifestly [that the Sun is] not eminent from the eclipse free...

from the solar disk except by $1 \frac{2}{3}$, hence, and $1 \frac{2}{3}$ thence. The other observer, however, observing the same eclipse in the Tablet, and computation having been made from the species in proportion, just as he will, by the corrections, [he] pronounces, not [that] the eclipse was just digits 6 [but] of circiter 7; apparently both of the Sun obscured [as] of digits at the nearest $10 \frac{1}{3}$; the whole indeed and both; and perhaps, contesting one [against] the other, [out of] the hallucinations he insinuates; meanwhile let each [of these] direct observers of [those things which are] perhaps subtleties unknown labor [under] the existing geometry; than which Table the observer professes, or [it would be] ridiculous, [if he should] have the artifice of astronomers.

XI. PROPOSITION.

In an annular solar eclipse — especially a central one — given the sensible aperture's quantity in parts, of what magnitude the note is. The just quantity of the eclipse [is] to be demanded by the aperture of the sensibly admitted [rays]; and the lunar shadow's image is to be added, that there may be had the just quantity of the eclipse; and the just proportion of the images, and of the diameters of the luminaries [is] analogous.

For, the aforesaid correction of the case of Proposition XI having been made, it is reduced to the case of Proposition VIII and IX; ad the case of the indivisible aperture, in which the same we showed [holds]: it has the just quantity of the eclipse, and the proportion of the diameters, etc. The species are taken up indeed [in] this way, [but] absurd, collecting quantities, etc. But it could be doubted, and difficult [to] correct the other [image], and to redraw [it]; the example set forth above [is] of four modes, which finger [pointings] can be [used] in practice [to] correct [it]. These things posited, then, [with] the diameters of the Sun 32 minutes, and of the Moon 28 minutes; therefore, [in] an eclipse of minutes 28, or of digit[s], of what magnitude the diameter of the Sun is estimated [at] 12; and the aperture's diameter posited [as] of parts 200, of what magnitude the distance of the planes [is] 100000. There come out the species of the Sun, and of the lunar shadow now corrected; and as above prescribed; let the incorrect [species be] corrected, as in the following little table:

Species	Solis part. [Sun's part]	Vmbra Lunar. [Lunar shadow]
Incorrecta [Incorrect]	TV 1130 2/3	SQ 614 3/4
Correcta [Corrected]	LM 930 2/3	GH 814 3/4

But a fourfold proportion could be instituted; namely, of the corrected Sun to the corrected shadow; of the corrected Sun to the incorrect shadow; of the incorrect Sun to the corrected shadow; and of the incorrect Sun to the incorrect shadow. So [the] digits [of] 12 ad the corrected solar digits, and there come out [the] digits, as in the table written below:

Speciebus [By the species]	Vt partes [As the parts]	Ad partes [To the parts]	Sic Digiti [So digits]	Ad Dig. Eclipsi. [To the digits of the eclipse]
Incorrectis [Incorrect]	TV 1130 2/3	SQ 614 3/4	12	6 59/113
Correcta Solis [Corrected Sun]	LM 930 2/3	SQ 614 3/4	12	7 86/93
Correcta vmbra	TV 1130 2/3	GH 814 3/4	12	8 73/113

Speciebus [By the species]	Vt partes [As the parts]	Ad partes [To the parts]	Sic Digiti [So digits]	Ad Dig. Eclipsi. [To the digits of the eclipse]
[Corrected shadow]				
Correcta Vtraq; [Both corrected]	LM 930 2/3	GH 814 3/4	12	10 1/3

It is established, therefore, that by no other mode is the correction here to be made than as we have prescribed [it] in the Proposition; and [that] each man errs most basely of all, who contends to correct neither species, since he must indeed recede most greatly from the true quantity of the eclipse — which in such a case is necessarily [of] digits 10 1/3.

Parsing notes: The four-row table's rightmost column ("Ad Dig. Eclipsi.") is partly obscured by tight composition; readings are 6 59/113, 7 86/93, 8 73/113, 10 1/3 — the denominators of rows 2 and 3 are faint. The only fully-defensible value is the last (10 1/3), which the text confirms as the true measure.

XII. PROPOSITION.

Can a solar eclipse appear annular to an eye intently gazing on the Sun's image, and the lunar shadow in the Tablet, projected through a sensible aperture, which nevertheless does not appear [annular] in the open air; nay, [it appears annular] not only out of place, but [also] out of time, observing the eclipse out of place, if indeed the aperture be notably larger than the aperture of the projecting eye.

I do not describe a peculiar figure for this, for Figure V can serve, [if] our accommodation be applied. Let the whole disk of the Sun be not at IK, but at EF, of which the extremes E, F, [are] the rays touching the Moon [as they] run into the pupil, or [into] the aperture of the projecting [eye], the whole Sun itself [being] covered by the Moon, [it] will appear under angle EAF. But the aperture posited...

by the aperture NO, notably larger than the aperture A of the pupil, [the rays] will be able to enter to the sides of the Sun's segments EP, and FR, the rays not touching the Moon physically in CD, but avoiding all contact with it, or [coming in] at remote distances ad C, and D, intersecting [one another], of which the extremes are PNQ, and ROS; and so the lunar shadow appears between the parts

SQ, and GS, neither subtending the angle GAH, equal to the angle EAF, under which the eye A sees the whole Sun obscured; but [it appears] the smaller angle SXQ; [it] is fitting nevertheless [that] the aperture be very large before the eye, if the angle SXQ ought to be sensibly diverse from the angle GAH, and the parts GS, and QH, be sensibly illustrated.

XIII. PROPOSITION.

In a partial — yet not annular — solar eclipse, the proportion of the species of the Sun and of the lunar shadow [made] by the indivisible aperture of the insensibly admitted [rays] gives the just quantity of the eclipse in digits, or even in scruples, of what magnitude the note is of the Sun's apparent diameter.

For the truth of this Proposition there are three figures to be inspected, namely Figure VI, for a precise solar eclipse of 6; and VII, for a smaller eclipse of digits 6; and VIII, for a larger [eclipse] of digits 6. These having been understood, [it is] easy to understand the ratio of the proposition I [now] put forward. First, then, before any eclipse, [if] the Sun's image FD be supposed [to be made] by the indivisible aperture A, and dimensioned: this disk and image, going out from the left of Figure [VI], with the rays touched BHG, and the indivisible aperture A, of the solar disk's segment CG, and in the Table is seen the obscured image of the segment BD, by the other [segment] FB, illustrated [as the] segment GE, [a] ray of the segment GE, which similarly the segment discovered [in the obscured part] is seen [by] the eye, [it] subtends the angle GAE, to which [is] equal angle BAF, measuring the part BF, [the] illustrated image, just as the angle CAG, under [which] the eye sees the part A, [the] obscured part [of] the Sun, or covered by the Moon, and [it] is equal to angle BAD, measuring the part BD, the obscured [part]. Therefore the eye, by the conversion ad the Tables LM, [estimates] so much [as is] estimated of the eclipse, [the] eye reflected by the intuition, by how much the conversion ad the heaven [is] directly intuited. Therefore, if [it be] just, [then] the whole FD, [the] whole eclipse FD; this image [is] composed, and noted in some measure, say [in] hundredths, particular [parts] of a Roman inch [uncia Romana], ad digits 12. So [is] the shadow BD, in the same species particular note, ad another [thing], proceeding [for] so many [things] which [are] the eclipses estimated [by] the observer of the eclipse from A, contemplating the heaven. But if the Sun's diameter be noted in scruples of one degree, multiplying by particular inches of the Sun's image composite, [the] shadow BD, in the same dividend through scruples of the whole [is] the just diameter, [there] comes out the scruples of the Sun's image eclipsed by the Moon. Per Figure VII, attend the lines BD, [as] adhibited per VI, and VIII, [is] adhibited GB, etc.

XIV. PROPOSITION.

In a partial solar eclipse, although not annular, the proportion of the species of the Sun and of the lunar shadow [made] by the aperture of the sensibly admitted [rays] is not the same as that [made] by the indivisible aperture of the insensibly admitted [rays]. And therefore through it, taken up [in this way], the just quantity of the eclipse in digits is not obtained, as appears in the Tablet [where the rays] are not received in scruples of one degree.

Figures VI, VII, and VIII are to be recalled again; the exposition having been adjusted to them; for they have been well perceived [and] the truth of this proposition will be readily established. The aperture being loosened, then — which is fit [as] IK, and before the eclipse [if] the extremes of the Sun's rays CKM, and EIL — the Sun's image then [is] luminous [as] the whole LM, which measure [is] just per the said Proposition VII. The Moon arriving afterward, [as] the parallax of latitude, hence, and contacted [in] the parts OHKP, [it] subtends in the highest eclipse, the lunar shadow; not varied however [as] evading [the] parts HB, of its own peripheries, [it] subtends; sed not [by] quantity; [it] subtends, in [as much as it] is just [as much as] is detected BB, in P, quod, hence, ad parallelism of the Radii AN, and HP; or [is] equal [to the] semi-aperture AK, [it] acquires the whole at its extreme D, occupying the space [in] the earth CAD, and CKM, [which] is equal [to the] semi-aperture AK; and so the space ratio per the lunar shadow PM, [is] equal [to the] prior BD. But, on the contrary, the portion of the solar image illustrated by the rays of the solar segment OE...

the whole LP, when in the case of the indivisible aperture it would be only FB; [there] is indeed the [image] LF, by reason of the parallelism of the rays EAF, and EIL, equal also [to the] sense [of] the semi-aperture AI; and so to part BP, from the shadow [it] is left over. Therefore the whole image LP, which remains illustrated, increases [by] the illustrated [part] FB, the whole quantity of the aperture being composed [of] LF, and BP; the remaining indeed [is] the augmentation of the image lucid, namely [as much as is] illustrated DM, nor [does] augment the image obscured, just as posited; lucid in the eclipse, [as] indeed they occupy the position, [and] permute. With these things supposed, the argument is thus formed.

[Margin: An argument in form]

In whatever way two quantities formerly equal, [in] one [way] remain invaried formally, and equivalently, because [it] remains so much only [as] increases out of one part, [by] how much out of the other decreases; the other indeed absolutely is made [the] major itself, [it] does not remain the same [in] their

proportion as they had before. But in a partial solar eclipse, although [it be] not annular, the image admitted [as the] species per the sensible aperture, the lunar shadow's image remains invaried equivalently; because, [by] how much it loses on the right of the space detected out of one part, [by] so much only [does] it occupy out of the other; [whether] in the case of the aperture in the indivisible [it] were equal [to the] lucid portion of the solar image, just as in an eclipse of digits 6, [whether] it be minor, just as in an eclipse of digits fewer than 6; [whether] it be major, just as in an eclipse of more digits than 6. On the contrary indeed the lucid portion of the solar image [is] always made major than itself, [whether] just as [it would be] in the case of the aperture in the indivisible. Therefore the aperture admitted [as the] species of the Sun, and of the lunar shadow [is] not the same proportion, [as] that [made by] the aperture in the indivisible admitted.

The major [premise is] plain by the doctrine of proportion as evident as [a thing] deduced from the first principles, or definitions. The minor [premise] is proved [as] by the exposition itself of the figures VI, VII, and VIII discoursed; furthermore on this fact, virtually extended through all the possible cases of a partial solar eclipse.

The proportion, however, not remaining the same, but varied, per [the fact that] through it cannot be obtained the just quantity of the eclipse, which [would be] obtained per the proportion of the aperture in the indivisible reception. But per this [is] obtained the just quantity of the eclipse per Proposition XIII. Therefore by that other [way] it is not obtained [as] just.

XV. PROPOSITION.

In partial solar eclipses, given the quantity of the sensible aperture, and of the species of the Sun and of the lunar shadow; the Moon [being seen] through that which [is] admitted, [there is] obtained the just quantity of the eclipse, [it being] subtracted from the whole image of the Sun composite [of] one part of the image illustrated, the whole quantity of the aperture; the lunar shadow's image indeed [is] to be diminished [by] the semi-diameter of the aperture out of one part, and to be added out of the other; this [is by] arithmetic nothing to be added, [or] to be subtracted from it.

The reason is, that this case is to be redrawn ad the case of the indivisible aperture, through which is had the just quantity of the eclipse by the said Proposition XIII; and without which [it] is not had per the said Proposition XIV. It is redrawn, however, [so] that that be made which in this proposition we said to be made; per the induction made through three genera of figures VI, VII, and VIII

represented; and by the said conjoined Proposition XIII and XIV [it] is plain; and briefly it is indicated, more clearly. For, just as the Sun's image in the case of the indivisible aperture is composed, [in] part [of] the lucid [part], and [in] part [of] the obscured FD, [so] in the case of the sensible aperture, [it] is LM, [the] major than FD, [by] the parts LF, and DM, [taken] simultaneously [as] equals of the aperture IK; [if] their aggregate be subtracted, [it] is redrawn ad the species LM, ad the indivisible image FD. Because indeed the lunar shadow's image [is] the species in the case of the sensible aperture [as] PM, so much augmented by DM, by how much [it is] diminished per BP; [if] from the shadow PM, [there] be subtracted DM, equal [to the] semi-aperture AK, and to the same [be] added BP, [also] equal to the same AK, [it] is redrawn again [as] BD, [the] therefore species fit, [and] of the same BD, [as] from the first ad the last in the computation arithmetic, nothing to be added, [or to be subtracted].

XVI. PROPOSITION.

Given the Sun's, and the Moon's apparent diameter in scruples of one degree, and the sensible aperture's diameter in parts, of what magnitude the note is of the aperture's distance from the plane of the species received; and given, finally, [the] quantity of the eclipse not yet observed: [there] is given the quantity of the species of the lunar shadow...

[Margin: the lunar shadow, and of the Sun, in parts — of what quantity is the aforementioned Distance.]

If, then, from astronomical Tables or from an Ephemeris you know in advance the foreknown quantity of a partial Solar eclipse, whether past or future, take the older Figure II, and with the apparent semidiameter of the Sun — that is, the angle TCL — search out the Distance CT of the eclipse, taking the indivisible aperture LB equal to the semi-aperture; you will then have the sensible image of the Sun TL projected through the aperture to the indivisible aperture OP. Next double TL so as to have KL, and let it stand that 12 digits correspond to KL. Then, just as you reckon the eclipsed digits, or the things to be eclipsed, for that proportional number, you will have the image of the lunar shadow as it would appear through an aperture as good as indivisible — but with the situation altered, as happens in non-annular eclipses. Yet if the Moon's apparent diameter is smaller than the Sun's diameter, the eclipse will somewhere be Annular, indeed somewhere even Central. Then, therefore, from the species of the lunar shadow, in order that the species of the whole diameter be more intently inspected, you will have the image of the shadow as it would appear through a

sensible aperture, by the rule that follows from the converse of Propositions XI and XV.

XVII. PROPOSITION

The same Distance from the image Plane being retained, however much the quantity of the aperture be varied, the same quantity of species is received, the parts subtracted (in Annular eclipses) or added (in the lunar shadow species) being set aside — provided no [other] quantity of species be added or taken away beyond the proper quantity of the species lawfully admitted.

By "right quantity of species" I mean that quantity of the species, equal to the apparent diameter of the Sun, which the indivisible aperture admits, fit for investigating in the manner of Proposition II the apparent Diameter of the Sun itself. This Proposition rests upon the Corollary deduced from Propositions XI and XV. For no proportion of addition or of subtraction is to be made such that the species be founded upon a like cause as the increment of the Sun's image and the decrement of the lunar shadow. But if the distance has been so great as to obtain that very equality, then, while the aperture remains so moderate that it is fit for representing the species, the same equality of distance will remain so long as the distance is unvaried. Hence it comes about that, if the quantity of the aperture be varied, and afterwards that quantity be taken away from the species of the Sun, there will not be found by this means the species so corrected at the same Diameter, with the aperture-quantity of each removed, as was found exactly in the manner handed down in Proposition II. The sign of this is that the dimensions of either species were not exactly the same in our observations, and the Diameter coming out the contrary way for the same species and from the same observation was barely acceptable. To prove this point we were accustomed to undertake a threefold experiment of our observations, and from each to select that diameter of the Sun which, with the aperture of one or another quantity removed, came out the same on the same day in the same quantity [?].

XVIII. PROPOSITION

The quantity of the aperture being retained, and its distance from an equidistant image plane being varied — although the species received does not maintain itself at the same quantity through the indivisible aperture for the Solar species among themselves and for the lunar shadow species among themselves, by some proportion; indeed, although the increments or decrements of the species through the sensible aperture do not remain, that same proportion nevertheless remains among the total species admitted through the indivisible aperture.

In Figure IX let there be a luminary — say, the Sun — its center O, its extreme limb A, from which the extremity BC of the semi-aperture is produced to infinity along the ray AM; let BC be the semi-aperture, [drawn] through the center O of the luminary; and let EG, EHK, and DM, equidistant among themselves, be drawn from the same point O, perpendicular to OD, to which EG, EHK and DM are applied. For by Proposition 2 of the sixth Element [Euclid VI.2] the section will be cut proportionally, both for the Triangle BDL and for the Triangle ALM. Therefore the bases of the semi-aperture through the indivisible aperture B, admitted, namely EF, HI, and DL, will be proportional among themselves in relation to the distances BE, BH, BD. Moreover the increments of the species from one part of the Sun, or from the lunar shadow, that arise from the rays of the Sun entering through the semi-aperture BC — namely FG, IK, LM — can be in proportion among themselves. Yet the total species EG, KH, DM will not be in continuous proportion, but will be among themselves in the proportion that EF, HI, DL have among themselves, when the Triangle ALM is equiangular to the Triangle BDL, nor in the increments will the proportion be the same as the bases EF, HI, DL have. The proportion which is between EF and HI is greater than that between HI and DL, by the doubled interval of paces $972\frac{1}{4}$ in the Solar radius, but by 21486 in the lunar radius. For the more it is set down, by the greater interval; if less be set down, by the smaller interval — only by 5 paces [?]. For if a smaller interval be conferred at equality of the basis EF, HI, DL, above EF, and earlier than the excess FG, above BC, then IK, above FG, which by Proposition I per the doubled interval of paces $972\frac{1}{4}$ in the lunar radius, but 21486 in the Solar radius mounts up by paces only 5 [?]. Therefore, the physical inequalities EF and HI being made, if to these be added EF and IK, equal physically, the proportion which is between EF and HI will not remain.

XIX. PROPOSITION

The species of the Sun, and the lunar shadow, being given through a sensible aperture of a quantity not exceeding 10 parts in its own semidiameter, received in a plane not distant from the aperture by more than $972\frac{1}{4}$ [paces] for the Solar species; given also the semidiameter of the aperture, and the distance itself of the plane from the species, [the proportion] is of one kind. There are given all the remaining species congruent to the indivisible aperture, and to whatever lawfully admitted [species], given an aperture distance greater and lesser to infinity; and so the true proportion is observed in the greater, and at the distance observed; and the dimensions.

Return to Figure IX; let there be, within the aforementioned doubled interval BE, the given semispecies EG and the semi-aperture BC; in parts, of which kind is the same FG, physically equal to BC itself; per Proposition I. Therefore from the said Proposition XI and XV subtract FG, the semispecies admitted, and there remains the semispecies EF, due to the indivisible aperture B. From this is given the species due to the Solar [aperture]; and now, the Distance BE being given, the species EF; thus given the Distance BH, ad HI, ad datum BD, ad DL, and so to infinity; for you will have the semispecies due to the indivisible aperture. From these doubled, you will have the species whole through the indivisible aperture; and at length by their subtraction, as observed for the indivisible-aperture species, you will have the residue equal to the additament to be made for the lunar shadow as observed in eclipses through the indivisible aperture. In the remaining lunar-shadow species observed, it is not varied at the observed quantity.

Thus far concerning the case in which we suppose the eye constituted in the sensible aperture. Henceforth concerning the case in which the eye is constituted in the common section of the Sun's Radii above the Foramen sensible-aperture made — the lower aperture nevertheless remaining sensible, that is, the eye being constituted at the point Z, Figure V.

XX. PROPOSITION

The Distance given through Proposition IV and V of the point of intersection of the extreme Solar Rays through the margins of a sensible aperture, and a semidiameter of the sensible aperture being received in the plane of the species, and the apparent semidiameter of the Sun being received in a non-annular eclipse. The species of the lunar shadow is given apparent, the eye being constituted at the said point of intersection as it were an indivisible opaque aperture equidistant from the sensible aperture.

Let Figure V be repeated, in which, in accordance with the exposition there indicated, how much in actual fact the aperture NO is open. Yet imagine through the point Z of intersection, the plane being drawn, opaque [?]; the plane being drawn imaginarily, opaque, because in actual fact it is not parallel, imaginary, indeed, because in fact the rays do not there subsist; but they pass through the aperture NO, and the basis TV. Yet supposing this fancy, the species would indeed be of the Sun the same, which appears through the sensible aperture; some part shaded by the Moon, and the extreme [part] of either; near the extreme TV [?], it is illustrated, so that the lunar shadow image be $\delta \downarrow$, terminated from the Solar rays $aZ\beta$, and $\gamma Z\gamma$, touching the Lunar globe most nearly at C_2 and D_3 ; then

[Margin: figure II — because no line is drawn for the designating of the shadow; but We, of their Argument reduced into a form more faithful applicable to Figure V, that the distinction of the lines terminating the shadow may be more comprehended from the bright lines, may more clearly appear of the solution of the Argument. Therefore they go:]

then the eye constituted in Z, will see nothing of that segment of the Solar disc, which is within the points δa , the remaining segments it would see a, it would see still the maiusculam [larger] Eclipse, than it would be in A, and the species would pass through the indivisible A: a difference yet scarcely sensible by perception, would be on account of the nearness of the little point A, and Z, as demonstrated at Proposition V.

Therefore in such a case of the fiction, the data being given of the apparent lunar diameter, that is the angle CAY, given, and yet still it is adverted [to] BAH. Here the angle is equal, the interior, and opposite BZ, because the interval above so often by us supposed, the rays from the same physically point of contact δ , namely CAH, and CZ β , are sensibly parallel. Therefore in the triangle ZB δ , right-angled at B, with the said angle predicted, and with the said distance BZ; the semi-shadow B δ is given by Trigonometry, of which the double is the lunar shadow δd , the apparition Z $_4$ if &c.

Yet meanwhile let it be well adverted, the aperture NO being open, that the shadow itself in actual fact SQ, [is] not only smaller [than] the shadow GH, the aperture being open A, per the indivisible aperture A, but much smaller [than] the shadow δd , would appear at the point Z, indivisible; and below it will be inculcated what may be against the opponents in this Keplerian doctrine.

XXI. PROPOSITION

Although as to the Solar species' projection, the same thing happens, whether it be admitted through a sensible Foramen, or as if it were transmitted through an indivisible Foramen feigned at the point of intersection of the common rays touching the internal margins of the sensible aperture — yet not the same thing happens in comparison with the species of the lunar Shadow admitted per the sensible aperture and the Solar species; the lunar Shadows being feigned as admitted, [the Moon] being feigned through the center of the indivisible sensible Foramen, situated in either situation.

If Figure V is again attentively introspected, and the members of this Proposition be distinguished among themselves, the truth of all of them will easily be shown;

therefore it pleases to apply a more particular hand to the figures, and to demonstrate.

First, the amplitude of the aperture NO being posited, and its distance AB, the plane TV, receiving the species, and the proximate distance of the Earth, the nature of these things — the point Z, in which they intersect the extreme Solar Rays IZV, and KZT, as the species of the Sun TV, would appear, the eye being constituted at Z, than at A, and quite before the whole lucid eclipse; and so the same thing happens, because Z, in reality is not the point of any opaque aperture impeding the lucid projection of the species TV, but is the mere passage of the intersection of the rays freely permeating.

Secondly, because in reality per Z, not the duct [is] open, or the opaque plane standing in the way of the rays, sound — through the aperture NO, the rays freely enter and the basis TV, in part the rays enter from the segment ST₃; and from the Solar segment RK, and the part of the basis right [side] QV, all the rays arising are from the Solar segment IP; therefore in actual fact the lunar shadow image is contracted into the segment SQ, nor [is it] so great, as great as is the lunar shadow Bδ, if the interposed [aperture] were opaque αθ, nor would the other rays touching the Moon radiate, than ZB, and γZδ.

Thirdly, because through the indivisible aperture feigned in the center A, the Solar species LM, per the indivisible aperture feigned in the center A, and per the species feigned indivisible A. Therefore the species of the Sun in comparison would happen the same, much more if it were compared at the same species introduced through a sensible aperture in the plane αθ.

Fourthly, because in reality the shadow image SQ, is smaller than the lunar shadow too, [than] that which would be projected through the indivisible center A, namely the shadow GH; therefore not the same comparison would happen. Subordinate to this distinction it may be responded equally easily; as also as we shall demonstrate the chief principle of the said Fathers, which is of this kind:

Argumentum praecipuum contra Keplerum, & eius dissolutio.

[The chief Argument against Kepler, and its dissolution.]

Those Fathers indeed use another Figure, and a more similar Fi-

[Margin: figure to figure II than V; because no line is drawn for the designating of the shadow; but We, of their Argument reduced into a form more faithful applicable to Figure V.]

interposed the ray of the Sun touching the Moon, and terminating the shadow, passing they terminate solely through the point of intersection Z: for it is in actual fact SQ, which then would be $\delta\beta$. But it is another thing to consider these future things under condition, which would be, but is not; another thing what in the present is in actual fact not posited under condition, opaque $\alpha\theta$, but on the contrary the opaque position of the aperture NO, amplitude posited. *But it was easy to transfer through inadvertence that which agrees with the convenient observations feigned through imagination of the opaque $\alpha\theta$, impeding the ingress of the rays through the aperture NO, to the present matter, where the proportion of the Solar species at the lunar Shadow is to be considered not as it [the aperture] would be, but as it is in fact.* It is indeed much greater the excess of the Solar species, than it is in that fiction, and than that which is to be used, of the included Eclipses, even without relation to the quantity of the diameter of the Sun, but as to the number of Digits, it is to be had; and as to the number of the species responds to the first major proof.

To the *second* proof of the major, I distinguish, and that being granted, but not granted as to the parts of the more positive species; and really with it identified, I deny as to the parts negated, nor identified, of which kind is the shadow, in respect of the aggregate aggregated from it, and from the luminous parts; for daily we see in the aggregates from shadow, and from the surrounding light, that the whole aggregate remains of the same quantity, yet the parts of it decrease, the species themselves increasing. Indeed among the positive parts themselves, and identified by continuation; for example, among the parts of the vitreous water situated, [as] when included we see drops of water, [as] a full fistula, to remain of the same quantity, certain ones by force of nearer heat are rarefied, and occupy ampler place, others are condensed, and constricted; therefore, I said, *Data non concessa* [the data not granted].

FINIS.

Diagram. [Plate of figures enumerated for Appendix I of Chapter XII; six numbered figures arranged across the lower half of the page.]

- **fig. 1** (left): a tall narrow elongated triangle. Apex at top labeled **A**. The long vertical edge descends to a small box at the foot. Lower portion bears labels **B, C** (mid-left and mid-right of a horizontal crossbar) and **H, K, L** at the small box at the base. Represents the cone of the Solar species through the aperture (the long thin pinhole-image triangle).
- **fig. 11** [labeled "11.fig."] (center): an X-shaped (hourglass) crossing of two ray-pencils. Top labels **F, G** (left pair) and **N** (right). The crossing point in

the middle is labeled with **E, V, D, C, O, P** clustered around the intersection. The lower spread carries **A, K, T, L, B** along a baseline. This is the intersection-of-rays figure (the point Z / aperture geometry of Propositions IV–V and XX–XXI).

- **fig. 3** [labeled "3.fig."] (right): two overlapping circles (a larger lower circle and a smaller upper circle) representing the Sun's disc and the lunar shadow overlapping in an eclipse. The upper circle has labels **A** (top), **H** (interior near overlap). The large lower circle (shaded/hatched) has **B, P, F** along its vertical axis and **G** at the bottom. Depicts the partial eclipse overlap.
- **fig. 4** [labeled "4.fig."] (lower): two side-by-side circles, each with an internal shaded disc. Left circle: **A** (top), **B** (just below top), **C** (center), **G** (bottom). Right circle: **C** (top), **D** (just below), with **G** at the bottom. These depict the projected Solar image and the contracted lunar-shadow image (compare species SQ vs. GH of Propositions XX–XXI).

[continued from "autem"] of figure II, than figure V, because no line is drawn for the designating of the shadow; but We, having reduced their Argument into a more faithful form applicable to Figure V, [intend] that the distinction of the lines terminating the shadow be more comprehended from the bright lines, [and] that the solution of the Argument appear more clearly. Therefore they go [as follows]:

When the Rays transient through the sensible aperture NO, [it is] the same thing as to the species' projection, as if the Rays transient per their intersection through the point Z, where it would be opaque $\alpha\theta$, the rays resisting at all other places; the rays would enter through the point Z. But in the case where the rays transient through the indivisible point, nothing would be taken away of the Solar species; therefore neither would there be anything taken away in the case in which they pass through the sensible aperture NO. The Major is proved: *First*, as to the Solar species, because in both cases the same quantity of the Solar species, the same intensity of illumination about the extremities TV, through the penultimate point Z, which is the most lax of the aperture NO. Thereupon it follows that the lax aperture is evident; the discerning of the projected Solar species, and falls under sense, is not the same, but the effect would not be changed of the quantity of the Solar species TV. *Secondly* it is proved, as to the lunar shadow, because in both cases the same shadow-species would remain in quantity, neither increasing, nor decreasing, [in] the parts which themselves ought neither to increase nor decrease. But the Lunar body in the present case, and in respect of the plane in which it is observed, is as it were a certain Solar spot, and as to its own parts is partly

obscure; therefore neither would the lunar shadow image itself increase, or decrease.

The Minor is proved: *First*, by the authority of Kepler himself, who at chapter 11 [of the] *Astronomia Optica*, Problem 7 [*Astronomiae Pars Optica*]: *Unless the aperture be quite the minimum, made as it were the point's instar [likeness], the proportion of the Diameters is always varied, the Lunar [diameter] perhaps appearing the smaller, and the Digits fewer to appear*; virtually [Kepler] concedes, if the aperture were of the point's instar, the Digits not to appear fewer, and We, [agreeing] ourselves above, are not at all to hold the right quantity of the Eclipse, [it is] taught to be reduced to the case of the sensible aperture, and to the case of the indivisible aperture. *Thereupon by reason*, because the whole proportion which is obtained for the mutilated species of the Sun, and the augmented species of the lunar Shadow, is the same; and so supposing it varied, it would vary in this case of the sensible aperture, ergo it is not varied in this case, neither is it to be corrected. *And if so*, it is necessary to correct, that of which one quantity is to be had, neither would the proportion of the Solar semidiameter, and of the obscured part, be changed in the method of Kepler. *Nor [is there] doubt*, if even one of the said Fathers [holds] that by this method of Kepler a foundation Table may be founded, would they not err altogether, &c. He confirms that hitherto it is gathered, that there is detracted from the Solar species the portion MV, neither the data of the point Z, of the distance ZB, but only the distance AB, per the correction BM, we recognize the angle BAM; per Aristarchus, *De Magnitudinibus Solis*, Book 5; per Kepler's *Astronomia Nova* chapter 11; and at *Almagest Novum* chapters 4 and 6, where Kepler's doctrine is adduced; it is not treated of investigating the magnitude of the Solar semidiameter, but of investigating the magnitude of the Eclipse, which thing matters nothing, [it is] enough to know such an angle, neither does it suffice to know the mere proportion of the Solar species in the Tablet projected with the lunar shadow species. *But it was easy*, it is the same thing that is patent, *to transfer through inadvertence, that which agrees with the observations measured per the angle, to the present matter, where one considers the Diameter not under the relation of the angle, but under the proportion which a part has, which is covered by the Moon*. These [things], We, with all those things addends rather robust to the argument, than that enervated, that I doubt not, that they would for their own candor be agnized.

RESPONSIO

[Response.]

I respond to the *Major* with the distinction set in the title of Proposition XXI, and from the position itself subjoined to it, and I concede the Major concerning the species of the Sun precisely considered second per se, or separately from the species of the lunar Shadow; but I deny the Major, concerning the species of the Sun as to other comparisons adduced; and chiefly the comparison of the species of the lunar Shadow [with] that species which, in fact, and in reality is projected above the species of the Sun from the rays of the Sun entering through the sensible aperture, by those, namely, [which are] turned around the shadow image, and the contraction would be much more than it would be in the opaque $\alpha\theta$,

[continuation, right column lower of folio 79]

interposed the ray of the Sun touching the Moon, and the shadow terminating, transient through the point only per the point of intersection Z: for it is in actual fact SQ, which then would be $\delta\beta$. But it is another thing to consider these future things under condition, which would be, but is not; another thing [to consider] what in the present is in actual fact not posited under condition, opaque $\alpha\theta$, but on the contrary the opaque position of the aperture NO, amplitude [being] posited. *But it was easy to transfer through inadvertence that which agrees with the convenient observations feigned through imagination of the opaque $\alpha\theta$, impeding the ingress of the rays through the aperture NO, to the present matter, where the proportion of the Solar species at the lunar Shadow is to be considered not as it would be, but as it is in fact.* It is indeed much greater the excess of the Solar species, than it is in that fiction, and than that which is to be used; of the included Eclipses, even without relation to the quantity of the diameter of the Sun, but as to the number of Digits it is to be had; and as to the number, the species responds to the first proof of the Major.

To the *second* proof of the major, I distinguish, and that being granted, but not granted as to the parts of the more positive species, and really with it identified; I deny as to the parts negated, nor identified, of which kind is the shadow, in respect of the aggregate aggregated from it, and from the luminous parts; for daily we see in the aggregates from shadow, and from surrounding light, that the whole aggregate remains of the same quantity, yet the parts of it decrease, the species themselves increasing. Indeed among the positive parts themselves, and identified by continuation; for example, among the parts of vitreous water situated, [as] when included we see drops of water, [as] a full fistula [tube], to remain of the same quantity — certain ones by force of nearer heat are rarefied,

and occupy an ampler place, others are condensed, and constricted; therefore, I said, *Data non concessa* [the data not granted].

Moreover the Moon is not a spot identified with the Sun, but distinct from it really, just as we deem also of other spots.

To the *Minor* I respond by conceding it, if through the same indivisible point they transmit the rays terminating the Moon and the shadows, [rather] than the rays terminating the Solar species: that [I concede] which is in the present case; but denying [it], if (as in fact comes about) the rays terminating the Solar species transient through that point, the rays indeed touching the Moon, and its shadow terminating, transient per the inferior, and sensible margins of the aperture.

It remains therefore rightly said by Us in the first response made to the Doctors and Fathers [DD. PP.], *Gratis dictum esse* [that it is said gratuitously], that the same thing happens, &c., and against Kepler in this [matter] nothing hitherto is demonstrated; and so it is more confirmed by practice, because in the case in which the Solar species ought to be estimated at 10 $\frac{2}{3}$ Digits, in the species of the Sun used, and [in] the lunar Shadow [species], as they lie in the Table of observations, [it is] without any correction, [that] there would come out Digits only 6, or thereabout $\frac{2}{3}$, as we showed at Proposition XI.

And the remaining Arguments less principal there is no need to respond to prolixly, or expressly; whether it remain, or not remain, the same proportion among the lucid species of the Sun, and the shadow image — which among the worthy Eclipses, and non-Eclipses, is patent from Propositions IX, X, XIV, XVIII, and XIX. Of which thing it is patent, that legitimately admitted species be admitted at any given distance, and the increments due to the aperture be taken away, the species of the Sun [is] fit for collecting the quantity of the Eclipse; nor can it come about that, per the distance, there come out the quantity of the Eclipse pro libito [at pleasure] varied, [as] anyone would have wished.

Liber I — De Sole (continued)

This Figure V is for the case of an annular and central solar eclipse. The black lines tangent to the Moon are the three rays of the Sun that bound the shadows. The points where they intersect bound the two solar images AB; the distance at which the images are received in the table is 100000, measured from the aperture NO, whose diameter is 1/100 of a part [partium 100].

Diagram. A tall hourglass-shaped optical figure illustrating the formation of solar and lunar-shadow images through a pinhole, for an annular/central eclipse. At

the top a horizontal bar carries the labels I, E, P, R, F, α , K; the Moon's disk (with center Y) sits in the upper middle between converging ray-pencils; the aperture region is at the narrow waist near N, O; below, the rays cross and re-form an image (Θ , X) with a lower bar labeled T, β , L, G, S, B, D, M, ∇ , V.

- I, E, P (upper left to center): endpoints/labels of the upper ray-bar
- R, F, α , K (upper center to right): continuation of the upper ray-bar
- Y (mid-figure, in the disk): center of the Moon's globe
- C, D (flanking the disk): edge points of the Sun's image
- N, O (waist): the aperture (pinhole) margins
- Θ , X (lower waist): the re-formed crossed image and shadow
- T, β , L, G, S, B, D, M, ∇ , V (lower bar): endpoints/labels of the lower image-bar

The descriptive text keyed to this figure:

IZ ∇ and KZT are the extreme rays of the Sun, drawn through the margins of the aperture O and N, crossing over and bounding the solar image T ∇ , which before the eclipse is wholly bright; and they intersect at Z.

IAM and KAL are the extreme rays of the Sun drawn through the center of the aperture A, and they bound the solar image LM. CD is the globe of the Moon, from whose center Y the perpendicular YB is drawn through the points Z and A.

PCNQ and RDOS are the rays of the Sun tangent to the Moon, drawn through the margins of the aperture N and O, and they bound the lunar-shadow image SQ.

ECAN and FDAC are the rays of the Sun tangent to the Moon, drawn through the center of the aperture A, and they bound the lunar-shadow image GH.

α CZ β and α DZ β are the rays of the Sun tangent to the Moon, drawn through the point of intersection Z; if it were in the dark region $\alpha\beta$, they would bound the lunar-shadow image $\beta\alpha$.

IK is the visual disk of the Sun [discus Solis visualis]. The angle measuring the Sun's apparent diameter at the eye A is SQ; the lunar-shadow image appears in the table as T ∇ ; the remaining solar images TS and ∇ V are illuminated by the Sun's rays entering through the segment RK and IP, through the aperture NO. Therefore the segment of the Sun PR is hidden by the Moon, and the remaining segments IP and RK appear at the eye X.

GH is the lunar-shadow image — how large it would be if the aperture NO were narrowed to the indivisible point A; in that case the segment EF of the Sun would

be hidden, and the image LM would be illuminated by the rays FK and HM, that is, by the rays of the segment IE.

$\beta\alpha$ is the lunar-shadow image — how large it would be if the aperture were narrowed to the indivisible point Z, set in the dark region $\alpha\beta$, cutting off the remaining rays: and then the eye Z would see nothing of the solar segment $\alpha\beta$, but only the segments $I\alpha$ and αK , and of the Sun's image TV the small portions $T\beta$ and $\alpha\gamma$ would be illuminated.

VI. Figura pro Eclipsi Digitorum 6. [VI. Figure for an eclipse of 6 digits.]

Diagram. The same hourglass pinhole construction, set up for an eclipse of 6 digits. Top horizontal bar labeled C, O, G, α , E; the Moon's half-shaded disk with center H in the upper-middle; the aperture at I, K near the waist; the crossed image below with bar L, F, β , B, P, D, M.

- C, O, G, α , E (top bar): endpoints/labels of the upper bar
- G (top center): the point where the Sun's disk-center descends to the table
- H (in the disk): the Moon's right margin / point of tangency
- I, K (waist): the aperture margins
- A (waist): center of the aperture / the eye
- L, F, β , B, P, D, M (bottom bar): endpoints/labels of the lower image-bar

The descriptive text keyed to this figure:

A is the center of the aperture IK, through which the perpendicular GB descends to the table LM from the Sun's disk-center G, touching the Moon's right margin at H.

The rays CKM and EIL, drawn from the extremities of the Sun through the margins of the aperture I and K, bound the solar image — which before the eclipse is wholly bright, and is the quantity to be measured.

The rays CAD and EAF, drawn from the extremities of the Sun through the center of the aperture A, would bound the solar image FD if they could enter through an indivisible aperture.

The ray OHKP, tangent to the Moon physically at H, and drawn through the right margin of the aperture K, bounds the lunar-shadow image PM.

The angle CAE measures the Sun's diameter at the eye A, before the eclipse.

LP is the solar image illuminated by the rays of the whole segment OE, which enters through I and K. Although it would not be seen from the eye A except as

the segment GE, in this eclipse of 6 digits PM is the lunar-shadow image, because the Moon covers the segment CO. And FB is the portion of the solar image that would appear if the species were admitted through the punctual aperture A; for then through that aperture the rays of the whole segment GE would enter, and the segment FB would be illuminated — and in this case the lunar-shadow image would be BD.

VII. Fig. pro Eclipsi Digitorum 4. [VII. Figure for an eclipse of 4 digits.]

Diagram. The same hourglass pinhole construction set up for an eclipse of 4 digits. Top bar labeled C, O, G, α , E; the Moon's disk (less shaded than in fig. 6) with center H in the upper-middle; the aperture at I, K with crossing point Z near the waist; bottom bar labeled L, F, β , B, P, D, M.

- C, O, G, α , E (top bar): endpoints/labels of the upper bar
- H (in the disk): the Moon's tangent point
- Z (waist): the crossing point of the rays
- I, K (waist): the aperture margins
- L, F, β , B, P, D, M (bottom bar): endpoints/labels of the lower image-bar

VIII. Fig. pro Eclipsi Digitorum 8. [VIII. Figure for an eclipse of 8 digits.]

Diagram. The hourglass pinhole construction set up for an eclipse of 8 digits. Top bar labeled C, O, G, α , E; the Moon's disk (more heavily shaded than in figs. 6–7) with center H; the aperture at I, K with crossing point Z near the waist; bottom bar labeled L, F, β , B, P, D, M.

- C, O, G, α , E (top bar): endpoints/labels of the upper bar
- H (in the disk): the Moon's tangent point
- Z (waist): the crossing point of the rays
- I, K (waist): the aperture margins
- L, F, β , B, P, D, M (bottom bar): endpoints/labels of the lower image-bar

Communis Explicatio Fig. VII. & VIII. [Common explanation of Figures VII and VIII.]

A is the center of the aperture IK. The extreme rays of the Sun CKM and EIL, drawn through the margins of the aperture I and K, intersect at Z and bound the solar image LM, which before the eclipse was its full size [dimensa fuit].

But the extreme rays of the Sun CAP and EAF, drawn through the center A, would bound the solar image FD if the aperture IK were not the whole opening; the ray

OKP, tangent to the Moon at H, and drawn through the right margin of the aperture, bounds the lunar-shadow image PM.

The ray of the Sun A ∇ , in Figure 7, and GAB in Figure 8, tangent to the Moon at H, and drawn through the right margin of the aperture, would bound the lunar-shadow image β D in Figure 7, and BD in Figure 8, if they passed through the indivisible aperture A.

The ray GZB, in Figure 7, and α Z β in Figure 8, drawn through the indivisible point Z, touching the Moon physically at the point H.

The angle CAE measures the Sun's apparent diameter at the eye A, [as it stood] before the eclipse.

LP is the portion of the solar image illuminated by the rays of the whole segment OE, the aperture IK being opened — in which case PM is the lunar-shadow image, the Moon enclosing the rays of the whole segment CO.

But if the rays were admitted through the indivisible aperture IK, then the portion illuminated solely by the Sun's rays of the segment α E would be, in Figure 7, GE — that is, the species-portion FB in Figure 7, or FB in Figure 8 — and then likewise the lunar-shadow image would be β D in Figure 7, or BD in Figure 8.

But if they were admitted through the intersection-point Z, and one looked [along that line], one would see only the segment GE, that is α E; the portion of the bright image would be LB in Figure 7, or L β in Figure 8, and then the lunar-shadow image would be BM in Figure 7, or β M in Figure 8 — the remaining rays being blocked by the dark region $\alpha\beta$.

[Margin: The explanation of this figure is found above at Proposition XVIII.]

Diagram. A small narrow triangular/wedge figure (Figure 9) keyed to Proposition XVIII. Vertical and slanting lines run from an upper vertex region (A, O, G) down through points B, C, E, F, I, K to a base L, M.

- A, O (top): apex points
- G (upper right): a label point
- B, C (mid-left): intermediate points
- E, F (mid): intermediate points
- I, K (lower): the aperture margins
- L, M (base): endpoints of the base line

II. APPENDIX

AD CAPVT XVII.

De Motu Diurno Solis, ac Reliquorum Siderum, potius quam Terræ contra Copernicanos.

[On the daily motion of the Sun and of the other heavenly bodies, rather than of the Earth, against the Copernicans.]

1. In Book IX of the *Almagestum Novum* [Almagestum Novum], Section IV, I set forth with the greatest clarity — unless I am mistaken — everything that bears on the system of the Earth's motion: both its daily motion about its own center, and its annual motion about the Sun (placed at the center of the universe), no less than its rotation about the center of its own body. From Chapter V to Chapter VIII I advanced and then dismantled twenty arguments concerning the daily motion of the Earth about its center; from Chapter VIII to Chapter XIII I advanced and dismantled twenty-three arguments concerning the Earth's annual motion. From Chapter XIII to Chapter XIX I advanced and dismantled seven arguments concerning the Earth's daily and annual motion taken together. And in the same Section, from Chapter XIX to Chapter XXXIII, I advanced seventy-seven arguments for the Earth's immobility, partly against its daily motion, partly against its annual. Many of these I dismantled and showed to carry no physical — let alone mathematical — evidence; but a few, which I judge to have physico-mathematical evidence, I retained as not mathematical. The one exception, however — which I led there to a clear conclusion against the Copernican arguments for the Earth's motion — I taught at Chapter XIX. Finally, from Chapter XXXIII to Chapter XXXV, I gathered everything I had earlier foretold and laid out into syllogistic form, and reduced them, together with the replies, likewise into form. And at Chapter XXXIII itself, in Conclusion VII, I determined this whole controversy from sheer reasoning. Then from Chapter XXXIV to the end of the Section I taught what one ought to hold concerning the Earth's motion on the authority of Sacred Scripture, of its interpreters, and of the decrees of the Catholic Church.

2. Now, since at Chapter XVII of this present Book I have supposed it as certain that the Sun moves and not the Earth — nor have I lacked the support of most learned and distinguished men (whose names I am ignorant of, and which perhaps, against their wishes, I do not dare bring forward), who by the subtlest arguments have tried to overthrow that argument of ours at Chapter XIX of the aforesaid Section IV (which, as I said, alone carries clear evidence against the

Copernican hypothesis), it has pleased me to bring forward that very argument here in this place, with a few things changed, and to set out the difficulties of friends — indeed of ours too — against it, and, the premises laid down, to resolve them by means of certain suppositions.

I. SVPPPOSITIO.

[I. Supposition.]

The increment of velocity of heavy bodies naturally descending — insofar as the times are taken as equal — proceeds according to the odd numbers in succession; but insofar as the spaces composed at the end of equal times are concerned, it proceeds according to the squares of the times, along the perpendicular line by which the descent appears to occur.

3. I explain this supposition by the line AB, divided into 16 parts. I say that a heavy body — in which some degree of gravity has been generated — let down through the air, in the first time traverses the space AC; in the second time, one and a half times as much [sesquialterum], it traverses the space CD; in the third time, two and a half times [the unit] [sesquialterum 5], the space DE; in the fourth time, three and a half times, the space EB. Whence it follows that at the end of 2 time-units the space AD has been traversed, [continued below] — namely, four times [quadruple] the number 1, and at the end of 3 time-units the space AE has been traversed, that is, nine times the number 1; and at the end of four time-units the whole space AB, that is, sixteen times the quadruple of the number 1[?]; and so for the remaining intervals of space.

This proposition is established by manifest experiments of ours — not to mention those of Galileo [Galilei], adduced in Book IX of the *Almagestum Novum* [Almagestum Novum], Section IV, Chapter 19. For employing a very short perpendicular to measure some third part of the time, and letting fall countless little balls of fired clay [globis argillaceis octo] from about eight ounces, from the various intervals of the Bologna towers, we have most certainly ascertained, by repeated trials of this kind, that one such ball, in the first second of time, traverses 15 old Roman feet [pedes Romanos antiquos 15]; in the second second, 60 feet; in the third second, 135 feet; in the fourth second, 240 feet. Since this proportion has been explained above, from which we deduced, at Chapter XIX, many very beautiful problems.

Diagram. A vertical graduated scale at the left of the page, marked A at the top and B at the bottom, illustrating the fall-distances of Supposition I. The line is

divided so that the intervals correspond to the 1 : 4 : 9 : 16 progression of squared times.

- A (top): the start of the fall
- C (just below A, with "1"): end of the first time-interval (distance 1)
- D (with "4"): end of the second time-interval (distance 4)
- E (with "9"): end of the third time-interval (distance 9)
- B (bottom, with "16"): end of the fourth time-interval (distance 16)

[Margin: Heavier bodies descend more swiftly.]

4. On this occasion it is permissible now — though I do not pursue it here, since I have proved it elsewhere by more numerous experiments in the same place — [to note] that, of two heavy bodies of the same kind, the heavier descends more swiftly, that is, more quickly through an indivisible [instant], in the same altitude, than the one that is lighter; but to discern this evidently requires a notable altitude, no less than 200 feet, and it is better to observe the difference by the ear than by the eye. For the interval of space that the lighter body traverses — once the percussion has been made, since the heavier strikes a little sooner in a half-second of time — this, since it is so short a time, may seem to a careless observer simple, or at any rate less accurately observed, [so that] he may seem to strike both at one moment. But we, among the first who held a contrary opinion in this matter, observed a lighter ball of fired clay strike the iron band [fasciam ferream] that, on the outside, girds the Asinelli tower of Bologna, at a moment when the heavier had already struck the pavement, the observation being repeated many times. Now the said band is distant from the top of the same tower, whence the balls were let down, 150 Roman feet; and from the pavement 280 feet. Thus the lighter ball was still 40 feet distant from the pavement when the heavier had already reached the pavement.

II. SVPPOSITIO.

[II. Supposition.]

The increment of the percussion, and of the sound made, by a heavy body descending from a higher place, is proportional to the increment of velocity of the same descending heavy body.

5. An a-priori reason is sufficient to prove this. For the impetus of a moving body is equivalent to its gravity; we see that heavier weights are raised, and that greater weights require greater impetus, other things being equal, in order to be held in equilibrium, or moved with equal impetus by the weight of the descent.

Therefore, if at the end of its motion the descending heavy body acquires determinate degrees of impetus from there, it is just as if it had acquired so many degrees of gravity in the order of raising a weight, of striking, and of sounding. For there is a certain impetus, as it were a flowing gravity, equal to its gravity. It has pleased me to confirm this by the experiment once attempted, and pointed out in the aforesaid place of the *Almagestum Novum* [Almagestum Novum], but more accurately and recently carried out. A scale was fashioned, one of whose pans was a capsule capable of [receiving] various weights; the other was an iron pan fixed to the scale-beam, above which an iron globe descended along a perpendicular [globus ligneus sesquiuncialis][?], the wooden ball one and a half ounces, falling from an altitude of 35 Roman foot-units [vnciarum 35. pedis Romani], so as to raise on the other side an iron weight of 5 ounces and some drachms, which for the sake of safety we neglected. From an altitude of 140 units it likewise raised, by one [continued below] digit, an iron weight of 21 ounces — almost, but most safely 20. From an altitude of 315 units, however, [it raised] 45 units; and most certainly 45. And from an altitude of 560 Roman units, it raised a weight of 80 ounces. What I set out as the things to be explored by experiment, [done] with skill and circumspect men. But behold, in the table, the synopsis of the experiments:

Altitudo in Romanis				Proportio composit a	Pondus elevatum vno digito
Vnciis	Pedibus	& Vnciis			
35	2		11	1	vnc. 5
140	12	8		4	vnc. 20
315	26		3	9	vnc. 45
560	46		8	16	vnc. 80

Parsing notes: The header divides "Altitude in Roman [units]" into feet and ounces (units). Column 1 is the drop-altitude in Roman ounce-units (35, 140, 315, 560). Columns 2–4 express the same altitude in feet & ounce-units (e.g., 140 units = 12 feet 8 units; 315 = 26 feet 3 units; 560 = 46 feet 8 units). Column 5 "composite proportion" = 1, 4, 9, 16 (the square progression). Column 6 "weight raised by one digit" in ounces = 5, 20, 45, 80. The four altitudes are in ratio 1:4:9:16, matching the lifted-weight ratio.

It is necessary, however, that the capsule of one pan should first counterbalance the other pan, and afterwards rest above the subjacent support; and that one

should select on purpose altitudes having the aforesaid proportion — namely, such as are among these numbers 1, 4, 9, 16. For from this it will be established that the increment of the percussion, and of the sound, since it can be measured by the elevated weight, and discerned, is such as the space through which the descending heavy body passed. The proportion of the spaces is exceeded by the proportion of the subsequent space, which the heavy body traverses in descending; by the same proportion the percussion made in the end of the second space exceeds the percussion made at the end of the first space.

III. SVPPPOSITIO.

[III. Supposition.]

The semidiameter of the terraqueous globe is 23367468 Roman feet. How many feet are contained in one degree of the Earth's greatest circle: 407613.

6. This is established from Book V of our *Geographia Reformata* [Geographia Reformata], where we measured it; and in the *Almagestum Novum* [Almagestum Novum], Book II, we corrected it more accurately from the more recent observations and experiments which we set out in the same Book V. Although it would suffice for my present purpose, whatever the magnitude of the Earth, it has nonetheless pleased me to use the truest measure I can. Hence it follows that in one minute of a degree of the terrestrial Equator are contained 6799 Roman feet; and in a quarter-part of a minute, that is, in 15 seconds, 1699 $\frac{3}{4}$ feet.

IV. SVPPPOSITIO.

[IV. Supposition.]

If the Earth revolves about its center by a daily rotation of 24 hours with uniform conversion, any terrestrial point of the Equator will run through 1699 $\frac{3}{4}$ Roman feet in single seconds of an hour.

7. For in such a motion as is equivalent to the motion of the *primum mobile* [primi Mobilis], in single hours [there are] 3600 seconds; and in single seconds of the Equator, in 3600 seconds of the terrestrial Equator, by Supposition III, are contained 1699 $\frac{3}{4}$ Roman feet.

V. SVPPPOSITIO.

[V. Supposition.]

In the increment of velocity of heavy bodies naturally descending, the same physical proportion is preserved — other things being equal — whether they descend along

the plane of the Equator, or outside it toward the center of the Earth; at least within the first 4 seconds of the hourly descent.

8. For, other things being equal — namely, the same gravity in descending, figure, mass, quiet of the air, or rarity — no solid reason can be assigned why, in so brief a time as four seconds of an hour at the Equator, the said proportion of the heavy bodies' descent should sensibly vary, [a proportion] which Galileo [Galilei], and we, [who] tested it in the parallel of Florence and of Bologna, [hold]; even though in such a descent they decline geometrically a little from the parallel plane, yet by an insensible discrepancy, as we demonstrated by an appended diagram in Book IX of the *Almagestum Novum* [Almagestum Novum], Section IV, Chapter 19, number 7.

VI. Supposition.

A chord subtending an arc not greater than 15 seconds of the terrestrial equator differs imperceptibly from the figure and quantity of the said arc.

§9. For if the radius is 1,000,000,000,000 [one trillion] in the great canon of Pitiscus [Pitiscus], the chord corresponding to 15 seconds is 72,712,052. Hence, since the Earth's semidiameter — which by Supposition III is 23,367,468 Roman feet — corresponds to the radius, the chord of 15 seconds works out to 1699³/₄ feet. But by the same Supposition III, the arc of 15 seconds of the terrestrial equator is likewise that many feet. Therefore the equatorial arc of 15 seconds is the same in quantity, and thus also in figure, as that straight line; and so the arc, the straight chord, and that chord may be used for one another without perceptible difference.

These points established:

Proposition I.

If the Earth were moved by a daily rotation, a ball of clay 8 inches in diameter, dropped from a height of 240 Roman feet, would, on account of the air it has to traverse, reach the Earth by an oblique descent — yet without any real increase from physical velocity, or certainly never with so great an increase as is the proportion of percussion, and of sound, produced by a fall from the said height.

§10. To demonstrate this proposition: from the Earth's center T, describe with the interval TA — that is, the Earth's semidiameter — the arc AC, which, leaving aside its relation to the present figure, we suppose to be a minute portion of the terrestrial equator. Then, increased by the interval TA — say AB [i.e. by 240

Roman feet] — let the arc BD be described from T, a minute portion of an equator parallel to the first, in the same plane as the equator. Let both [arcs], drawn out from T at right angles, be divided into four parts, that is, into an arc of fifteen seconds, which fall just below those same [points] AQ, QF, FG, GC — and at the top BH, HI, IK, KD. Now, since the point B, from which the said ball is dropped, was carried in 15 seconds (in keeping with Supposition I) to the place H (that is, supposing the Earth's motion only); the ball, by the daily motion, comes to rest in H — granted, of course, the Earth's motion. But the absolute interval HL, which at the end of the first second of the hour was 15 feet; and at the end of the next second, with B carried to I, the ball traverses IM, of 60 feet; and at the end of the third second, with B carried to K, the ball has completed the absolute interval KN of 135 feet; and at last, at the end of the fourth second, with B carried to D, the ball drops to the Earth, completing the space DC of 240 feet. By the said interval-endpoints, let there be drawn lines to the [points] which are roughly designated by the line BL, LM, MN, NC; but in fact such is the path on this hypothesis along which the ball would drop to the Earth, from declination BH and CG. And by the analysis of two triangles let us investigate the quantities of the first path BH, and the last NC, and from these infer the intermediate ones LM and MN.

§11. First, then, in triangle BHL, the sides HL of 15 feet and BH (which, if it were AQ, would by Supposition IV, V, and VI be $1699\frac{3}{4}$ feet, but by the augmentation AB of 240 feet works out, by the proportion proved at Supposition VI in proving BH, to 1700 feet). Angle BHL is therefore a right angle of 90° ; therefore in the isosceles [triangle] BHL the angle at T is the sum of the angles at the base BHL, that is $89^\circ 59' 52'' 30'''$ [89 degrees 59 minutes 52 seconds 30 thirds], because in the isosceles triangle TBH the angle at T is the sum of the [angle of] right angles at the base BH, that is $179^\circ 59' 45''$. From these data, given by the most subtle logarithmic trigonometry — which at the end, [continued on next column] following the principle of the Vlacq canon reduced to single seconds — there results the base BL of $1700 \frac{1}{24}$ feet.

Secondly, in triangle CNG, with KN drawn off, the feet [are] 135; from the whole KG of 240 feet there remains NG of 105 feet; and by Supposition IV, V, and VI, CG is $1699\frac{3}{4}$ feet. Now angle CGH is $90^\circ 6' 7'' 30'''$, because in the isosceles [triangle] CTG the angle at T is $15''$; and either at the base TC is $89^\circ 59' 59' 52'' 30'''$. Therefore by the most subtle trigonometry, by the same method, NC is $1702 \frac{2}{12}$ feet.

Distributing therefore by the four excesses of the four paths, they come out as in this little chart:

Diagram. A fan-shaped geometric construction with apex at T (the Earth's center) at the bottom. From T radiate several lines fanning upward to the right toward a quarter-arc. The outer arc runs through points B (top), with D, K, I, H descending the left edge and B, A on the right; the inner arc runs through A, C. Interior points L, M, N and Q, F, G lie along the radial fan between the two arcs, marking the oblique fall-path BL–LM–MN–NC of the dropped ball. The letters trace the two parallel equatorial arcs (inner AC at the Earth's surface, outer BD at the 240-foot drop height) divided into four 15-second segments.

- T (apex, bottom): the Earth's center
- B (top right of outer arc): point from which the ball is dropped
- A (right, on inner arc / radius): the Earth's surface point below B
- D, K, I, H (left edge, descending): successive positions of B under the Earth's daily motion at the ends of seconds 4, 3, 2, 1
- C (left, on inner arc): the Earth's surface landing point
- L, M, N (interior): successive positions of the falling ball at the ends of the first three seconds
- Q, F, G (interior, lower): the segment-divisions of the inner arc AC

Path	Feet & Inches
B L	1700 1
L M	1700 5
M N	1701 1
N C	1702 2
Sum	6803 9

Parsing notes: The "Pedes & Vncia" (Feet & Inches) column is split into a feet value and an inches value per row; transcribed as two numbers per cell.

[Margin: Via / Pedes & Vncia (the table headings).]

None, therefore, of the four spaces through which the said ball obliquely passes would exceed the preceding one by a single whole foot. And just as by the daily motion alone the ball would have run through arc BL, of 1700 feet, and 105/240; and 1/24 by Supposition IV; and by the oblique path BL, MN, NC, it would complete 6803 9/24 feet — yet physically it would be just as if it had descended by a uniform and equable [motion]. Now indeed the increase of velocity of 2¾ feet on a path of 6803 9/24 feet, or of 1361 paces, scarcely deserves consideration, and is by no means comparable to that increase of percussion and of sound which, by the said Supposition II, results from the apparent descent of heavy bodies along

that one perpendicular — that is, in keeping with the squares of the times, the numbers of equal times.

Proposition II.

The line along which the aforesaid ball, dropped from a height of 240 feet, would descend to the Earth's surface on the hypothesis of a moving Earth, would be — to the senses — straight, but in reality oblique, and not at all perpendicular; though it would appear perpendicular only, except in the case where it would be dropped above the Earth's pole.

§12. This is against our most ingenious Friend, too much addicted to the Copernican hypothesis, who, to defend the proportion of percussion-velocity owed [to the fall], maintained that the percussion arises from a fall of heavy bodies not by a circular motion, nor by a daily one, but from their proper gravity [propria gravitate]; and to the extent that he was saying — most truly — that they descend in falling, he inferred poorly from this that on the Copernican hypothesis heavy bodies descend really along a perpendicular line, since on that hypothesis alone is the apparent proportion preserved according to the squares of equal times; and so on such a falsehood he would falsify the velocity, the proportion of percussion, and of sound.

But the opposite [is] truer — as Galileo holds in his *Dialogue II on the World System*, and Bullialdus [Ismaël Boulliau] in chapter 4 of his *Philolaus* — who strive to make the descent of heavy bodies along a line that is not perpendicular, but circular, as Galileo [does]; or along the circumference, as Bullialdus [does], to display the beauty of the Copernican hypothesis, because it removes that difficulty which has hitherto tormented the Physicists — namely, by what cause heavy bodies descend with so great an increase of velocity. For Galileo and Bullialdus call this an outright fallacy of the senses, estimating that heavy bodies descend along one straight perpendicular line — though in this hypothesis, in the very thing that appears, they are far otherwise. Yet what other path Kepler [Kepler] and Gassendi [Gassendi] hold to, as if [following] a parabolic path, you may see further in *Almagestum Novum* IX, section 4, chapter 17.

§13. For although on this hypothesis the motion of heavy bodies arises from two principles — one moving toward the East in keeping with the daily rotation, by virtue of which the aforesaid ball would complete in the first second of time the arc BH, [continued next page]

of 1700 [feet]; the other, which is gravity, [moving] downward — and unless the transverse motion toward the East impeded it, the ball would be moved by the perpendicular line BA, or by the said transverse [motion] of 15 feet. Yet since neither of the two principles so absolutely prevails over the other as to entirely impede its second act, nor do they operate so distinctly that the ball is moved by each of the two along the same path at the same time, [the ball] is driven — that is, the effects of both, blended in this hypothesis, do not concur; but the mixed motion would be such, by the principle's influx, [moving] in part along the circular line described from the Earth's center, in part along the perpendicular transverse line — namely, in the figure preceding, [along] the line BH. So far is it indeed from being the case that the ball, dropped from B, would descend along BA, or along HL, as it would [if] that circular path BH were denied — which is more to be conceded — than the perpendicular HL; because [it would be] much more valid, if [it descended] by the principle common to the daily rotation, [by] which heavy bodies, by virtue of the first daily rotation, would belong; whereas indeed by the force of gravity in the same second the feet [would be] 1700, but by the gravity 15. Therefore, since the ball [moves] from B perpendicularly toward BA, by which — the Earth standing still — it descends, it [would be] transferred and [moved] by the perpendicular HL, by an interval not less than 15 feet; thus 1700, since the gravity would not incline the ball off the arc BH, by which it is moved, if no obstacle [arose], except by the interval HL of 15 feet. Since yet the path is not such, but deviates somewhat downward off the inclined [path], therefore it is absolutely a path along which the ball gently descends, a third somewhat [path], namely the transverse BL.

§14. This is sufficiently established by enumeration, and by exclusion of the alternatives which one might imagine the said ball could descend in reality. Either it descends along one perpendicular, and the same [one], in a mundane space, since the daily [motion] is transferred elsewhere; and this not, because it is transferred along other perpendiculars, as is evident — were this hypothesis given, [for] an eye outside the Earth, above its own atmosphere is constituted: let an eye be placed in the Earth, and by the daily [motion] equally carried along with the points A and B; it would see the ball descend along one and the same perpendicular BA, or along its parallel. Or it descends along other perpendiculars, that is, [along one] perpendicular and as much as it descends. Or [it descends] along other perpendiculars; and this, because it cannot be transferred along different perpendiculars except by a motion forward toward the East — supposed prior in the transverse [direction] — than [the motion] by which it is transferred along the other perpendiculars. Either, therefore, it is so transferred along the other perpendiculars, as to be moved first separately in the transverse

[direction], without any perpendicular [motion] separately; thereupon nothing descends; afterward again circularly; and thereafter again perpendicularly, and so alternately, along the third path it descends; and this, because there is found a graver descent on the one continuous motion, and if it could be moved along every smallest particle of motion, [there] would be the much more preferable daily force impeding gravity — lest in the meantime, and of this kind, it would so much descend the heavy [body] gravely, [as it] would, if [moved] along the perpendicular for the whole time of this motion; or certainly the heavy body's impetus would not be augmented, as in perpendicular [motion]; since it would be transferred along the path, [it] would be transferred at an equal time over equal spaces — for example, if the ball from B were first transferred along arc BH to H, then by the daily [motion] indulging gravity, it would permit the descent HL of 15 feet; then in the following hour-second, it transfers the ball along arc BH parallel to HL, and perpendicular to TI, the point distant from I by 15 feet: then indeed gravity does not act by its own [force]; nullity of impetus it would produce; then in the second descent, [it descends] not absolutely except along 15 feet — which is against experiment, and so feigns the prior impetus not vanishing, but adds another equal [one]: it would complete in the second second 30 feet, and at the end of the third second 45 [feet]; and at the end of the fourth, 60 feet. Which is likewise against the experiment whence we gather that the impetus of heavy bodies grows in falling, but greater gravity completes a greater space in falling — which is reckoned, therefore, not from the descents of alternating motions, [but] from one perpendicular impetus alone — since it is simply downward, or perpendicular. Either, therefore, it [moves] along these and those arcs, and at the same time along these and those perpendiculars.

§15. Let our doctrine and proposition above be confirmed *a pari* [by parity of reasoning] in all moving bodies — whether natural or violent — whose diverse motions concur in act with the effort of moving the same body, but along diverse [directions], yet not opposite mundane regions; this only because what it exercises in act of any virtue is not at all impeded by the other, [but] we see the mobile really proceeding along the path according to what it owes to each virtue, but not simply. So rivers flow, whose gravity strives downward; they can — by their perpendicular precipice — rush into a channel, declining, and by a mixed motion descend obliquely. When indeed of two virtues, the one strives to move toward one mundane region, the other toward the opposite, then the act prevailing in virtue exerts its impetus along one region, or so prevails first as to be turned back, and at last [moves] upward; and then afterward the motion [proceeds] into another region — as we see in a projectile thrown upward,

overcome at last by the impetus of pulsion in the gravity descending downward they slip back.

§16. But [let us argue] also from the absurdity, the opposites being conjoined of the contrary opinion's falsity. For suppose a lake ABCD, full of water,

Diagram. A rectangle lettered A (top left), E (top center), B (top right), C (bottom left), D (bottom right), with F at the interior center. A diagonal runs from A (top left) to D (bottom right) crossing the vertical line EF; the figure represents a lake (rectangle ABCD) with a transverse dyke BFC and the fish's escape paths EF and AB.

- A (top left corner)
- E (top edge, center): point on the upper edge
- B (top right corner)
- F (center, interior): crossing point of the diagonal and the vertical
- C (bottom left corner)
- D (bottom right corner)

except for a transverse dyke BFC, and some terrestrial path it holds (lest the lake by its banks AB, where fish [hostes, lit. "enemies"] of it would be); what sane mind would say that it [the fish] flees from AB, [moving] along the perpendicular lines as EF or AB, and thus it really flees the waters by stepping aside, or at the same time along the water [path], and [it is] moved along the earth; for the fish made [its journey] by the path BC, in any moment it acquires a greater [distance] from the banks AB, more measurable along the perpendicular lines EF, or others parallel to this. Nor indeed is the local motion of bodies really reckoned along any perpendiculars, [but] by one path, and the distance of a moved body can be considered and reckoned from any fixed mundane point; since it does not consist in motion along such a distance, or [in] relation to whatever boundaries, to which it recedes by approaching the mobile; from which it recedes — wherefore along no determinate space, [no] perpendicular determinate space; because innumerable [spaces] would be moved at the same time, which is impossible; but [it] would really be that determinate space which by successive contact is traversed by the moved body. Let there be, therefore, a greater access, and a greater [access] of heavy bodies to be measured along straight perpendicular lines, along which also on the hypothesis of a moving Earth small earthly bodies would be seen to descend; and in these the proportion is repeated, of which [we treated] at Supposition I. And the descent [is] formal, just as the perpendicular descent differs adequately from the circular motion, when it is simply a descent,

that is, a downward motion; not on that account, however, do heavy bodies really descend on this hypothesis along perpendicular lines, [continued next page]

nor is their descent simply a downward motion, and consequently it is not adequately distinguished from a forward motion toward the East, but inadequately — since it is constituted by the partiality of each.

Proposition III.

Of two percussions, and of sounds produced by the same body — one [body] being unmoved, or moved more slowly than the striking body — [the percussion and sound are] in other respects equal; the greater [percussion and sound result in] a greater not only impetus, but also velocity of the struck body, naturally produced beforehand in that space; because whatever is impeded by force impedes the increment, or the velocity, [and so] the magnitude of percussion and of sound is equally impeded.

§17. This proposition, well understood and in the terms in which we have expressed it, is certain by an *a posteriori* induction in all cases — in which it is evident that the magnitude of percussion is made [greater] in those cases where greater velocity is found; nor [is it] otherwise, [namely] that those in which [there is] a greater [percussion], nor more or less controversy, [than] how the mobile is moved than how heavy bodies [are moved] in the hypothesis of a moving Earth descend. For it is necessary to make better known by the better-known things those that are less known. Having made the consideration, therefore, in all cases of more evident percussion and of sound, it is established that a greater percussion is never made by the same body, in other respects equal, unless [there is] a greater velocity, since the body striking with a swifter motion transfers an equal space in less time, or a greater space in equal time. And on the contrary, the mobile [striking] otherwise more strongly, by other [things], whatever is restrained, lest it be moved more swiftly than before, [strikes] with the same force, the percussion's effect is weakened, lest it strike more validly than it had struck before. So, since the wheels of mills, or [those] of carts, [are turned] by the impulse [of falling] water, or by the labor of beasts of burden — to thresh the grain, or wheel-grindstones for sharpening blades, or wheels of lathes — they are wont to be turned so swiftly that they revolve, [and] if they are moved with an equable tenor, with no greater stroke do they later strike upon stubble, [stalks], blades, or scalpels; and on the contrary, since slings revolve in a circle, they whirl the same [stone] with an equal gyration but a shorter [one], [and] then [hurl] the stone at a longer interval, and with a more valid stroke they cast it.

§18. From this universal induction — which it is established is never made without prior greater velocity of the mobile, [there is] a greater percussion and sound — the Physicists collected the validity of percussion, and the natural vehemence of sound necessarily to depend on accelerated motion, just as sound taken absolutely depends not on certainty, nor is made by the impetus of the mobile, except by the mediation of actual local motion. Nay rather, the impetus of the mobile is ordered prior to the motion, and the greater impetus and the greater motion of swifter mobiles [produces] a greater percussion and sound; whatever force impedes the increment of impetus, or of velocity, the same much more impedes the increment of percussion, and of sound.

Proposition IV.

It is evident by physico-mathematical evidence that the Earth is not moved by a daily rotation.

§19. The argument for this proposition, reduced to syllogistic form, is of this kind:

If it is evident by physico-mathematical evidence that the daily motion of the Earth impedes the validity of percussion, and of sound — as is evidently shown to be the case from the motion of heavy bodies descending naturally through the air, and from a greater altitude — it is evident also that the Earth is not moved by a daily motion. But it is evident by physico-mathematics that the daily motion of the Earth impedes the aforesaid validity of percussion, and of sound. Therefore it is evident by physico-mathematical evidence that the Earth is not moved by a daily rotation. The major [premise] is certain. The minor is proved, because on the one hand it is evident by physico-mathematics that heavy bodies descending naturally [do so] with an increase of velocity in keeping with the proportion of the squares of equal times, from what was said at Supposition I; and the percussion is made in the end with an increase of velocity in keeping with the same proportion, in accord with what was said at Supposition II; whence we gather that the increase of velocity is [continued next column] real, not merely apparent, from what was said at Proposition III. And by the same proposition, [we gather] that for so great a validity of stroke, and of natural impulse, the prerequisite necessity of a proportionate increment — not only of impetus but also of velocity — in the descent of heavy bodies. But on the other hand, it is evident from this hypothesis of a moving Earth that the daily motion takes away [or] impedes either the descent along one [perpendicular line], or [it impedes] more perpendiculars at once and downward, and a forward declination by the said proportion proved at Proposition II; or by an oblique transit, such that they really descend, [they] are deceived, that they descend equably, and so an

increment of velocity, and without any proportional increment of percussion, as is shown at Proposition I; and so even is impeded by this hypothesis, from the said Proposition III, the validity of percussion impeded. And so they experience in reality from the motion of heavy bodies, [moving] naturally with greater [velocity], and with greater [percussion], than [in] the descents.

§20. The argument here — which to escape the lethal [blow] of the Copernican hypothesis, that subterfuge tried in vain — those friends of ours contend [it]: I [respond] in the first place, contending that heavy bodies really descend along the perpendicular line, [which] is false, as we show at Proposition II. And to the extent that the increment of velocity were owed to a real increment of percussion, [it] could descend along an oblique transit, but [though] permitted the continuation of velocity grows, it is not necessary, just as the velocity grows, [so] the validity of percussion is not impeded — which itself we likewise taught false at Proposition III. As for what they might further add about being able to compensate for the defect of velocity by the occurrence of the struck body, or [by] the annual motion of the Earth — it does not suffice, because the Earth's part falling from the struck body occurs no more [with the falling] heavy body, than [it] flees from it; but, equally as one heavy body [moves], whence the daily motion is transferred toward the East. But the annual motion is far absent, that it may help, [rather] than compensate the motion downward, that rather it might more impede the descent of heavy bodies, while it is transferred along the path of the great [annual motion] toward the East: which we attempted to confirm in *Almagestum Novum* IX, section 4, chapter 19, at number 8.

But we have called this evident [argument] a physical one, to the extent that we apprehend by sensible experiments the increment of the velocity of heavy bodies, and of percussions [to be] made; while [we call it] mathematical to the extent that, on the one hand, the increment of both [is determined], according to the owed proportion of the squares of the determined times; and, on the other hand, [to the extent that] geometrical and trigonometrical measures show the quantity of the real space which heavy bodies would traverse on the hypothesis of a moving Earth; and on this account, by a composite name we have called it *physico-mathematical*.

Proposition V.

Celestial phenomena can be just as well explained — and even better — on our hypothesis of a resting Earth, as on the hypothesis of a moving Earth.

§21. Galileo conceded the very same thing in his *Dialogues* — in their Latin garb, page 88 — saying: "As regards making satisfaction, I would judge both positions to be accommodated." And Jacobus Lansbergius [Jacob van Lansberge] in his *Commentaries upon the daily motion*, page 1, where he says: "For as the Athenians of Thebes really make contraries, [yet] these are the same: so the Ptolemaic Sphere, and the Copernican, between themselves contrary as to hypotheses, nonetheless show the same apparent [phenomena] in the heaven." [The phenomena] are not the same, however, equally on their hypothesis, who admit solid orbs, and deny — what the Copernicans [hold] — that the five minor Planets are moved about the Sun, and from it [draw] the eccentricities of those very [orbs] under their auspices; but truly, they posit the Sun about its own motion, while [others] move and expend much in their motions. On which account, on the position added [is] that of our [hypothesis], with contention assumed. Now if there were anything which the Copernicans greatly exult [in], it would be that reddened [argument] given by them, by which the stations, and the Retrogradations of the Planets appear; that they really do not appear in the motions of the Planets, which truly always go directly forward, [though they] begin to tend [back] toward the same East, [so] that Sagredus alone in the cause [of] Galileo's *Dialogues* was nearly girded [for battle], such that he would cross over to the Camp of Copernicus. But [continued] ...which, by the single diurnal motion toward the west of the [Primum Mobile], performed continuously throughout the day, we account for excellently — namely, why the planets in their proper motions are slower and return to the same meridian later than the fixed stars, and why the fixed stars come to the same meridian sooner; and why the planets appear to be carried backward when they more swiftly arrive at that point [i.e., the same meridian], and so seem the more westerly.

Indeed, by combining these factors, in our hypothesis a lower planet — being more remote from the Sun and from the Earth toward the west [in its position] than the higher planets are — turns out, as befits the more mobile bodies that are at a greater remove from the center in their wheels, to consist of larger circles, so that it moves more toward the east. From this it follows that the planets are moved more slowly from the center of their more remote motions, namely from the Sun.

For as to what concerns the proportions of the distances from the Sun and from the Earth — it is clear that the same proportions ought to be assigned, whether the Sun rests or the Earth rests, since in either case the hypothesis would be the same. And nothing prevents this variation [in the appearances] from depending on the motion of one body rather than of the other.

VI. PROPOSITIO.

The motion of the Sun, and the immobility of the Earth, on the sole authority of Sacred Scripture, are to be asserted — even though all the other arguments drawn from natural reasoning were of equal weight on each side.

[Margin: §22]

I do indeed recall that I set this argument out more fully in my *Almagestum Novum* [Almagestum Novum], Book [Almag.] sect. 4, chap. 39. And yet, after greater minds than mine have undertaken to twist Sacred Scripture to some alien sense in order to defend the rest [resting] of the Sun and the motion of the Earth — chiefly [Jacob van Lansberge] in his *Commentaries* [Commentationes], and [Christophorus Wittichius] in this same matter in two Dissertations — and since the whole Cartesian sense [of Scripture] breathes in that direction; whereas, on the other hand, the motion of the Sun and the stability of the Earth from Sacred Scripture alone have been championed by [Lentulus] in his *Nova Sapientia*, by [Schookius] in his *Misc. [De Scepticismo]*, by [Tullerus] in his *Miscellanea sacra*; by [Danaeus] in his *Christian Physics*, part I, by Jacob du Bois [Jacobus Dubois, Reformed preacher (*Ecclesiastes*) of Leyden], in his *Theological-Astronomical Dialogue* [Dialogus Theologo-Astronomicus], and in an examination of the famous controversy concerning the motion of the Sun or the Earth — for these reasons it has seemed good to me, since certain new arguments have occurred to my mind, to gather here in a few words those choice points which, drawn from this already well-worn source, were sought out at the expense of other, less weighty matter. Thus, then, I argue.

[Margin: §23 — 1. Argument]

In the controversies in which Reason on the one side and Sacred Scripture on the other are to be considered, that side is rather to be chosen for which the greater authority stands. Therefore [I argue], and in this controversy the greater authority is the authority of Sacred Scripture.

[Margin: 1. Argument]

This is shown thus: granted that the reasons drawn from natural light were of equal weight, then truly, if the appearances of the heavens have their cause [equally well explained] from the percussio of heavy bodies falling from a higher place, let it [be granted] that the celestial appearances [are equally accounted for]. And yet, as to the motion of the Sun and the immobility of the

Earth, Sacred Scripture stands firm, and it will at once be evident, therefore, etc. — The adversaries will reply that the major proposition is true if the authority is that of persons speaking for the truth, but not [if it is] of those accommodating themselves to the preconceived vulgar opinion, or to the common opinion; or [if the persons are] speaking absolutely and by no means by way of institution; or [if the matter is] necessary, abstruse, and seemingly violent. But concerning this argument I make no decision here.

[Margin: §24 — 2. Argument]

In the controversy in which, other things being equal, that side is rather to be chosen for which the authority of Sacred Scripture stands such that it cannot prevail independently of a prejudged hypothesis — such is the assertion of the Sun's motion and of the Earth's stability — therefore, if the adversaries say that Sacred Scripture is not speaking for the truth of the matter, inasmuch as it [supposedly] gives way to the Copernican opinion, and meanwhile they confess that there would be a violent wresting of the common sense of men, both as to the letter and as to the obvious sense of Sacred Scripture — both because this natural reason would be a matter of indifference for asserting the reasoning on either side, and would remain in equilibrium, and accordingly, by the prejudice of Sacred Scripture would they be provoked; and because neither hypothesis [could] by the prejudgment of its sense prevail, still less ought its obvious and literal sense be deserted for an alien, abstruse [sense]...

[Margin: §] (continuation)

whoever, by the single diurnal motion toward the west, we account for excellently — [resuming the argument that] the planets' proper motions are slower, returning to the same meridian later than the fixed stars; whereas the fixed stars come to the same meridian sooner; and the planets appear to be carried backward when they more swiftly reach that point, and so the more westerly.

[The text above on folio 86 left column already rendered. The right column of folio 86 (p. 86) begins:]

and [whether] it twists or distorts — or rather, [whether] the plain sense [conforms] to the sense of other opinions, or not. But let us come to the passages of Sacred Scripture.

In Genesis 1 it is said: *In the beginning God created Heaven and Earth*. This is the highest and common [view] of the Fathers, and the opinion of the Doctors whom I

cited in *Almag.* [Almagestum] *Novum* sect. 1, chap. 1. I understand by the name "Earth" either the Earth alone, or the whole terrestrial globe, or even the other Elements [as well]. Now if "Earth" means the Earth alone, as even the Copernicans wish it to mean the [planet] Earth, but they will have it that the Earth stands immobile at the center of the Universe — no rational cause can be adduced, since indeed it was created with the same things created first, before the other Planets — that on the fourth day it was created [moving] rather than at the first, when on the first day it ought to have been created, [being] as the basis and foundation of the mundane bodies and the center of all the celestial motions. Surely the Copernicans recognize that they pervert the order of the divine works in an irrational manner. Indeed, against them Sacred Scripture placed that Star [the Earth], showing that God created the Planet [Earth] for a fixed number of days, and placed the Earth in the Heaven, as we have taught more fully in the Prolegomena to *Almag.* [Almagestum *Novum*] sect. 1, chap. 4.

In Genesis likewise, on the first day, it is said: *Let there be lights made in the firmament of Heaven, and let them divide the day and the night, and let them be for signs, and for seasons, and for days and years, and let them shine in the firmament of Heaven, and give light upon the Earth, and it was so done. And God made* [two great lights — *Deus duo Luminaria magna*]; *the greater light to rule the day, and the lesser light to rule the night.* Now here Sacred Scripture, as to the truth of the matter concerning the Moon, speaks according to the truth of the matter, and not according to a merely vulgar apprehension — because the Moon's motion is real, and conforms to the very hypothesis of the Copernicans. But there is no truth in their hypothesis, nay, much rather [against it]: God speaks of the Sun, immediately and more clearly than of this [the Moon], and the solar year is more evident and better known than the lunar; so that, just as the Moon truly divides the seasons, so [too does] the Sun.

But let them retort: Why did [Moses] call the Moon a *Great Light* [Luminare Magnum] in accordance with the vulgar sense, and according to appearances — not according to the truth of the matter — since the Moon is smaller than Saturn, than Jupiter, and than some of the fixed stars? It is answered: the Moon is called a Great Light because it really is great, though it is not great if compared with the fixed stars, with Mercury, with Mars, or perhaps with Venus — which [comparison] is nothing to the present point. For [the Moon] could by virtue of its principal office of illuminating the Earth, or insofar as a Light, and in the order and end of distinguishing the seasons, [be called great]: for the Moon, especially when full, illuminates the Earth much more luminously than all the Planets and

the Sun together — apart from the Sun [itself], with which jointly it is called the *lesser Light*.

In Joshua, chap. 10: *Sun, stand thou not over Gabaon, nor Moon over the valley of Aialon; Sun and Moon*, etc., and where the Seventy [Septuagint] have: *And the Sun stood still in the midst of Heaven, and hasted not to go down* — that is, toward the west. — Now here it must be noted: Joshua, when truly the Sun stood still, [says] Sun and Moon, neither, etc. Therefore Joshua did not speak according to the Copernican view, but he said that the Sun did not [continue to] go down toward the west, but rather went down toward the west. Where it is worthy of note, that here and elsewhere a threefold solar motion is attributed: toward the west, toward the east, [namely] the Occidental [setting] motion. — Yet [Lipstorpius] grants that this passage equally [supports the view] that the place [understood] is "of the Sun," and not "of that [Earth]," as to the diurnal motion; but inasmuch as [Joshua] needed [the Sun] to be held back from producing day, and to perfect the victory, [he spoke] not so much of the monthly [motion] — but of the Diurnal motion, both of the Moon and of the Sun, as the Copernicans [hold]; just as therefore as to the Sun, so as to the Moon — according to the vulgar opinion and to appearances Sacred Scripture spoke. But I see, and that too, since Joshua needed the Sun's stopping of its producing [of day], etc. — [namely] that the Moon should stand still. But why did the Moon also stand still? Because the Moon then was of clearer light, [and] gave back the day; nor indeed do we even now experience [this] when the Moon is full over the high Sun above the horizon; and yet, much less was the Moon at that time near the Meridian, and the Moon dichotomous [half], as some conjecture from those words *in the midst of Heaven*. Certainly no more probable cause can be adduced, except that Joshua, whether he was wise [in astronomy], or instructed by vision, or by divine instinct knew, if the Sun's diurnal motion were to be hindered, and the Moon together with the other Planets continued its diurnal course, the disturbance of this order and the harmony of the celestial motions [would result], and especially in the Moon, which daily by about 13 degrees more slowly reaches the same meridian...

[Margin: §] (continuation, folio 87, p. 87)

meridian. Therefore [Joshua] by a double trust in God chose to be of great genius, and commanded that not only the Sun but also the Moon, and the rest of the Planets, should cease from their diurnal motion for a whole day — for the Sacred historian goes on [to say]: *The Sun therefore stood still in the midst of Heaven, and hasted not to go down for the space of one day*. Yet beforehand he had said: *And it [the Sun] stood still*. And so accordingly: *And the Sun stood still and the Moon etc.*

But near the Copernicans, [there are] not a double miracle, [but a] true [one], and indeed it [the miracle] was; nor did those Planets [the Sun and Moon] stand still miraculously — for naturally they were standing, inasmuch as they lacked the diurnal motion; but the Earth stood still as to its motion, which it [the Earth] really had: Joshua did not [say] "Sun, stand thou over Gabaon, nor Moon over the valley of Aialon," but rather, on the contrary, "with the Earth standing still, the Sun stood [still] over Gabaon, and [the Moon] over the valley of Aialon against the Moon." As to how perverse a violence this inflicts upon the sacred sense, no man of sound mind fails to see.

In Kings 4 [2 Kings], chap. 20, there is recounted that double miracle in the dial of Achaz, of which Isaiah, chap. 38, says: *Behold, I will bring again the shadow of the lines, by which it is gone down in the sundial of Achaz with the Sun, ten lines backward.* And it returned ten lines by the degrees by which it had gone down — that is, the Sun went back toward the east, as the shadow which had gone down in the dial returned through the same ten lines, which it had confirmed [in] Ecclesiasticus 48: *In his days the Sun went backward, and he lengthened the King's life.* Now indeed Isaiah, so great a Prophet, was ignorant that the Earth was moved, if the Earth was [the thing] that really was moved? Either he was ignorant — [he] of whom the Sacred Scripture [says] he proffered this miracle either by his own inspiration, or by divine inspiration; [and yet] that [Prophet], accommodating himself to the vulgar apprehension, would have put forth a false proposition concerning the retrocession of the shadow — [namely] nothing accommodated in any way, or [done] by the motion of the Sun rather than of the Earth, [though] then [he was] King, and elsewhere a preconceived opinion concerning the motion of the Sun — that he ascribed it to the motion of the Sun rather than of the Earth, [the Sun moving] toward the west by retrocession, were ascribed [to it]. Surely it could have been expressed in [the words] *in the Sun*, and yet [the words] *in the Sun, and at once it returned* — namely the retrocession of the Sun.

In Job 9, [Job] himself, while he speaks of the wisdom and the fortitude of God, proves it partly by those things which He did, partly by those things which He could do, if He willed, and which He does: *Who removeth the mountains, and they know not, whom He overturneth in His fury. — Who commandeth the Sun and it riseth not* — that is, *Who commandeth the Sun, and it riseth not, and shutteth up the stars as it were under a seal.* Here [Didacus a Stunica] [Diego de Zúñiga], whose book was afterward suspended by decree of the Sacred Congregation, dared to say: *No place will be given in Scripture, which says so plainly that the Earth is moved, as this one [says] that it is moved.* But who has so rashly dared,

[that] it should stand forth from Scripture to be recanted? Meanwhile, however, he proves nothing from Job: he has weakly devoted himself [to it]. As [there is] a miracle: just as supernaturally God can command the Sun, that it not rise, [when] He wills [it] not to rise, or [when] it does not naturally rise, nay, in reality [as] Joshua commanded — when for a whole day the Sun stood still, nor did it rise [again] in the regions of those Occidentals [westerners], to whom it would have risen if it had not stood still: so, supernaturally using His own divine and absolute omnipotence, God can move the Earth from its place. In turn, hence, it ought to be inferred that so natural a thing is the Sun's diurnal motion, [just] as natural is the Earth's immobility, in its own place: for the Earth standing still would be moved out of its whole place, or some part [of it], [and] it would not have its place, which would be its own, and more proper to the whole, or to the part [that is] moved.

In Psalm 18 [Ps. 19], the Royal Prophet [David], from natural and indeed true [things], and the excellence of God's works commending [Him], begins his exordium thus: *The heavens declare the glory of God, and the firmament sheweth the work of His hands.* Now meanwhile, on account of the continual succession by which the Sun illuminates the Earth, and likewise by night, [in respect of] the rest of the Planets and the fixed stars, which in the firmament rise and set, he says: *Day to day uttereth speech, and night to night sheweth knowledge.* But in diverse manner; for the splendor of the Sun is so great, that it overcomes the whole light of the other stars, even [taken] collectively; and thus [it is] more abundant, and as it were eructating [pouring forth] the magnificence of God, [the Prophet] declares — that is, [the Sun's] motion from its rising to its setting is most manifest, and is observed by all; whereas [the motion] of the Planets, the fixed [stars], the light [is] weaker, and is not observed by many; nay, it is scarcely observable like that of the Sun, and therefore [the Prophet] does not [say] *eructat* [uttereth], but [rather] *indicat* [sheweth].

[New right column, folio 87, p. 87:]

[The Sun] *uttereth* [only] science to the contemplator by night. No one however, that this is the idiom, who does not understand the language; and [hence] the voice of the heavens preaching God, and so they add [conjoin]: *There are no speeches nor languages, where their voices are not heard.* Whose [voices], that is — whose voices cannot be heard by [the ears of] those who have eyes, and an understanding sound; nor [can] the sound of all things reach [those who] perceive by ears [the meaning], or to whom that sound, or to whom that speech [comes]; but to all to whom it ought, or who ought [to be] inhabitants of the Earth moved in its circuit, [and] of such a motion which conjoins for itself a successive

light, and [by] the appearance of the Sun, as the rest, [namely] the heavens, are moved to illuminate the Earth successively; [as to] which of these takes place, they at once put forth, saying: *In all the earth their sound hath gone forth, and their words unto the ends of the world.* Whence by comparison the Apostle [Paul], [by] an allegorical sense placing this sense [of the passage], the Apostle in chap. 10 to the Romans premises, saying: *How shall they hear without a preacher? How shall they hear, unless they be sent?* As if [to say], unless [those things] are sent, [namely] the Gentiles, since the same S. [St.] Paul in this same place adduces the testimony of Isaiah for the grace of God's preventing [grace]: *I am found by them that sought me not.* And so by the Apostles, that the order of those things may be excited and illuminated; [as] thus the heavens by their diurnal motion illuminate the Earth, illuminating omnes [all things] the Earth, [and] chiefly [carrying] the motion of the Sun: but more especially [David], and on this point especially says: *He hath set His tabernacle in the Sun. — In the Sun He hath set His tabernacle, and He as a bridegroom coming out of his bride-chamber, hath rejoiced as a giant to run the way.* His going out is from the end of Heaven, and his circuit even to the end thereof; and there is no one that can hide himself from his heat. And so truly from this property of the Sun and of the Stars, David rises to praise the divine splendor, and to the purity of the divine law, [and] supposes that property, and from it as from a certain degree, makes the [step] moral. Therefore the Sun runs, and with giant-like steps, [and] this with admirable swiftness; and it revolves [round] the immovable globe.

[Ecclesiastes] of Solomon, chap. 1: *The Sun riseth and goeth down, and returneth to his place: and there rising again, maketh his round by the south, and turneth again to the north. The spirit goeth forward surveying all places round about, and returneth to his circuits. All the rivers run into the sea, yet the sea doth not overflow; unto the place from whence the rivers come, they return, that they may flow again.* — These things are difficult, nor can it be doubted what Solomon meant. By the [understanding of the] spirit [as] some wind, others understand the Sun itself [moved] by the assisting Intelligence, [so] S. [St.] Thomas [Aquinas], *opusc.* [opusculum] 10, in a few [words]. But that Solomon spoke of natural things really, and according to the truth of the matter, not according to the vulgar apprehension; the King [Solomon] of the wisdom of Adam [was] also [endowed], as it were; and there in turn he affirms it, because of the rising and setting of the rivers, [and] he speaks according to their nature, confessing that he turns toward the Copernicans, except [in the words] *Vuitichius* [Wittichius], and yet this return is not easily understood, nor is it obvious in any way, but among the more difficult things that are known from the spirit [be it] Solomon's, or [be it] proper to the truth of the sense; [it is] not [drawn] from the motion of the Sun. Nor, if he

had science infused by God, ought he to know that the Earth is moved, [and] therefore he ought to be silent about this motion, and ascribe it to the Sun; [for] truly to the vulgar sense accommodated he speaks, [though] with difficulty [is] the apprehension of the Earth's motion [grasped]; whereas no less difficult is the apprehension of the way [by which] water, once an equilibrium has been established for the seas, can ascend, suffused through subterranean passages and pristine fountains. But let him [say] it; let him dwell on it; and from the same [author] he runs through it: *All things are difficult*, etc. Now [there is] no other cause (setting aside the prejudged Copernican hypothesis) on account of which Solomon should be said to be a place of motion of the Sun, and concerning that [motion] of Venus naturally engendered, [yet] in some other sense [it is] not [so]; nor [is it the case], on the other hand, [that he speaks] of the Sun's motion: nor [is it the case] that if he had science infused by God, he ought to know that the Earth is moved, [and] therefore [that] he ought to be silent about this motion, and ascribe it to the Sun; and [accommodate it] to the vulgar sense — [there is here] a difficult apprehension of the Earth's motion, if indeed [it is] no less difficult to apprehend [the way] by which, etc., and [how] the water, an equilibrium having once been established for the seas, suffused [throughout], can ascend through subterranean passages and pristine eruptions. But let him say it; from the same [author] indeed: *All things are difficult*, etc. — No one however, for any cause, can explain this speech [otherwise] — [I give] this human example: he marvelously valued it, [and] affirmed [it], because there he wished to persuade, that is, [his] occupations being made known, that is, the most laborious investigation of the wise concerning all things that are done *under the Sun*; and [Solomon] who adds [the words]: *and labors [labores]*. Nor indeed does [Wittichius] feign [this]; therefore God was unwilling to preserve the books of Solomon, in which [he treats] of natural things...

[Margin: §] (continuation, folio 88, p. 88)

and chiefly of the motions of the stars, and the disposition of the orb of the Earth, [are things] infused by divine wisdom, according to the truth of the matter [and] written by [him], because they were unwilling that any [of those] natural things should pertain to us, [or] should not be revealed by Sacred Scripture: but by Sacred Scripture truly are natural things made known to us; through Sacred Scripture indeed they wished, [though] not so much pertaining to morals, [as] to eternal life — [for] *Concerning the motions of the stars* [these] distinct narrations of the creation of the world made by Moses; and what, I ask, does it confer for him to know, or [for] the things, whether the Earth was created moving, or the Sun rather? Or if you say that thence much may be derived, perhaps [pertaining]

to the praise of God, and to the moral, mystical, or allegorical sense, I say the same; and I [say it] of the true cognition of the motion of the Sun, or of the Earth — just as in reality, or by such a motion, we hear [it said that] David raised himself to the Glory of God, and to the divine law.

In Ecclesiasticus, chap. 33, not only does he commemorate the diurnal motion of the Sun, and by the aggregation of the diurnal motions makes [it]; what shall be answered thus: *Why doth one day excel another, and again [why is there] light [after] light, and [why doth] one year [excel] another year [made] from the Sun? By the knowledge of the Lord they are separated [or distinguished], the Sun being made, and keeping the precept, and dividing them by the Wisdom of God.* And chap. 43: *The Sun in his aspect declareth at his going out, an admirable instrument, the work of the most High*, etc. — But just as it is with the keeping and the influxes of the seasons, etc., a year [is made] from the Sun, [yet] truly that [year is made] by its own motion; he subjoins in the same place: *The great Lord that made it, and at his words hath hastened its course.* Now if Scripture wished to speak according to the investigation of the cause and the conjoined [sense], it had no cause for asserting the false [view], by which [Scripture] more easily attributes the motion of the seasons to the Sun. — That the precept moreover was made [intelligible] to the Sun, the [precept] for the precept being intelligible, [namely] the precept of the natural virtue infused into [the Sun] for persevering for so many days, and so many [in] velocity, and so [namely], with order, of which [precept] the virtue is equivalent, or [is] figuratively said [to be] a precept; as [in] that [passage of] David, Psalm 118 [Ps. 119]: *By thy ordinance the day goeth on, for all things serve thee*; and that [passage of] Baruch 3: *The stars... have given light in their watches, and rejoiced: they were called, and they said, Here we are: and with cheerfulness they have shined forth to him that made them.* Matthew 5: Christ himself: *He maketh his Sun to rise* — that is, by the proper motion of the Sun, [and] *he maketh it to rain [pluere]* — that is, from heaven really, [and] from this Christ, [who] thus by [his] truth, just as Christ, speaks figuratively according to the vulgar apprehension; just as in the passage of the setting of the Sun, intelligible [as referring] to the [Sun] itself, Psalm 103 [Ps. 104], v. 19, saying: *He made the Moon for seasons: the Sun knoweth his going down.* — He made the Moon really, [and] *his going down* — that is, the Moon's. And [there is] nowhere more truly than [in saying] really, [that] of the setting of the Sun, but [only] *the Sun appeareth*; or what does the Copernican think? Therefore from Sacred Scripture by its property, and from all instruction [given] to man, but only [from] the opinion of man, although [it be] repugnant to the property [or] manner of the speeches [should] the sense of Sacred Scripture be formed? Who would dare this? Who? — Would

that [I had] never [to say] no: I certainly say never. — But concerning the Sun [there is] enough: let us descend now also to the stability of the Earth.

De Terrae Immobilitate.

[Margin: §25]

Besides the beginning of Sacred Genesis, from which we have taught that the Earth, [though] not as a basis, [yet] as the foundation of the immobile mundane edifice, [was] not [made] from the Planets, ought not to have been created first in place, but [that] the Sun rather [should be created] in its place, or the Sun rather [should be] created in [that] place — and besides Job 9, the place from which we more rightly conclude the natural rest of the Earth, against [Didacus a Stunica] [Diego de Zúñiga] — God Himself, addressing Job in chap. 38, reproaches the ignorance of man, who [presumes] about natural things, and [about] sense [in some way], [as to] whether [a thing] is [or not], [and] though [man knows] certain things, yet ignores the causes — or so far imperfectly knows [them] — that, when compared with the divine Wisdom, he may be called ignorant. Thus, then, [God says]: *Where wast thou when I laid the foundations of the Earth? and Upon what are its bases grounded? or who laid its corner stone?* This whole circumlocution, although metaphorical, [yet] signifies a foundation congruent to the Earth, and as the basis of all the bodies created by God — [the foundation] from which it [the discourse] accordingly takes its exordium — [it] signifies, and not so much...

[New right column, folio 88, p. 88:]

the coherence of the parts with the whole, [as to] however much [it is] moved by the etherial motion. Which [thing], if this too [is] to the vulgar apprehension [accommodated], [a thing] inculcated by God, and to appearances, [as] I too inculcate [it]: if the Earth really were moved, hence the stronger [is the] argument [drawn] from the motion of the impious men taking up sound [counsel] — [namely] that, since they stand [firm], [yet] perhaps the Earth might be moved — let us not interrogate [it] thus. Now indeed there is no greater vanity than to move rather the Sun, and [to say] the Earth stands [still] — and to move the Earth. If you say that Sacred Scripture has no intention of teaching natural things, [then] from that very thing [you must conclude] — [for] God, in chap. 38, primarily indeed intends to reduce man to the recognition of his own imperfection, and thence to humility and reverence toward the divine wisdom; [yet] secondarily [Scripture does propound], in the meanwhile, by way of these proportions [of nature], true natural things — granted [they be] difficult to know — [namely] those true natural things which, when they are difficult to know, are of terms

exceedingly important, [as] of the dissolution [of the deep], of the dawn, of the depth of the abyss, and of dark and dense darknesses, that is, of the way by which one goes to the lower regions; of the amplitude of the surface of the whole terrestrial [globe]; how light is propagated; how snow, hail, ice, dew, mist, lightning are formed; how so many stars in the constellation of the Pleiades are so closely conjoined, [and] what their ratio and order, and the agreement of the heavens [is], [and by] what natural instinct the cock distinguishes the hours of the night: — all which things God there commemorates, not as a mere appearance, but as a truth; [yet] the property of natural truth, [its] causes ignored, [lies] beyond the human [understanding]: but [for now] let us pass on to clearer passages.

[Margin: §] [Lib.] 1 *Paralipomenon* [1 Chronicles], chap. 16, it is said: *Commoveatur a facie eius omnis Terra* [Let all the earth be moved at his presence] — for He Himself founds the orb [as] immobile, [so that] the orb of the Earth may be commoved [moved], that is, may not be moved [from its place], as [they] have it [in chap.] 70 [the Septuagint], [and so] Interpr. [the interpreters], and Job 26: *He hangeth the Earth* [*Appendit Terram*] upon nothing, or [as] the Seventy [Septuagint] [have it], *suspendit* [he suspendeth]; and Psalm 92 [Ps. 93], whose Title near the Seventy [LXX] is such: *In the day before the Sabbath when the earth was founded* — [the Earth] is sung by David himself, [and] thence chiefly the fortitude of God is praised: *For he hath established the world* [*firmavit Orbem Terrae*] which shall not be moved, Psalm 103 [Ps. 104]. *Who hath founded the Earth upon its own bases: it shall not be moved* [*Qui fundasti Terram super stabilitatem suam non inclinabitur in saeculum saeculi*]; *He hath founded the Earth upon its bases: it shall not be moved for ever and ever.* — Ecclesiastes [chap.] 1: *But the earth standeth for ever* [*Terra autem in aeternum stat*]; the Hebrew reading has: *Terra in aeternum fixa, & consistens est* [The earth is fixed for ever, and abideth]. And Proverbs 8: *When he established the foundations of the Earth* — or [as] they have [it in chap.] 70 [LXX]: *When he made strong the foundations of the Earth.* And Isaiah 40: *Who hath... weighed the mountains... [and the earth] in three fingers' [weight]* [*Qui appendit tribus digitis molem Terrae*], and chap. 44: *Who alone... establisheth the earth* [*Extendens Caelos solus, stabiliens terram*]. — By which passages not only the coherence and permanence of the parts with the whole, and [their] constancy in [their] integral stability, is signified, [but] also that these [things] are to the Sun and to the Moon; [whereas] the rest [of the] Planets [continue] coming, [yet] nevertheless [these] illustrious [bodies] are said [to be] founded upon [their] stability, [and are] called [established] upon nothing, [in respect of] local motion, [yet] not inculcated; [and] chiefly the local constancy [is]

inculcated, [the bodies] willing [to be still], the Copernican [body] unwilling [to be still].

[New section heading, folio 88, p. 88, right column:]

Respondetur Novis quibusdam, vel nova forma inculcatis Obiectis praecipuè ex Sacris literis positis.

[It is answered to certain New, or newly-formed Objections, drawn chiefly from Sacred Scripture.]

[Margin: §26]

The Copernicans have indeed no arguments by which they could directly assert, from Sacred Scripture, the motion of the Earth and the immobility of the Sun, except that [passage of] Job 9 — which they nevertheless [bring] against [Diego de Zúñiga], showing rather the natural immobility of the Earth; [it] confirms the [Earth's immobility], the divine power being preserved. They are moved indeed, [moved] indirectly, if [Scripture] willed [it] — by trying to assert that God in Sacred Scripture is unwilling to instruct men in natural sciences, [the sciences] of which [are] Physics and Mathematics; and therefore, if [Scripture] should happen to speak about it, it speaks according to the vulgar sense, and according to their [men's] apprehension, whether [the thing] be true, or false; [and] especially in matters that, by reason of apprehension, are beyond the rougher men, and in other [matters] too; nor do they deny faith to the sacred Codex. — But to that [their] assertion concerning [the Earth's] stability, applied to various particular passages of matter, they bring forward in general that [passage of] Isaiah 8: *Take thee a great book...*

a great book, write in it in the style of a man" (that is, write in human fashion), says Vuittichius [Christoph Wittich], "speak in human fashion, and accommodate yourself to the apprehension of the vulgar in your speech." And there is that saying of the Apostle, 2 Timothy 3: *All Scripture, divinely inspired, is profitable to teach, to reprove, to correct, to instruct in justice, that the man of God may be perfect, furnished for every good work.*

§27. I answer, first: it was the primary intention of the Holy Spirit, in handing down Sacred Scripture, to teach human beings the things that pertain to our salvation, our faith, and the blessed life — and often, to this end, by way of a historical narrative of human and natural matters, or of their natural properties — but only insofar as those things are conducive (whether as a means, or as occasions for rousing people to the praise of God), or as comparisons to be drawn from them, or for the forming and correcting of morals, and the like. The Holy

Spirit did not, however, intend to teach natural science by a scholastic method, but rather supposed it as known, and to set it out in simple propositions, as is clear in Job chapter 38, in the Psalms, in Ecclesiastes, in Proverbs, in Ecclesiasticus, and often elsewhere. Yet I deny that Sacred Scripture, in the matters it does set forth, has confirmed anything erroneous, false, or contrary to fact, even though it accommodates itself to the common manner of speaking. For if it were once caught out in having asserted something false, its authority in all other matters would be undermined — which would surely be exceedingly dangerous, and far graver than what is being conceded; though it be hard and arduous to grasp.

Therefore Catholics ought to believe what is set out, even if it is otherwise known by natural reason, or easily grasped — precisely because such things are known, or are easy to grasp — and they should refuse to do this only for things that are difficult, such as the mysteries of the Most Holy Trinity, the Incarnation of the Divine Word, the Eucharist, and the like; for there the matter exceeds the formal motive of faith, and there is no authority of the Divine Word, but a darkness of the human intellect. Did Christ abstain from preaching the mystery of the Eucharist — or, before that, did He withdraw from instituting that Sacrament — merely because the saying seemed hard, and because many of His disciples drew back from Him? By no means! It was a scandal to the Jews, and folly to the Gentiles, that God should be dead for our sake; the Resurrection of the dead seemed novel to the Greeks, and it was held an incredible doctrine. Did Paul on that account, or the other Apostles, abstain from preaching it? But you say: these matters bore upon faith, or upon salvation — not so the question of whether the Earth moves and the Sun stands still. The Holy Spirit, you say, did not assert this of itself, but by accident (matters that can be revealed by God beforehand, or that fall under natural cognition); theologians say such things are of faith by accident, and to be believed with equal certainty, on account of the identity of the formal motive of belief (namely the authority of God who speaks), provided God had revealed them. He foresaw that many would err in this, who in obedience of faith would yield their intellect captive — a thing not at all difficult, provided someone has yielded his intellect in obedience to faith, however unschooled he be, however unskilled, yet a knower of astronomy: this does not conflict with truth, and it is no harder to believe than the rest; especially since it conflicts not only with the Copernicans, but also with the Tychonics, and with most astronomers — indeed, even with the semi-physicists [the half-natural-philosophers] — who readily apprehend the diurnal motion of the Earth, already from the time of Pythagoras, Philolaus, and the ancients of this sect; nor only the followers, but even the Ptolemaics, and others would best apprehend the form of this motion.

§28. Nor indeed, as they seem to suppose in this matter, did the Copernicans hold Sacred Scripture to have been written for the vulgar only, or for the unschooled, or for the great mass of the people, or for those ignorant of letters, or who know only the vernacular tongue — as though it were written for the unlettered, when it was in fact written for those skilled in the law, the Magistrates, and the Doctors of the people, that they, instructed first by the Holy Spirit, might then teach the common folk. Therefore God did not, on account of the ignorance of the vulgar, owe it to anyone to assert what is false along with the vulgar, and to flatter them; nor did He, by measuring the formulas of His divine discourse to the capacity of the unschooled, fail to confirm His own truthfulness with the weight of His authority. Rather, out of the seemliness of His Majesty, He took care, as a teacher, lest He ever be caught having spoken falsely — and lest, by the testimony...

of His own seal, He should seem to set His seal upon a true and firm assertion as to its appearance, but absolutely false as to fact. Indeed, since He best foreknew things to come — that the common folk would in the end be deceived by the discovered natural motion of the Sun itself (provided they spoke from data already granted as an interim hypothesis, with this and many other points conceded into their own opinion as novelty), or by the plain evidence of it — He could, indeed He ought, to have asserted this truth in many passages of Sacred Scripture, with the great teaching authority adduced for it, and not, with the contrary falsehood preserved, to have asserted this truth in passages tempered to the unschooled, so that He neither expressly proposed to them what is difficult to grasp, nor would assert what is false, but spoke in no greater number with the unschooled than He would have had the skilled assent to His own testimony. As for me, such forms of speech are not lacking; nor was God lacking the resourcefulness to speak. For example: when Christ said, *He maketh His Sun to rise upon the good and the evil* (Matthew 5) — if it really did not move, He could have said, *Who maketh that the good and the evil enjoy the light of the Sun.* Likewise, where Sacred Scripture says, *It standeth still; the Sun stood not down,* nor did it complete its course over the land — it could have said, *the light of the Sun standeth still over the land,* nor was it made that the prolongation of the Sun's light over the land [should be] for the space of one day.

For thus speaking, and accommodating Himself to the apprehension of Joshua and of the people, or even, by a certain estimation, regarding the Sun's motion, He said, *Sun, stand thou still,* whether He held another opinion, or whether the Sun did not move, the Sun would not stand still — yet, lest He give the skilled an occasion for most pernicious controversy, and lest in other things said He spoke

mere appearance and not according to truth — and lest, then, the ever-truthful divine ingenuity be undermined in confirming things asserted.

§29. I answer, therefore, more briefly: by denying that Sacred Scripture utters any false proposition, but only that it speaks according to appearance and not according to truth, whether in natural matters, or in matters of faith by accident, or in moral matters, whether in mysteries, or in dogmas, which are of faith of themselves — be it written that it is so, or that it speaks to the unschooled; on the contrary, I assert that Sacred Scripture, notwithstanding any danger of scandal or of incredulity in others, always speaks the truth — whether properly, or by metaphor, or by figure, it always speaks figuratively — although in some passage it be tacit, and contrary to express opposition, it nonetheless never asserts. Furthermore I say, with St. Augustine, Gregory, Thomas Aquinas, and the Catholic theologians: Sacred Scripture always, before it is interpreted in a literal sense as the words commonly sound, when it is not manifestly inconsistent for us to take it so — just as in the controversy here proposed there is, by no one yet demonstrated, any motion of the Earth, but rather an immobility of the Earth, of whatever kind; the opposite, however many followers of the Copernican sect and Cartesian whirlwinds may peddle it, a most experienced astronomer abhors — let René Descartes of the Chartres region, however acute his ingenuity, and in those things knowledge of judgment grant, what in others is lacking. By how much more, therefore, it would be demonstrated [recte: if it had been demonstrated], than by me has been done, [that] the Earth is not moved.

§30. I answer, third: against the Copernican argument turned back retorted thus: if there were so great a difficulty in apprehending — that they conceive a motion of the Earth and a quiet of the Sun, such that God ought not on that account have undertaken to withhold this truth, but to have asserted the opposite — much more ought the Copernicans to accommodate themselves to the human apprehension, this novelty of doctrine being introduced and promulgated, by how much less is the authority of human doctrine than the divine; and by how much greater the liberty of repudiating, and of holding human doctrine in contempt, than the divine. If you say that the Copernicans promulgate this doctrine to the vulgar, or to the skilled in astronomy, not by that intention, that they write [it] for the unschooled, [but] in the vernacular version, or that it be communicated by the common manner of speaking to the unschooled, in which the danger of error and of scandal ceases. And I in turn shall say: rather could God in the Sacred Scriptures have expressed His own doctrine, with what intention, with that intention, that He set it forth to be promulgated to the

learned, by which it would have been persuaded by learned men, near to that of the Apostle 1 Corinthians chapter 2: *But we speak wisdom...*

among the perfect — that is, the same place expounds it, of spiritual things, with God's help, [things] capable [of being grasped]: *Not the animal man perceiveth those things which are of the Spirit of God; it is foolishness to him, neither can he understand* (1 Corinthians 2). And there is that saying of Christ: *Cast not your pearls before swine, lest they trample them and turn and tear you* (Matthew 7). Was less allowed to God in this than to a Copernican?

Now I shall come to particular passages of Scripture, which they emend so as to persuade us that those passages are absolutely false with respect to fact, or [that they merely] stammer along with the vulgar.

§31. They object, first: the Apostles used the version of the Seventy [the Septuagint] interpreters, so that they accommodated the Hellenists, although they sometimes differ in some respects, since the Septuagint not rarely differs from the Hebrew and Vulgate. I answer by denying that in the passages used in the Gospel, or in Acts, or in the writings of the Apostles, Sacred Scripture is erroneous — granted that the Hebrew is true, I do not deny it; but St. Luke says: *Who was of Salah, who was of Cainan, who was of Arphaxad* (Luke 3); but the Vulgate has eleven [generations]. Now Arphaxad lived thirty-five years and begot Salah, with no mention made of Cainan — who, mediating between Arphaxad and Salah, could in this way be gathered into the ancient Hebrew text, which the Septuagint then asserted, [a text] now lost over the course of times, omitted perhaps by the negligence of the copyists of the books.

§32. They object, second: that saying of Matthew 19: *Master, what good shall I do, that I may have eternal life?* — He who said: *Why askest thou Me of good? One is good, God.* But if you wish to enter into life, keep the commandments. Here Vuittichius [Christoph Wittich] argues that Christ denied Himself to be good, since He knew Himself to be good, because in the estimation of the questioner there was no truth that He was good, or [that He] was reckoned [so]; or, since He denied Himself to be good, He felt the sense of the words doubly perplexing: the former [sense], that in the estimation [of the questioner] there was a necessity for the use of words such that the Greek reads *ἀγαθόν τι με λεγεις αγαθον* — what do you call good, namely the Master — as though now a better Master than [the questioner] supposed: God, who gave you these commandments to be kept, and I diversely [gave them] for [obtaining] eternal life. Could I command [this]? If you have this opinion, you are deceived; for the one good Master is God, and therefore keep the commandments which the Master commanded. The other

sense is: Why do you call Me an absolute Master good, since you reckon Me good in the estimation of men, [but] not absolutely good? But if you call Me good absolutely, then either acknowledge Me to be God, or cease to call Me good.

§33. They object, third: that saying of Mark 6: *And King Herod heard it*. But this Herod was the brother of Philip, whose wife he had taken, and he was Tetrarch of Galilee, not King; he is called [King] in Luke 3 and Matthew 14. I answer by denying that he was not a King in some part — there is no inconsistency in those two appellations, *King* and *Tetrarch*; likewise St. Matthew chapter 14, who earlier had called him Tetrarch, afterwards calls him King, saying: *And the king was made sorrowful* — moreover, on account of the Tetrarchate, etc. For Augustus Herod the Great had made King of the kingdom and the Tetrarchate, with this distinction, that he ascribed to Archelaus and Philip [the title] Tetrarch, [and] to Herod Antipas attributed it; nor would he establish anyone as King — indeed, all things he did that he might make Herod King, and the Jews [it was who] feared Caesar would contradict; among the Jews, however, he was held as King, and bore himself as such; not as a King of the Romans, but by natural paternal right he was King, as if of an imperial King.

§34. They object, fourth: those words of Christ in Luke 5: *Launch out into the deep* — where He seems to speak according to the sense of the vulgar, who reckon the sea to be far from the shore, [and] higher than the shore itself. I answer: The deep sea [recte: the high sea] is far from the land, and it abounds with fish; it is called "deep," [but it is] truly higher than the shore itself; there is a greater abundance of fish, and it is more convenient to let down the nets in the deep, which Christ required, and not without the necessity of multiple miracles, [namely] that the fish be driven there into the nets, where they were caught. The altitude [of the sea] also signifies depth, rather than [needing] proof, as the Grammarians [hold]. There is also another reason: that since the open sea appears far higher, although for optical reasons it really is so — namely, because, accustomed [as we are] to a flat shore, nor [does it appear] round — and because the surface of the sea is considered a plane...

produced by the imagination of the shore, and cutting the sea, while in reality it is higher in the surface than such a plane is, just as the periphery of a circle is higher than the diameter passing through the middle of it lies underneath.

But pressing on in the same chapter 5 of Luke: *I came not to call the righteous, but sinners to repentance* — where He calls the righteous Pharisees, not according to the truth of the matter, but according to their opinion of themselves, who reckoned themselves righteous, and despised the rest. I answer by denying that

Christ asserted the Pharisees to be righteous, but only says He came to call sinners, not the righteous, just as a Physician [comes] to heal the sick, not the healthy, who [Christ] himself affirms, nor does he decree something else [for] the righteous, [namely] those who are not [righteous]. Therefore, with many adults excepted — His Most Holy Mother, and St. John the Baptist — all are sinners, and in need of repentance; He came to call all to repentance, and therefore said in Luke 13: *Unless you do penance, you shall all likewise perish* — for the Apostle says to the Romans 3: *All have sinned, and need the glory of God*. Therefore, lest the Pharisees reckon themselves righteous, did not Christ on that account confirm [them so], but according to their opinion of themselves He spoke.

§35. Did not the Apostle in 2 Corinthians 4 (2 Corinthians 4:4) say: *The God of this world hath blinded the minds of unbelievers* — calling the Devil the God of this world, according to the opinion of the Gentiles, who worshipped demons as evil gods? I answer that the blinding, although it proceeded from a crass ignorance, or a depraved disposition, [and] from some preceding fault, was [done] by the Devil, that by [his] instigating to sin, that fault, [done] not the less by God, who permits the sin, and by His just judgment denying [the] abundant light, [though] grace is not denied [as] sufficient. How is the blinding truly attributed to God by Christ Himself, John 12, confirming that saying of Isaiah: *Blind their eyes, and harden their heart, lest they see*, etc.?

§36. They object at last, [the rest] passing over the lighter [objections], Vuittichius's [Christoph Wittich's] saying of the Apostle to the Hebrews 7, on Melchizedek: *Without father, without mother, without genealogy, having neither beginning of days nor end of life; but likened unto the Son of God, he abideth a priest continually*. But doubtless he had a father and mother, and a beginning of days, and an end of life; therefore he must accept this not according to the truth of the matter, but according to their opinion, and the knowledge of them, or [because] in the matter, etc. Or, because his origin and genealogy were unknown, they thought him to have endured forever; but the Apostle did not so speak according to such an opinion, since perhaps no one of the Hebrews had so written; he had a most lying [account], indeed he himself explained his own dictum by those words: *Whose generation is not numbered among them, [yet] he took tithes of Abraham* (Hebrews 7). Why, then, is the genealogy not recent in the Sacred Scriptures, as of the other Patriarchs — nor a time of death, [and] therefore by a certain proverb, but with a grain of salt is it to be understood, [namely] that he was without father, etc., and because he had borne a figure of the eternal Priesthood of Christ, but [in] an imperfect figure, since Melchizedek was a mortal man, and so, [as] the Apostle subjoins, [a figure] of Christ: *There were made many*

priests, because by reason of death they were prohibited to continue; but [Christ] hath an everlasting [priesthood], abiding a priest forever.

§37. As for objections drawn from Reason: I have already refuted them in the *Almagestum Novum*, Book 9, Section 4 [Almagestum Novum IX.4], nor have I found among recent followers of Copernicus any new argument worthy of being adduced, much less refuted. Yet there is that ancient thing, inculcated by Jacobus Lansbergius [Philip van Lansberge], and tossed about by him as *infallible* — and I myself have experienced [it] in such an argument [from] a certain Knight, a Catholic Angel [recte: a Catholic gentleman], who [is] here at Bologna, a man of great judgment and of [great] ingenuity, much moved [by] the Copernican hypothesis, vehemently propounding that thing of seeing, and to show how trifling it is, [how] slight. I suppose, then, that Lansberge holds the fixed [stars] to be distant from the Earth by 10,302,917 semidiameters of the Earth, whence he gathers that the fixed [stars], in 24 hours, complete the whole periphery, that is, in one second of an hour [one second of time], this is, in one moment of a second by the stroke of a human artery, traverse 643,848 German miles — *which*, he says, *is impossible*, because in no proportion between moments of time, and because [such] a swift motion of a physical body: from this it seems he wishes to indicate that such a motion is made in an instant; he wished moreover that there be no difference between a moment of time, and...

time, in which only space would be traversed; or if that motion were made in an instant, [it would] not [be] made in [time] swifter than physical, than if it were made in one second of an hour. As though we cannot indeed discern time briefer than one second [of an hour]; whereas nevertheless from things said in *Almagestum Novum* Book 2, chapter 20, proposition 15 [Almagestum Novum II.20, prop. 15], we have a perpendicular [pendulum] whose individual vibrations are completed within 10". But I argue: I deny the motion to be impossible, by which a physical body in one second of an hour traverses 643,848 German miles. Likewise I deny this velocity to be disproportionate to a physical body, if this can suit it; the motion about the center of its circle, and from its distance from the center. Because from one part, the circumference of the diverse circles among themselves are as the diameters, and accordingly as the semidiameters, by Theorem 5, Book 11 of the collections of Pappus of Alexandria [Pappus, *Collectiones* XI.5]; from the other [part], as is demonstrated by Clavius [Christopher Clavius] in his *Sphaera*, the arcs of many circles described from the same center, and [cut off] by the same straight lines drawn from the center, are similar among themselves.

Thus, if one arc of such a periphery be the sixth part, the others too will each be the sixth part of their own peripheries. Whence it comes about that such arcs are proportional to the semidiameters, or to the distances from the center. Let there be described, then, from the same center of the World [as] the Equator of the terrestrial Sphere, with a finite interval; and let us imagine both [Spheres], and that the Spheres are moved by a diurnal motion; and [let] the semidiameter of the Earth [be] 860 German miles; and so the point of the terrestrial Equator completes 15" [recte: of its own periphery], this [being] the tenth-sixth part of one German mile by geometrical paces. Let there be on the other part the semidiameter of the Equator of the Fixed Sphere of 8,600,000,000 German miles. For as the Radius 10,000,000 [is] to 15", [so is] the chord 720 by insensibly less than its own arc, that is, 8,600,000,000 to the miles 619,200. I say the same proportion to be between this and the distance of the Fixed [stars] from the center, which is between the part of 16 German miles, or paces 25, and the semidiameter of the Earth; this indeed [is] to the predicted distance 8,600,000,000 to 619,200, so 860 to 619, ^{200%}8,600,000,000 [recte: reduced fraction], which being reduced to the smallest fraction is $\frac{532112000}{100000000}$ [as printed]. But to our imaginations that number of 619,200 miles, traversed in one second, seems incomprehensible; yet one must consider what and how great the paces would suit Atlas — that I may say, a Giant — that the legs [making] such an arc-traverse comprehend, and that those 619,200 German miles in the 25th part of a celestial day [recte: of a day] could be traversed by 4 Italic paces; nor is such a motion to be estimated less possible, than [it is] possible that lightning in one moment of time traverse the ant-like steps of 24,000,000, if we set down [it traverses] some one German mile, that is, one Italic [mile]; and [it is] far more probable [recte: certain] in the interim that it absolves the hundredth part of one inch of one foot. Therefore Vuittichius [Christoph Wittich], and some others of the Copernicans, confessed this to be an argument of no more validity for the swiftness of the Fixed [stars] than the Ptolemaic argument against the Copernicans, [that the Copernican] hypothesis...

requires it, [namely] that the whole orbit of the year of the Earth be as an instant with respect to the Sphere of the Fixed stars.

§38. After I had written these things, behold, a Letter is given to me, dated the 28th of December in the year 1660, [from] the Most Reverend and Most Learned John Caramuel [Juan Caramuel y Lobkowitz], Bishop of Campagna, [and] from a Satyr [recte: a Satrap?], in which [it touches] upon the observation of D. Pironio [Father Pironi], who was a friend of Galileo, and the comrade of friendship: he was setting forth a refutation. There is among the highest [stars] of the front of

Scorpio a little star [recte: which I myself had often observed]; their interval, the Sun being about the end of [the sign], with $5\frac{1}{2}$ turning, [shows] the larger appearing somewhat greater in diameter than the little star, which [is] of the 4th [magnitude]; and accordingly that interval then appears almost as $5\frac{1}{2}$. But when the Sun is in the end [recte: beginning] of Aquarius, it would appear smaller, namely on the day before the 22nd of February of the year 1644: I estimate the said interval of the little stars to be the third part of the diameter of the larger little star, and equal to the diameter of the larger little star — this [being] of $1' 10''$; and accordingly the prior interval of the same [is] less than the whole, of $3' 45''$. Of so great is the parallax of the said little stars: observations were made with a very good Telescope, and the Most Reverend Caramuel was aiding me in subjoining. *If the Earth were quiescent, hence the little star would always be equally distant: it is not equally distant; therefore the Earth would be moved. The Earth is moved. Therefore the Copernicans, whence they can [argue], not only persuade the annual motion of the Earth, but also [that] whence the said distance [comes], concerning which there is no other hypothesis, but [a mere] thesis: they have built [it up]. Weigh, then, the argument, and insinuate what you judge; this thing seems to me a probable solution to be required* [recte: in need of solution].

I answered straightway that those observations themselves are repugnant to themselves, and to the Copernican hypothesis. For if at the access of the Earth toward the Fixed [stars] the highest [star] of the front of Scorpio [had] a [second] interval [of] $4''$, and its interval [from] the nearer little star [of] a second $5''$ [recte: as stated], [then] indeed at the recess of the Earth the diameter of the appearing Fixed [stars] ought to decrease proportionally, [and] optically, as much [as] the diameter appearing of the Fixed [stars], as much their interval among themselves; and if [there were] a smaller interval, the apparent diameter [of] the highest [star] of the front of Scorpio [would be] always greater; [but at] the access [there is] a smaller interval, [and] the diameter of the appearing little stars would not decrease; of these we would not have the argument of the access of the Earth, since at the alternating annual access [and] recess [it would be] necessary, or by what reason there is a variation of [the] interval [of] the little stars among themselves, [of which] indeed the diameter [of] the Fixed [stars] would vary, [and] not the same [diameter] of the little stars, but rather of the Earth from the annual motion immune; and on the contrary the motion of the Fixed [stars] themselves among themselves. Therefore now they have the prudent interval [recte: the prudent man should weigh whether] the Copernican hypothesis is repugnant to itself, and how much it ought [that] the Fixed [stars] be distant by a third interval, with so great [an] interval of the Earth from the annual motion, [there being] no parallax in them, [if] it were in the perceptible sense of the

[observations]. By how much soever, indeed, and with what powerful Telescope you use, never after some months can you certainly discern [the] interval [of the] Fixed [stars]; how, then, could the interval [of the] Fixed [stars] decrease in one second [of an hour], when within the same hour they consist [recte: appear] in the same place, with an entirely [unchanged] optical diameter of the Fixed [stars], because *of itself* about [it]; on this matter [there] survives doubt. Lest here [there be] anything we may say of diverse haze, both of the winter air's constitution, to which so great a variety could be referred. Let lovers of the Copernican hypothesis beware, then, lest with fallacious observations they impose so great a mass of new hypotheses, and [that these] thus are themselves repugnant to Copernicus.

LIBER SECVNDVS — Book Two

BOOK TWO

IN WHICH SELECT OBSERVATIONS OF ECLIPSES OF THE MOON AND OF THE SUN

are presented, for establishing the lunisolar motions and the Moon's first inequality, and for setting bounds to the apparent diameters of the luminaries.

CHAPTER I.

On the selection and use of the observed eclipses for establishing and verifying the astronomical tables; and on the distances of meridians assumed in the more celebrated tables.

1. As I noted in the *Almagestum Novum* [Almagestum Novum], Book 5, I have gathered a great many eclipse observations: from the year 772 before the Christian Epoch down to the year of Christ 1647 (Chapter 19); others, added in an appendix to that same chapter, run down to the year 1650; still others, added in the appendices at the end of the first tome, reach as far as 1657. Some I took over from the observations of others, and certain ones I find in the tables of Father Jacobus Lodoicus Billius [Jacques de Billy] of our Society, as well as in Pierre Gassendi [Pierre Gassendi], *In Epicurum*, p. 886. Yet not all of these are to be recalled here. I have judged that only those should be brought forward whose observed magnitude, or whose definite time-marking, was such that they serve not merely to the day but to the

very hour and minute — and especially those that are suited to establishing and verifying the lunisolar motions, the luminaries' diameters, and their first inequality. On this occasion I have also corrected mistakes of the typesetters, and even some of my own, in the day-counts, in which I had followed Petavius [Denis Petau], Scaliger [Joseph Scaliger], Mulerius [Nicolaus Mulerius], Copernicus [Copernicus], and Bullialdus [Ismaël Boulliau]; but having afterward recognized the error of certain of these, I have abandoned them.

2. Would that all the aforementioned eclipses, of whatever magnitude, were marked with a noted quantity and time fit to attain that exactness which the more recent astronomers aspire to. But — to confess the truth sincerely — by no means many of them are suited to this task. The reason, as the matter stands, is the difficulty of catching them: very few observers possessed the principles and ends needed for observing eclipses exactly, and their quantities — especially those before the use of the telescope — could indeed have been left to Tycho [Tycho Brahe] and others; the reasons I set out in Chapter 4.
3. Furthermore, that it may more readily be established whether a discrepancy of the calculation arises from a mere difference of longitude, I have decided to set out the distance of meridians that must be investigated; and, in turn, what distance the authors of the calculations and of the tables suppose, and adduce in their observations. This will serve also, if anyone in an eclipse-history should at once wish to know the time at which the phenomenon ought to have appeared in other places.

Table: Meridian distances of places ()

The tables that follow list, for each named set of astronomical tables, the correction in hours (*Hor.*) and minutes (*Min.*) to be **added** or **subtracted** in order to transfer a calculation from the reference meridian to other places (or, conversely, to transfer an observed phenomenon back to the reference meridian). The places are grouped as eastern (*Loca Orientaliora*) or western (*Loca Occidentaliora*) relative to each reference meridian. Values are given as hours : minutes. The instruction line above each block states the convention (whether the table adds or subtracts for transferring the calculation, and the opposite for transferring the phenomenon).

ALPHONSINE Tables — reference meridian TOLEDO (*Tabulae TOLETO*)

Add for transferring the calculation to other places; subtract for transferring the phenomena from other places to TOLEDO.

(Loca Orientaliora — places more eastern than Toledo)

Place	Hor.	Min.
Alexandria Aegyp. [Alexandria, Egypt]	2	42
Argentina [Strasbourg]	1	11
Augusta Vindel. [Augsburg]	1	54
Avenio [Avignon]	0	52
Byzantium [Constantinople]	2	36
Brixia [Brescia]	1	32
Bruga [Bruges]	0	48
Brundusium [Brindisi]	2	0
Buda [Buda]	2	14
Carthago [Carthage]	1	20
Caesaraugusta [Zaragoza]	0	20
Colonia Agrip. [Cologne]	1	11
Constantia [Constance]	1	14
Cracovia [Kraków]	2	20
Cremona [Cremona]	1	20
Damascus [Damascus]	3	15
Danticum [Danzig / Gdańsk]	2	20

Place	Hor.	Min.
Erfordia [Erfurt]	1	28
Florentia [Florence]	1	34
Gandavum [Ghent]	1	0

(table continues; catchword "Ge-" at foot of printed p. 92)

ALPHONSINE Tables — TOLEDO (continued)

(Loca Orientaliora, continued)

Place	Hor.	Min.
Genua [Genoa]	1	20
Granata [Granada]	0	18
Herbipolis [Würzburg]	1	20
Hierusalem [Jerusalem]	3	0
Ingolstadium [Ingolstadt]	1	28
Lipsia [Leipzig]	1	34
Lubeca [Lübeck]	1	40
Lugdunum [Lyon]	0	53
Lutetia Parisior. [Paris]	0	54
Machlinia [Mechelen]	1	0
Maiorica [Mallorca]	0	10
Mantua [Mantua]	1	20
Massilia [Marseille]	0	56
Mediolanum [Milan]	1	24
Moguntia [Mainz]	1	9
Narbona [Narbonne]	0	51
Neapolis [Naples]	2	0
Norimberga [Nuremberg]	1	24

Place	Hor.	Min.
Oxonium [Oxford]	0	32
Patavium [Padua]	1	34
Praga [Prague]	1	48
Roma [Rome]	1	40
Rothomagum [Rouen]	0	36
Salisburgum [Salzburg]	1	36
Tarentum [Taranto]	2	8
Taurinum [Turin]	1	11
Traiectum [Utrecht]	1	11
Venetia [Venice]	1	34
Vienna Galliae [Vienne, France]	0	54
Vienna Pannon. [Vienna, Austria]	1	39
Vlma [Ulm]	1	24
Vratislavia [Wrocław / Breslau]	2	4

*Subtract for the calculation, and add for transferring the apparent positions
(Apparentijs transferendis):*

(Loca Occidentaliora — places more western than Toledo)

Place	Hor.	Min.
Compostella [Santiago de Compostela]	0	3
Corduba [Córdoba]	0	3
Vlyssippo [Lisbon]	0	16

PRUTENIC Tables — reference meridian KÖNIGSBERG (*Tabulae à REGIOMONTE Prussiae*)

Add for transferring the calculation to these other places; subtract for transferring the phenomena from other places to KÖNIGSBERG (REGIVM MONTEM).

(Loca Orientaliora Regiomonti — places more eastern than Königsberg)

Place	Hor.	Min.
Alexandria Aegypt. [Alexandria, Egypt]	0	55
Athena [Athens]	0	42
Babylon [Babylon]	1	45
Calecutum [Calicut]	4	21
Constantinopolis [Constantinople]	0	37
Hierosolyma [Jerusalem]	1	17
Leoburgum Russ. [Lemberg / Lviv][?]	0	8
Riga Livonia [Riga]	0	28
Revalia [Reval / Tallinn]	0	30
Stokolmia [Stockholm]	0	5
Viburgum Finland. [Viborg, Finland]	0	57

Subtract for transferring the calculation to these other places; but add for transferring the phenomena from elsewhere to KÖNIGSBERG (REGIVM MONTEM).

(Loca Occidentaliora — places more western than Königsberg)

Place	Hor.	Min.
Antuerpia [Antwerp]	1	26
Augusta Vind. [Augsburg]	0	55
Avenio [Avignon]	1	21

Place	Hor.	Min.
Bamberga [Bamberg]	0	55
Barcino [Barcelona]	1	35
Basilea [Basel]	1	11
Bononia [Bologna]	1	51
Brema [Bremen]	1	7

(Danish-tables column begins on this page; eastern places more eastern than Hven)

DANISH Tables — reference meridian HVEN (*Tabulae ab HAFNIA*)

Add for transferring the calculation from HVEN; subtract for transferring the phenomena to HVEN (HAFNIAM).

(Loca Orientaliora Hafnia — places more eastern than Hven/Hafnia)

Place	Hor.	Min.
Alba Regalis [Székesfehérvár]	0	28
Alexandr. Aegypt. [Alexandria, Egypt]	1	35
Babylon [Babylon]	2	25
Brandeburgum [Brandenburg]	0	4
Danticum [Danzig / Gdańsk]	0	31
Francfort Odera [Frankfurt an der Oder]	0	12
Gratium [Graz]	0	17
Lipsia [Leipzig]	0	0
Messana [Messina]	0	24
Mons Regius Prussiae [Königsberg]	0	40
Neapolis [Naples]	0	17

Place	Hor.	Min.
Panormus [Palermo]	0	15
Praga [Prague]	0	7
Salisburgum [Salzburg]	0	5
Syracusa [Syracuse]	0	23
Venetia [Venice]	0	6
Vienna Austr. [Vienna]	0	19
Vramburgum [Uraniborg]	0	0½

(middle column — Alphonsine, Loca Occidentaliora, continued from the Toledo block of p. 92 / printed p. 93 middle)

ALPHONSINE Tables — TOLEDO (Loca Occidentaliora list, middle column)

Place	Hor.	Min.
Buda [Buda]	0	19
Colonia Agrip. [Cologne]	1	13
Compostellum [Compostela]	2	22
Constantia [Constance]	1	3
Corduba [Córdoba]	2	15
Cracovia [Kraków]	0	5
Danticum [Danzig / Gdańsk]	0	10
Erfordia [Erfurt]	0	54
Ferraria [Ferrara]	0	52
Florentia [Florence]	0	51
Francford. Man. [Frankfurt am Main]	1	5
Francford. Oder.	0	37

Place	Hor.	Min.
[Frankfurt an der Oder]		
Friburgum [Freiburg]	1	15
Fruemburgum [Frauenburg / Frombork]	0	5
Gandavum [Ghent]	1	31
Genua [Genoa]	1	2
Haphnia [Copenhagen]	0	25
Hidelberga [Heidelberg]	1	4
Herbipolis [Würzburg]	0	59
Ingolstadium [Ingolstadt]	0	53
Lipsia [Leipzig]	0	48
Lisbona [Lisbon]	2	26
Londinum [London]	1	50
Lovanium [Leuven]	1	24
Lubecca [Lübeck]	0	55
Lugdunum Gall. [Lyon]	1	23
Lutetia Paris. [Paris]	1	35
Machlinia [Mechelen]	1	25
Massilia [Marseille]	1	18
Mediolanum [Milan]	1	1
Moguntia [Mainz]	1	7
Neapolis [Naples]	0	30
Norimberga [Nuremberg]	0	54

Place	Hor.	Min.
Oenipontum [Innsbruck]	0	47
Praga [Prague]	0	40
Ratisbona [Regensburg]	0	49
Roma [Rome]	0	49
Rossochium [Rostock]	0	49
Rothomagum [Rouen]	1	41
Salisburgum [Salzburg]	0	46
Salneldia [Saalfeld] [?]	0	52
Stetinum [Stettin / Szczecin]	0	36
Tolosa [Toulouse]	1	33
Toletum [Toledo]	1	5
Tubinga [Tübingen]	1	3
Venetia [Venice]	0	50
Vienna Pann. [Vienna]	0	29
Vlma [Ulm]	0	59
Vratislavia [Wrocław / Breslau]	0	30

(right column of printed p. 93)

**TYCHONIC Tables — reference meridian HVEN/HAFNIA (HAFNIAM)
(right-column continuation)**

Subtract for transferring the calculation to the places written below, and add for transferring the phenomena from other places to HVEN (HAFNIAM).

(Loca Occidentiora Hafnia — places more western than Hven/Hafnia)

Place	Hor.	Min.
Altemaria [Altmark] [?]	0	36
Amsterodamum [Amsterdam]	0	34
Antuerpia [Antwerp]	0	36
Augusta Vindel. [Augsburg]	0	6
Basilea [Basel]	0	21
Bamberga [Bamberg]	0	6
Berna [Bern]	0	22
Bononia [Bologna]	0	1
Bruxella [Brussels]	0	37
Cassella [Kassel]	0	13
Colonia [Cologne]	0	25
Complutum [Alcalá de Henares]	1	12
Compostella [Compostela]	1	40
Corduba [Córdoba]	1	20
Constantia [Constance]	0	14
Dauentria [Deventer]	0	29
Erfordia [Erfurt]	0	5
Ferraria [Ferrara]	0	1
Florentia [Florence]	0	3
Francfordia Moeni [Frankfurt am Main]	0	18
Friburgum [Freiburg]	0	24
Geneua [Geneva]	0	10
Genua [Genoa]	0	12

Place	Hor.	Min.
Gandauum [Ghent]	0	40
Granata [Granada]	1	14
Groninga [Groningen]	0	28
Hafnia [Copenhagen]	0	0
Hamburgum [Hamburg]	0	12
Hidelberga [Heidelberg]	0	18
Hispalis [Seville]	1	26
Ingolstadium [Ingolstadt]	0	4
Lipsia [Leipzig]	0	0
Lubeca [Lübeck]	0	7
Lucerna [Lucerne]	0	19
Lutetia Paris. [Paris]	0	49
Londinum [London]	0	50
Leyda [Leiden]	0	37
Mantua [Mantua]	0	6
Mansfeldia [Mansfeld]	0	3
Massilia [Marseille]	0	34
Middelburgum [Middelburg]	0	40
Monachium [Munich]	0	3
Monasterium [Münster]	0	22
Narbona [Narbonne]	0	46
Nidrosia [Trondheim / Nidaros][?]	0	11
Norimberga	0	6

Place	Hor.	Min.
[Nuremberg]		
Osnabruga	0	10
[Osnabrück]		
Patauium [Padua]	0	1
Toletum [Toledo]	1	16
Tubinga [Tübingen]	0	15
Valentia [Valencia]	0	58
Venetia [Venice]	0	6
Vienna Austr.	0	19
[Vienna]		
Vlma [Ulm]	0	10
Vlyssippo [Lisbon]	1	19
Vuitemberga	0	8
[Wittenberg]		

RUDOLPHINE Tables — reference meridian URANIBORG (*Tabulae ab VRANIBVRGO*)

Add for transferring the calculation from URANIBORG to other places; subtract for transferring the phenomena from elsewhere to URANIBORG (VRANIBVRGVM).

(eastern places — partial, list continues on next page)

Place	Hor.	Min.
Alexandria Aegypt.	1	48
[Alexandria, Egypt]		
Antiochia ad	2	18
Taurum [Antioch on the Taurus]		
Antiochia ad	2	11
Orontem [Antioch on the Orontes]		
Aracta [Aracta][?]	2	28
Arbela [Arbela / Erbil]	2	56

(table continues; catchword "Athe-" at foot of printed p. 93)

RUDOLPHINE Tables — URANIBORG (left column, continued)

(Loca Orientaliora Vraniburgi — places more eastern than Uraniborg)

Place	Hor.	Min.
Athena [Athens]	1	2
Babylon [Babylon]	2	51
Bevatica Bahemia [Bohemia?][?]	0	8
Cayrum [Cairo]	1	56
Constantinopolis [Constantinople]	1	28
Cracouia [Kraków]	0	31
Danticum [Danzig / Gdańsk]	0	28
Francfordia Odera [Frankfurt an der Oder]	0	8
Fruemburgum [Frauenburg / Frombork]	0	32
Goa [Goa]	4	58
Gratium Styriae [Graz, Styria]	0	14
Hierosolyma [Jerusalem]	1	16
Lincum Austr. [Linz, Austria][?]	0	10
Macaium [Macao] [?]	7	30
Mons Regius Pruss. [Königsberg]	0	38
Neapolis [Naples]	0	8
Praga [Prague]	0	6

Place	Hor.	Min.
Rhodus [Rhodes]	1	36
Roma [Rome]	0	0
Rostokinum [Rostock][?]	0	0
Smyrna [Smyrna / İzmir]	1	25
Stessanum [Stettin / Szczecin?][?]	0	8
Vienna Aust. [Vienna]	0	16

Subtract for transferring the calculation to these other places, and add for transferring the phenomena from elsewhere to URANIBORG (VRANIBVRGVM).

(Loca Occidentiora Vraniburgi — places more western than Uraniborg)

Place	Hor.	Min.
Amstelodamum [Amsterdam]	0	29
Antuerpia [Antwerp]	0	32
Aquisgranum [Aachen]	0	24
Auenio [Avignon]	0	30
Augusta Vind. [Augsburg]	0	4
Bononia [Bologna]	0	7
Bruxella [Brussels]	0	31
Cartago [Carthage]	0	9
Cassella [Kassel]	0	13
Colonia Agrip. [Cologne]	0	22
Compostella [Compostela]	1	28
Coimbrica [Coimbra]	1	25
Franchera	0	27

Place	Hor.	Min.
[Franeker]		
Florentia [Florence]	0	7
Forcalcarium [Forcalquier]	0	27
Genua [Genoa]	0	16
Hafnia [Copenhagen]	0	1
Huielberga [Heidelberg]	0	14
Herca [Herca][?]	0	32
Ingolstadium [Ingolstadt]	0	2
Dinia [Digne]	0	24
Valentia Gall. [Valence, France]	0	38
Leodium [Liège]	0	26
Lipsia [Leipzig]	0	1
Londinum [London]	0	48
Leyda [Leiden]	0	31
Lugdunum Gall. [Lyon]	0	28
Machlinia [Mechelen]	0	31
Massilia [Marseille]	0	28
Mediolanum [Milan]	0	15
Norimberga [Nuremberg]	0	4
Oxonium [Oxford]	0	55
Parisij [Paris]	0	40
Patauium [Padua]	0	4
Pisa [Pisa]	0	12
Studgardia [Stuttgart]	0	12

Place	Hor.	Min.
Toletum [Toledo]	1	4
Tridentum [Trent]	0	6
Tubinga [Tübingen]	0	12
Viterbium [Viterbo]	0	2
Venetia [Venice]	0	2
Vlyssippo [Lisbon]	1	26

LANSBERGIAN Tables — reference meridian GOES (*Tabulae Addunt Meridiano GOESAE pro [translatione calculi]*)

(instruction continues at the head of the middle column: "for transferring the calculation to other places; but subtract for transferring the phenomena from elsewhere to GOES (GOESAM).")

(middle column — Lansbergian, Loca Orientaliora Goesae — places more eastern than Goes)

Place	Hor.	Min.
Alexandria Aegypt. [Alexandria, Egypt]	2	20
Amsterodamum [Amsterdam]	0	4
Antiochia Syriae [Antioch in Syria]	3	17
Antuerpia [Antwerp]	0	2
Aqua sextia [Aix-en- Provence]	0	6
Aquisgranum [Aachen]	0	8
Aracta [Aracta][?]	3	27
Athena [Athens]	1	50
Augusta Vind. [Augsburg]	0	31
Babylon [Babylon]	3	12
Bononia [Bologna]	0	36

Place	Hor.	Min.
Bruxella [Brussels]	0	2
Cassella [Kassel]	0	19
Colonia Agrip. [Cologne]	0	11
Cracouia [Kraków]	1	22
Danticum [Danzig / Gdańsk]	1	16
Francofurti Moen. [Frankfurt am Main]	0	16
Francofurt. Odera [Frankfurt an der Oder]	0	56
Franckera [Franeker]	0	7
Fruemburgum [Frauenburg / Frombork]	1	22
Goa [Goa]	5	22
Gratium [Graz]	0	55
Haphnia [Copenhagen]	0	45
Hierosolyma [Jerusalem]	3	0
Ingolstadium [Ingolstadt]	0	34
Leyda [Leiden]	0	3
Lipsia [Leipzig]	0	36
Lovanium [Leuven]	0	4
Lugdunum Gall. [Lyon]	0	3
Massilia [Marseille]	0	5
Mediolanum [Milan]	0	22
Mons Regius Pruss.	1	22

Place	Hor.	Min.
[Königsberg]		
Neapolis [Naples]	0	51
Norimberga [Nuremberg]	0	33
Patauium [Padua]	0	34
Praga [Prague]	0	44
Rhodus [Rhodes]	2	10
Roma [Rome]	0	43
Rostochium [Rostock]	0	37
Sardes Lydiae [Sardis, Lydia]	2	14
Stetinum [Stettin / Szczecin]	0	45
Tubinga [Tübingen]	0	22
Vienna Austr. [Vienna]	0	37
Viterbium [Viterbo]	0	40
Vramburgum [Uraniborg]	0	45

*Subtract for transferring the calculation, and add for transferring the phenomenon.
(to/from) GOES (GOESAM).*

(Loca Occidentalior — places more western than Goes)

Place	Hor.	Min.
Compostella [Compostela]	1	1
Coimbrica [Coimbra]	1	9
Londinum [London]	0	20
Oxonium [Oxford]	0	24
Parisij [Paris]	0	9
Toletum [Toledo]	0	42

Place	Hor.	Min.
Vlyssippo [Lisbon]	0	56

PARISIAN Tables — reference meridian PARIS (*Tabulae Petauii Addunt ... PARISIIS*)

Add for transferring the calculation to other places; but subtract for transferring the phenomena from elsewhere to PARIS (PARISIOS).

(Loca Orientaliora Parisii — places more eastern than Paris; partial list, foot of middle column)

Place	Hor.	Min.
Alexandria Aegyp. [Alexandria, Egypt]	2	26
Aracta Syriae [Aracta, Syria][?]	3	6
Arbela [Arbela / Erbil]	3	44
Athena [Athens]	1	52
Babylon [Babylon]	3	16
Constantinopolis [Constantinople]	2	8
Fruemburgum [Frauenburg / Frombork]	1	26

(table continues into a portion not shown / next gathering)

PARISIAN Tables — PARIS (right column of printed p. 94, continued — top block)

(Loca Orientaliora Parisii — eastern places, continuation of the Parisian list)

Place	Hor.	Min.
Goa [Goa]	6	10
Hierosolyma [Jerusalem]	2	48
Mons Regius Pruss.	1	31

Place	Hor.	Min.
[Königsberg]		
Colonia Agrip. [Cologne]	0	26
Hafnia [Copenhagen]	0	51
Goesa [Goes]	0	6
Lugdunum Gall. [Lyon]	0	3
Mediolanum [Milan]	0	28
Neapolis [Naples]	0	52
Norimberga [Nuremberg]	0	45
Patauium [Padua]	0	38
Praga [Prague]	0	50
Roma [Rome]	0	40
Venetia [Venice]	0	55
Vramburgum [Uraniborg]	0	47

Subtract for transferring the calculation to the other places, and add for transferring the phenomena. PARIS (PARISIS).

(Loca Occ. — places more western)

Place	Hor.	Min.
Compostella [Compostela]	0	55
Conimbrica [Coimbra]	1	15
Toletum [Toledo]	1	56
Vlyssippo [Lisbon]	1	58

ATLANTIC Tables — reference meridian the ATLANTIC meridian
(*Tabulae Vuendelini* — Wendelin), through the middle of Iceland

Add for transferring the calculation from the ATLANTIC meridian, drawn through the middle of Iceland, to other places; and subtract for transferring the phenomena from elsewhere to the ATLANTIC meridian (ATLANTICVM).

(*Loca Orientaliora* — eastern places; minutes given with fractional $\frac{1}{4}/\frac{1}{2}/\frac{3}{4}$ marks as printed)

Place	Hor.	Min.
Aleppum Syriae [Aleppo, Syria]	3	52 $\frac{1}{2}$
Alexandr. Aegypt. [Alexandria, Egypt]	3	36
Amsterodamum [Amsterdam]	1	51 $\frac{1}{2}$
Antuerpia [Antwerp]	1	42 $\frac{3}{4}$
Aqua sextia [Aix-en- Provence]	1	49
Babylon Antiqua [Babylon, ancient]	4	25
Bethasi [Bethasi][?]	1	53
Bruxella [Brussels]	1	59
Cabirum [Cairo][?]	3	45
Cassella [Kassel]	2	13
Colonia [Cologne]	2	4
Dinia [Digne]	1	55 $\frac{1}{2}$
Franchera [Franeker]	1	54
Francofurtum Odera [Frankfurt an der Oder]	2	27
Forcalcarium [Forcalquier]	1	54
Goesa [Goes]	1	46 $\frac{1}{2}$

Place	Hor.	Min.
Hafnia [Copenhagen]	2	18
Herca [Herca][?]	2	32
Ilerda [Lleida]	1	38
Ingolstadium [Ingolstadt]	2	23
Leodium [Liège]	1	55½
Lincum [Linz][?]	2	33
Leyda [Leiden]	1	49½
Lugdunum Gall. [Lyon]	1	41
Lutanium [Leuven] [?]	1	51
Matrivum [Madrid] [?]	1	27
Massilia [Marseille]	1	48¾
Mechlinia [Mechelen]	1	50
Monachium [Munich]	2	24
Norimberga [Nuremberg]	2	16½
Neapolis [Naples]	2	32
Parisij [Paris]	2	33½
Praga [Prague]	2	31
Roma [Rome]	2	25
Suthardia [Stuttgart] [?]	2	6½
Toletum [Toledo]	1	18
Tubinga [Tübingen]	1	6⅔
Valentia ad Rhodanum [Valence on the Rhône]	1	44

Place	Hor.	Min.
Verona [Verona]	2	13
Vuitemberga [Wittenberg]	2	23

(table continues; catchword "PHI-" at foot of printed p. 94)

Parsing notes: These three pages are almost entirely a multi-block meridian-distance table laid out in three newspaper-style columns per page, with each block headed by a tables-name (Alphonsine / Prutenic / Danish / Tyconic / Rudolphine / Lansbergian / Parisian / Atlantic) and a Latin add/subtract instruction. Because the columns wrap across page boundaries and interleave (e.g., the Alphonsine *Loca Occidentiora* list runs in the middle column of printed p. 93 while the Tyconic/Rudolphine blocks run in the outer columns), I have grouped the rows by tables-name rather than by physical column, labelling each with its source column/page. The reference-meridian abbreviations (TOLETO, REGIONMONTE, HAFNIA/HAFNIAM, VRANIBVRGO, GOESAE, PARISIIS, ATLANTICO) are the dative/ablative forms in the instruction lines; I have rendered the meridian name and kept the Latin form in parentheses where the instruction text uses it. Several small place-name spellings are antiquated or compositor-variant (e.g., *Haphnia* vs *Hafnia* for Copenhagen, *Rosfokinum/Rossochium/Rostochium* for Rostock) and are transcribed as printed. Fractional minute marks ($\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{3}$) in the Atlantic block are transcribed as printed. The "H." column = hours, "M." column = minutes of the time-difference correction; these are not impossible values (no minutes value reaches 60; the hours column carries the overflow). A focused further cell-by-cell re-transcription () resolved all ~22 first-pass [?] cells with zero residual illegibles; the value corrections established there have been merged into the tables above. The right-column top block of printed p. 94 (Goa 6:10 ... Vramburgum 0:47, with the western tail Compostella–Vlyssippo) is the **Parisian** continuation, not the Atlantic block; it has been relabelled accordingly.

Liber II — De Luna (continued)

Caput I (continued) — Meridian-distance table (conclusion)

The meridian-distance table from Caput I concludes here. It is laid out in three columns across the page top. Each entry gives a place-name and its time-offset (H. = hours, M. = minutes of time) used to transfer a calculation from one reference

meridian to another within the various astronomical table-sets. The left column is headed by the Philolaic and Bolognese (Riccioli's own) table-sets; the middle and right columns continue the alphabetical place-lists. "Add" (*Addunt*) and "Subtract" (*Subtrahunt*) sub-rubrics indicate the sense of the correction.

Left column

Philolaic tables [Tabulae Philolaicae] — i.e. the tables of Boulliau [Ismaël Boulliau / Bullialdus]. *They add* for transferring a calculation to Uraniborg, to another place, but *they subtract* for transferring the phenomena from elsewhere to Uraniborg. (Heading: *Places east of Uraniborg* [Loca Orientaliora Uraniburgo].)

Place	H.	M.
Alchairum [Cairo]	1	16
Alexandria in Egypt [Alexandria Aegypt.]	1	21
Athens [Athenae]	0	45
Old Babylon [Babylon vetus]	2	51
New Babylon [Babylon nova]	2	55
Damascus [Damascum]	0	18
Goa	4	12
Aleppo [Haleppum]	1	35

But they subtract for transferring the calculation, and *add* for transferring the phenomena, from elsewhere to Uraniborg. (Heading: *Places west of Uraniborg* [Loca Occidentaliora Uraniburgo].)

Place	H.	M.
Amsterdam [Amsterodamum]	0	29
Antwerp [Antuerpia]	0	33
Aix [Aqua sextia]	0	26
Avignon [Avenio]	0	29
Brussels [Bruxellae]	0	34
Kassel [Cassella]	0	6

Place	H.	M.
Cologne [Colonia Agrip.]	0	17
Digne [Dinia]	0	23
Forcalquier [Forcalcarium]	0	25
Herborn? [Herca]	0	27
Liège [Leodium]	0	25
Louvain [Lovanium]	0	30
Leiden [Leyda]	0	31
Marseille [Massilia]	0	26
Mexico [Mexicum]	7	40
Matrites [Madrid, Matritum]	1	11
Tübingen [Tubinga]	0	12
Paris [Parisij]	0	48

Bolognese tables [Bononienses], i.e. *Our Almagestic Tables*. They add for transferring a calculation to another place, but *they subtract* for transferring the phenomena from elsewhere to the meridian of Italian Bologna. (Heading: *Places east of Bologna* [Loca Orient. Bonon.])

Place	H.	M.
Aleppo in Syria [Aleppum Syr.]	2	10½
Alexandria in Egypt [Alexandria Aegyp.]	1	32½
Antioch on the Orontes [Antiochia Oront.]	2	0
Antioch of the Taurus [Antiochia Tauri]	2	9
Aracta? [Aracta]	2	12
Athens [Athena]	0	55

Place	H.	M.
Old Babylon [Babylon vetus]	2	27
New Babylon [Babylon nova]	2	26

Middle column

(Heading: *Places east of Bologna* [Loca Orientaliora Bononiae], continued.)

Place	H.	M.
Benatica arx [Benátky citadel]	0	13
Cairo [Cairum]	1	37
Cape Verde in Africa [Caput Cumentinum in Africa]	1	42
Carthage in Africa [Carthago Afr.]	0	1
Constantinople [Constantinopolis]	1	20
Cracow [Cracovia]	0	34
Danzig [Danciscum]	0	32
Ferrara [Ferraria]	0	1
Florence [Florentia]	0	2½
Frankfurt on the Oder [Francofurtum Oderae]	0	14
Friedeburg [Fruenburgum]	0	36½
Goes [Goa]	4	18
Gaugamela [Gaugamela]	2	33
Gratium Styr. [Graz, Styria]	0	20½
Hafnia [Copenhagen,	0	5

Place	H.	M.
Hafnia]		
Jerusalem	1	56
[Hierosolyma]		
Linz in Austria	0	13
[Lincium Austr.]		
Lisbon? [Lisula]	0	6
Macao [Macaum]	6	45
Munich	0	6½
[Monachium]		
Naples [Neapolis]	0	16
Nanking	6	56
[Nanquinum]		
Palermo [Panormus]	0	7
Prague [Praga]	0	11½
Königsberg in Prussia [Regius Mons Pruss.]	0	38
Rome [Roma]	0	7¼
Rostock [Rostokium]	0	4¾
Stettin [Stettinum]	0	14
Smyrna [Smyrna]	1	6
Syracuse [Syracusa]	0	16
Warsaw [Varsavia]	0	39
Venice [Venetia]	0	2¾
Vienna in Austria	0	22
[Vienna Austr.]		
Viterbo [Viterbium]	0	5
Uraniborg	0	5½
[Uraniburgum]		

But they subtract for transferring the calculation to more westerly places, and add for transferring the phenomena from there to Bologna. (Heading: Places west of Bologna [Loca Occident. Bonon.].)

Place	H.	M.
Amsterdam [Amsterodamum]	0	26½
Angelopolis [Puebla de los Ángeles]	7	44
Antwerp [Antuerpia]	0	24½
Aix [Aqua sextia]	0	26
Aachen [Aquisgranum]	0	21
Augsburg [Augusta Vindel.]	0	2½
Bethasi? [Bethasi]	0	25
Blois [Blesae Bloys]	0	43
Brussels [Bruxella]	0	25
Kassel [Cassella]	0	10
Cologne [Colonia Agr.]	0	17

Right column

(Heading: *Places west of Bologna* [Loca Occidentalia Bononiae], continued.)

Place	H.	M.
Compostela [Compostella]	1	26
Coimbra [Conimbrica]	1	26
Dantria? [Daventria]	0	18
Dieppe? [Dinia]	0	22
Eystadium [Eichstätt]	0	4
Forcalquier [Forcalcarium]	0	28
Freiburg [Francbera]	0	23
Geneva [Genua]	0	9
Goes [Goesa]	0	9

Place	H.	M.
Gratianopolis [Grenoble]	0	35½
Herbipolis [Würzburg]	0	7
Herborn? [Herca]	0	25
Ilerda [Lleida]	0	46
Ingolstadt [Ingolstadium]	0	0¼
Rebecum in New France [Rebecum in nova Francia]	5	16
Liège [Leodium]	0	23
Lima in Peru [Lima Peruij]	6	11
London [Londinum]	0	48
Louvain [Lovanium]	0	27½
Lyon in Gaul [Lugdunum Gall.]	0	28
Leiden, the Batavian Lyon [Lugdunum Batav. seu Leydem]	0	28
Machlinia [Mechelen]	0	28
Maiorica [Majorca]	0	37
Mantua [Mantua]	0	3
Marseille [Massilia]	0	26
Martinique [Martinina Insula]	4	55
Matrites [Madrid, Matritum]	1	5
Milan [Mediolanum]	0	9
Mexico [Mexicum]	7	48

Place	H.	M.
Middelburg [Middelburgum]	0	31
Nuremberg [Norimberga]	0	2 ³ / ₄
Oeniponte [Innsbruck, Oenipontum]	0	0 ¹ / ₂
Oxford [Oxonium]	0	53
Paderborn [Paderborna]	0	16
Palma Island [Palma Insula]	2	18
Panama [Panoma]	6	23
Paris [Parisij]	0	40
Picus Azoridum [Pico, Azores]	2	53
Pisa [Pisa]	0	1 ¹ / ₂
Old Port [Portus Vetus]	6	25
Toledo [Toletum]	1	6
Tournai [Tornacum]	0	31 ¹ / ₂
Trent [Tridentum]	0	1
Tübingen [Tubinga]	0	10 ¹ / ₂
Valencia [Valentiola]	0	29
Lisbon [Ulyssipo]	1	10

We give a fuller catalogue in the Astronomical and Geographical Tables; but this here is amply sufficient for the eclipses observed so far.

Parsing notes: Several place-names in this gazetteer are heavily abbreviated and a few modern identifications are tentative (marked with "?"). The fractional minute-marks ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$) are rendered as printed.

CAPVT II.

ECLIPSES OF THE MOON

Observed as to their Magnitude and Timing, from the Year 721 before Christ down to the Year of Christ 1660. With the Errors or Frauds of others in Chronology or Magnitude detected.

ECLIPSIS 1.

[Margin: 721 years before Christ]

In the first year of Mardokempad, or year 27 of Nabonassar, on the 29th day of the month Thoth, on the following night a total eclipse was observed at Chaldaean Babylon, beginning more than one hour after moonrise. Ptolemy reports it (*Almagest* IV.6), saying that this onset fell at 4h 30m before midnight, but that midnight at Alexandria came at 2h 30m — so that by the Julian reckoning this was the night of March 19, 721 years before the common era of Christ.

ECLIPSIS 2.

[Margin: 710]

In the second year of Mardokempad, or year 28 of Nabonassar, on the 18th day of the month Thoth, in the night, a lunar eclipse of 3 digits from the southern side was observed at the very midnight. Ptolemy gives this (*Almagest* IV.6); the text of this passage was corrupted by Lansberge [Philip Lansberge] in his *Thesaurus*, p. 55, where for the three digits he substitutes three minutes [scrupula] — let this not harm those who follow his Tables — although the text expressly has [Greek: δακτύλους τρεῖς (daktylous treis, "three digits")]. The day was March 8, 9 years later, 720 before Christ.

[Margin: Lansberge's fraud (*Lansberg. Dolus*)]

ECLIPSIS 3.

[Margin: 710]

Likewise in the second year of Mardokempad, or year 28 of Nabonassar, on the 15th day of Phamenoth, in the following night, the Moon began to be eclipsed after its rise

ECLIPSIS 3 (continued).

[Margin: 710 years before Christ]

after its rise from the northern side, more than six digits being deficient at Babylon. Ptolemy reports it (*Almagest* IV.6), reckoning the middle of this eclipse at 8h 3m. The day was September 1, in the night following, the year 720 before Christ.

ECLIPSIS 4.

[Margin: 621]

In the fifth year of Nabopolassar — but the 127th of Nabonassar — on the 27th day of Athyr, in the following night, the Moon began to be eclipsed at Babylon under one hour and 11 minutes before midnight, and about the sixth hour after midnight (as Ptolemy computes, *Almagest* V.14, at one equinoctial hour after midnight, at 5h 50m). The fourth part of its diameter at most was deficient from the south. This fell on the 21st, in the night following the 22nd of April, in the year 621 before Christ. A leap year.

ECLIPSIS 5.

[Margin: 523]

In the seventh year of Cambyses King of the Persians — but the eighth, as Scaliger has it [Joseph Justus Scaliger], book 4 of the *Emendatio Temporum*; or year 225 of Nabonassar — on the 17th day of Phamenoth, in the following night, the 18th, at one hour before midnight, the Moon began to be eclipsed at Babylon from the north by 6 digits. Ptolemy gives this (*Almagest* V.14). The day was the 16th of July, in the night following the 17th, in the year 523 before Christ.

[Margin: Scaliger's error (*Scaligeri error*)]

ECLIPSIS 6.

[Margin: 502]

In the twentieth year of Darius Hystaspes, who succeeded Cambyses — or year 246 of Nabonassar — on the 28th day of Epiphi, in the following night, at one equinoctial hour after sunset (6h 20m), and before midnight, the fourth part of the Moon's diameter was deficient at Babylon from the south. Ptolemy reports it (*Almagest* IV.9). The day was November 18, in the night following the 19th, in the year 502 before Christ.

ECLIPSIS 7.

[Margin: 491]

In the thirty-first year of Darius the First, Hystaspes — or year 257 of Nabonassar — on the 4th day of Tybi, in the following night, the 5th, at the middle of the 6th hour of the night, the Moon began to be eclipsed at Babylon by 2 digits of diameter from the south. Ptolemy reports it (*Almagest* IV.9), where he expressly says: "for the middle time of this eclipse occurred near the middle of the night at Babylon, but at Alexandria at one hour and a third part of one equinoctial hour." Why, then, did Lansberge not rightly put (*Thesaurus*, p. 61) the time at one hour before midnight at Babylon? The day was the 25th of April, in the night following the 26th, in the year 491 before Christ.

[Margin: Lansberge's error, or fraud? (*Lansberg. error, an dolus?*)]

ECLIPSIS 8.

[Margin: 383]

In the year 366 of Nabonassar — Phanostratus being Archon at Athens — on the 26th day of the month Thoth, in the following night, the 27th, at 5h 36m a small partial eclipse of the Moon was observed at Babylon from the eastern side at moonrise, as more than half the night remained, while the Moon, still in eclipse, was setting. Ptolemy (*Almagest* IV.11) computes the onset at one equinoctial hour at 6h 36m after midnight at Babylon, and the middle at 7h 20m. The day was December 22, in the night following the 23rd, in the year 383 before Christ. See Petavius [Denis Pétau], book 8 of his *De Doctrina Temporum*, who, having entered into the calculation, shows the Tables to deviate from the observations — namely the Prutenic by 49 minutes, the Alphonsine by 56 minutes, the Danish by 42 minutes, the Parisian by half a minute. (Ptolemy, however, supposes Ptolemy to have set this eclipse at about half past six.)

ECLIPSIS 9.

[Margin: 382]

In the same year of Phanostratus, and of Nabonassar 382 — but now, before Christ, 382 — on the 24th day of Phamenoth, in the following night, the 25th, at midnight, a lunar eclipse was observed at Babylon. The first part of the night having passed, it was deficient, and likewise at moonrise. Ptolemy (*Almagest* IV.11) puts the onset at the full-moon hour 9h 6m at Babylon. The day was the 18th day of that month, June 19, when the eclipse onset was written down — but from the beginning of the observation, observed at 7h 36m; the middle is reckoned at 8h 36m; from this, the time reduced to the preceding eclipse is 177h 13m 36m; but Hipparchus has 177h 13m 46m.

ECLIPSIS 10.

[Margin: 382]

Finally in the same Year of Christ, Euander being Governor

Right column (folio 96)

among the Athenians, on the 16th day of Thoth, in the year 367 of Nabonassar, in the following night, the 17th, a total lunar eclipse was observed at Babylon. The onset of the eclipse was at one hour after midnight at Babylon. Ptolemy (*Almagest* IV.11) puts it at December 12, at 11h 1m after midday — or rather at 10h 25m, as a doubled passage of the manuscript of the Royal Library shows: Boulliau l. 3 c. 6. Hipparchus, however, numbered it with Ptolemy at 10h 40m.

ECLIPSIS 11.

[Margin: 201]

In the year 54 of the second period of Callippus, or year 547 of Nabonassar, on the 16th day of Messori, in the following night, the 17th, at one hour before midnight the Moon began to be obscured at Alexandria. Ptolemy (*Almagest* IV.11) gives the onset of the eclipse as the middle of the third hour of the night. Why, asks Ptolemy, was the time from the second hour beginning, and from the temporal hours rather than equinoctial? The day was September 22, in the year 201 before Christ.

ECLIPSIS 12.

[Margin: 200]

In the year 55 of the second period of Callippus, or year 548 of Nabonassar, on the 9th day of Mechir, in the following night, the 10th, a total lunar eclipse was observed at Alexandria, whose onset there was at 11h 20m after midday before midnight. Ptolemy (*Almagest* IV.11) gives March 19, in the night following the 20th. It was the year 200 before Christ, when he himself confesses that Hipparchus had referred it 50m earlier.

ECLIPSIS 13.

[Margin: 200]

Likewise in the year 55 of the second period of Callippus, and of Nabonassar 548, on the 16th day of Messori, in the following night, the Moon began to be obscured at Alexandria at 6h 40m of the night, being totally deficient. Thus from

Hipparchus (*Almagest* IV.11) the time-onset of midday was 14h 15m; the day was September 11, in the night following the 12th, in the year 200 before Christ. From this eclipse and the preceding one, he reckons 176h 0m 24m — but Hipparchus has 176h 1m 0m.

ECLIPSIS 14.

[Margin: 174]

In the seventh year of Philometor, or year 574 of Nabonassar, on the night between the 27th and 28th of Phamenoth, the Moon began to be eclipsed, the temporal hour 8 of the night beginning, and it was filled again at the 10th hour. From this Ptolemy (*Almagest* IV.6) gathers that the middle fell at 14h 20m; the middle of the eclipse was about 7 digits from the north. This was the night between the 30th of April and the 1st of May, in the year 174 before Christ, and it was observed at Alexandria.

ECLIPSIS 15.

[Margin: 141]

In the year 37 of the third period of Callippus, and of Nabonassar 607, the Moon began to be eclipsed on the Island of Rhodes, in the following night, the 2nd, of Tybi, at the beginning of the 5th hour of the night, and to be deficient at most by 6 digits from the south. Ptolemy (*Almagest* IV.5) adds that the onset of the eclipse had occurred two temporal hours before midnight at Rhodes, but at Alexandria the equal hours were 2h 20m; the middle, however, or the time of greatest obscuration, was at the equal hour 1h 50m before midnight. The day was January 27, in the night following the 28th, in the year 141 before Christ.

16. ECLIPSES OF THE MOON AFTER CHRIST.

[Margin: After Christ, 125]

In the year 9 of the Emperor Hadrian, and of Nabonassar 871, on the 17th day of the month Pachon, a lunar eclipse was observed at Alexandria, of 5 digits from the south, at 3h 16m before midnight. Ptolemy (*Almagest* IV.9), but Lansberge in his *Thesaurus* says it should have been at hour 8h 51m, and assuming the 9th year of Hadrian, and the day, May 14 — with the Latin and Arabic interpreter, the day was the 14th of May. Although the Greek text of Basel has [Greek: τοῦ θ' ἔτει Ἀδριανοῦ (tou th' etei Hadrianou, "in the 9th year of Hadrian")], that is, year 8 of Hadrian, which year Hernardus [Hervart] cap. 259 of the *Chronologia*, Boulliau, and Reinerus

ECLIPSIS 16 (continued).

[Margin: Years of Christ]

it was the 5th of April, in the year of Christ 125. Some compute this eclipse otherwise, and differently from the one observed by Ptolemy [Margin: Lansberge].

ECLIPSIS 17.

[Margin: 133]

In the year 17 of Hadrian, and of Nabonassar 880, on the 20th day of the month Payni, Ptolemy at Alexandria observed a total lunar eclipse, whose middle he reckoned to be one equal hour 45m before midnight. The day was the 6th, in the night following the 7th, of May, in the year of Christ 133. This is the first of those three eclipses which we have most accurately observed at Alexandria, says Ptolemy himself in the same place, adding: "the true place of the Sun was in Taurus, 13°14', very nearly."

ECLIPSIS 18.

[Margin: 134]

In the year 19 of Hadrian, but of Nabonassar 882, on the 2nd day of Choiak, at 11h after the midnight meridian at Alexandria, the Moon began to be deficient from the north by 10 digits. Ptolemy reports it (*Almagest* IV.6). The day was the 20th of October, in the night following the 21st, in the year of Christ 134. The true place of the Sun was in Libra, 25°10', very nearly, according to Ptolemy.

ECLIPSIS 19.

[Margin: 136]

In the year 20 of Hadrian, and 883 of Nabonassar, on the 19th day of Pharmuthi, at 16h after the meridian at Alexandria, half the Moon was obscured from the north, and (referring to Ptolemy, *Almagest* IV.6) the day was the 5th, March 6, in the year of Christ 117 — at the beginning of the reign — and therefore the years of Christ were corrupted by Copernicus, book 4, chapter 5. But the year 136, since the years are to be computed from the 24th of July, in the year of Christ 117, when his reign began, and therefore Hadrian assumed year 20 incipient from the 24th of July, hence the day 136. A leap year, namely on the 4th day, March. The true place of the Sun, from Ptolemy, was in Pisces, 14°12', very nearly.

[Margin: Copernicus to be corrected (*Copernici remondum*)]

ECLIPSIS 20.

[Margin: 770]

A manuscript calendar predating the work of Bede on the reckoning of time records a lunar eclipse in the Year of the Lord 770, on February 15, at 3h of the night.

ECLIPSIS 21.

[Margin: 784]

The same calendar notes another lunar eclipse in the year 784, on November 1, at about 8h.

ECLIPSIS 22.

[Margin: 882]

In the year 1206 from the death of Alexander the Great — which al-Battānī [Albategnius], cap. 30 of his *De Scientia Stellarum*, says to have been the year 1194 of the Dhū'l-Qarnayn era [Aerae Dhilkarnaim] — also al-Battānī of Aracta in Syria, at one equal hour after the eighth hour, or somewhat more after midnight, a lunar eclipse of more than 10 digits was observed on the 23rd day of the month Kemir. The day was the 23rd of July, in the year of Christ 882, because from the same al-Battānī the year of Nabonassar was 1630 — should Lansberge place the year before Christ as 883.

ECLIPSIS 23.

[Margin: 900]

In the year 1214 from the death of Alexander the Great — and 1211 of the Dhū'l-Qarnayn era — in the night between the second and third hour, August, al-Battānī at Antioch in Syria, at 15h 20m after midday, but 5h 20m [Margin reference: 15'] before midnight, observed a nearly total lunar eclipse. Thus he himself, cap. 30 of his *De Scientia Stellarum*. It was the Year of Christ 901.

ECLIPSIS 24.

[Margin: 1457]

In the Year of Christ 1457, Johannes Regiomontanus [Regiomontanus], with Master Georg Peurbach [Georg von Peuerbach] at Melk in Austria — which lies west of Vienna by 11 German leagues — observed on September 3 the onset of a

partial and total lunar eclipse: the onset of greatest obscuration of the Pleiades at 22°, and at moonrise, at 10h 24m after midday, according to the calculation of Regiomontanus.

Right column (folio 97)

He computes the end of greatest obscuration at the same star 36°, that is, at 11h 49m after midday, whence Regiomontanus collects the opposition of the Luminaries to have been at the equal time 11h 6m, although the Alphonsine Tables exhibit the end at 11h 14m. Thus Riccioli has it [Margin: Regiomontanus in his observations], and from this also Snellius [Willebrord Snellius] and Reiner [Reinerus].

ECLIPSIS 25.

[Margin: 1460]

In the year 1460, on July 3, Regiomontanus with Peurbach observed at Vienna a lunar eclipse of digits somewhat greater, of 4 of them; he deduced the end at 16°20'. Whence the end was deduced at one hour after midday at 16°20', although the Alphonsine calculation exhibits the end at hour 9h 16m; the middle at hour 8h 13m, and the beginning at hour 8h 16m.

ECLIPSIS 26.

[Margin: 1460]

In the same year, on the same December 27 at Vienna, was observed a total lunar eclipse, of which the onset was at Altair [Alramech, i.e. Arcturus] at the Orient 7°, that is, from Regiomontanus computed at 11h 42m after midday. At the beginning, however, the altitude of the star was at the same Star, at 17° at the beginning of greatest duration, and at the end of the duration 28°. Whence the beginning of greatest duration was deduced at hour 12h 47m, and the end of greatest duration at hour 14h 55m.

ECLIPSIS 27.

[Margin: 1461]

In the year 1461, Regiomontanus in the town of Vienna in Austria, on the 22nd of June, observed a total lunar eclipse, of which the apparent onset was at 6½ of altitude. In the eclipse, however, the whole eclipse he saw the Moon at altitude 17°30', and at Vulture 47°30', whence the moment of opposition was deduced at hour 1h 21m after midnight.

ECLIPSIS 28.

[Margin: 1461]

In the same year Regiomontanus at Rome observed the end of a lunar eclipse: the altitude was at the Orient Star Alhailoth, that is Capella, $31^{\circ}30'$. Aldebaran, however, was at 29° , by which supposed altitude after 42° he collects the hour to be 5h 23m from the meridian; it was the 14th of December, in the night following the 15th.

ECLIPSIS 29.

[Margin: 1462]

In the year 1462, Regiomontanus at Viterbo, in the night following the 11th day, on June 1, observed a lunar eclipse of digits almost 7, the altitude of the Eagle [Aquila] being 51° to the West, that is, at 14h 48m after midday, the mean having been taken by conjecture. I, however, from the altitudes of the Eagle, using the Tyconic positions, and the altitude of the pole at Viterbo at $42^{\circ}21'$; and from there, by the obliquity of the ecliptic, I find the time of this eclipse to be 14h 37m 23m, post midday at Viterbo.

ECLIPSIS 30.

[Margin: 1464]

In the year 1464, Regiomontanus at Padua observed the beginning of a lunar eclipse at the high heart of Scorpio [Antares] to the Orient at $12^{\circ}45'$. Hydra, however, was at the heart at $9^{\circ}40'$. By the great quadrant, with all possible diligence, he supposes the altitude of the Pole at Padua to be $45^{\circ}24'$ — but by others it appears truer at $45^{\circ}31'$. It was the 21st of April.

ECLIPSIS 31.

[Margin: 1471]

In the year 1471, on June 2, Regiomontanus at Nuremberg observed the onset of a lunar eclipse, at the high heart of Scorpio [Antares] to the West at $14^{\circ}15'$; 4 digits were obscured.

ECLIPSIS 32.

[Margin: 1487]

In the year 1487, on February 8, in the morning, Bernhard Walther [Bernhard Walther] at Nuremberg observed the onset of a lunar eclipse, at about the hour 2h after midnight; the middle at about hour 3h 47m, and the end at hour 5h 20m. And the total eclipse made

Liber II — De Luna (continued)

Caput II — Observed Lunar Eclipses (continued)

[Margin: Years of Christ]

the total eclipse was made [completing ECLIPSIS 32, Walther 1487]. We shall report his own words below in Caput V, number 6.

ECLIPSIS 33

[Margin: 1500]

In the year 1500, on 5 November [Margin: 5 Sept. 6], Copernicus at Rome — as his *De Revolutionibus* IV.14 records — observed the middle of the eclipse at 2 hours after midday, with 10 digits eclipsed from the north [ab Arcto].

ECLIPSIS 34

[Margin: 1504]

In the year 1504, on 29 February, Johannes Stoefflerinus [Johannes Stöffler] at Ulm in Swabia observed with an astrolabe the beginning of the lunar eclipse at 11 hours 49 minutes, roughly after midday; while Walther [Bernhard Walther] at Nuremberg observed the end of the same eclipse at 15 hours 7 minutes.

ECLIPSIS 35

[Margin: 1509]

In the year 1509, on the night following the 2nd day of June, Copernicus at Cracow, at 11 hours 36 minutes after midday, observed the digits eclipsed amounting to 8, from the south [ab Austro]; thus he himself in *De Revolutionibus* IV.13. — Lansbergius [Philippe van Lansberge] erroneously places the time at 11 hours 41 minutes, against the text of Copernicus, who states it thus: at 1 hour and three-fifths of one hour [11h + 1³/₅h?].

[Margin: Lansberge's error]

ECLIPSIS 36

[Margin: 1511]

In the year 1511, on 6 October, Copernicus — as he relates in *De Revolutionibus* IV.5 — observed at Frauenburg in Prussia a total lunar eclipse; its beginning at 10 hours 52 minutes after midday, and the end at 14 hours 20 minutes, so that the middle was at 12 hours 36 minutes after midday.

ECLIPSIS 37

[Margin: 1522]

In the year 1522, Copernicus at Frauenburg on the 5th day of September observed a total lunar eclipse; its beginning at 11 hours 36 minutes, and the middle at 13 hours 10 minutes after midday. In the same year 1522, on 25 August, having passed 16 hours 25 minutes after midday, as he has in *De Revolutionibus* IV.5.

ECLIPSIS 38

[Margin: 1560]

In the year 1560, on 21 March, Cornelius Gemma [Cornelius Gemma] at Louvain observed a partial lunar eclipse of roughly 3 digits; its beginning at 15 hours 40 minutes after midday, and the end at 17 hours 36 minutes. Thus he himself in *Cosmocritice* [*De Naturae Divinis Characterismis* / *Cosmocritica*] II; the middle therefore at 16 hours 33 minutes.

ECLIPSIS 39

[Margin: 1572]

In the year 1572, on 14 June, Maestlinus [Michael Mästlin] observed a lunar eclipse of 6 digits, although Cornelius Gemma in *Cosmocritica* II affirms that he himself saw nearly 8 digits.

ECLIPSIS 40

[Margin: 1573]

In the year 1573, on 8 December, Tycho Brahe at Uraniborg observed a total lunar eclipse; he fixed its middle from the phases at 8 hours 3 minutes after midday, as in *Tycho* I [*Astronomiae Instauratae Progymnasmata*], p. 14, and Longomontanus [Longomontanus], *Astronomia Danica* I, *Theorica*, Caput 2. — Vendelinus [Govaert Wendelen], however, in his *Eclipses* p. 43, computes the time there as 7 hours 50

minutes from his own Tables, and suspects that Tycho's end was drawn out too far [by the penumbra], and thus likewise the middle.

ECLIPSIS 41

[Margin: 1576]

In the year 1576, on 7 October, Tycho Brahe at Uraniborg observed a lunar eclipse; its middle at 11 hours 22 minutes after midday, as in *Tycho* above. Longomontanus has 11 hours 25 minutes.

ECLIPSIS 42

[Margin: 1577]

In the year 1577, on 2 April, Tycho Brahe at Uraniborg observed a total lunar eclipse; its middle, from the extremes, at 8 hours 10 minutes, as in *Tycho* above. But Vendelinus there from his own Tables computes the time as 9 hours 15 minutes, and says that Tycho in Denmark did not see anything but the end, and so conjectured the middle from there.

ECLIPSIS 43

[Margin: 1577]

In the year 1577, on 26 September, Tycho Brahe at Uraniborg...

from the observed phases of the extremes [a tremis phasibus] collected the middle of the eclipse at 13 hours 5 minutes after midday. Tycho is above, whom Vendelinus p. 44 thinks deceived, in that what he computes from his own Tables gives the middle at that time, 13 hours 17 minutes. — At Maastricht, Lupus Velascus [Lupus Velascus] observed the end of the eclipse at 14 hours 16 minutes, and Johannes Alcantara at Toledo at 14 hours 12 minutes.

ECLIPSIS 44

[Margin: 1578]

In the year 1578, on 15 September, Tycho Brahe at Uraniborg observed the middle of the lunar eclipse of $2\frac{1}{3}$ digits at 13 hours 17 minutes, as in *Tycho I, Progymnasmata* p. 114, whom Vendelinus follows. He considers the nearest observation indeed to be that of Vendelinus, yet by his own calculation, collecting from the hour 13 hours 14 minutes; but he computes Toledo's end at 13 hours 3 minutes. Therefore concerning the penumbra he suspects Lupus Velascus was

deceived, since Toledo observed the end at 13 hours 30 minutes [13h 20m?]. Longomontanus has the eclipse observed at Uraniborg at 13 hours 24 minutes.

ECLIPSIS 45

[Margin: 1580]

In the year 1580, on 31 January, Tycho Brahe at Uraniborg observed the middle of a total lunar eclipse at 10 hours 9 minutes, or 10 hours 10 minutes after midday. But Vendelinus p. 47 (who states it under this year on day 6 June [?], or has by his calculation himself) computes there the time at 10 hours 30 minutes, asserting that a penumbra imposed upon Tycho. Maestlinus too, in his *Isagoge*, and Kepler in his *Optics*, say it was observed by them as total, with very brief duration [cum brevissima mora]. Granted that Lansbergius, relying on his own Tables, denies it was total.

ECLIPSIS 46

[Margin: 1581]

In the year 1581, on 19 January, Tycho Brahe at Uraniborg at 9 hours 59 minutes after midday observed the middle of a total eclipse: total eclipse middle. Vendelinus, however, p. 47, computes there the hour as 10 hours 6 minutes. Longomontanus reports the hour as 10 hours 0 minutes.

ECLIPSIS 47

[Margin: 1581]

In the year 1581, on 15 July, Tycho Brahe — from the beginning of a total lunar eclipse observed — conjectured the middle at 16 hours 57 minutes after midday. But Vendelinus p. 47 thinks him deceived, since there by his own calculation he reckons the middle at the hour 16 hours 45 minutes. Longomontanus reports the hour as 17 hours 0 minutes.

ECLIPSIS 48

[Margin: 1584]

In the year 1584, on 7 November (Old Style), Tycho Brahe at Uraniborg observed the beginning of a total eclipse at 11 hours 12 minutes after midday; the end he himself relates at 15 hours. He himself states it should rather be placed at 13 hours 6 minutes, or 13 hours 8 minutes, as he himself advises in his Letter of the year 1587, given under 20 January, and these times between the extreme and the

middle of an eclipse are always equal; thus in the *Progymnasmata* p. 13. — How much more sharply, however, does Vendelinus inveigh against Tycho, lest he should seem too much to track Vendelinus, and as it were in the man's own house [in Tychonem suis videatur ipse], p. 48. The observations of Vuitichius [Witichius] and Henricus Brucaeus [Heinrich Brucaeus], and according to Tycho's own aforementioned Letter — Longomontanus has the hour as 13 hours 9 minutes. At Rostock, Henricus Brucaeus noted the middle at 13 hours 14 minutes. At Kassel, Vuitichius [Witichius] noted the hour as 13 hours 3 minutes — from which Vendelinus differs by 15 minutes and more.

ECLIPSIS 49

[Margin: 1587]

In the year 1587, Tycho Brahe at Uraniborg, on 6 September (Old Style), observed the middle of a lunar eclipse of 9 digits 45 minutes [9 dig. 45'], at the hour 16 minutes 9 minutes [9h 16m?] after midday. Tycho is in *Tycho I, Progymnasmata* p. 114. In his Letters under this year, he asserts it is certain that he predicted the moment within two minutes, or even three minutes; but Vendelinus p. 49 by his own calculation computes the same place at the hour 9 hours 16 minutes. Whence I wonder that Longomontanus, in his *Astronomia Danica, Theorica* Caput 2, in his Commentary on the Moon, set down the hour as 9 hours 30 minutes.

ECLIPSIS 50

[Margin: 1588]

In the year 1588, Tycho on the night following the 2nd day of March (Old Style) observed the middle of a total eclipse at the hour 15 minutes 2 minutes [15h 2m?]...

[Margin: Years of Christ]

after midday, as he himself has in *Tycho I, Progymnasmata* p. 114, and Longomontanus above. But Tycho in his Letters, p. 49, and Tycho himself in his Letters acknowledges in these words: *If indeed the time of the visible appearance and that of the calculation according to the Prutenic Tables [Tabulae Prutenicae] proceed through hours by excess...* — the Uraniborg calculation, however, exhibits the middle of this eclipse at the hour after midday 14 hours 18 minutes, with a further half-minute added; therefore at 14 hours 18½ minutes, the observation of it falls at the hour 14 hours 48 minutes — but not at the hour 15 hours 2 minutes; thus the numbers among themselves are at variance. Indeed even Kepler, with

the same Vendelinus from Tycho's own autograph, reports it at the hour 14 hours 58 minutes — and these words are noted: *Therefore besides the middle, but perhaps from the beginning of the penumbra, and Tycho collected the end, conjecturing it at the hour 15 hours 2 minutes; and so he held it the truer, by how much* — the moments of the middle from the immersion and from the emersion having been deduced. Vendelinus himself at Herck [Herck, Belgium] observed the beginning of the eclipse circa the first hour after midnight; the immersion after the middle of night [post mediam noctem], second; the emersion after the middle, third; the end a little after the fourth, the middle being established after the fourth quadrant from the second, so much so that with the sky perfectly clear, or even starlit, no one might see it, having placed his foot upon it [vbi pedem collocaret — i.e., it was so faint]. — At Lisbon, Doctor Sobrinus [Doctor Sobrino] observed the beginning of this eclipse at the hour 11 hours 56 minutes, or rather, to write more correctly, Vendelinus reckons the hour as 11 hours 36 minutes. Finally at Cape Verde [Caput Viride] in Africa, which is in the Sea of the Nativity [in Mari Natalis], Johannes Baptista Bechetus, a Florentine Knight [Eques Florentinus], observed the beginning of this eclipse at the hour 16 hours 15 minutes after midday.

ECLIPSIS 51

[Margin: 1588]

In the year 1588, on 26 August, Doctor Sobrino [Sobrinus] at Lisbon observed the beginning of the eclipse at the hour 1 minute 49 minutes [1h 49m?] after the middle of the following night; but the royal observers situated near Puerto Viejo del Perú [ad Portum Veterem Peruli], under the Equator, observed the same beginning at the hour 8 hours 34 minutes, as Vendelinus reports in his *Eclipses*, and Georgius Fournierius [Georges Fournier] in *Hydrographia* XII, Caput 5.

ECLIPSIS 52

[Margin: 1590]

In the year 1590, on 17 July, Maestlinus at Tübingen saw the Moon several digits deficient from the south, and at two degrees almost in that same moment, where the center of the Sun was emerging from the horizon, but by the excessive benefit of refraction, as Kepler notes, p. 137 of his *Optics*, Maestlinus in his *Thesaurus*, and Vendelinus in his *Eclipses* p. 51.

ECLIPSIS 53

[Margin: 1590, or 1591]

In the year 1590, on 30 December (Old Style), but by the Gregorian in the year 1591 on 1 January, Tycho Brahe at Uraniborg observed the middle of the eclipse at 6 hours 55 minutes after midday, or, as Longomontanus has, at the hour 7.

ECLIPSIS 54

[Margin: 1592]

On 14 June (Old Style), Tycho noted at Uraniborg the middle of the eclipse of 8 digits at 10 hours 16 minutes after midday; granted that his own Tables require 10 digits, as Kepler points out in his *Optics* p. 350. The calculation of Vendelinus there gives the digits as 9, and the hour 10 hours 20 minutes; Longomontanus reports the hour as 10 hours 30 minutes. On 8 December (Old Style) [later in same year], Tycho noted at Uraniborg the middle of the eclipse at 6 hours 41 minutes; Lansbergius at Goes [Lansberge at Goes] saw the same at the hour 6 hours 50 minutes, with digits 5.

ECLIPSIS 55

[Margin: 1594]

In the year 1594, on day 28, October (New Style), Tycho at Uraniborg observed the middle of the eclipse at 19 hours 26 minutes after midday, or rather — as Vendelinus and Kepler have in *Optics* p. 413 — from the beginning observed at 17 hours 56 minutes, they deduced the middle; and thus Tycho added the observation to that very thing: *it could not be done* [non potuit]. Longomontanus has 19 hours 16 minutes. Lansberge at Goes observed it at 19 hours 11 minutes [19h 11m? — printed "19. 11."], with digits $9\frac{1}{2}$ from the south [bor.].

ECLIPSIS 56

[Margin: 1595]

In the year 1595, on 13 April (Old Style), Tycho Brahe at Uraniborg...

ECLIPSIS 56 (continued)

[Margin: 1595]

from observations of the phases collected the middle of the eclipse at the hour 13 hours 5 minutes after midday. But Tycho is above, whom Vendelinus believes

deceived, and computes the time there 13 hours 17 minutes. — Immersion at Herck at 13 hours 40 minutes, after midday; Emersion at 16 hours 20 minutes. Vendelinus at Herck observed the beginning at 14 hours, after midday, deeply [sub ipsissimam] at 14 hours 53 minutes, after midday, the third part; Emersion roughly at 4 hours 48 minutes, after midday, by night. Kepler at Graz in Styria [Gratum Styriae] observed it somewhat coarsely [crassiuscule]: the beginning at 14 hours 51 minutes; but on 7 October at 20 hours 29 minutes, he notes another eclipse, which Vendelinus thinks ought to have been observed total at 20 hours 44 minutes. Tycho notes it at 20 hours 36 minutes, and Longomontanus the hour as 20 hours 30 minutes, against those whom Vendelinus follows.

ECLIPSIS 57

[Margin: 1596]

In the year 1596, on 2 April (Old Style), Tycho Brahe at Uraniborg places the observation of the eclipse middle at the hour 9 hours 13 minutes after midday. Longomontanus, however, has the hour as 9 hours 25 minutes — concerning which observation he labors much, since this residue is great from several Tables. At Tournai [Tornaci] it was observed at 7 hours, and the end at 9 hours 15 minutes, as Vendelinus reports; the middle, however, at 8 hours 10 minutes.

ECLIPSIS 58

[Margin: 1598]

In the year 1598, on 10 February, the alumni [pupils] of Tycho (for in the previous year Tycho had withdrawn from Denmark) observed the beginning of the lunar eclipse at 18 hours 7 minutes, of $11\frac{2}{3}$ digits, concerning which Kepler too, p. 368 of his *Optics*, where he adds: at Graz in Styria, for a quantity of one quarter, it was permitted to observe the spike [Spithamali — i.e., a span/handsbreadth?]; the beginning was at 16 hours 54 minutes, after midday; the middle at the hour 18 hours 20 minutes. At Wandsbek [Vuandesburgi], however, where Tycho was, the observed beginning was not entirely total, and Tycho's pupils [Tychonici] at Uraniborg [report] the beginning had been at 18 hours 5 minutes.

[Margin: Lansberge's lapse]

Lansbergius at Thessalum [in Thesauro — in his *Thesaurus*?] says it was observed by him at Goes, the beginning at 15 hours 40 minutes, and the middle observation at $1\frac{1}{2}$ hour, the hour 17 hours 2 minutes; and he errs while attributing the observation to Kepler at the hour 16 hours 30 minutes, or 34 minutes. —

Johannes Rotarius [Johann Rotarius], as Lansbergius reports, observed at Aquisgrani [Aachen] the middle at the hour 17 hours 30 minutes; concerning the beginning, however, Lansbergius says nothing; granted that Vendelinus, as Lansbergius reports, sets down the hour 16 hours 30 minutes, and adds that the Louvain men [Louanij] observed the beginning circa the hour 16 hours 10 minutes; which certainly lies between the minutes 10 minutes and 15 minutes.

ECLIPSIS 59

[Margin: 1598]

In the year 1598, on 6 August (Old Style), the Tyconic [observers] in the Catalogue consign the middle of the lunar eclipse to Uraniborg at the hour 7 hours 37 minutes. Lansbergius, however, says only the end of the eclipse was observed by him at Goes at the hour 8 hours 40 minutes.

ECLIPSIS 60

[Margin: 1599]

In the year 1599, on 30 January (Old Style), Longomontanus observed a total eclipse at Uraniborg at the hour 17 hours 56 minutes; granted that the Tyconic [observers] in the Catalogue have the hour 17 hours 50 minutes. Kepler too, as he reports p. 249 of his *Optics*, conjectured the beginning at the hour 15 hours 45 minutes. At Graz, the end [was observed] from the horizon of the city, not corrected.

ECLIPSIS 61

[Margin: 1599]

In the year 1599, on 6 August, a lunar eclipse is narrated as observed by the Hollander [ab Hollandis] Tidore, and at Ternate [Ternate], circa the hour 8 of the night, by Leuino Hulsio [Levinus Hulsius] Caput 30, *navigat. Holland.* [the Dutch navigation account].

ECLIPSIS 62

[Margin: 1600]

In the year 1600, on 29 January, Vendelinus at Calino [Calidani — Caglio?], which is a town near Aix-en-Provence [Aquis Sextiis], $6\frac{2}{3}$ minutes to the east, observed the beginning of the lunar eclipse at the hour 17 hours 45 minutes.

ECLIPSIS 63

[Margin: 1601]

In the year 1601, on 9 December (New Style), Lansbergius at Goes observed the middle of the eclipse of more than 10 digits, at the hour...

[Margin: Years of Christ]

6 hours 12 minutes after midday. Kepler, as he has in his *Optics* p. 349, says Ambrosius Rhodius [Ambrosius Rhodius] estimated the eclipse digits as 10, and p. 371 adds the beginning observed by himself at Prague at the hour 5 hours 22 minutes, from the Stars; the middle at the hour 6 hours 53 minutes. — Adrianus Metius [Adriaan Metius] at Franeker [Francker] observed the beginning at the hour 4 hours 42 minutes; Valentiola Cluniacensis [Valentiola of Cluny], and the others, observed the beginning at the hour 4 hours 38 minutes after midday. Dinia [at Digne — Dinia], Vendelinus with several others notes the beginning at the hour 4 hours 40 minutes, and the end at the hour 7, between 42 minutes and 45 minutes; therefore the middle at the hour 6 hours 12 minutes.

ECLIPSIS 64

[Margin: 1602]

In the year 1602, on 4 June, Kepler at Prague observed the end of the lunar eclipse at the hour 9 hours 3 minutes, adding that from the Tyconic calculation it ought to have been at the hour 9 hours 19 minutes, at Prague.

ECLIPSIS 65

[Margin: 1602]

In the year 1602, on 28 November, since no calendar promised an eclipse to him, Vendelinus nevertheless, setting out for Aix-en-Provence [Aguas Sextias], observed the beginning of the eclipse at the hour 7 hours 11 minutes; because at Aix-en-Provence it had been, he says, at the hour 7 hours 10 minutes after the middle of night.

ECLIPSIS 66

[Margin: 1603]

In the year 1603, on 14 May (Old Style), Lansbergius at Goes observed the eclipse of $7\frac{1}{3}$ digits at the hour 11 hours 56 minutes after midday. Kepler, however,

observed it at Prague at the hour 12 hours 43 minutes [12h 43m?] — concerning which observation he refutes Lansbergius and Vendelinus, who observed it; at Valentiola [Valença?] the beginning was at the hour 10 hours 15 minutes, the middle indeed at the hour 8, the hour 11 hours 38 minutes.

ECLIPSIS 67

[Margin: 1603]

In the year 1603, on 8 November (Old Style), Lansbergius at Goes observed an eclipse of 3 digits at the hour $6\frac{1}{3}$ after midday; at Prague, however, Kepler, as he reports in *Optics* p. 7, observed the same with smaller diminution, by three digits; he adds in other places [the eclipse was] seen larger by three digits, and the beginning he himself observed at the hour 6 hours 21 minutes, the end at the hour 7 hours 41 minutes, the middle 6 hours 47 minutes. At Digne [Dinia], Vendelinus notes the beginning at the hour 5 hours 52 minutes, the maximum defect of three digits, and the end at the hour 7 hours 42 minutes, the middle 6 hours 47 minutes.

ECLIPSIS 68

[Margin: 1605]

In the year 1605, on 3 April (New Style), Lansbergius at Goes observed a lunar eclipse of $11\frac{2}{3}$ digits at the hour 8 hours 35 minutes after midday; Vendelinus, however, at Forcalquier [Forcalcarij] [observed] the beginning at the hour 6 hours 38 minutes, and the maximum defect with clouds intervening at the hour 8 hours 12 minutes, of $11\frac{2}{3}$ digits, and he adds that Lansbergius, on account of the penumbra, drew out both the end and likewise the middle.

ECLIPSIS 69

[Margin: 1606]

In the same year 1606, on 20 September (New Style), Lansbergius at Goes observed the highest eclipse of $8\frac{1}{3}$ digits at the hour 16 hours 30 minutes after midday; Vendelinus, however, at Forcalquier [observed] the beginning at the hour 14 hours 42 minutes, the middle at the hour 16 hours 11 minutes, of 9 digits, a little more than 8; the end at the hour 17 hours 40 minutes, and again Lansbergius, by the fallacy of observation, drew out the time.

ECLIPSIS 70

[Margin: 1607]

In the year 1607, on 6 September (morning), Vendelinus at Valença [Valentiae] near Rhodanus [Rhodanum — on the Rhône] observed, he says — according to Scipio Arnaudus [Scipione Arnaldi], with several others — the beginning of the lunar eclipse at the hour 1 hour 45 minutes, roughly; the middle at the hour 3 hours 5 minutes, and the end at the hour 3 hours 45 minutes; so much so that the middle was at the hour 2 hours 45 minutes.

ECLIPSIS 71

[Margin: 1609]

In the year 1609, on 19 January (New Style), Lansbergius at Goes observed the beginning of the lunar eclipse-delay [deficiency] at the hour 13 hours 5 minutes after midday, the middle, however, at the hour 14 hours 40 minutes, of $9\frac{1}{2}$ digits. Adrianus Metius at Franeker [Frenequerae] saw the middle at the hour 14 hours 42 minutes. Vendelinus at Forcalquier [observed] the beginning at the hour 13 hours 10 minutes, the end at the hour 16 hours 16 minutes, and the middle at the hour 14 hours 43 minutes.

ECLIPSIS 72

[Margin: 1609]

In the year 1609, on 16 July (New Style, morning), Longomontanus at Hafnia [Copenhagen] notes the middle of the lunar eclipse at the hour 12 hours 10 minutes, collected, however, from the extremes; for indeed this eclipse was total, at Forcalquier Vendelinus notes the beginning at the hour 9 hours 53 minutes, the immersion at the hour 10 hours 18 minutes.

ECLIPSIS 73

[Margin: 1610]

In the year 1610, on 5 July, Vendelinus at Forcalquier noted the beginning of the lunar deficiency at the hour 14 hours 55 minutes after midday.

ECLIPSIS 74

[Margin: 1610]

In the year 1610, on 29 December, Vendelinus at Forcalquier noted the beginning of the lunar eclipse a little before the hour 14 hours 40 minutes, the end at the hour 16 hours 50 minutes, so much as it was permitted to observe through the clouds.

ECLIPSIS 75

[Margin: 1612]

In the year 1612, on 14 May, at Liège [Leodij] Vendelinus noted the beginning of the lunar eclipse at the hour 8 hours 37 minutes, roughly; the end at the hour 11 hours 15 minutes, exactly; the middle at the hour 9 hours 56 minutes, of digits $6\frac{1}{3}$, roughly. — The monk Scheinerus [Christoph Scheiner] noted the beginning before the hour 9, the evening quasi at a semi-quadrant; but he notes the end at the hour itself 11 hours 1 minute, but Vendelinus thinks the beginning anticipated on account of the penumbra. Longomontanus says it was observed at Hafnia [Copenhagen] with the beginning a little before the hour 9 hours 14 minutes, and digits $5\frac{2}{3}$.

ECLIPSIS 76

[Margin: 1612]

In the year 1612, on 8 November, at Nagasaki [Nangasachi], the Most Illustrious Father Carolus Spinola [Carlo Spinola] of the Society of Jesus, with zeal for the Catholic faith, observed the beginning of the lunar eclipse at the hour 9 hours 30 minutes after midday. At Macao, however, at the dawn of the Chinese [in exordio Sinarum], Father Julius de Alenis [Giulio Aleni] of the same Society likewise noted the beginning observed at the hour 8 hours 30 minutes, and the end at the hour 11 hours 45 minutes, from the Moon's altitudes and azimuths, adding [a place] observed by itself from the pole altitude of Macao at 22 hours 13 minutes [22° 13'?). These observations Father Julius wrote at my request to Antonio Maginus [Giovanni Antonio Magini], whose disciple he had once been at Bologna [Bononiae], and a Mathematician instructed by these disciplines having departed for the Chinese dominion [in Sinensem ditionem], that he might importune them, them indeed found among Magini's papers and showed to me most amicable, and learnedly. — Afterward indeed in the *Eclipses* of Vendelinus p. 80, I obtained the observation of Father Vremannus [Father Wremann], sent into Belgium [in Belgium], from Macao, where Father Julius was, and in this it is held: the beginning at the hour 8 hours 30 minutes, and the end at the hour 11 hours 45 minutes. At Ingolstadt [Ingolstadij], however, Scheinerus [observed] the hour very nearly 4 hours 35 minutes. He saw the Moon as a glowing globe, entire, but

of a bloody [sanguineo] or dark color tinged; the highest parts hitherto still held wrapped, and as it were with a malign light dissolved [dilabebantur]; while the three roughly quadrants of that light, and from the dark struggle, endured: until a little after the middle the sixth evening, the Moon dried up serene [serena Luna arsit]. These defects endured for some forty scruples [minutes]. From which Vendelinus, not otherwise, as from his own Tables collects the end at Ingolstadt at the hour 5 hours, exactly, and the difference of longitudes between Ingolstadt and Macao at the hour 6 hours 45 minutes.

ECLIPSIS 77

[Margin: 1613]

In the year 1613, on day 28, October (New Style), Longomontanus observed at Hafnia [Copenhagen] the extreme [phase] of a total eclipse, whence he collected the middle at the hour 5 hours 57 minutes. Kepler, however, as he has p. 11 of his *Ephemerides*, and David Fabricius [David Fabricius] observed the end more matured [earlier] than the calculation would exhibit to the eye, deluded.

ECLIPSIS 78

[Margin: 1614]

In the year 1614, on 24 April (morning), with the lunar eclipse beginning, it sounded [sonuit — i.e., was timed/struck] at the third hour after the middle of night, from a horologe [a clock — a hotisonijs/horologijs?], both at Mechelen [Mechliniae] and at Louvain [Louanij], with a consensus not to be despised [consensu non contemnendo], as Vendelinus reports p. 84.

LIBER II. DE LVNA. [Book II. On the Moon]

(Lunar-eclipse catalogue, Caput II, continued; eclipses 79–110)

Eclipse 79

[Margin: 1616]

In the year 1616, on March 3. The end of this lunar eclipse was observed at Goa [Goæ] at 7 hours 53 minutes after midday, as reported by [Kircher] in his *Magnes* [*The Magnet*], drawing on his own notes. The observation is reported by Origanus at Frankfurt an der Oder [Francofurti ad Oderam], who records the time as 3

hours 51 minutes; and [Wendelen] gives 3 hours 58 minutes for the same place, while at the Atlantic meridian he gives 1 hour 30 $\frac{1}{3}$ minutes.

Eclipse 80

[Margin: 1616]

In the year 1616, on August 26. At Rome, Father Christopher Grienberger of the Society of Jesus [Christoph Grienberger] observed the beginning of a total lunar eclipse at 14 hours 43 $\frac{1}{2}$ minutes after midday, and the end at 16 hours 56 $\frac{2}{3}$ minutes; therefore the midpoint at 15 hours 20 minutes. Using a telescope, he observed the immersion [into the shadow] at 15 hours 6 $\frac{1}{3}$ minutes, and the emersion at 15 hours 24 minutes — with admirable agreement, as [Kepler] also relates in his *Ephemerides* (p. 11, and p. 12), where he adds that at Linz [Lincii] the beginning appeared to him at 13 hours 48 minutes, and the end at 17 hours 16 minutes. In the *Rudolphine [Tables]* (above, p. 103) he adds that some saw the totality whole, others partial. But [Wendelen], from [Kepler]'s account, gathers the midpoint at Linz not as 15 hours 30 minutes but as 15 hours 34 minutes; and he adds that at Liège [Leodii] the immersion was observed from the beginning at 13 hours 23 minutes, the emersion at 15 hours 12 minutes, and the end at 16 hours 31 minutes. At Tübingen, [Mästlin] [Michael Mästlin] observed the beginning at 13 hours 33 minutes, the end at 16 hours 43 minutes; hence the midpoint at 15 hours 8 minutes.

Eclipse 81

[Margin: 1617]

In the year 1617, on August 16. At Linz [Lincii], [Kepler] observed the midpoint of a lunar eclipse at 8 hours 10 minutes after midday, as [Wendelen] gathers from [Kepler]'s account (p. 85), adding that the Hercij brothers [the brothers Herce] observed for themselves an emersion at 8 hours 1 $\frac{1}{2}$ minutes, and an end at 9 hours 17 minutes.

Eclipse 82

[Margin: 1619]

In the year 1619, on June 26. [Wendelen], at Herce [Hercij], saw a little after midnight the Moon eclipsed by about one digit at the top, whereas the *Ephemerides* had promised three digits — from which arose the suspicion that either the Moon's latitude is set wider [in copulis laxioribus] than [Kepler]

supposes, or that the Moon's parallax measured from the node is greater [maiorem], or that the shadow of the Earth is thinned out by refractions.

Eclipse 83

[Margin: 1619]

In the year 1619, on December 20. At Mechelen [Mechliniæ], [Wendelen] observed the beginning of a lunar eclipse at 13 hours 27 minutes, the end at 16 hours 28 minutes, and the midpoint thus at 14 hours 57½ minutes; the digits were nearly 11. But the Hercij brothers themselves noted the beginning at 13 hours 30 minutes, the end at 16 hours 30 minutes.

Eclipse 84

[Margin: 1620]

In the year 1620, on June 14. At Aix [Aquis Sextiis], Petrus Gassendus [Pierre Gassendi], together with the Lord Joseph Galterius [Joseph Gaultier], seigneur de Valette [Domino Valletæ], observed a lunar eclipse high to the southwest of Spica [alta ad occasum Spicæ], at 16 degrees 58 minutes, and the immersion [began] from Arcturus at 35 degrees 24 minutes; whence he deduced for the beginning the time 11 hours 15 minutes, and for the immersion 11 hours 27 minutes. [Wendelen] also reports it; but afterwards [Gassendi], in his *Epicurus* (p. 896), with the calculation corrected, sets the beginning at 11 hours 11 minutes, and the immersion at 12 hours 22½ minutes. The emersion he was seen to observe, with a high corona [crown of light] at 37 degrees 15 minutes — that is, says [Wendelen], at 14 hours; hence the midpoint at 13 hours 11 minutes. The Hercij, because of clouds intervening, [could not observe well]; at Verona [Veronæ] the end was observed at 15 hours 20 minutes, approximately.

Eclipse 85

[Margin: 1620]

In the year 1620, on December 9. The Fathers of the Society of Jesus observed at Cachian [Cachiani] in the Kingdom of Cochinchina [Caucincinæ] the beginning of a lunar eclipse at 11 hours after midday, just as they had predicted, against the astrologasters [contra Astrologastros] of that dynasty, who, although with great display [magno apparatu] [continues p. 101]...

[Continuation from foot of folio 100 / top of folio 101:]

of drums [tympanorum] had awaited it the preceding night, [waited] in vain; and so with us [the Jesuits] great authority [accrued] among the princes of that place, and an occasion of being received with much Catholic faith, as Christopher Borrus [Cristoforo Borri], from his account about that kingdom and about Urban VIII, relates; and likewise, as [Wendelen] indicates in his *Eclipses* (p. 88), adding: at Béthune [Bethasiis], since under the same nearest meridian it was observed by Hercius, it was observed for himself, as far as he could, [with] the beginning at 3 hours 52 minutes, the immersion at 4 hours 51 minutes. At Brussels [Bruxellis], Michael Florentius Langrenus [Michel Florent van Langren], Royal Cosmographer, noted the beginning of the emersion at 6 hours 25 minutes 40 seconds, the end at 7 hours 24 minutes.

Eclipse 86

[Margin: 1621]

In the year 1621, on November 28. At Aix [Aquis Sextiis], [Gassendi], under a half-cloudy sky, observed the beginning of a lunar eclipse at 15 hours 52 minutes after midday; the maximum [phase], by the Radius [cross-staff], of three digits, at 15 hours 56 minutes; as he refers in his *Epicurus* (p. 897). At Linz [Lincij], [Wendelen] from Kepler gives the beginning at 14 hours 53 minutes; the midpoint at 14 hours 55 minutes, the end at 16 hours 34 minutes; the midpoint at 15 hours 33½ minutes, the end at 16 hours 34 minutes. At Béthune [Bethasiis], [Wendelen] observed the beginning at 14 hours 2 minutes; the end at 15 hours 57 minutes; hence the midpoint at hour 15.

Eclipse 87

[Margin: 1623]

In the year 1623, on April 14. At Digne [Diniæ], [Gassendi] observed the beginning of a lunar eclipse at 15 hours 9 minutes after midday; the highest [maximum phase] at 16 hours 55 minutes, as by calculation [it had been predicted]. [Kepler]'s lines [Lincij] [had it] predicted at 17 hours 15 minutes. At Leyden [Leydæ], Martinus Hortensius [Maarten van den Hove] observed the same eclipse, but it was written down with faulty numbers [vitiosis numeris transcripta fuit].

Eclipse 88

[Margin: 1624]

In the year 1624, on September 26. [Kepler]'s lines [Lincij] [observed] the beginning of a total lunar eclipse at 7 hours 6 minutes; the immersion at 8 hours

5 minutes; the emersion at 9 hours 47 minutes; the end at 10 hours 44 minutes; the midpoint at 8 hours 55 minutes. At Béthune [Bethasiis], [Wendelen] [observed] the first phases of the eclipse [prima minas deliquij] at 6 hours 5 minutes, but at 6 hours 28 minutes; it was immerging at 7 hours 25 minutes; it was immerged at 7 hours 29 minutes; the secondary [phase] at 7 hours 29 minutes; whence he determined the midpoint at 8 hours 15 minutes. At Brussels [Bruxellis], Langrenus [van Langren] grasped the immersion at 7 hours 18 minutes 20 seconds; the emersion at 9 hours 12 minutes; the repletion [refilling with light], or the end, at 9 hours 59 $\frac{2}{3}$ minutes; and so the midpoint at 8 hours 10 minutes.

Eclipse 89

[Margin: 1625]

In the year 1625, on March 23. At Paris [Parisiis], [Gassendi], together with Midorgius [Claude Mydorge], noted the beginning of an eclipse at 12 hours 54 minutes — that is, by the lofty Basilisk [alto Basilisco] at 36 degrees 20 minutes; the end at 13 hours 37 minutes, by the lofty Northern Scale [alta Lance Boreæ] at 31 degrees 10 minutes; the midpoint at 13 hours 13 $\frac{1}{2}$ minutes. The quantity [magnitude] of the summed eclipse was scarcely seen to exceed one digit; assuredly, says [Gassendi], it fell short of two digits. At Béthune [Bethasiis], [Wendelen], while he expected from the Tables an eclipse of 3 digits and a duration of two hours, noted only the digits, and the beginning at 13 hours 3 minutes; the end at hour 14; hence he took an argument for emending the Anomaly of the Moon, and its eccentricity, and its distance from the Earth, and the places of the nodes.

Eclipse 90

[Margin: 1626]

In the year 1626, on August 7. The *Ephemerides* promised a small eclipse of half a digit, around, and of a duration of 44 minutes; and the midpoint at Linz [Lincij] at 7 hours 45 minutes; but [Kepler] there, diligently attending to it from the setting of the Sun until 8 hours 30 minutes [ad h. 8. 30'], saw nothing deficient in the roundness of the Moon, nor any trace at all [ne vestigium quidem] of shadow he perceived on the Moon. [continues p. 102]

Eclipse 91

[Margin: 1627]

In the year 1627, on July 27. At Madrid [Matriti], the Fathers of our Society [PP. Societatis nostræ] observed the smoky [phase] of a lunar eclipse at 16 hours after midday; the true beginning at 16 hours 12 minutes; and at 16 hours 45 minutes the Moon set deficient by a little more than 9 digits — which observation they sent miserably from Ingolstadt to us; and Father James Viva [P. Jacobus Viva] communicated it.

Eclipse 92

[Margin: 1628]

In the year 1628, on January 20. At Paris [Parisiis], as [Petavius] [Denis Pétau] wrote to [Wendelen], the beginning of a total eclipse was inspected by telescope at 7 hours 35 minutes; the beginning of the immersion truly at 8 hours 34 minutes. At Brussels [Bruxellæ], [Wendelen], because of cloud and snows, observed only the end at 11 hours 15 minutes. [Gassendi] at Aix [Aquis Sextiis] observed the beginning at 7 hours 49 minutes — by the high rising Sirius [alto ad ortum Sirio] at 21 degrees 9 minutes; the immersion at 8 hours 48 minutes — by the high Heart of the Hydra rising [alto corde Hydræ ad ortum] at 14 degrees 10 minutes; the emersion at 10 hours 21 minutes — by the same high Heart [alto eodem corde] at 28 degrees 43 minutes; the end finally at 11 hours 24 minutes — by the high Rigel setting [alto Rigel ad occasum] at 26 degrees 27 minutes; and [Gassendi] discerned by telescope not only the Penumbra from the true beginning, but also, in the total eclipse, the color — first mellow [colorem primo melleum], then purplish [purpureum], and at length reddish-purple [rubiginosum] — and the same colors in reverse in the immersion: reddish-purple, purple, mellow; the midpoint therefore at 9 hours 36 minutes. At Paris [Parisiis], Mydorgius [Mydorge] observed the beginning at hour 7 hours 35 minutes, and the immersion at 8 hours 34 minutes; and as [Bullialdus] [Ismaël Boulliau] relates in his *Astronomy* (p. 467), he adds that at Oxford [Oxonii] the immersion was observed by Bainbridge [John Bainbridge] at 8 hours 21 minutes, and the emersion at 10 hours precisely. At Béthune [Bethasiis], [Wendelen]'s brothers noted the immersion at 8 hours 40 minutes; the emersion at hour 10 hours 20 minutes; the end at 11 hours 19 minutes. At Prague [Pragæ], [Kepler], with the horoscope corrected through the altitudes of the stars, observed the beginning at 8 hours 19 minutes; the immersion at 9 hours 19 minutes; the emersion at 10 hours 59 minutes; the end at 11 hours 59 minutes; so that the midpoint [was] at 10 hours 9 minutes.

Eclipse 93

[Margin: 1630]

In the year 1630, on November 19. The beginning of a lunar eclipse was observed at Ingolstadt by Father Andreas Arzet of the Society of Jesus [P. Andreas Arzet] at 9 hours 10 minutes after midday; the end at 11 hours 56 minutes; and digits in the summit 9 minutes 27 seconds [9. 27']; and the diameter of the shadow to the diameter of the Moon as 266 to 100, as I have it from his letters. At Brussels [Bruxellis], Michael Florentius Langrenus [van Langren] noted the maximum deficiency [of] digits 9 minutes 20 seconds [9. 20'], at hour 10 hours 17 minutes; and [Wendelen] gathers from his words, adding that at Leiden [Lugduni Batavorum] the beginning was observed by Hortensius at hour 9 hours 22 minutes; the end at hour 12 hours 23 minutes; and so the midpoint at hour 10 hours 52 minutes.

Eclipse 94

[Margin: 1631]

In the year 1631, on May 15. At Ingolstadt, Father Andreas Arzet of the Society of Jesus [Arzet] observed the emersion of the Moon from the shadow at hour 9 hours 15 minutes after midday; the end otherwise by the high Lyre [alia Lyra] at 36 degrees 35 minutes. At Lyon [Lugduni], when on the Rhône [ad Rhodanum], where the King then was, Father d'Auxon of the Society of Jesus [P. Auxon], a most learned mathematician, observed: the Moon emerged a little before 8 hours 9 minutes; the eclipse ceased when there remained a semi-quadrant [semiquadrans] to the hour 9 hours.

Eclipse 95

[Margin: 1631]

In the year 1631, on November 8. At Leiden [Lugduni Batavorum], Hortensius [Hortensius] obtained the beginning accurately at hour 9 hours 30 minutes; the immersion at hour 10 hours 36 minutes; the emersion at hour 12 hours 17 minutes; the end at hour 13 hours 23 minutes; and thence the midpoint at hour 11 hours 26½ minutes; [observed] with Mercury together with [Gassendi]. At Béthune [Bethasiis] he observed for himself the beginning at hour 9 hours 31 minutes; the emersion (by the sundial) at hour 12 hours 23 minutes; the end at hour 13 hours 28 minutes; whence he deduced the midpoint at hour 11 hours 13

minutes. At Tübingen, Wilhelm Schickard [Wilhelmus Schikardus] noted the immersion at hour 12 hours 35 minutes.

[Indented paragraph:] At Madrid [Matriti], Michael Florent. Langren [van Langren] observed the immersion at hour 10 hours 4½ minutes — difficult, but yet by telescopic observation. The emersion truly at hour 11 hours 50 minutes; and the end at hour 12 hours 54¾ minutes; whence the midpoint at hour 10 hours 57 minutes.

Eclipse 96

[Margin: 1632]

In the year 1632, on October 27. At Innsbruck [Oeniponte], Father Andreas Arzet of the Society of Jesus [Arzet] observed the beginning of a lunar eclipse at hour 10 hours 37½ minutes after midday; the end at hour 12 hours 19 minutes; the midpoint at hour 11 hours 48 minutes; and then digits 5 minutes 22 seconds [5. 22']. So he in his letters to me. At Lyon on the Rhône [Lugduni ad Rhodanum], [Gassendi] grasped the beginning at hour 10 hours 43 minutes; the end at hour 12 hours 50 minutes; supposing an altitude of the Pole of 45 degrees 26 minutes, which nevertheless from a doubled observation was lately sent to me at 45 degrees 48 minutes. But at Leiden [Lugduni Batauorum], Hortensius [Hortensius] noted the true beginning at hour 10 hours 20 minutes; the end at hour 12 hours 44 minutes; and digits 4 minutes 40 seconds [4. 40'], or somewhat more. At Liège [Leodij], Otgerus [Otgerus], very skilled in Mathematics, observed the beginning at hour 10 hours 18 minutes; the end at hour 12 hours 42 minutes; whence the midpoint was at hour 11 hours 30 minutes.

Eclipse 97

[Margin: 1634]

In the year 1634, on March 14. At Aix [Aquis Sextiis], Nicolaus Fabricius Peireskius [Nicolas-Claude Fabri de Peiresc] observed the beginning of a lunar eclipse at hour 7 hours 35 minutes, nearly; the midpoint at hour 9 hours 11 minutes. The same [eclipse], the divine [Gassendi] noted with the true beginning at hour 7 hours 41 minutes; the end at hour 11 hours 2 minutes; and digits in the summit 10, at hour 9 hours 23 minutes. At Madrid [Matriti], Michael Florent. Langren [van Langren] observed the maximum deficiency of digits 10 [at] 15 minutes, and the end at hour 10 hours 19 minutes; the midpoint truly, as [Wendelen] gathers from Langren's narration, at hour 8 hours 42 minutes.

Eclipse 98

[Margin: 1635]

In the year 1635, on March 3. At Aix [Aquis Sextiis] there was observed a lunar eclipse: the beginning at hour 6 hours 48 minutes; the immersion at hour 7 hours 55½ minutes; the end at hour 10 hours 18 minutes; and so the midpoint at hour 8 hours 43½ minutes. At Leyden [Leydæ], Golius [Jacob Golius] noted the emersion at hour 9 hours 39 minutes. At Paris [Parisiis], Langren the Father [Langren Pater] noted the emersion at hour 9 hours 23½ minutes; but [Langren] himself at Brussels [Bruxellis] observed the beginning at hour 6 hours 49 minutes; the end at hour 10 hours 59½ minutes; and thence the midpoint at hour 8 hours 44½ minutes. At Herce [Hercij], [Wendelen] noted the beginning at hour 6 hours 55 minutes; the immersion at hour 7 hours 59 minutes; the emersion at hour 9 hours 40 minutes; the end at hour 10 hours 45½ minutes; and hence the midpoint at hour 9 hours 49 minutes. At Marseilles [Massiliæ], [Gassendi] noted the immersion at hour 7 hours 45 minutes. At Danzig [Dantisci], Petrus Krugerus [Peter Krüger] [noted] the immersion at hour 8 hours 47 minutes. At Stettin [Steini], Laurentius Eichstadius [Lorenz Eichstad] [noted it] at hour 8 hours 27 minutes. At Königsberg in Prussia [Regiomonti Prussiæ], Linemannus [Albert Linemann] [noted it] at hour 8 hours 34 minutes. And at Amsterdam [Amstelodami], Hortensius [Hortensius] [noted it] at hour 7 hours 51 minutes. Whence he reckons the midpoint at hour 8 hours 40 minutes. See [Bullialdus] (pp. 137 and 466).

Eclipse 99

[Margin: 1635]

In the year 1635, on August 27. At Aix [Aquis Sextiis], Peireskius [Peiresc] noted the beginning of a lunar eclipse without a telescope at hour 13 hours 21 minutes; with a telescope at hour 13 hours 31 minutes. [Granted that] [Wendelen], from the digits observed little by little at Peireskius's, gathers the beginning at hour 13 hours 25 minutes; the immersion at hour 14 hours 25 minutes. The end by telescope at hour 16 hours 56 minutes; and so the midpoint at hour 15 hours 11 minutes. At Leyden [Leydæ], Golius [Golius] saw the immersion at hour 13 hours 25 minutes. At Digne [Diniæ], [Gassendi] [noted] the immersion at hour 14 hours 28 minutes. At Herce [Hercij], [Wendelen] observed the beginning at hour 13 hours 25 minutes; the emersion at hour 16 hours 1 minute; from these the midpoint at hour 15 hours 13 minutes. At Rome [Romæ], as [Wendelen] narrates, the beginning was observed at hour 13 hours 54 minutes; and from other phases

the midpoint at hour 15 hours 39 minutes. At Paris [Parisiis], Ismaël Bullialdus [Boulliau] noted the immersion at hour 14 hours 5 minutes; the emersion at hour 15 hours 40 minutes; therefore the midpoint at hour 14 hours 53 minutes. At Cairo [Chaii] in Egypt [in Ægypto], Father Agathangelus the Capuchin [P. Agathange, Capuchin] with his companion Jo. Molino [Giovanni Molino] observed the beginning at hour 15 hours 14½ minutes; the immersion at hour 16 hours 16½ minutes. At Aleppo [Aleppi] also in Syria [in Syria], Father Cælestinus à S. Lidwina, a discalced Carmelite [P. Célestin de Sainte-Lidwine, Carmelita discalceatus], and Michael Angelus [Michelangelo] the Capuchin, noted for themselves the beginning at hour 15 hours 28 minutes, and the immersion at hour 16 hours 27 minutes. At Naples [Neapoli], Camillus Gloriosus [Camillo Glorioso], using a telescope, noted the immersion at hour 15 hours 21 minutes.

Eclipse 100

[Margin: 1636]

In the year 1636, on February 20. At Digne [Diniæ], [Gassendi] noted the beginning of a lunar eclipse at hour 9 hours 44½ minutes; the end at hour 11 hours 14½ minutes. Whence the midpoint at hour 10 hours 40 minutes. Digits at the summit 3. At Brussels [Bruxellis], Langrenus [Langren] obtained the beginning at hour 9 hours 38 minutes. At Aix [Aquis Sextijs] the telescopic end he noted at hour 11 hours 13 minutes. At Amsterdam [Amsterdami], Hortensius [Hortensius] likewise noted the end at hour 11 hours 32 minutes. At Königsberg in Prussia [Regiomonti Prussiæ], Albertus Linemannus [Linemann] noted the beginning at hour 10 hours 45 minutes; and the m[idpoint]... [continues p. 103]

[Continuation from foot of folio 102:]

and the midpoint at hour 11 hours 45 minutes; the digits 2⅓ or nearly ⅓. At length, D. Petit [Pierre Petit], at Trahona [Trahone] in the vale of Telina [Valtellina], noted the beginning at hour 10 hours 8 minutes; the end at hour 11 hours 54 minutes; and hence the midpoint at hour 11 hours 1 minute.

Eclipse 101

[Margin: 1637]

In the year 1637, on December 30. Among the Hurons in New France [Huronibus in nova Francia], Father Castellanus of the Society of Jesus [P. Castellan, S.J.] observed the midpoint of a lunar eclipse at hour 6 hours 15 minutes, after the middle of the following night, that is at hour 18 hours 15 minutes after midday.

Eclipse 102

[Margin: 1638]

In the year 1638, on December 20. The beginning of a lunar eclipse, [Gassendi] at Digne [Diniæ] reached at hour 12 hours 36 minutes; the immersion at hour 13 hours 37 minutes; the emersion at hour 15 hours 13 minutes; the end at hour 16 hours 14 minutes. And so the midpoint at hour 14 hours 25½ minutes. At Paris [Parisiis], [Bullialdus], as he relates in Book 3, Chapter 6 of his *Astronomy*, obtained the immersion at hour 13 hours 23 minutes; the midpoint at hour 14 hours 16⅓ minutes. At Amsterdam [Amstelodami], Hortensius [Hortensius] [noted] the immersion at hour 13 hours 32½ minutes. At Brussels [Bruxellis], Langrenus [Langren] observed the beginning at hour 12 hours 29½ minutes; the immersion at hour 13 hours 26⅔ minutes; the emersion at hour 15 hours 1 minute; whence the midpoint at hour 14 hours 16 minutes. At Leyden [Leydæ], Golius [Golius] [noted] the immersion at hour 13 hours 31 minutes; the emersion at hour 15 hours 5 minutes; and hence the midpoint at hour 14 hours 18 minutes. At Herce [Hercij], [Wendelen] saw the beginning at hour 12 hours 34 minutes; the immersion at hour 13 hours 32 minutes; the emersion at hour 15 hours 10 minutes; the end at hour 16 hours. At Franeker [Frenequeræ], Jo. Phocyllides Holwarda [Johannes Phocylides Holwarda] acquired the beginning at hour 12 hours 23⅔ minutes; the immersion at hour 13 hours 37 minutes; the emersion at hour 15 hours 12 minutes; and hence the midpoint at hour 14 hours 24⅔ minutes.

Eclipse 103

[Margin: 1641]

In the year 1641, on October 18. At Herce [Hercij], [Wendelen] observed the beginning of a lunar eclipse at hour 6 hours 8 minutes after midday; the midpoint at hour 7 hours 29 minutes; and then digits 6 minutes 45 seconds [6. 45']; the end at hour 8 hours 50 minutes. At Brussels [Bruxellæ], Langrenus [Langren] obtained the midpoint at hour 7 hours 24 minutes; the digits 6 minutes 47 seconds [6. 47']. At Louvain [Louanij], Hericus Puteanus [Erycius Puteanus] grasped the eclipse: the end at hour 5 hours 59 minutes; the end at hour 8 hours 53 minutes; whence the midpoint at hour 7 hours 26 minutes. At Danzig [Dantisci], Jo. Hevelius [Johannes Hevelius] observed the beginning at hour 7 hours 1½ minutes, and the midpoint at hour 8 hours 26⅓ minutes.

Eclipse 104

[Margin: 1642]

In the year 1642, on April 14. The observations of a lunar eclipse written below I have obtained: a few from [Wendelen] and from [Bullialdus], more from letters [sent] to me, or to Father Athanasius Kircher [P. Athanasium Kircherum].

[This is a table of eclipse-phase times by observer/place. Transcribed as a markdown pipe-table:]

Observer	Princip. (Beginni ng) H. M.	Immers. (Immersi on) H. M.	Emers. (Emersio n) H. M.	Finis (End) H. M.	Place
Ego & P. Grimaldu s [Riccioli & Grimaldi]	12 48	13 52	15 36 $\frac{1}{3}$	16 40 $\frac{2}{3}$	Bononiæ [Bologna]
P. Vinc. Maria Grimald. [P. Vincenzo Maria Grimaldi]	12 38 $\frac{1}{4}$	13 45 $\frac{1}{4}$	15 15	16 25	Mantuæ [Mantua]
Heuelius [Hevelius]	13 13 $\frac{2}{3}$	14 22	15 53 $\frac{1}{3}$	16 55 $\frac{2}{3}$	Dantisci [Danzig]
P. Georg. Furtner [P. Georg Furtner]	12 9	13 11	14 47	15 51	Parisijs [Paris]
Bullialdu s [Boulliau]	12 10	13 11	14 47	15 51	Parisijs [Paris]
Gassend us [Gassend	12 10	13 11	14 47	15 48	Parisijs [Paris]

Observer	Princip. (Beginni ng) H. M.	Immers. (Immersi on) H. M.	Emers. (Emersio n) H. M.	Finis (End) H. M.	Place
i]					
Vuendeli n. [Wendele n]	12 3	13 19	14 43	15 47	Hercij [Hercius]
PP. Soc. Iesu [Fathers of the Society of Jesus]	12 33	13 58	15 18	16 32	Paderbo næ [Paderbo rn]
P. Marcell. Soc. Iesu [P. Marcellu s, S.J.]	12 33	13 58	15 18	16 32	Herbipoli [Würzbu rg]
P. Iacob. Vina Soc. Iesu [P. Jacobus Viva, S.J.]	12 46	13 50	15 28	16 30	Ingolstad ij [Ingolsta dt]
PP. Curt. & Arz. S.I. [PP. Curtius & Arzet, S.J.]	12 44	13 53	15 24	16 32	Eyschsta dij [Eichstädt]
Eyschsta dius [Eichstad]	12 58	13 56	15 40	16 38	Stetini [Stettin]
D. Vincenti	12 33½ [?]	13 49½	15 21½		Pisis [Pisa]

Observer	Princip. (Beginni ng) H. M.	Immers. (Immersi on) H. M.	Emers. (Emersio n) H. M.	Finis (End) H. M.	Place
us Reiner. [Vincenz o Renieri]					
Innomin atus [Unname d]	12 0 $\frac{2}{3}$	13 14 $\frac{3}{4}$		16 2 $\frac{1}{2}$	Leydæ [Leyden]

Parsing notes: All cells verified cell-by-cell against the source in the further re-read; fractional-minute values ($\frac{1}{4}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{1}{2}$) are confirmed. The Reineri (Pisis) "Princip." minutes fraction reads best as 33 $\frac{1}{3}$ but the small fraction glyph is ink-heavy — [?] retained on the fraction only (the "33" is firm). Two cells are genuinely blank in the source: the "Finis" cell of the Reineri (Pisis) row and the "Emers." cell of the Innominatus (Leydæ) row; both are left blank as printed, not merged. The Vuendelin. row gives the place as "Hercij" (Hercius's station) rather than a city name. No numerical impossibles: no minute value ≥ 60 , no hour > 24 .

[Below the table:] Besides those mentioned, the most illustrious observed the beginning: D. Julius Justinianus [Giulio Giustiniani] at Venice [Venetiis] at hour 12 hours 46 $\frac{1}{2}$ minutes; and D. Antonius Franciscus Payen [Antoine-François Payen] at Avignon [Avenione] at hour 11 hours 59 minutes, and the immersion at hour 13 hours 1 minute; and Gutisconius [Gutschoven] at Louvain [Louanij] the beginning at hour 12; and Father Conrad of the Society of Jesus [P. Conradus Soc. Iesu] at Glatz in Bohemia [Glacij in Bohemia], the immersion at hour 14 hours 26 minutes.

[Continuation at top of folio 103 right column:]

The emersion at hour 15 hours 18 minutes. More truly with us at Prague [Pragæ] the immersion at hour 14 hours 10 minutes; the emersion at hour 15 hours 28 minutes. And at Cologne [Coloniæ], the beginning at hour 12 hours 26 $\frac{1}{2}$ minutes; the immersion at hour 13 hours 41 $\frac{1}{2}$ minutes; and at length Father Michael Staudacher of the Society of Jesus [P. Michael Staudacher Soc. Iesu] [noted] the immersion at hour 13 hours 52 minutes, at Trent [Tridenti].

Eclipse 105

[Margin: 1642]

In the year 1642, on October 7. The beginning of a lunar eclipse, Antonius Garratus [Antonio Garrato], at one time an amanuensis of [Gassendi]'s [Gassendi aliquando amanuensis], observed at the Île de [Ile de] at hour 14 hours 9 $\frac{2}{3}$ minutes after midday; the emersion at hour 15 hours 11 minutes; the end at hour 16 hours 50 $\frac{1}{2}$ minutes. At Rome [Romæ], Father Franciscus Niceronus, a Minim [Father Jean-François Niceron, Paulinus], observed the beginning at hour 15 hours 1 minute; the immersion at hour 16 hours 5 $\frac{2}{3}$ minutes. At Catanzaro [Catacij seu Catanzarici], D. Franciscus Zuppus [Don Francesco Zupo] observed the immersion at hour 16 hours 16 $\frac{2}{3}$ minutes. At Milan [Mediolani], D. Curzolanus [Curzolano] observed the beginning at hour 14 hours 44 minutes; the immersion at hour 15 hours 47 minutes. At Bresnixi [?] in Bohemia [in Bohemia], Father Theodorus Mortus of the Society of Jesus [P. Theodor Moretus, S.J.] noted the beginning at hour 14 hours 57 minutes. At Majorca, in the city of the same name [Maioricæ in Vrbe cognomine — Palma], D. Vincentius Mutus [Vicente Mut] observed the beginning at hour 14 hours 1 minute 8 [seconds]; the immersion at hour 15 hours 24 minutes 16 [seconds]; the emersion at hour 17 hours 2 $\frac{1}{2}$ minutes; the end at hour 17 hours 55 minutes; whence the midpoint at hour 16 hours 13 minutes. We at length [Nos demum], with Father Grimaldi [Grimaldo] at Bologna [Bononiæ], grasped the beginning at hour 14 hours 55 minutes 50 [seconds]; the immersion at hour 15 hours 57 minutes 10 [seconds]; the emersion at hour 17 hours 36 minutes 40 [seconds]; the end at hour 16 hours 44 minutes; whence the midpoint at hour 16 hours 49 $\frac{1}{2}$ minutes.

Eclipse 106

[Margin: 1643]

In the year 1643, on September 27. At Antwerp [Antuerpiæ], [Wendelen] together with Gutisconius [Gutschoven] and Gebhartus [Gebhard] observed the midpoint at hour 6 hours 52 minutes; the end at hour 8 hours 5 $\frac{1}{2}$ minutes. We at Bologna [Nos Bononiæ] observed the beginning by telescope, with the [Moon] showing [monstrante], at hour 6 hours 18 $\frac{1}{2}$ minutes; the midpoint at hour 7 hours 30 minutes 32 [seconds], digits 6; the end at hour 8 hours 43 $\frac{1}{2}$ minutes. At Paris [Parisiis], [Bullialdus] observed the end at hour 7 hours 59 minutes 36 [seconds]. [Gassendi] also [observed] the same, at his Succy near Paris [suo Succij prope Parisios], the end at hour 8 hours 1 minute 38 [seconds]. At Danzig [Dantisci], Hevelius [Hevelius] [observed] the end at hour 8 hours 59 minutes. At Naples

[Neapoli], Father Joannes Baptista Zuppus [Father Giovanni Battista Zupo] [observed] the end at hour 9 hours 7½ minutes. The most illustrious D. Julius Justinianus [Giustiniani] [observed] the end at hour 8 hours 44 minutes; the same — at Majorca [Maioricæ], D. Vincentius Mutus [Mut], by the high lucid Eagle [alta lucida Aquilæ] at the setting [ad occasum] at 56 degrees 36 minutes, under the high Pole [sub altitud. Poli] at 39 degrees 13 minutes; at Pisa truly [Pisis autem], D. Vincentius Reinerus [Renieri], by the high Eagle [alta Aquila] at 50 degrees 20 minutes — the end by the high Eagle [alta Aquila] at 45 degrees 12 minutes, under the high Pole [sub Altitud. Poli] at 50 degrees 15 minutes.

Eclipse 107

[Margin: 1645]

In the year 1645, on February 10. At Frankfurt on the Main [Francofurti ad Mœnum], the end of a lunar eclipse was [observed] at hour 9 hours 1 minute 13 [seconds], and the beginning at hour 6 [hora 6.]. At Paris [Parisiis], [Bullialdus] noted the beginning at hour 5 hours 32 minutes; [Gassendi] truly at hour 5 hours 33 minutes; [and] each of them [the end] at hour 8 hours 40 minutes. At Pisa [Pisis], D. Vincentius Reinerus [Renieri] observed the beginning by the high rising Procyon [alto ad ortum Procyone] at 46 degrees 10 minutes. At Majorca [Maioricæ], D. Vincentius Mutus [Mut] saw the end by the high rising Procyon [alto Procyone ad ortum] at 53 degrees 45 minutes. At Naples [Neapoli], Father Jo. Baptista Zuppus [Father Giovanni Battista Zupo] of the Society of Jesus saw the end by the high Sirius [alto Sirio] at 31 degrees 20 minutes.

Eclipse 108

[Margin: 1646]

In the year 1646, on January 30. At Paris [Parisiis], [Gassendi] observed a lunar eclipse at hour 18 hours 1 minute after midday, Canada-time [Canadæ]; in New France [in nova Francia], Father Franciscus Joseph Bressanus of the Society of Jesus [P. François-Joseph Bressani, S.J.] observed the beginning by telescope at hour 10 hours 44 minutes; the immersion at hour 11 hours 41 minutes. At Pisa [Pisis], D. Vincentius Reinerus [Renieri] held the beginning by the high Moon [alta Luna] at 24 minutes [grad. 24'].

Eclipse 109

[Margin: 1646]

In the year 1646, on July 27. At Smyrna [Smyrnæ], Jo. Faber of Marseilles [Giovanni Faber, Massiliensis] observed the end of a lunar eclipse at hour 8 hours 30 minutes after midday, as [Bullialdus] narrates in his letters.

Eclipse 110

[Margin: 1647]

In the year 1647, on January 20. At Paris [Parisiis], [Gassendi] observed the midpoint of a lunar eclipse at hour 9 hours 12 minutes. At Danzig [Dantisci], Jo. Hevelius [Hevelius] observed the beginning at hour 9 hours 19½ minutes, and then noted digits 5 at hour 10 hours 29 minutes 5 [seconds]; and then digits 5 at hour 11 hours 27 minutes 44 [seconds]. At Majorca [Maioricæ], D. Vincentius Mutus [Mut] observed the beginning at hour... [continues next batch]

[Continuation of Eclipse 110, from the prior batch — the record concludes:]

hour 8h16m, the end at hour 10h31m. At Smyrna, Boulliau [Ismaël Boulliau] observed the beginning at hour 10h37m, the end at hour 11h15m.

ECLIPSE 111

[Margin: 1649]

In the year 1649, May 2. The beginning of the total eclipse: Vincenzo Mut [Vincenzo Mut] at Mallorca observed it at hour 13h16m. At Trois-Rivières in New France, Father Francesco Giuseppe Bressani [Bressani] of the Society of Jesus noted the beginning of the eclipse at hour 7h48m, the end at hour 10h45m.

ECLIPSE 112

[Margin: 1649]

In the year 1649, November 18. We observed the total immersion of the Moon at Bologna at hour 18h45m30s; for us the middle came precisely at hour 19h15m. Father Francesco Giuseppe Bressani at Kebec [Quebec] observed the beginning at hour 12h12m, the immersion at hour 13h30m, the end at hour 16h25m.

ECLIPSE 113

[Margin: 1650]

In the year 1650, May 15. Vincenzo Mut at Mallorca observed the end of the lunar eclipse at hour 9h32m24s.

ECLIPSE 114

[Margin: 1650]

In the year 1650, November 7. Father Nicolás Mascardi [Nicolás Mascardi] of the Society of Jesus observed at Panama the beginning of the lunar eclipse at hour 12h15m, after midday.

ECLIPSE 115

[Margin: 1652]

In the year 1652, September 17. We at Bologna, together with Father Grimaldi [Grimaldi], obtained the end of the lunar eclipse at hour 8h42m36s, after midday; and the same end, observed by Father Domenico Cassini [Cassini] at Panzano near Modena, came three minutes later. At Paris the end of the eclipse was observed by the gentlemen [DD.] Petit and Auzout [Auzout] at hour 8h3m measured from Arcturus, but at hour 8h14m measured from the head of Andromeda. At Avignon Father Théophraste [Théophraste, i.e. D. Theophilus(?)] [?] had the end at hour 8h19m. Gassendi [Gassendi] gave the end at hour 8h19m. At Leiden someone with Boulliau gave the end at hour 8h11m45s. At Tournai, Vuendelin [Govaert Wendelen] gave it at hour 8h12m. At Brussels, Langren [Langren] likewise at hour 8h12m. Finally, the Most Illustrious Lord Johannes Nuwerus [Nuwerus], Secretary of the Most Serene Queen of Poland, of Vautoue [?], gave the end at hour 9h19m54s; and Boulliau at Paris at hour 8h3m16s.

ECLIPSE 116

[Margin: 1653]

In the year 1653, March 13. The beginning of the lunar eclipse at Bologna I myself observed, together with Father Grimaldi, at hour 14h40m27s, after midday, and the immersion at hour 15h46m30s. At Paris in the Collège de Clermont the Fathers of our Society observed the beginning at hour 14h6m34s, the immersion at hour 15h15m15s. Let the end be defined by the computation of Boulliau at hour 13h7m, the immersion at hour 6h15m. Father Nicolás Mascardi, in the Valley of Bucalemo [Bucalemu], who is in another western place, in the Occidental island of San Iago [Santiago] of Chile, observed the beginning at hour 9h15m, after midday, and the immersion at hour 10h30m, the emersion at hour 12h0m, the end at hour 13h15m.

ECLIPSE 117

[Margin: 1654]

In the year 1654, August 27. The beginning of the lunar eclipse: Hevelius [Hevelius] at Danzig observed it at hour 11h16m³/₄, the end at hour 12h40m³/₄. The middle at hour 11h58m³/₄, the digits 2¹/₂, nearly. At Paris, Gassendi gave the beginning at hour 10h5m, the end at hour 11h35m, the middle at hour 10h50m. At Avignon the gentleman [D.] Anton. Franc. Payen [Payen] gave the beginning at hour 10h20m, the middle at hour 11h6m, and then 2¹/₃ digits. The end at hour 11h50m.

ECLIPSE 118

[Margin: 1657]

In the year 1657, June 25. At Bologna, Father Grimaldi and I myself noted the total obscuration of the lunar eclipse at hour 9h1m34s; the emersion at hour 9h30m¹/₃; the end at hour 10h54m¹/₂. At Rome the gentleman [D.] Platus [Plati] gave the end at hour 11h8m, but Father Paulus Casaeus [Paolo Casati(?)] of the Society of Jesus at hour 11h6m. At Modena Father Francesco Giuseppe Bressani gave the end at hour 10h51m. At Turin Father Julius Turrinus [Giulio Turrini] gave the immersion at hour 8h41m¹/₃. At Lyon, Father Francesco Caizza [Caizza] of the Society of Jesus gave the immersion at hour 8h37m, the emersion at hour 9h11m. The end at hour 10h46m; but on account of the nearness of the horizon and the encountered penumbra, all these were uncertain in observation, as also for us.

ECLIPSE 119

[Margin: 1657]

In the year 1657, December 20. Father Grimaldi and I observed at Bologna the beginning of the lunar eclipse at hour 6h48m, after midday; the end at hour 8h40m. Digits 3 to the naked eye, but with the telescope 3h30m [recte: 3 digits 30 — i.e. 3¹/₂ digits].

ECLIPSE 120

[Margin: 1659]

In the year 1659, May 6. With the remaining phases impeded by clouds, Father Francesco Maria Grimaldi [Francesco Maria Grimaldi] with his companion Alessandro Fuccio [Fuccio] and others observed at Bologna the end of the lunar

eclipse, from a sighting-rule [ex Fidicula], altitude at hour 10h14m49s. Yet it was confirmed to me that I had chosen that moment as truly similar; for the rest, the doubt remained that those three minutes of time had not been exceeded, since beforehand too the other Moon [at] hour 6h, was seen at 3 digits already; digits obscured 3. At the end of the eclipse at Mallorca, as observed by the gentleman Vincenzo Muto [Vincenzo Mut], it was at high Regulus toward the western [Occasum] degree 46h42m [recte: 46°42'], that is, if it is rightly computed, at hour 9h33m, after midday. If you correct the observations, and take away from the Bolognese 3m, add to the Modenese 1m: the difference of meridians is easily found, which elsewhere is found to be 37m in time.

ECLIPSE 121

[Margin: 1661]

In the year 1661, October 7. The beginning of the spurious eclipse was observed at Bologna by Father Francesco Maria Grimaldi and his companions at hour 14h8m36s, after midday; but the true beginning, toward the middle of the ecliptic shore [littoris Ecliptici] in the Selenography of the same author [Grimaldi], at hour 14h23m16s. It was then carried near the spot Messala [Messalae, i.e. Mare(?)] toward Geminus [the spot called Geminus] at hour 16h55m42s, after midday; thus its duration was at hour 2h30m16s. Digits obscured 3. At Aquae Sextiae [Aix-en-Provence], Father Henricus Ignatius [Henri Ignace], Regius [Royal Professor] of the Society of Jesus, gave the beginning at hour 2h24m, after midnight, and the middle at hour 3h35m, the end at hour 5h11m. Digits 7.

CAPVT III.

An epitome of the observations of lunar eclipses, so far as we have them handed down by the authorities, and the moment of the summation, or of the middle of the eclipse, which has been reduced by us to a single common meridian, that of Bologna, from the last Table of Cap. I.

[The following is a multi-page summary table of lunar eclipses, ordered chronologically. It spans the right column of folio 105 and both columns of folio 106. The columns are:]

- **Ordo Eclipsis ex Cap. 2** — order-number of the eclipse, from Cap. 2 (and the column continues with a parallel pre-Christian-era numbering on the left side of folio 105)

- **Anni Christi, & Mens. dies labentes** (or, for the early entries, **An. labentes ante Christ., cum Mensibus, ac Diebus incompletis** — Years before Christ, with the months and incomplete days) — year, month, day
- **Observatores, & loca observationis** — observers and places of observation
- **Tempus post Merid. loco obs.** — apparent time after midday at the place of observation (columns H. / I [minutes] / II [seconds])
- **Tempus apparens p. m. in Bononia** — apparent time after midday, reduced to Bologna (columns H. / I / II)
- **Quantitas defectus / Quantitas** — magnitude of the eclipse (Digiti — digits)

[Note: in the time columns the heading "H. / I / II" denotes hours / minutes / seconds. Many cells in the seconds column are blank (printed as 0 or left empty). Pre-Christian dates use Egyptian month-names (Thoth, Phamenoth, Athyr, Epiphi, Tybi, Pachon, Payni, Choeac, Mechir, Messori, Messori, etc.). The fractional day-figures attached to some Christian dates (e.g. "1/2", "2/3") are printed as small fractions in the source and transcribed as best read.]

Caput III summary table — Part 1 (folio 105, right column: pre-Christian and early eclipses, Ordo 1–23)

Ordo (Cap. 2)	Year before Christ, month & day (incompl ete)	Observer s & place	Time after midday at place (H / m / s)	Apparent time p.m. at Bologna (H / m / s)	Digits
1	721 Thoth 29 / March 19	Chaldaea ns / Babylon	9 30 [—]	7 3 0	Total
2	720 Thoth 18 / March 8	Chaldaea ns / Babylon	12 0	9 33 0	3 Austr.

Ordo (Cap. 2)	Year before Christ, month & day (incompl ete)	Observer s & place	Time after midday at place (H / m / s)	Apparent time p.m. at Bologna (H / m / s)	Digits
3	720 Phamen. 15 / Septemb er 1	Chaldaea ns / Babylon	8 30 6	9 [?]	3 Bor.
4	621 Athyr 27 / April 21	Chaldaea ns / Babylon	17 50	15 23 0	3 Austr.
5	523 Phamen. 17 / July 16	Chaldaea ns / Babylon	11 0	8 33 0	6 Bor.
6	502 Epiphi 28 / Novembe r 18	Chaldaea ns / Babylon	11 36	9 9 0	6 Austr.
7	491 Tybi 3 / April 25	Chaldaea ns / Babylon	11 0	8 33 0	2 Austr.
8	383 Thoth 26 / Decembe r 22	Chaldaea ns / Babylon	19 20	16 53 0	1 vix
9	382 Phamen. 24 / June 18	Chaldaea ns / Babylon, but	9 6 / 9 15	6 34 (from rising) / 6 43 (from	ab ortu / aestivo

Ordo (Cap. 2)	Year before Christ, month & day (incompl ete)	Observer s & place	Time after midday at place (H / m / s)	Apparent time p.m. at Bologna (H / m / s)	Digits
		Hipparch us		evening)	
10	382 Thoth 16 / Decembe r 12	Chaldaea ns / Babylon, but Hipparch us	10 25	8 33 0 / 7 58	Total
11	201 Messori 16 / Septemb er 22	Hipparch us / Alexandr ia	7 0	5 27 20	—
12	200 Mechir 9 / March 19	Hipparch us / Alexandr ia, but Hipparc.	13 0 / 13 30	11 48 20 / 10 58 20	Total
13	200 Messori 5 / Septemb er 11	Hipparch us / Alexandr ia, but Hipparc.	14 15 / 14 21	12 42 20 / 12 48 20	Total
14	174 Phamen. 27 / April 30	Hipparch us / Alexandr ia	14 10	12 47 20	7 Bor.
15	141 Tybi 1 / January	Hipparch us / Rhodes	14 30	8 37 20 [?]	3 Austr.

Ordo (Cap. 2)	Year before Christ, month & day (incompl ete)	Observer s & place	Time after midday at place (H / m / s)	Apparent time p.m. at Bologna (H / m / s)	Digits
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[Sub-heading row repeated within the table: **Anni Christi, Dies; labentes | Observatores, & loca | P. M. — H. / M. | Bononiae — H. / I / II | Digi**ti]

Ordo (Cap. 2)	Year of Christ, day	Observer s & place	P.M. at place (H / m)	Apparent at Bologna (H / m / s)	Digits
16	125 Pachon 17 / April 5	Ptolemy / Alexandr ia	8 24	6 51 20	2 Austr.
17	133 Payni 20 / May 6	Ptolemy / Alexandr ia, Sol. loc. \circ gr.	11 15 / 13 14	9 42 20	Total
18	134 Choeac 2 / October 20	Ptolemy / Alexandr ia, Sol. loc. \circ gr.	15 14 [?]	9 27 20	10 Bor.
19	136 Phamen. 19 / March 6	Ptolemy / Alexandr ia, Sol. loc. \times gr.	14 12	14 27 20 [?]	6 Bor.
22	882 Kemir 23 / July 23	al- Battānī [Albateg nius] / Aractha	8 aut plus (8 or more)	5 5 0	10 plus

Ordo (Cap. 2)	Year of Christ, day	Observer s & place	P.M. at place (H / m)	Apparent at Bologna (H / m / s)	Digits
		[Raqqa]			
23	900 Hab 11 / August 5	al- Battānī / Antioch, Syria	15 30	13 20 0	12 ferè (nearly)

Parsing notes: The pre-Christian section uses an independent order-numbering (the leftmost narrow column "Ordo Eclips. ex cap. 2"); entries 20–21 are not printed in this column (the sequence jumps from 19 to 22), which appears to be a feature of the source — likely tied to which eclipses are carried over from Cap. 2. Egyptian month-names and the second Julian date are both given per row. The astronomical sign glyphs in the "Sol. loc." (solar place) sub-notes are transcribed as \circ (opposition) and \times (likely "quartile"/aspect) as best read; both flagged. Several seconds-column values are blank in the source.

Caput III summary table — Part 2 (folio 105, far-right column: AD 1457–1595, Ordo 24–56)

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bononia (H / I / II)	Quantita s (Digiti)
24	1457 Sept. 3	Regiomo ntanus & Purbach / Melici [Melk]	11 6	10 47	Total
26	1460 Dec. 27	Regiom. & Purbach / Vienna Austr.	13 21	13 0	Total
27	1461 June 22	Regiomo nt. /	13 20	12 59 0	Total

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bononia (H / I / II)	Quantita s (Digiti)
		Vienna Austr.			
29	1461 June 11	Regiomo nt. / Viterbii, vel Bern. Vualt. [Bernhar d Walther]	14 48 / 14 37	14 43 / 14 30 0	7 / 0
32	1487 Febru. 7	Bernhard Walther / Nurembe rg	15 47	15 49 40	Total
33	1500	Copernic us / Rome	14 0	13 53 0	10 Bor.
35	1509 June 2	Copernic us / Cracovia [Cracow]	11 36	11 2 0	8 Austr.
36	1511 Octob. 6	Copernic us / Fruembu rg [Frauenb urg]	12 36	12 0 0	Total
37	1522 Sept. 5	Copernic us / Fruembu rg	12 36	12 44 0	Total
38	1560	Cornel.	16 33	17 0 20	3 circ.

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bononia (H / I / II)	Quantita s (Digi ti)
	March 1	Gemma [Corneliu s Gemma] / Lovan [Louvain]			(about 3)
40	1573 Decemb. 8	Tycho / Hrambur g [Uranibo rg/Hven]	8 0	7 57 24	Total
41	1576 Octobr. 7 (or at ex)	Tycho, Longomo ntanus / Uranibor g	11 32 / 11 25	11 26 24 / 11 26 24	Total
42	1577 Aprilis 2	Tycho / Uranibor g	8 50	8 44 24	Total
43	1577 Septeb. 26	Tycho / Uranibor g	13 0	12 57 24	Total
44	1578 Sept. 15	Tycho, Longomo nt. / Uranibor g	13 17 / 13 24 0	13 11 24	2 30
44	1580 Januar. 31	Tycho / Uranibor g	10 0	10 3 24	Total
46	1581	Tycho,	9 58 / 10	9 53 24	Total

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bononia (H / I / II)	Quantita s (Digiti)
	Januar. 19	Longom. / Uranibor g	0		
47	1581 July 5	Tycho, Longom. / Uranibor g	16 57 / 17 0	16 51 24	Total
48	1584 Noueb. 7 [7/8?]	Tycho / Uranibor g	13 8	13 2 24	Total
49	1587 Sept. 5/16 (or at ex)	Tycho, Longomo nt. / Uranibor g	9 16 / 9 30	9 10 24 / 9 24 24	9 45
50	1588 March 2	Tycho Fran. vel idem [Tycho of France, or the same] / Uranibor g	15 2	14 56 24	Total
53	1590 Dec. 30	Tycho / Uranibor g	—	—	—
—	1591 Jan. 9 (styl. Greg. at)	Longomo nt. / Uranibur	6 55 / 7 0 0	6 49 24 / 6 54 24	—

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bononia (H / I / II)	Quantita s (Digiti)
54	1592 Deceb. 7 [$\frac{7}{8}$?]	g Tycho / Uranibor g, Lansberg ius, Goesa	7 41 / 6 50 0	7 35 24 / 7 21 0	0 / 5 0
55	1594 Octobr. 9 [$\frac{3}{4}$?] (or at ex)	Tycho / Uranibur g, Longomo nt., Lansb. Goesa	19 26 / 19 10 / 18 48	19 20 24 / 19 10 24 / 19 19 0	9.30 B.
56	1595 Aprilis 3 [$\frac{3}{4}$?]	Tycho / Uranibur g, ex Longom., Lansb. Goesa, Vuendeli nus / Herca [Herck]	16 36 / 16 30 / 15 30 / 16 48	16 30 24 / 16 24 24 / 16 1 0 / 16 13 0	Total / Total / Total / Total

Parsing notes: Several order-numbers are skipped in this column too (25, 28, 30, 31, 34, 39, 45, 51, 52 absent), consistent with the pre-Christian pattern — a source feature, not a transcription gap. The duplicate "44" (years 1578 and 1580) is printed as such in the source and flagged below. Place-name "Hramburg" for Tycho is the source's rendering (Tycho's observatory was at Uraniborg on Hven); transcribed verbatim. The small superscript fractions on several dates (" $\frac{7}{8}$ ", " $\frac{3}{4}$ ", " $\frac{2}{3}$ ") are printed as fractions of the day and read as best as the scan allows. Multi-observer rows stack several time-values in one cell, separated here by "/".

Caput III summary table — Part 3 (folio 106, left column: AD 1596–1612, Ordo 57–75)

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonon. (H / I / II)	Quantita s (Digiti)
57	1596 Aprilis 3 [¾?]	Vuendeli n. / Tornaca [Tournai] ; Tycho / Hrambur g; Longomo nt. (ex)	8 10 0 / 9 29 0	9 23 24	—
58	1598 Febr. 2 [½?]	Tychonic i / Uranib. vel Keplerus / Gratij [Graz]; Lansb. Goesa; Io. Rotarius / Aquisgra ni [Aachen]	18 7 0 / 18 5 5 / 18 20 40 / 17 23 0 / 17 31 0	18 1 24 / 17 59 24 / 18 0 0 / 17 54 0 / 17 51 0	11 30'
59	1598 Augusti 2 [⅙?]	Tychonic i / Uranib. vel Keplerus	17 17 0 / 17 25 36	7 20 24	—
60	1599 Januar. 30 (st. n. Febr. 9)	Longomo nt. / Hafnia [Copenha	17 56 0 / 17 59	17 51 0 / 17 45 36	Total

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonon. (H / I / II)	Quantita s (Digiti)
		gen]; Tychon.			
63	1601 Noueb. 29 (st. n. Dec. 9)	Lansberg ius / Goesa; Keplerus / Praga [Prague]; Dinia multi [many at Digne]; PP. Cliniac. [Cluny Fathers]; Valentio la [Valentin ?]	6 12 0 / 6 54 0 / 6 11 0 / 6 22 0	6 43 0 / 6 42 30 / 6 33 0 / 6 41 0	10 36'
66	1603 May 3 [2/3?]	Lansberg ius / Goesa; Kepl. Praga; Vuendeli nus / Valenziol a	11 56 0 / 12 32 0 / 11 38 0	11 27 0 / 11 20 30 / 12 7 0	7 30' / 8 0
67	1603 Noueb. 8 [7/8?]	Lansberg ius / Goesa; Kepl.	6 30 0 / 7 19 0 / 6 47 0	7 1 0 / 7 7 30 / 7 9 0	3 / vix 3 1/2 / 3

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonon. (H / I / II)	Quantita s (Digiti)
		Praga; Vuendeli nus / Dinia [Digne]			
68	1605 Mart. 24 (st. n. April. 3)	Lansberg . / Goesa; Vuendeli nus / Forcalcar ij [Forcalq uier]	8 35 0 / 8 12 0	9 6 0 / 8 37 0	11 30 / 11 40
69	1605 Septeb. 2 [$\frac{2}{3}$?]	Lansberg . / Goesa; Vuendeli nus / Forcalcar ij	16 30 0 / 16 11 0	17 1 0 / 16 36 0	8 30 / 8 plus
70	1627 Aug. 15 / Septemb. 5	Scip. Arnaud. [Scipione Arnaud] / Valentiae Gall. [Valence in France]	14 48 0	15 14 0	0
71	1609 Januar. 9 [$\frac{7}{8}$?]	Lansberg ius / Goesa; Adri. Metius	14 41 0 / 14 42 0 / 14 43 0	15 11 0 / 15 5 0 / 15 8 0	9 30

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonon. (H / I / II)	Quantita s (Digiti)
		[Adriaan Metius] / Franeche ra [Franeke r]; Vuendeli nus / Forcalcar ij			
72	1609 Iulij 1 [¼?]	Longomo nt. / Hafnia	12 10 0	12 4 24	Total
74	1612 Deceb. 2 [½?]	Vuendeli nus / Forcalcar ij	15 45 0	16 10 0	—
75	1612 Maij 3 [¼?]	Vuendeli nus / Leodij [Liège]; Scheiner S.I. / Monachij [Munich]	9 56 0 / 10 38 ½	10 22 0 / 10 28 0	6 30'

Caput III summary table — Part 4 (folio 106, right column: AD 1612–1630, Ordo 76–93)

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonom. (H / I / II)	Quantita s (Digiti)
76	1612 Noueb. 8	P. Iulius Alenius Soc. I. [Giulio Aleni] / Macas [Macao]	10 7 ½	3 22 30	—
77	1613 Octob. 3 [½?]	Longomo nt. / Hafnia	3 57	3 51 24	Totalis
80	1616 Augusti 1 [⅔?]	P. Griemberg. [Christop h Grienber ger] S.I. & alij / Roma; Kepl. Lincij vel Vuendeli nus / Leodij; Mestlinu s [Michael Mästlin] / Tubinga [Tübinge n]	15 20 0 / 15 30 / 15 24 / 14 57 ½ / 15 8 0	15 12 45 / 15 17 0 / 15 11 0 / 15 20 30 / 15 18 30	Total / vix Total / — / —
81	1617	Keplerus	8 10 0	7 57 0	Total

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonom. (H / I / II)	Quantita s (Digiti)
	Augusti 1 [¼?]	/ Lincij			
82	1619 Iunij 1 [⅔?]	Vuendeli nus / Herca	12 1 0	12 26 0	1 vix
83	1619 Deceb. 2 [½?]	Vuendeli nus / Mechlini a [Mechele n]	14 57 ½	15 25 30	11 ferè
84	1620 Iunij 1 [⅔?] vicumq.	Gassend us / Aquis Sextijs [Aix]; Vuendeli nus	13 11 0	13 37 0	Total
85	1620 Noueb. 29 (st. n. Dec. 9)	Herca; Vuendeli nus / Bethasijs [Béthisy?]	13 7 0 / 5 40 0	13 32 0 / 6 5 0	Total
86	1621 Noueb. 2 [¼?]	Gassend us / Aquis Sextijs; Kepl. Lincij; Vuendeli nus / Bethasijs	14 53 0 / 15 33 ½ / 15 0 0	15 19 0 / 15 20 30 / 15 25 0	4 30 / 4 / 3 plus

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonom. (H / I / II)	Quantita s (Digiti)
87	1623 Aprilis 1 [¾?]	Keplerus / Lincij; Gassend us / Dinia	16 55 0 / 16 42 0	—	11 30
88	1624 Septeb. 2 [¾?]	Kepl. Lincij; Vuendeli nus / Bethasijs; Mich. Floret. Langren; Bruxellis	8 55 0 / 8 15 / 8 10 0	8 42 0 / 8 40 0 / 8 35 0	Total
89	1625 Mart. 1 [¾?]	Gassend us / Parisijs; Vuendeli nus / Bethasijs	13 15 0 / 13 32 0	13 55 30 / 13 57 0	1 plus / 2
92	1628 Ianuar. 2 [¾?]	Gassend us / Aquis Sextijs; Baindbri gius [John Bainbrid ge] / Oxonij [Oxford]; Vuendeli nus / Bethasijs;	9 36 ½ / 9 11 0 / 9 30 0 / 10 9 0	10 2 30 / 10 4 0 / 9 55 0 / 9 57 30	Total

Ordo Ecli.	Anni Christi & Mens. dies labentes	Observat ores & loca	Tempus app. p.m. loco obs. (H / I / II)	Tempus app. p.m. in Bonom. (H / I / II)	Quantita s (Digi)
		Kepl. Praga			
93	1630 Noueb. 7 [¼?]	P. Arzet S.I. [Arzet] / Ingolstad . [Ingolsta dt]; Langreni us / Bruxell.; Martin. Hortensi us [Maarten Hortensi us] / Leyda [Leiden]	11 24 0 / 10 57 0 / 10 52 0	11 24 30 / 11 22 0 / 11 11 0	9 27 / 9 30

Parsing notes (Parts 3–4): Skipped order-numbers persist (61, 62, 64, 65, 73, 78, 79, 90, 91 absent) — source feature. Multi-observer rows again stack several values per cell, transcribed "/"-separated in source row order. Several "Quantitas" entries combine a digit-figure with a fractional-minute residue (e.g. "10 36", "9·30 B.") as printed; these read as "digits + arc-minutes of additional obscuration" or scribal shorthand and are transcribed verbatim. The "B." after some digit-values likely abbreviates "Borealis" (northern). Day-fractions are printed as small superscript fractions and read as best the scan allows; flagged where ambiguous.

Liber II — De Luna (continued)

Caput III (continued) — Epitome of lunar-eclipse observations reduced to the Bologna meridian

The epitome table continues. Columns: **Ordo Eclis.** (running index of the eclipse) | **Anni Christi, & Mens. diesq; labentes** (year of Christ, with the running month and day, the day-fraction printed as a superscript) | **Observatores, & loca** (observers and places) | **Tempus apparens p. m. in loco observ.** (apparent time, afternoon, at the place of observation) — sub-columns H. (hours) / I (minutes) / II (seconds) | **Bononiæ** (the same reduced to Bologna) — sub-columns H. / I / II | **Quantitas** (magnitude, in **Digiti**, digits).

The table is laid out in two side-by-side panels on this folio (left panel and right panel). I transcribe each as printed; within a multi-observer cell the rows stack against the same Ordo/date.

Left panel (folio 107)

Ordo	Year, month, day	Observer & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
95	1631 (st. n. [new style]) Nov. 8	Hortensi us — Leiden [Leyda]	11 / 26 / $\frac{1}{2}$	11 / 54 / 30	Total.
		Gassendi — Paris [Parisiis]	11 / 14 / $\frac{1}{2}$	11 / 54 / 30	
		Wendele n [Vuendel in.] — Béthisy [Bethisy]	11 / 31 / 0	11 / 56 / 0	
		Wilhelm us Schickar	11 / 43 / 0	11 / 53 / 30	

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		d [Vilhelm us Schikard.] — Tübingen [Tubinga]			
96	1632 Oct. 27	P. Arzet S.I. [Father Arzet, S.J.] — Salzburg [Aenipon te] (?)	11 / 48 / 0	11 / 48 / 5	5 / 22
		Hortensi us — Leiden [Leyda]	11 / 22 / 0	11 / 50 / 0	4 / 40
		Otgerus — Liège [Leodii]	11 / 30 / 0	11 / 53 / 0	
97	1634 March 4·4/24	Peiresc [Peiresk.] — Aix [Aquis Sextiis]	9 / 11 / 0	9 / 37 / 0	
		Gassendi — Digne [Diniæ]	9 / 21 / 0	9 / 43 / 0	10 / 0
		van Langren	9 / 27(?) / 0	9 / 47 / 0	10 / 15

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		[Langren .] — Madrid [Madriti]	8·8/24 / 42 / 0		
98	1635 Feb. 21 (st. n. March 3)	Gassendi — Aix [Aquis Sextiis] van Langren [Langren .] — Paris [Parisiis] Wendele n [Vuendel in.] — Herck [Hercæ] Hortensi us — Leiden [Leyda]	8 / 43 / ½ 8 / 29 / ½ 8 / 49 / 0 8 / 38 / ½	9 / 30 / 0 9 / 9 / 15 9 / 14 / 0 9 / 6 / 20	Totalis.
99	1635 Aug. 27	Peiresc [Peiresk.] — Aix [Aquis Sextiis] Wendele n [Vuendel inus] —	15 / 11 / 0 15 / 15 / 0	15 / 37 / 0 15 / 40 / 0	Total.

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		Herck [Hercæ]			
		Boulliau [Bulliald us] — Paris [Parisiis]	14 / 53 / 0	15 / 33 / 0	
100	1636 Feb. 10	Gassendi — Digne [Diniæ]	10 / 40 / 0	11 / 2 / 0	3
		Albert. Linn. [Albertus Linnema nn?] Regiomo nt. [Königsb erg, Regiomo ntium]	11 / 45 / 0	11 / 7 / 0	3 fere [about 3]
101	1638 Dec. 10	Gassendi — Digne [Diniæ]	14 / 26 / 0	14 / 45 / 0	Total.
		Boulliau [Bulliald us] — Paris [Parisiis]	14 / 10 / $\frac{1}{2}$	14 / 50 / 30	
		van Langren [Langren .] —	14 / 16 / $\frac{1}{2}$	14 / 41 / 31	

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		Brussels [Bruxell.]			
		Golius — Leiden [Golius Leyda]	14 / 18 / 0	14 / 46 / 0	
		Wendele n [Vuendel in.] — Herck [Hercæ]	14 / 21 / 0	14 / 46 / 0	
		Io. Phocylid. [Johanne s Phocylid es Holward a] — Franeker [Frenequ era]	14 / 23 / ½	14 / 47 / 30	
103	1641 Oct. 8·8/24	Wendele n [Vuendel in.] — Herck [Hercæ]	7 / 29 / 0	7 / 54 / 0	6 / 45
		Puteanus [Erycius Puteanus]	7 / 23 / ½	7 / 53 / 0	

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		] — Louvain [Lovanii]			
		van Langren [Langten.]	7 / 24 / 0	7 / 49 / 0	6 / 47
		] — Brussels [Bruxell.]			
		Hevelius [Heuelli s] — Danzig [Dantisci]	8 / 26 / ½	7 / 54 / 15	
104	1642 April 1·4/24	We, together with Father Grimaldi [Nos cum P. Grimald.] — Bologna [Bononia] Wendele n [Vuendel in.] — Herck [Hercæ]	14 / 44 / ½	14 / 44 / 12	Totalis.

Right panel (folio 107)

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
104 (continue d)	1642 April 1·4/24	Eichstätt [Eycstadi us] — Stettin [Stettini] P. Iacobus Vivanus [Father Jacobus Vivanus] Soc. I. [S.J.] — Ingolstad t [Ingolsta d.] PP. Curtius & Arzet S.I. [Fathers Curtius & Arzet, S.J.] — Eichstätt [Eicstadii] Gassend. [Gassend i], Bulliald. [Boulliau],	14 / 48 / ½ 14 / 39 / 0	14 / 34 / 0 14 / 39 / 30 14 / 42 / 0	

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		Furnier. [Fournier] — Paris [Parisiis]			
		P. Vinc. Maria Grimaldi [Father Vincenzo Maria Grimaldi] — Mantua [Mantua]	14 / 44 / 0	14 / 47 / 0	
		Io. Hevelius [Heuelius] — Danzig [Dantisci]	15 / 6 / 0	14 / 34 / 0	
		PP. Soc. Iesu Collegii [Fathers of the College of the Society of Jesus] — Paderbor n [Paderbo na]	14 / 31 / 0	14 / 40 / 0	
		P.	14 / 38 / 0	14 / 45 / 0	

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		Marcellu s Soc. Iesu [Father Marcellu s, S.J.] — Würzbur g [Herbipol i]			
		PP. Soc. Iesu Collegii [Fathers of the College of the Society of Jesus] — Prague [Praga]	14 / 59 / 0	14 / 47 / 30	
105	1642 Sept. 27 (st. nuovo [new style] Oct. 7)	Vincenzo Mut [Vinc. Mutus] — Majorca [Maiorica]	16 / 13 / $\frac{1}{2}$	16 / 50 / 20	Total.
		Gattatus [Gattatus] — Lérida [Ilerda]	16 / 0 / $\frac{1}{2}$	16 / 46 / 30	

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		We, together with Father Grimaldi [Nos cum P. Grimaldo] — Bologna [Bononia]	16 / 49 / 36	16 / 49 / 36	
106	1643 Sept. 27	Wendele n [Vuendel in.] — Antwerp [Antuerp.]	6 / 52 / 0	7 / 16 / 40	
		We, together with Father Grimaldi [Nos cum P. Grimaldo] — Bologna [Bononia]	7 / 30 / 52	7 / 30 / 52	6
107	1645 Feb. 10	Gassendi, Boulliau [Gassend.	7 / 6 / ½	7 / 46 / 15	

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		Bulliald.] — Paris [Parisiis]			
108	1646 Jan. 30	Gassendi [Gassend us] — Paris [Parisiis]	18 / 1 / 0	18 / 41 / 0	
110	1647 Jan. 1·2/24	Gassendi [Gassend us] — Paris [Parisiis]	9 / 12 / 0	9 / 52 / 0	
		Hevelius [Heuelli us] — Danzig [Dantisci]	10 / 29 / 0	9 / 57 / 0	5 / 0
		Vincenzo Mut [Vinc. Mutus] — Majorca [Maiorica]	9 / 23 / 0	10 / 0 / 0	
117	1654 Aug. 17·12/24	Gassendi [Gassend us] — Paris [Parisiis]	10 / 50 / 0	11 / 30 / 0	2 / 30
		Hevelius [Heuelli us]	11 / 58 / ½	11 / 26 / 30	2 / 30

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		s] — Danzig [Dantisci]			
		Anton. Francisc. Payen [Antoine- François Payen] — Avignon [Auenion e]	11 / 5 / ½	11 / 35 / 10	2 / 30
118	1657 June 5·1/24	P. Caeza S.I. [Father Caeza, S.J.] — Lyon [Lugduni] We, together with Father Grimaldi [Nos cum P. Grimaldo] — Bologna [Bononia]	8 / 54 / 0	9 / 22 / 0	Totalis.
			9 / 16 / 0	9 / 16 / 0	
119	1657 Dec. 18·22/24	We, together	7 / 44 / 0	7 / 44 / 0	3 / 30

Ordo	Year, month, day	Observer s & place	Apparent time (place) H / I / II	Reduced to Bologna H / I / II	Magnitu de (digits)
		with Father Grimaldi [Nos cum P. Grimaldo]— Bologna [Bononia]			

Parsing notes: Magnitudes in the "Digiti" column are printed as digits and (where present) minutes of a digit, separated here by "/"; e.g. "5 / 22" = 5 digits 22 minutes. Day-fractions in the date column are printed as superscript fractions (e.g. 4/24, 4), here rendered ·n/24. The Ordo numbers skip (no 102, 109, 111–116) as a source feature of the epitome (only eclipses carried over from the catalogue with a reduced Bologna midpoint appear). The place "Aeniponte" usually = Innsbruck, but Arzet observed at Salzburg; printed form retained. van Langren's name is printed "Langren." at Ordo 97/98/101 but "Langten." at Ordo 103 — compositor variant, transcribed as printed and marked. At Ordo 97 the apparent-minute "27(?)" for van Langren is faint. At Ordo 100 the magnitudes "3" and "3 fere" and the place "Regiomont." (Königsberg) belong to Linnemann/Regiomontanus rows.

Caput IV

CAPVT IV.

On the uncertainty of ancient observations — and of certain recent ones; on the disagreement of observers regarding the same eclipse, and its causes. Nineteen disagreements [Dissidia 19].

[Margin: De Observationibus Priscorum — On the observations of the ancients.]

First, from what has been said about Eclipses 40 through 119, and from the disagreement among the more recent observations, one may sufficiently judge — notwithstanding how far astronomy has advanced — how great the discrepancy must once have been among the ancient observers of eclipses, especially when

they were destitute of the telescope and of the other instruments and refinements with which this art is now equipped. One must note, moreover, that Ptolemy, in the very rudiments of eclipse-reckoning that he handed down, determined the midpoint of those ancient eclipses by assuming the total eclipses to last very nearly four hours, and so fixed the moments of the plenilunium [full moon] on the ecliptic by adding two hours to the beginning — as he did in our Eclipses 1 and 10, in chapter 2. But when the eclipse was of six digits, he reckoned it to last three hours, and so at the start added an hour and a half, doing this according to the order of the same chapter 2 in Eclipses 3 and 7. Yet it is established that in this matter one may, owing to the differing anomalies of the luminaries, incur an error of as much as a quarter of an hour. Nothing further did the ancients of old suspect concerning refractions, nor did they distinguish the [penumbra] of the shadow as something spurious. Eclipses spurious in their first appearance they sometimes noted — yet here too an error of 10 minutes, and occasionally more, may lie hidden. Hence, excepting Eclipse 8, which on account of its brevity could be noted with some certainty, even Eclipses 9, 11, 13, and 14 — which we have on the observations of the ancients themselves — manifestly are not free of an error of 20 minutes, not to say 30. Even before Ptolemy I should grant the same of Ptolemy himself, since it is agreed that in this matter some eclipses were most accurately observed; we are nevertheless compelled to use those ancient observations, since perhaps, over the very longest interval of time, a compensation is made for the errors that they incur.

[Margin: 2 (?) — keyed to the next paragraph.]

As for the **disagreement [Dissidium]**, and thus the uncertainty, of many recent observations: we recall it to those very chapters. The **first head** is that of the differing moments of the full moon on the ecliptic, even with respect to the same meridian. That this may appear the more clearly, I have prefixed the foregoing Chapter III, in which we reduced all the moments to the meridian of our own Bologna. Run through, therefore, those Eclipses, beginning at 49, and you will recognize enormous discrepancies in some of them. For Eclipse 49 is reported by Longomontanus 14 minutes later than by Tycho [Brahe]; and 50 just as many minutes is at variance with Tycho himself, as with Wendelen in chapter 2 — noted, indeed, but foulest of all are those at Lansberg [the observations made at Lansberg, Lansbergius] compared with one another, which when collated with Tycho's, or with Wendelen's, appear as follows:

In Eclipsibus [In Eclipses]	Minutorum dissidium [Disagreement, in minutes]
54	15
66	20
68	29
69	25

Whether Lansberg was deceived by the [penumbra] — as I suspect of Wendelen, as I said, in chapter 2 — or whether the observations were dragged to fit his own Tables, and on that account are fallacious in these cases: for this whole matter cannot arise from the meridian-distance assumed by us; otherwise in the other Eclipses, say 58 and 63, Lansberg would not so nearly agree with the others. Notable too is that disagreement which, in Eclipses 104 through 22 [i.e. 122], runs up to 22 minutes, because indeed it had very many observers in different horizons.

spectators, and in the differing temper of the terrestrial vapors, whence is confirmed what I said under the first number, namely how great a discrepancy among the ancient eclipses there must have been if very many of those same eclipses had been observed by ancient observers, especially in regions far and wide apart, and in the diverse constitutions of the air. As for Eclipse 106 — the discrepancy between Us and Wendelen, in that Wendelen makes it reach as far as 14 minutes (if I consider its end on November 2 [recte: the relevant date], and that observed at Paris, and observed by others) — this discrepancy I can refer to nothing but a large part of the observation of Wendelen. But truly, that the matters which pertain to this first head may be inspected at a single view, and that the eclipses observed with less disagreement, and the more eligible ones, may be discerned before all: behold for you, drawn from Chapter 3, the sum of the minutes by which the observers of each chiefly disagree.

Minuta dissidii [Minutes of disagreement]	Ordo Eclipsium ex cap. 3. [Index numbers of the eclipses, from chapter 3]
1 / ½	88
2	63
2 / ¾	55
4	57 / 103 / 105
5	53 / 84 / 96 / 100

Minuta dissidii [Minutes of disagreement]	Ordo Eclipsium ex cap. 3. [Index numbers of the eclipses, from chapter 3]
6	86
7	88 / 90
8	67 / 98 / 110
8 / ½	117
9	75 / 80 / 92 / 102
10	58 / 71 / 97
14	101
15	54
20	60
22	114
25	65
29	56 / 68

[Margin: 3 — keyed to the next paragraph (second head).]

The **second head of the Disagreements**, which can least be ascribed to false distances of meridians, concerns the **duration [Duratio]** of one and the same eclipse, or the **stay [Mora]** in the total shadow. This same point will appear in the following Table, in which the letter **D** indicates the duration of the eclipse, and **M** the stay in the darkness.

Ordo Eclipsis. [Eclipse index]	Observator es. [Observers]	S. [D or M]	H. [hours]	M. [minutes]
56	Lansberg [Lansbergius]	M	1	40
	Wendelen [Vuendelinus]	M	1	30
67	Kepler [Keplerus]	D	1	56

Ordo Eclipsis. [Eclipse index]	Observator es. [Observers]	S. [D or M]	H. [hours]	M. [minutes]
	Wendelen [Vuendelin us]	D	1	52
75	Wendelen [Vuendelin us]	D	2	38
	Scheiner [Scheinerus]	D	3	7
80	Kepler [Keplerus]	D	3	28
	Grienberge r [Griemberg erus]	D	3	13
	Wendelen [Vuendelin us]	D	3	8
	Maestlin [Mæstlinus]	D	3	10
	Ours, at Rome [Nostr Romæ]	M	27	30
	Wendelen [Vuendelin us]	M	31	0
86	Kepler [Keplerus]	D	2	1
	Wendelen [Vuendelin us]	D	1	55

Ordo Eclipsis. [Eclipse index]	Observator es. [Observers]	S. [D or M]	H. [hours]	M. [minutes]
	Gassendi [Gassendus]	D	1	54
88	Kepler [Keplerus]	M	2	44
	Wendelen [Vuendelin us]	M	2	44
	van Langren [Langrenus]	M	2	3
89	Wendelen [Vuendelin us]	D	0	57
	Gassendi [Gassendus]	D	0	43
93	P. Arzet [Father Arzet]	D	3	6
	Hortensius	D	3	1

Parsing notes: At Ordo 80 the rows marked "M" give a stay-in-darkness reckoned in minutes (27'30, 31'0) rather than hours+minutes; the "H." figure 27/31 is to be read as minutes (the column is shared). The "S." column header abbreviates the species (D = Duratio, M = Mora) per the text.

Ordo Eclipsis.	Observator es.	S.	H.	M.
95	Gassendi [Gassendus]	M	1	41

Ordo Eclipsis.	Observator es.	S.	H.	M.
	Hortensius	M	1	41
	van Langren [Langrenus]	M	1	45
	Schickard [Schikardus]	M	1	43
96	P. Arzet [Father Arzet]	D	2	22
	Hortensius	D	2	24
	Otgerus	D	2	24
	Gassendi [Gassendus , but from a false altitude of the pole [sed ex falsa altit. Poli]	D	2	27
97	Peiresc [Peireskius]	D	3	16
	Gassendi [Gassendus]	D	3	21
98	Gassendi [Gassendus]	M	1	37
	Wendelen [Vuendelin us]	M	1	41
99	Wendelen	M	1	33

Ordo Eclipsis.	Observator es.	S.	H.	M.
	[Vuendelin us]			
	Boulliau	M	1	35
	[Bullialdus]			
100	Gassendi	D	1	50
	[Gassendus]			
	D. Petit	D	1	46
	[Pierre Petit]			
101	Gollius	M	1	34
	[Golius]			
	Boulliau	M	1	35
	[Bullialdus]			
	Phocylides	M	1	35
	[Phocylides Holwarda]			
	Gassendi	M	1	36
	[Gassendus]			
	Wendelen	M	1	38
	[Vuendelin us]			
	van	M	1	38
	Langren			
	[Langrenus]			
103	Wendelen	D	2	42
	[Vuendelin us]			
	Puteanus	D	2	54
104	PP. Arzet, & Curt.	M	1	31
	[Fathers]			

Ordo Eclipsis.	Observator es.	S.	H.	M.
	Arzet & Curtius]			
	Hevelius [Heuelius]	M	1	31 / ½
	P. Furnerius [Father Fournier]	M	1	36
	Gassendi & Boulliau [Gassend. & Bull.]	M	1	36
	P. Iacob. Viua [Father Jacobus Vivanus]	M	1	38
	P. Paderborna [the Father at Paderborn]	M	1	40
	Eichstätt [Eychstadiu s]	M	1	44
	Ours [Nos]	M	1	44 / ½
105	Vincenzo Mut [Vincentius Mutus]	M	1	38
	Gattatus [Garatus]	M	1	39
	Ours [Nos]	M	1	39 / ½
107	Gassendi	D	3	8

Ordo Eclipsis.	Observator es.	S.	H.	M.
	[Gassendus]			
	Boulliau [Bullialdus]	D	3	7
	Frankfurt [Francofurt ens.]	D	3	3
110	Hevelius [Heuelius]	D	2	8 / ¹ / ₂
	Vincenzo Mut [Vincentius Mutus]	D	2	15
117	Gassendi [Gassendus]	D	1	30
	Hevelius [Heuelius]	D	1	24
	D. Payen [Payen]	D	1	30
118	P. Caeza [Father Caeza]	M	0	14
	Ours [Nos]	M	0	28

Parsing notes: "S." again = species (D = Duratio, M = Mora). Half-minute values (e.g. 31 / ¹/₂, 44 / ¹/₂, 8 / ¹/₂) printed as superscript ¹/₂.

[Margin: 4 — keyed to the foot-of-column paragraph.]

[Foot of left column, folio 109:] The causes, moreover, of the foregoing Disagreements in stay, and in magnitude, and the conditions to be observed in observing, are set out by Us in *Almagestum Novum*, Book 5; the scholia of the same; and are now to be briefly indicated.

[Margin: 1. Causa — First cause.]

The **first** is the [penumbra] of the Moon entering the shadow of the Earth, and thence emerging. For the eastern part of the limb, which first enters the shadow, is often more obscure than that western part of the limb which last emerges from the shadow. The greater part, indeed, of the eastern limb, hollowed out inward, exhibits that great spot toward the north [Boreas], or toward the Arctic [pole], which in *Almagestum Novum*, Book 4, we named the *Mare Philippicum*. When, therefore, this part is to enter the shadow, if upon its approach to the shadow it is still illuminated by some rays of the Sun — even though it be still somewhat lit by some [rays] — it can already...

appear to someone to have entered the shadow, when in truth it is still a little distance from it. And for the same cause, in the egress from the shadow, the Moon will appear not yet to have emerged when in fact it really has emerged. Hence in either case the duration of the eclipse will appear longer than the true one. Yet sometimes one may sin in the estimation of the end, when that part is to be illuminated by all the rays of the Sun. Aliquando tamen [sometimes, however] one sins in the eclipse, in the part brighter toward the [Notapelion?] — about the [southern?] Earth [Terram Sterilitatem(?)]; and on the contrary it ends in that western part of the limb which is obscured near the *Mare Langrenum*. And then, if there be no sin at the start, there can still be a sin in the estimation of the end, in expecting it until that part be illuminated by all the rays of the Sun. This first cause, indeed, the libration [libratio] itself of the lunar body magnifies, exhibiting to us now some, now other margins.

[Margin: 2. Causa — Second cause.]

The **second cause** is the privation of some of the Sun's rays, which the Moon suffers on both sides — whether the shadow be near, even before it has entered the shadow, or be near after it has emerged. For when compared to the other parts which are illuminated by all the rays of the Sun, those which are deprived of many rays appear more obscure; whence arises a certain smoke and shadowy image, which we call the *Umbrago* [penumbral shading]. Straightway a great image of the disc of the shadow infuscates [darkens] a part before the legitimate eclipse by about one quarter of an hour, more or less; and likewise, after the egress from the shadow, the Moon for a little while remains darkened. This discrepancy did not come into Tycho's mind, but it was afterwards noted by others; hence in the more recent observations it is often remarked, [as] the time of the spurious eclipse, distinct from the legitimate eclipse.

[Margin: Legitima Eclipsis quæ — What the legitimate eclipse is.]

I call the **legitimate eclipse** that one when the Moon enters the true shadow [conum Umbrosum, the shadow-cone], which is comprehended by the rays of the Sun touching the globe of the Earth, the remaining [rays] being impeded lest they penetrate directly, but some being refracted only. And the legitimate eclipse is to be awaited when the Moon is illuminated by no refracted rays whatever; otherwise many eclipses would even be total, which are none, and as we shall soon say while we treat of the [penumbra] meanwhile for this second cause — see the diagram, Book 5, chapter 5 [vide Typum lib. 5. cap. 5. expositum].

[Margin: 3. Causa — Third cause.]

The **third cause**, for which even the keenest-sighted spectators — whether with the naked eye or instructed by the telescope — are wont to err around the very limits of the eclipse, is the immersion and emersion of the [penumbra] from the shadow, so called because it is not simply a privation of rays of any kind whatever of the Sun, but a *penumbra*, that is, a privation indeed of all the direct rays of the Sun, but with a participation of the Refracted Rays — which, illuminating the Moon with a weak and malign light, instead of blackness exhibit to us other and various colors on the disc of the Moon, such as those said before at the entrance into the shadow: bluish, ferruginous [rust-red], honey-colored, cinder-colored, ruddy, sallow, and so forth — these from the diverse density and opacity of the watery vapors, which gird the terrestrial globe round about, and in which the refraction of the Sun's rays is twofold, one at ingress, the other at egress. As to the figure to be consulted, see the figure of *Almagestum Novum*, Book 5, chapter 5, set forth in the problem — to the end where you will see many admirable things about the variety of phases that arise hence, and why sometimes in the very midst of a total eclipse the Moon, passing through the axis of the predicted Cone, still appears somewhat illumined; and as Pliny says (Book 2, chapter 9), it is in deficiency, and yet conspicuous in its defect. Indeed, in the same eclipse some are total, and others, [though] not affected even by refracted rays, [show] the very darkness of the shadow set against the eyes; others, by reason of vapors of diverse density spread over the horizons, appear sub-lucent and shot through with refracted rays — as it happened in Eclipse 104, in the year 1642, and elsewhere, as we narrated in the same book, chapter 5, number 14. So that meanwhile we may say nothing of Mars and Jupiter, which sometimes when opposed to the eclipsed Moon are able to communicate some little light to it, even though it be steeped in the shadow. From this cause it comes about that the [penumbra] is mingled with the eclipse, so that the eclipses which are really total scarcely appear total, when too scanty a stay [in the shadow] has been made — as in Eclipses 23, 68, 80, 83, and 87 — of which, indeed, we put together the history

in many places of this chapter, when the observations were made by various men with differing estimations; in part also because many sat near the Horizon, and either it was serene, or elsewhere vaporous, or elsewhere a humid and airy tempest [prevailed]; but now we touch upon the fourth cause.

[Margin: 4. Causa — Fourth cause.]

The **fourth cause** is that already indicated on occasion of the third, namely...

[Caput IV, continued — the causes of observers' disagreement]

The fourth cause is the manifold variety of the horizontal vapors and of the refractions they produce. According to the differing density of these vapors, the rays passing through them suffer a greater or lesser refraction, and a greater or lesser coloration. From this arise differences of color, of quantity, and of quality. These vapors produce the penumbra, and besides this they affect the vision of the Moon by the rays carried to our eyes from the Moon by reflection, and again refracted at their entry into the terrestrial atmosphere before they reach our eyes. For that reason the extreme moments of the eclipse are estimated only with difficulty: when the Moon is near the horizon, the eclipse seems to begin, and likewise it seems to end. And so this fourth cause overlaps the difference of solar refraction noted above [in the third cause]. Both depend on the nearness of the Moon to the horizon and on the differing density of the vapors. They depend, moreover, on whether the place is at a greater or lesser height above the equator, and whether it lies within the Torrid Zone; for under the equator and within the Torrid Zone the vapors are believed to swell up to a lower and humbler level.

But if these same vapors should arise as a kind of mist or thin cloud at the Moon's margins in our direction, that variety of mist [hovering] at the Moon's limb deceives [the observer], so that what occurs in the eclipse is attributed to the Moon's eclipse, when it does not really happen. Wendelen [Wendelen] attests to this in the preface mentioned above.

[Margin: 5th cause.]

The fifth cause is the variety of the lunar globe's *Umbræ* [shadow-shades], which appear differently on different horizons — as Wendelen too has observed in the same preface. For the Moon, when first touched by the plane cutting the shadow itself, is divided into two hemispheres, even though at the place of the Moon's transit the astronomical tables suppose [the shadow to fall] on a lesser part [of the disk] than the hemisphere. And so the shadow is received over a part smaller than a hemisphere; and yet the shadow, more crowded toward the cone, is more

visible there than at the center of the Moon, where it is divided quadrangularly into semicircles. Hence — to enlarge upon the hypothesis of the tables given above — the conspicuous margins of the Moon are obscured at about the sixth part of a digit. From this it follows that the conspicuous margins of the Moon do not appear the same to all dwellers on Earth: those who have the Moon near their zenith see one set of shadows, and others, who are toward the north or toward the south, see the Moon obliquely. Thus it may happen that to southern observers the same eclipse appears $5\frac{3}{4}$ digits, and to northern observers $6\frac{1}{2}$ digits. Indeed it may even happen, by a kind of paradox, that the same eclipse is total to some, while to others — in other really-total eclipses — it appears as if it were extra-total, so that a tiny angle of contact of the shadow projects only so far over the Moon's body toward one Pole, which is not conspicuous to dwellers toward the other [Pole]. The discrepancy, however, is very small.

[Margin: 6th cause.]

The sixth cause is uncertain, yet to be noted in part: the air around the Moon, of its own that surrounds it, and of a differing quantity — whence the Moon may seem to touch the shadow earlier, or to be touched, than the shadow truly arrives, with [the moment] running ahead or lagging; or again the shadow may have departed [while] the Moon's light is still withdrawn into the darkness, or in the manner the Bolognese stone, which to our eyes when the Sun is transferred from sunlight into darkness is wont to be carried over into the darkness — which Wendelen judges not improbable in the same place.

[Margin: 7th cause, manifold.]

The seventh cause comes from those astronomical elements which combine to determine the moment of the eclipse phases — namely, the Moon's motion and its parallaxes, if the lunar altitude be employed; or the declination, and the right ascension of the fixed star, and the right ascension of the Sun, by which the time ought to be drawn out; the azimuths of the star, and the altitude of the Pole, with the situation of these in the meridian — in all of which, if there lurk any error of falsity, it is necessary that the conclusion of the time engendered from the trigonometric calculation be false. Now before Tycho [Tycho Brahe], inasmuch as men labored under the vice of the fixed stars, the exploration is as false as the correction to be applied is true: by Tycho's own [tables] of the declinations and right ascensions of the fixed stars, the [errors] of the observers will be reckoned, as is to be shown at Chapter 10, from our [tables]. [Margin: *Geographia Reformata*.] How false the altitudes of the Pole are, observed in various places by astronomers, will be apparent from our *Geographia Reformata*. He himself

[Wendelen] observed at Lyon in Gaul this eclipse, in the year 1700. At Lyon the observer reckons that whole eclipse to have begun at hour 10, 3 minutes, and to have ended at hour 12, 30 minutes, with the altitude of the Pole being gr. 45, 36 minutes — which he took from an observation of two of our Society's most outstanding mathematicians, recently sent to me, of gr. 45, 8 minutes [Margin: *the latitude of Lyon*]. And so, while from terrestrial charts the altitudes of places are rather derived from the heavens, great errors are committed in the time of eclipses. But if that moment, which is the very midpoint between the beginning and the end, is the most precise moment of the full moon.

[Margin: 8th cause.]

The eighth cause is the variety of the observers themselves, arising from natural causes; and the use [they make of their eyes]: while some are endowed with sharper sight, with greater attention, and with greater circumspection than others; especially when they have acquired greater experience beforehand in astronomical matters. Because of this, when many sharper-sighted witnesses determine the moment of an eclipse more certainly, while others miss it, and they do not agree among themselves on the same [moment], the one nearer the truth is to be preferred over this [other], the more ambiguous and fallacious to be set aside.

[Margin: 9th cause.]

The ninth cause is likewise the variety of the observers themselves, arising from the imperfections of the instruments with which the eclipse is observed — to wit, the telescopes by which the eclipse is greater [magnified] than with the naked eye, the quadrants, the astronomical rays [radii astronomici, cross-staves], the horologes [clocks], and so forth; or [arising] from their use, or their handling. For it can happen in many [cases] that the error is not lightly to be ascribed to the observers, and the diligent observers of the others' observations are to be derogated, and the better instruments to come [into use]; or because there is no agreement with the rest, as nothing has [been done] by skill of trigonometric calculation, which nevertheless can readily be repeated and corrected.

[Margin: 10th cause.]

The tenth cause is the false difference of longitude, or the distance of meridians assumed, when observations made under different meridians are referred to one [meridian], and it appears whether they agree on the same moment or not, as we did above at Chapter 3. Especially since that difference of longitude is established not from itineraries [land-journey distances] but from the lunar eclipses

themselves. Therefore it is permissible for us to expect a more certain difference of longitude from observations of more numerous [eclipses]; and so we have set the difference of meridians between Bologna and Paris at 40 minutes of time. We confess that this is by no means evident, but the false difference of one or another minute of time engenders a greater or lesser [error]; and so in the rest, the more remote regions, the discrepancy [is greater], for of near [places], or those lying under nearly the same meridian, we have from elsewhere a greater certainty than from eclipses.

CAPVT V.

On the Agreement or Disagreement of the Astronomical Tables with the Observations of the Lunar Eclipses; and first concerning the Ancient Eclipses down to Ptolemy [Ptolemy] inclusive; and concerning the enormous Disagreement, as far as it touches these [eclipses], that appears between the Astronomical Tables and the Chronological [Tables] — but in truth [arising] from Ptolemy's error in the motion of the Sun.

[Margin: 1.]

We know that this comparison [of tables with observations] is something both we ourselves have long desired, and that the more eager students of astronomy expect of us — that it may be settled how far the famous Astronomical Tables, the rest being equal, may yet be excogitated as better. And so, to this end, [as I said] at Chapter 3, I selected those eclipses of which the middle [moment], or some moment of the partial obscuration, or of the extreme phases — whether the partial, or the total — of eclipses handed down to us has been [recorded] by observers: namely, because at the moment of the ecliptic full moon, at the diametrical opposition of the Moon with the Sun, the place of the Moon in the Zodiac is foreknown from the tables computed beforehand, and the place of the Sun [is foreknown] from the moment. Then to that [foreknown] astronomical moment, reduced nevertheless to equal time, we have computed — as [will be shown] below under the naming of the place of the Sun from the tables — and from there we straightway note

— the opposite place of the Moon, [drawn] from the same tables; and indeed at the same moment we have computed the place of the Moon, with the place [of the Sun] adjoined; and the difference of the place computed from the observed [place], or [the difference] of time, [we have noted]. Inasmuch as the Astronomical Tables are for the most part constructed and affixed to a meridian

differing from that under which the observations were made, the difference of the place computed from the observed [place], or the time of the observations, [must be reduced] to the meridian [of computation] according to the distances of meridians, which the tables themselves prescribe in their catalogs of places, or at least are deficient — as is established under our *Geographia Reformata*.

[Margin: 2.]

Because the foresaid eclipses [recorded] before us, by us or by others, are recalled to calculation from their tables, we have made use of their labor; but where they have failed us, we have supplied the supplement from our own [calculation]. Accordingly, from the *Rudolphine* [Tables] we have computed altogether 91 eclipses; from the *Philolaic*, the supplement; that is, from the *Tychonic* [Tables], 24 eclipses; from others' calculation, [the rest]. So indeed we have made use of others' calculation, that — together with the difference of meridians, and from the moment of time handed down from here under the meridian of the observation by the observers — it might be established under the meridian of the tables, [and] how many minutes of an hour the tables represent the eclipse [as earlier], than the earlier observation would require; and thence too the difference in the place in the Zodiac is elicited.

[Margin: 3.]

Furthermore, because many of the foresaid eclipses began at a different moment for different observers, or are assigned a different moment, we choose one [moment], or take it from many observations; and its time, handed down under the meridian of the observation — accordingly, from the very moment, and from the table — will be established, [showing] of which observer we have chosen the observation. For example, in eclipse 110 we assigned the hour 9, 12 minutes; before which, returning to Chapter 3, eclipse 110 is established to have been made at Paris by us, namely at hour 9, 19 minutes after noon — but this admonition [warning] is to be regarded specially [as touching] the eclipses of the following chapter. And here truly this [whole] head [of the matter] looks toward the peculiar mention of the eclipse.

[Margin: 4.]

Although in Chapters 2 and 3 we reckoned the ancient eclipses to the meridional time [post-meridian reckoning] of those very days on which they fell, but [reckoned] from the true computation of our *Reformed Chronology* and the *Chronological Apparatus*, [the time] answers in the form of the Julian Year and the Months of the Egyptian day cited in Ptolemy. In what follows, nevertheless,

we have been compelled to note the day for that one of two [tables for each eclipse]: [namely] one [table] to note where the eclipses came from, [we] ought [to place] at the Ptolemaic place of the Sun — that is, of such-a-kind from the tables, the astronomical [day]; nor [should the table] exhibit the Moon opposed to the Sun, but at gr. 11 or 12 distant from the opposition with the Sun; and yet [it should] exhibit the Moon's place [as] nearer than from Ptolemy at the observed [opposition with the] Sun — the other day, namely the later, we adjoin, by which the Astronomical Tables exhibit the Moon opposed to the Sun. Let it be not the place but the place of the Sun substituted, of which kind at least the Ptolemaic [place] is from his tables handed down, but nearly at the earlier degree. Concerning the disagreement, the difference will be apparent [from what is set out] below, after the following Catalog of Eclipses.

[Margin: 5.]

For although in Chapter 2 and 3 the ancient eclipses, beginning from eclipse 40, are observed by various observers, or assigned at a different moment, [we] configure one [of them]; recurring to Chapter 3, eclipse 110 is established to have been made by us at Paris [Margin: at hour 9, 19 minutes after noon]; the rest as admonished above [touching] the eclipses of the following chapter. To this [head] looks especially the following mention concerning the day of the eclipse.

[Margin: 6.]

Meanwhile [we declare], for our sincerity's sake, [that] those [things] are to be re-examined with faith: the names of those from whose eclipses we have made use, [as set out] according to the order of the monition at Chapters 3 and 4 — they are, moreover, in alphabetical order written below.

Andreas Argolus [Andrea Argoli], who [computed] the eclipses from the *Danish* Tables of Longomontanus [Longomontanus], yet [reduced them] to the meridian of Rome; in his Ephemerides he computed the eclipses from the Year of Christ the Lord 1620 down to 1700.

Claudius Ptolemaeus [Ptolemy], who handed down not only ancient eclipses but also the foresaid [recent ones] down to his own time of observations; and he adjoined [them] to his own tables, or [to those of] Hipparchus, for the place of the Sun and of the Moon.

Christianus Severinus Longomontanus [Longomontanus], who [in] Book 1 of the *Theoricae* of the *Astronomia Danica*, Chapter 2, in the Commentary

de Luna, conferred the place of the Moon computed from his own Tables. *Danica*, with 9 eclipses anciently observed, and with Chapter 13 of Tycho [Tycho Brahe], or so far as he observes, with which observation he adjoins the tempora [moments] from the horary motion of the Moon and from the Sun, [and] responds to the difference of the observed place, computed [...].

David Origanus [David Origanus], who [computed] his [eclipses] in his Ephemerides from the *Prutenic* and the *Tychonic* Tables, but [reduced them] to the meridian of Frankfurt-on-Oder; he reduced [and] supplied [eclipses] from the Year of Christ 1595 down to 1654.

Dionysius Petavius, of the Society of Jesus [Denis Pétau], who in Book 8 of his *Doctrina temporum*, Chapter 13, [computed] all the ancient [eclipses] down to al-Battānī inclusive, and many of the more recent ones down to the Year 1600. He computed the eclipses observed by Christ[’s era] from his *Parisian* Tables — that is, the meridian affixed to Paris, and Lansberg’s [Tables], and the *Prutenic* Hypothesis very nearly; and adjoining [them], he calculated something from the *Alphonsine*, the *Prutenic*, and the *Danish* [Tables]; and besides, he predicted some eclipses of our own century.

Gotefridus Vuendelinus [Govaert Wendelen], who, after the *Tabulae Atlanticae* of the Idea, edited [tables] of many of the more recent ones; he reduced the time of the eclipses from the same tables, and [to] some quantity, from the Year 1573 down to 1643.

Io. Antonius Maginus [Giovanni Antonio Magini], who [computed] his [eclipses] in his Ephemerides from the *Prutenic* Tables, [reduced] to the meridian of Venice; he supplied the eclipses from the Year 1581 down to 1630.

Franciscus Montebrunus [Francesco Montebruno], who, from the Lansbergian Tables [reduced] to our Bolognese meridian, completed the calculation of the eclipse from the Year 1641 down to 1660.

Ioam. Keplerus [Kepler], who, from the *Rudolphine* Tables, in his Ephemerides computed the eclipses from the Year 1617 down to 1620 under the meridian of Uraniborg. We, however, have recalled to calculation 91 lunar eclipses from the *Rudolphine* [Tables].

Ismaël Bullialdus [Ismaël Boulliau], who, in Book 3 of his *Astronomia Philolaica*, Chapter 7, computed the eclipses from his own *Philolaic* Tables, ancient [ones] and recent, 25 [of them] down to the Year 1573; and these [he computed] from his *Philolaic* [Tables], adjoining a calculation [down to] the Year 1643. He selected

those from the *Philolaic* [Tables] adjoining a calculation [down to] the Year 40 [reduced] to the meridian of Uraniborg, which he selected.

Michaël Maestlinus [Michael Maestlin], who, from the *Prutenic* Tables [reduced] to the meridian of Tübingen, supplied the eclipses from the Year 1577 down to 1590.

Nicolaus Copernicus [Copernicus], who computed the eclipses observed by himself, and adjoined the place of the luminaries deduced from his own tables.

Philippus Lansbergius [Philip van Lansberge], who, from the *Goesian* meridian, computed the eclipses from his own tables, and in his *Thesaurus* of Lunar Observations of the first Class — he reported the eclipses, most of the ancient ones, and the more recent [ones] observed, the most certain ones; but perhaps these tables would resist [contradict] him.

Therefore note: the Indices of the foresaid Tables, which we shall use below, are written out below.

Alphons. — the *Alphonsine* Tables, in the calculation of Petavius, Regiomontanus, or Magini.

Atl. — the *Atlanticae* of Wendelen, from his own calculation.

Dan. — the *Danica* in the supputation [calculation] of Longomontanus, or Petavius, or Argoli.

Lansf. — the *Lansbergian*, from the computation of Lansberge himself, or Montebruno.

Parif. — the *Parisian*, from the calculation of Petavius.

Phil. — the *Philolaica*, from the supputation of Boulliau, or Ours.

Prut. — the *Prutenica*, from the calculation of Petavius, or Buntingus [Buntingus?], or Maestlin, Magini, and for the most part Origanus.

Rud. — the *Rudolphina*, by the supputation of Kepler very rarely, but everywhere [used] in all our eclipses, [or] from Ours.

Tych. — the *Tychonica*, from the supputation of Origanus, or Ours.

Ptol. — the *Ptolemaica*.

The Moments of the Ancient Eclipses, and the Quantity observed, and collated with the Time, and the Quantity represented by the Tables written

below; e indicates the Excess of the computed place of the Moon, and d the Defect of the exact opposition with the Sun.

This page presents a large citation-grade discrepancy table comparing ancient eclipse observations with values computed from the various astronomical tables. It is transcribed as a native markdown pipe-table below, not as a figure. The table continues onto the following batch.

Column headers (reading across the head-band):

- **Ordo Eclips. ex cap. 2.** — Order-number of the eclipse, from Chapter 2.
- **Observatio, & Tabulae.** — The observation [source] and the Tables.
- **Tempus Apparens post Merid. in loco Observationis.** — Apparent time after noon at the place of observation, sub-columns: *Mens.* (month), *D.* (day), *H.* (hour), *M.* (minute).
- **Solis locus Verus ex Tabulis & inde ϑ loci Ω** — True place of the Sun from the Tables, and thence the [opposite] place; sub-columns: *Sig.* (sign), *Gr.* (degree), *l* (minutes), *ll* (seconds).
- **Lunae locus Verus ex Tabulis computatus.** — True place of the Moon computed from the Tables; sub-columns: *Sig.*, *Gr.*, *l*, *ll*.
- **Differentia loci e computati & observati.** — Difference of place, e [excess] computed and observed; sub-columns: *Gr.*, *l*, *ll*.
- **Tempus huius Differentiae.** — Time of this difference; sub-columns: *H.*, *l*, *ll*.
- **Quantitas in digitis.** — Quantity in digits; sub-column: *Digit.*
- **Differentia Quantitatis.** — Difference of quantity; sub-column: *Digit.*

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h u 1 0 8 9 7 8 8 0 1 5 c
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 D S 1 8 3 □ 4 0 □ 1 2 0 d 1 0 0 2 0
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 L S 1 8 3 1 3 1 1 3 7 d 0 4 0 0 8 5 3
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 a p 0 7 0 3 7 1 3 3 2 4 c 5
 r r 1 .
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 P A 2 1 5 2 5 9 1 4 5 d 4 1 2 & 3 2
 h p 0 7 0 3 0 1 5 2 5 4 c 0
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 u p 0 7 0 3 4 8 2 5 4 8 4 1 c
 d r 1 .
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L A 2 1 5 □ 3 2 □ 2 3 2 d 0 3 0 3 4 2 1
 a p 1 7 0 2 3 9 5 5 6 6 0 6

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) e l l . . l l . l l . l l . l l . t.

a u 5 1 5 6 6 1 1 4 c 5
 r l 1 .
 i i 2
 f j
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 P I 1 1 0 1 5 2 3 1 1 d 3 1 2 & 5 1
 h u 5 1 5 4 7 6 0 8 7 5 c 5
 i l 1 .
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 j
 R I 1 1 0 1 5 4 4 5 1 d 5 2 2 &
 u u 5 1 5 9 6 8 4 8 4 c
 d l 1 .
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 L I 1 1 0 □ 2 2 □ 1 2 2 d 0 1 0 0 2 6 2
 a u 6 1 1 8 1 7 8 0
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) e l l . . l l . l l . l l . t

b j
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P I 1 1 0 1 4 2 1 2 4 d 2 3 0 4 4 7 2
a u 6 1 6 5 4 6 5 4 0 5 7 9 5
r l 0
i i
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Parsing notes: The leftmost zodiac-sign glyphs (♊ Pisces, ♈ Aries, ♎ Virgo, ♎ Libra, ♉ Taurus, ♏ Scorpio, ♋ Cancer, ♐ Capricorn, ♊ Pisces) appear only at the head of each block in the Sun and Moon columns and carry forward to the following rows of that block; I have placed each glyph in the row where it is printed. The Sun-column "ll" (seconds) sub-column is blank throughout this opening (values given only to minutes). The "Tempus" minutes/seconds and several "ll" cells are blank where the source leaves them blank; "&c." in the time-minutes column is printed verbatim by the source (abbreviating a recurring 24/25/30-minute figure). The "d"/"e" prefixes in the Difference-of-place column are the *defectus/excessus* markers explained in the table caption. Table continues onto the next batch (catchword "Phil."). The "Differentia Quantitatis" final column is largely blank in

this opening and several digit-values straddle two physical rows in the source; flagged alignments noted with best-fit placement.

Liber II — De Luna (On the Moon)

Caput V (continued)

The great ancient-eclipse discrepancy table continues. Each numbered eclipse is compared across the source-tables (Ptolemy's observation, the Lansbergian, Parisian, Philolaic, and Rudolphine tables, and in some cases Tycho/the Danish [Astronomia Danica] and Prutenic tables). The column structure is:

- **Ordo Eclipf. ex c. 2** — eclipse number (from Chapter 2's catalogue)
- **Observatio & Tabulae** — observation source / table-set
- **Tempus Apparens post Merid. in loco Observationis** — apparent time after noon at the place of observation (Month | Day | Hour | Minute)
- **Solis locus Verus ex Tab. & inde ☉ locus ☉** — true place of the Sun from the tables, and hence the Sun's opposition point (Sign, degrees ' ")
- **Lunae locus Verus ex Tabulis computatus** — true place of the Moon computed from the tables (Sign, degrees ' ")
- **Differ. loci computati & observati** — difference between computed and observed place (degrees ' '), prefixed by **d** (*defectus*, deficit) or **e** (*excessus*, excess)
- **Tempus huius Differentiae** — time-equivalent of this difference (hours ' ")
- **Quantitas in digitis** — magnitude in digits (Dig. ')
- **Differ. Quantitatis** — difference in magnitude (Digit. ')

Zodiac glyphs head each Sun/Moon block and carry forward through the rows beneath. Hours are reckoned from noon. The "&c." entries in the time-difference column abbreviate a repeated/continued value.

table

		O			D			T			D											
		b			i			ff			i											
		s			f			.			d											
		./			⊙)			.											
T																						
O	a	M	S			S			l			D										
r	b	o	i			i			o			i										
d	l	n	g			g			c			f										
.	e	.	D	H	M	n	°	'	"	n	°	'	"	i	'	"	H	'	"	.	'	
P	J	1	1	0	1	5	3	1	2	4	d	2	5	0	5	4	5	1				
h	u	6	1		6	3	5	6	6	5		6	0		3	0					5	
i	l										0											
l	y																					
R	J	1	1	0	1	5	5	1	2	5	d	3	0	1	4	0						
u	u	6	1		6	8	4	6	6	4		2										
d	l										0											
.	y																					
6	O	E	2	1	3																3	0
b	p	8	1	6																		
s	h																					
e	i																					
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v	h																					
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P																						
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L	N	1	1	3	□	2	5	2	□	9	4	4	d	1	3	2	&				1	2
a	o	8	1	6		1	7	5			5	9		1	6	4	c					5
n	u												1				.					
s	e												2									
b	m																					
.	b																					
.																						
P		1	1	3		2	8	1		8	3	5	d	2	2	2	&				4	0
a		8	1	6		1		8			8	2		9	7	5	c					

O										D										
b										i										
s										ff		T								
/				⊙			⊙			f		.								
T										.		d								
O a M				S			S			l		i		D						
r b o				i			i			o		ff		i						
d l n				g	⊙		g	⊙		c		f		g						
.	e	.	D H M	n	°	'	"	n	°	'	"	i	'	"	H	'	"	.	'	
R	1	1	3	2	5	3	2	4	0	e	7	5	0	1	4					
u	9	1	6	1	6	1	1	8	0	0	1	5	0							
d																				
.																				
7	O	T	3	1	3	□	2	4	5	□	1	3	3	d	1	1	2	&	2	0
b	y		1	0			8	7	1		6	6	4		1	7	4	c		
s	b													1				.		
e	i													2						
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P	A	2	1	3	2	4	1	1	1	9	d	4	7	2	&	1	3			
a	p	4	1	0	7	3	6	5	6			7	3	c		3				
r	r										1			.						
i	i										1									
f	l.																			
.																				
P		2	1	3	2	5	1	1	4	4	d	5	3	2	&	2	1			
h		4	1	0	7	6	6	6		5		1	1	4	c		0			
i											1			.						
l.											1									
R		2	1	3	2	4	4	1	3	4	d	6	5	2	&	2	4			
u		4	1	0	7	1	5	5	5	0				4	c		0			
d											1			.						

O b s / T O a M r b o d l n . e . D H M n ° ' " n ° ' " i ' " H ' " . '

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P 2 1 2 2 1 1 1 2 6 d 1 5 2 & 2 2
 h 1 9 0 6 4 9 4 2 3 4 c 0
 i 1 .
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R 2 1 2 2 6 2 1 2 2 d 2 0 2 &
 u 1 9 0 6 2 2 8 4 8 4 c
 d 1 .
 . 1

P D 2 1 2 □ 2 1 5 □ 0 3 0 3 0
 a e 2 9 0 7 5 4 3

r c
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P 2 1 2 2 1 7 2 1 4 d 1 2 0 2 5 2 2
 h 2 9 0 7 4 7 2 1 6 3 0
 i 0

O b s / T
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r h o l e m . a e s t i v o

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 a u 7 9 4 2 2 9 1 3 4 c 0
 r n 1 .
 i i 2
 f j

P I 1 9 6 1 5 5 7 3 1 d 1 4 2 & 6 4
 h u 7 9 3 8 6 6 1 6 4 c 0
 i n 1 .
 l i 2
 j

R I 1 9 6 1 4 1 8 1 5 d 2 1 2 &
 u u 7 9 0 5 6 9 3 6 3 c
 d n 1 .
 . i 1
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P I 1 9 6 □ 2 4 2 □ 2 4 1 d 0 6 0 0 1 7 3
 a u 8 0 3 0 0 3 4 2 0
 r n 0
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.	e	.	D H M	n	°	'	"	n	°	'	"	i	'	"	H	'	"	.	'
P	1	9	6	2	5	0	2	4	5	d	6	1	1	3	0	6	4		
h	8			0	5		0	6	1			9	2	0			0		
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R	1	9	6	2	2	2	2	3	1	e	2	5	0	4	1				
u	8			0	9	3	0	7	8	0					0				
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1	O	T	1	1	0	□	1	3	0	□							T		
0	b	h	6	1			7	0									o		
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P	D	1	1	0	1	2	5	3	5	5	d	2	5	2	&	1	0		
a	e	1	1		5	7	1			4		1	7	4	c	7			
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f	m																		
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.																			
P	1	1	0	1	2	3	3	7	1	d	1	1	2	&	1	4			
h	1	1		5	5	8			9		8	9	4	c	9	2			
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l. 2
 P 1 1 0 1 2 5 3 5 2 d 2 2 2 &
 r 1 1 5 7 2 5 2 7 4 c
 u 1 .
 t 2
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 R 1 1 0 1 1 2 1 2 4 d 5 4 2 &
 u 1 1 5 9 5 3 8 0 7 7 c
 d 1 .
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 P D 1 1 0 □ 1 2 5 □ 1 1 2 d 8 3 0 1 4 1 0
 a e 2 1 6 6 9 6 8 9 0 6 4 7
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 P 1 1 0 1 2 4 1 1 5 e 6 5 0 1 5 1 4
 h 2 1 6 4 6 6 7 4 0 2 0 4 9 2
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 P 1 1 0 1 2 0 1 1 0 d 1 0 0 2 0
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O b s / T O a M r b o d l n . e . D H M n ° ' " n ° ' " i ' " H ' " . ' D i f f . d i f f i g D i f f i g

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O b s / T O a r d . M b l e . D H M n ° ' " S i g n ° ' " S i g n ° ' " D i f f . l o c i ' " T . d i f f . H ' " D i g . '	2	7	0	2	1	4	1	5	2	d	2	2	2	&		
	1			5	3	9	3	2	3		1	6	4	c		
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R u d . D S a n p . t e m b . P P a o r i f . P h i l R u d	2 1	7 1	0 1	2 4	2 0	8 0	1 3	4 2	4 0	d 7	3 7	2 7	2 1	& c	9	8
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										d	5	0	0	1	0	
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										d	5	2	0	1	0	1
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											0			9	0	8
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O b s / T O a M r b o d l n . e . D H M n ° ' " n ° ' " i ' " H ' " . '

table

O b s / T O a M r b o d l n . e . D H M n ° ' " n ° ' " i ' " H ' " . '

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D M 9 1 1 2 8 5 1 3 2 d 5 2 2 &
 a e 3 0 5 1 3 6 7 4 c
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O b s / T O a M r b o d l n . e .										D i ff f . l o c i ' " H ' "										
S i g ⊙										S i g ⊙										
D	H	M	n	°	'	"	n	°	'	"	i	'	"	H	'	"	.	'		
P	M	1	1	1	2	3	4	1	4	2	d	5	2	2	&	1	2			
a	a	8	3	0	4	9	8	2	6	0		3	8	0	c	7	0			
r	r										9				.					
i	t																			
f	i																			
.	j																			
P		1	1	1	2	4	2	1	5	1	d	5	2	2	&	1	1			
h		8	3	0	4	8	1	2	6			2	0	3	c	6	4			
i											1				.					
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o																				
b																				
.																				
R		1	1	1	2	3	2	1	2	4	d	1	4	2	&					
u		8	3	0	4	9	7	2	0	0		8	7	4	c					
d											1				.					
o											2									
l																				
D	S	1	1	1	□	2	8	0	□	2	1	0	e	6	6	0	1	0	1	2
a	e	9	3	0	6					6	4	0				2	7	0		
n	p																			
.	t.																			
P		1	1	1	2	3	5	2	5	5	e	1	0	0	3	0	1	1		
a		9	3	0	5	8	6	5	6	5	0	8			6	6	4			
r																				
i																				
f																				
.																				
P		1	1	1	2	4	2	2	6	3	e	1	7	0	3	4				

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O a M				S			S			l			i					D		
r b o				i			i			o			ff					i		
d l n				g	⊙		g	⊙		c			f					g		
.	e	.	D H M	n	°	'	"	n	°	'	"	i	'	"	H	'	"	.	'	
h	9	3	0	5	7	9	6	6	0	9			6	4						
i																				
l.																				
R	1	1	1	2	3	3	2	3	1	d	7	1	0	1	4					
u	9	3	0	5	8	5	5	1	5			0	4	0						
d										0										
o																				
l.																				
1	O	M	5	1	1	□	1	1	0	□									T	
3	b	e		4	5		5	2												O
s	s																			t
e	o																			a
r	r																			l.
v	i																			
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P																				
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e																				
m																				
.																				
D	M	5	1	1					2	1	2	d	1	2	2	&				
a	e		4	5					7	5		7	0	4	c					
n	s										1				.					
.	o										2									
r																				
i																				
P	S	1	1	1	1	3	5	1	5	1	d	3	2	2	&	1				

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/				⊙)		f		.								
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O a M				S			S		l		i			D					
r b o				i			i		o		ff			i					
d l n				g	⊙		g)	c		f			g					
.	e	.	D H M	n	°	'	"	n	°	'	"	i	'	"	H	'	"	.	'

h	1	4	5		5	0		5	0		0		1	6				
i											0							
l.																		
R	1	1	1		1	1	1		1	1	3	d	1	4	0	2	2	
u	1	4	5		5	0	6		4	7	2		3	4		7	5	
d											0							

1	O	P	2	1	2	□	6	1	0	□									7	6
4	b	h	7	4	0			4												

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Parsing notes: This is an extremely dense citation-grade table spanning three folio pages. Sign-glyphs head each Sun/Moon block and carry forward over the rows beneath until the next glyph appears; where a cell is blank in the source (especially the Moon's-place columns for the lead "Observatio" row of each eclipse), it is left blank here. The *defectus* (d) / *excessus* (e) prefixes are preserved verbatim in the difference-of-place column. "&c." in the time-difference column abbreviates a value continued from the row above. Several digit-magnitude cells are split between the "Quantitas in digitis" and "Differ. Quantitatis" columns and were merged into the final two columns; a few interior rows of eclipse 11, 13, and 18 appear to be doubled (table-set repeated for the day-before vs. day-of comparison), reproduced as printed. Where ink-bleed or gutter shadow made a glyph ambiguous, the most consistent reading with the column's progression was chosen; remaining doubtful single glyphs are flagged inline.

Caput V (conclusion of the analysis) — Page 115, lower text

Exponitur iam Dissidium Apparens inter Astronomicas Tabulas LuniSolares, & Chronologicos Canones, detectis insigniorum alioquin virorum erroribus.

Now is set forth the apparent disagreement between the astronomical luni-solar tables and the chronological canons, with the errors of otherwise distinguished men exposed.

7. For a long time I was anxious over the discord that seemed to hold — partly among the passages of Censorinus [Censorinus] themselves; partly among those who, relying on his authority, followed chronology; and finally between the solar astronomical tables and the lunar ones. On the one hand, the earlier passage of Censorinus, *On the Birthday [De Die Natali]*, chapter 8, together with the authority of the Arabs, wanted us to take the Sun's place — and hence the moment of the

predicted eclipses — as following Ptolemy; so that we would calculate the predicted eclipses by the swift day rather than as astronomers commonly reckon. And so the first eclipse [in the catalogue] would have fallen on 7 March, and likewise the rest before Ptolemy — indeed, four eclipses before the observed one — by the very fact of being predicted. For example, eclipse 17 would have happened at 11h 15' after noon of the fifth day. On the second view, following the later passage of Censorinus, it is necessary to say that the predicted eclipses fell on the following day, as set down in the foregoing catalogue. For example, eclipse 19 [fell] on 8 March, and eclipse 17 at 11h 15' after noon on 6 May; whence it follows, by way of the Chronological Canons, that the beginning of the year of Nabonassar, in the form of the Julian year, began from the meridian of 26 February.

So that we may state this more clearly and resolve it, let us lay down certain points beforehand as fixed and settled.

8. First, it is certain from other authorities, but especially from Censorinus, chapter 10, that the Romans began the civil day from the preceding midnight. But the Egyptians especially — and the astronomers in particular — took the beginning of the day from the rising of the Sun, as is clear above all from Ptolemy, *Almagest* book 3, and chapter 8. Therefore, with Censorinus's passage soon to be cited, the beginning of the Egyptian year did not [fall] on some Roman Kalends, or on some day before the Kalends entire, but began before the day VI. Kal. or XII. Kal. — that is, the Egyptians reckoned the beginning of the year 12 hours before the beginning of the Roman day, as is customary.

9. Secondly, it is certain from Ptolemy in many places that the Egyptians reckoned the days from sunrise as for the observations of eclipses, and likewise the phenomena, with the customary [hours] reckoned as incomplete; and they took the difference accordingly, and for the most part, after a day already named, they added a following day not yet begun. Thus *Almagest* book 3, chapter 8, when he says that the equinox was observed by him in the 17th year of Hadrian, and on the 7th [day]: Athir [Athyr], after midnight, in the two nearest equal hours. A little later he says: *from the first hour of Nabonassar in the first year, and the midday of the month Thoth among the Egyptians, up to the autumnal equinox set forth to us, we gather 879 years and 66 days and 2 hours.* But if he had taken the seventh day [Athyr] for the exact and completed [day] beyond the named years, he would have reckoned 67 days. Further, *Almagest* book 4, chapter 8, he says: *from the first hour of the month Thoth of the first year of Nabonassar up to the midpoint (according to the ancient eclipses, the time of which we have spoken) of the second*

eclipse, of the Mardocempad [Mardokempad], in the year of Thoth 18, the following 19, equal in 50-sexagesimal hours: but the time gathered is of 27 Egyptian years, 17 days, and 11 hours and 10' nearly. But if the 18th day of Thoth had already been completed, there would be counted in this collection 18 days. Copernicus [Copernicus] therefore errs, as often as in these cases he reckons—

[Margin: Copernici error. — "Copernicus's error."]

he numbers [numerat] the day designated by Ptolemy for the completed ones [pro exactis], or for the elapsed ones [peractis], as at Book 4, chapter 5, section 6, where he says: "On the twentieth day from the transit of the month Pauni, and soon after on the second of the elapsed days of the month Choiac, and a little later, after the transit, on the 19th day of Pharmuthi." But Ptolemy numbers the days here in another way, namely at Book 4, chapter 6: he sets down the year of the first of these eclipses as the 5th of Pauni still elapsing, and likewise the second on the 2nd of Choiac, then the third on the 19th of Pharmuthi, which the twentieth day was about to follow.

[Margin: Copernicus's error]

10. There remains finally one matter, controverted among the most learned men: the first year of the vulgar Epoch of Christ. Was it the forty-sixth of the Julian years, and likewise the first bissextile [leap year]? For the eclipse of the Sun which befell — as [Dio] Cassius reports at Book 60 — at the Nativity of the Emperor Claudius, this, on the authority of Suetonius (in the Kalends of August of the year of the Julian Epoch 90), is represented from the Astronomical Tables for the Year of the Epoch of Christ 45, on the Kalends of August, and so by other eclipses. By these arguments and the like, it is confirmed in our Reformed Chronology, as it is also the common opinion of most chronologers, that the year 1 of Christ began at the Kalends of January in the year of the Julian period 46.

11. Fourthly, it is finally established that the Egyptian year, inasmuch as it consisted always of exactly 365 days, in every fourth year began one day sooner than the Julian year — namely after the 24th of February — and on the contrary began to retrocede in the descent of the years, and conversely to advance toward the beginning of the world in the ascent. With these points laid down, the occasions of the controversy now indicated are more easily explained.

[Margin: Opinion of the Arabs on the years of Nabonassar and of Christ]

12. Jacobus Christmann [Jacob Christmann], in his book *De Kalendario Romano* page 182, writes: "The Arabs," he says, "reckon exactly in commemorating the intervening years between Nabonassar and Christ, since at the beginning of the third book of his *Almagest* they are written down from Nabonassar up to Christ as 747 transit-years, and on day 131." A little after, Paul [Christmann?] subjoins: "The observing Arabs, prudent in their reckoning, do not take the era of Christ from his Conception, nor from his Circumcision, but from the last day of December, which precedes the Circumcision or the Kalends of January of the year 46 Julian. But if you reckon from the Year of Christ 747, then it is the 26th of February." But if the year before Christ were to be reckoned, it would be at the last midnight of December preceding the Circumcision of Christ, and they would be the years 747 of so many tenths; how does Christmann number 110? — when in this way he asserts that Regiomontanus erred. Therefore if they are 131, it is fitting to begin the numbering at the midnight of the 25th of February of the year 747 before Christ. Hence it follows that the beginning of the months of the Egyptians corresponds to those days which the astronomers commonly denote as preceding by midnight: and as for the example of eclipse 17, [the one which] Ptolemy reckoned to have been on the 20th of Pauni — not, as the common reckoning has it, on the 21st.

[Margin: Opinion of the Arabs on the years of Nabonassar and of Christ]

13. I reply, however, that this opinion of the Arabs does not evince what they wish. For although the Arabs, prudent in their reckoning, have accommodated themselves to the era after Dionysius Exiguus [Dionysius the Little], introduced in the Christian world for numbering the years of Christ — and thus the years 747 — yet the beginning of Nabonassar is the 26th of February. When they considered the Astronomical Tables, they nevertheless fixed the year at the last midnight of December, for the sake of commodity, lest they might omit a whole astronomical day in the reckoning. Therefore Censorinus is rather to be examined. [Margin notes alongside: Censorinus / Scaliger's lapse in chronology]

14. Censorinus, in his book *De Die Natali* [On the Birthday] chapter 8, and Varro [whose index serves as it were], note the most illustrious epochs of the years thus: "Unless I am mistaken (whose year is as it were an index, and the title is in a way of use), and from the Olympiad" — first of all is the year 1014 of the Olympiads [?] which befell in those days on which the Olympic Games are celebrated. From the founding of Rome 1191, and

indeed at the Palilia, whence the years of the Urbs are numbered. Of their own years, which bear the Julian name, 283, ever since Julius Caesar by his own constitution made the beginnings; but those years which are called from Augustus [Margin: From Petavius and from Christmann] 267, perfect, that is the 7th, that is the 13th: M. Crassus, D. F. Augustus, by the judgment of Munatius Plancus, from the Senate and the rest received this name, that is the 7th, that is M. Vipsanius Agrippa, III consul. But the Egyptians, who two years before [came] under the power of dominion, and the people, R[oman?] conquered, hold the years of the Augustans...

[Margin: From Petavius and from Christmann]

15. But it is clearly established from Censorinus himself that one must read, in the prior place, "before the 6th day of the Kalends of July" [ante diem VI. Kal. Iul.]; for this day he confirms...

he confirms from another more notable day, at once subjoining: "Since from this point a hundred [years] elapsed for Pius and for Bruttius — the present consuls — they are the same days which were [counted] before the 12th of the Kalends of August" [ante diem XII. Kal. Aug.], as Codex, Scaliger, Christmann, and Petavius have it. But for the year — beginning the 25th, that is to say, of those years which are the Egyptian beginnings — the beginning of Thoth was anticipated for so many days. Therefore the beginning of Thoth fell, with Pius and Bruttius as consuls, at the midnight preceding the twelfth before the Kalends of August, that is, in the meridian of the 20th of July. To St. Margaret, sacred, etc. After a hundred years, it falls in that meridian on the 25th of June, that is, in that meridian which was before the 6th of the Kalends of July [ante diem VI. Kal. Iul.]. I know that Scaliger and Manutius acknowledge an error, but rather in this second place of Censorinus, and it is restored for "before the 12th of the Kalends of August" [ante diem XII. Kal. Aug.]; but in dubious cases of correcting either of these places, one must rather stand by the number of years, which favors the opinion of the beginning of Nabonassar at the 26th of February both as a matter of fact, and according to the eclipses of the Sun or the Moon. By the Astronomical Tables, they can be gathered, namely on the days which Ptolemy designates: by which the eclipses noted in the preceding Catalogue are computed, in which they suppose the year of Nabonassar 986 begun [*incaepisse*] at the midnight preceding the 6th, that is, in the meridian of the 25th of June. We conclude, therefore, that Censorinus not only does nothing against us, but rather favors us. Let this be asserted, having retained that reading "before the 7th of the Kalends of July" [ante diem septimum Kal. Iul.].

[Margin: An emendation in Censorinus is not to be made]

16. A greater, indeed almost the sole, difficulty remains regarding the place of the Sun, which Ptolemy assigns to the eclipses, and which he has observed at Book 4, chapter 6. For eclipse 17, made at Pauni of the 20th, which follows at Book 11, hour 11.15' after the meridian of the 20th, has the Sun positioned in Taurus Grade 11.14' approximately; and eclipse 18 at Libra Grade 26.37'; and eclipse 19 has the Sun constituted in Pisces Gr. 14.12'. Nor is it otherwise had in the Greek text, or in the Codices [in the] M.S. Besides, on the Aequinoctial point, the same Ptolemy in the same year of Adrian 17, who observed eclipse 17 the seventeenth day, by two hours after the meridian of the 7th of Athyr [Margin: ...], follows for whatsoever Astronomical Tables one receives — apart from the Lansbergian — that the Moon was in Taurus Grade 13, and just minutely, but no fewer, after the meridian of the 20th of Pauni in Taurus Grade 13, and just about 14'; nor by more than 34'. But from our Solar Tables it follows that the Sun was in Taurus Grade 13, and minutely about 16'; whence by supposition it follows that Pauni was the 20th, since it began at the meridian of the 5th of May; but from this it follows likewise by the same Astronomical Tables that the Moon was, from the moment of the same opposition, distant from the place of the Sun by the whole 11. of Grades, or at most Grade 11.30'; or, if you wish, at the least Grade 11.30'; and if it is to be seen, by the preceding Catalogue. But if the Moon be held in the place of the opposition, as a Plenilunium [full moon] requires, it ought above all to be proceeded eclipse-wise on the 6th of May, at the hour 11.15' after its meridian: it follows by the same Tables (subtracting the Lansbergian) the place of the Sun by Grade most-of-all-further than what Ptolemy has noted to have been in Taurus Grade 14, and just minutely than 14' minus. But what we said of eclipse 17 holds in all the ancient eclipses of the twenty taken in the preceding Catalogue, and examined later by the most celebrated Astronomical Tables.

17. The other [point] is to be said of two: either Ptolemy errs, nor do the other Astronomers err in their Tables, regarding the place of the Sun; yet that nevertheless they erred in the place of the Moon in the Tables by about 12 Grades. If the prior day be retained in the aforesaid Catalogue of those reckoned according to the Julian year, we wish to retain it. On the contrary, however, if we wish to retain it with the common reckoning of Astronomers — the later day — and not to commit so enormous an error to the Astronomical Tables, what shall we say of the place of the Moon? For

Ptolemy errs by an entire Grade [*Margin: ...*], either the Astronomical Tables (and likewise the now-celebrated Tyconic ones) would have erred by one Grade, and in eclipse 17, with the 6th day retained, at hours 11.15' after the meridian: the Sun was discovered to be lacking in Taurus Grade 13.14'; it would be necessary that the Mean motion of the Sun — which commonly does not exceed signs 11. Grade 29.45'40" — to come out at signs 11. Grade 29.45'42".20".

Whence it would follow that the Aequinoctial year is of days 365. hours 5.48'.3".& 42" — absurdly indeed and notable, it is to the experts of Astronomy; or one must admit the inequality of the years, once not excluded at Book 3 [of the] *Almagest*, [as it is] now [admitted].

18. But neither can it be said that the Astronomical Tables erred, either at eclipse 12 in the motion of the Moon at the time of Ptolemy, or that Christ's [time] represented the eclipses; or [that they] were lacking in the predicted Catalogue, and as an example at eclipse 17, ought to have been at hour 11.15' after the meridian of the 1st of May, to exhibit the Sun in Taurus Grade 13.14'; thence likewise the Moon in Scorpio Grade 13.14' approximately, which the Tables themselves represent in Scorpio Grade 13. approximately. For we have other eclipses noted on more certain days in the Roman manner, at the time of which Ptolemy and Christ note the same — which the same Tables rightly represent without error of an entire Grade. For example, as for the eclipse which Dio Cassius affirms befell at the Nativity of the Emperor Claudius — M. Vinicius II [and] M. Statilius Corvinus consuls, that is, in the Year of the Epoch of Christ 45, on the Kalends of August (as Suetonius has it *De Die Natali Claudii*) [On the Birthday of Claudius] from the Astronomical Tables, and in the species of the Rudolphine [Tables] there is exhibited: the true Novilunium [new moon] of the first of August, hours 9.& minutes 55. after the middle midnight, at which point the Romans began the Kalends. And of others. Hence therefore we recognize that it cannot be that by these Tables an error of twelve grades subsists in the motion of the Moon in that eclipse. Therefore one must either represent eclipse 17 by the said Tables, [in which] it is necessary the 6th of May, after whose meridian, at hour 11.15', Alexandria, the Moon was in Scorpio Grade 14.30' approximately, & the Sun in Taurus Grade 14.30' approximately, necessary too; or rather Ptolemy erred in the place of the Sun by one grade, assigning [it], because [it is] of that Aequinoctial of that year by one grade more slowly made than they put it, [than] truly more truly; or the Tables exhibit it for some hours

before the meridian of the 1st of September, as the Chronological Canon — days of Athyr the 6th, and we said at chapter 6, section 15.

[Margin: Ptolemy's error in the Aequinoctials]

19. Lest, however, it should seem we are accusing Ptolemy of having erred by a whole day in the Aequinoctial — for that it suffices an Armilla [armillary ring] of the Aequinoctial, as he indicates at Book 3, chapter 1: he himself saw in an observation of this kind [the sun's light] declining a little from the plane truly toward the Southern part, [whereas] truly minutely. And he himself there attests both Armillas to have remained the greater part at their site, an obliquity at the time; but in emending the defect of those by their own fault, it can easily be deceived: then with the Obliquity of the Ecliptic, as we said at chapter 6: then with the false opinion of the quantity of the Aequinoctial year, with the false Hypothesis too of the immobility of the Apogee of the Sun. It could even be that the Armilla at the ancients was not so exactly placed, or had been [placed] through some error in the altitude of the Aequator.

[Margin: Ptolemy's error in the Aequinoctials]

I. CONCLVSIO [Conclusion I].

With the LuniSolar Astronomical Tables sound, and [their] Egyptian days from Ptolemy in the Observations of the Lunar Eclipses, one must assert that the year of Nabonassar 886. began at the midnight preceding the 6th [day] of July, that is, in the meridian preceding the 12th of the Kalends of August [ante diem XII. Kal. Aug.], as the vulgar codex of Censorinus has it, *De Die Natali* chapter 8. The year of Nabonassar 986. began at the midnight preceding the 25th of June, that is, in the meridian preceding the 7th of the Kalends of July [VII. Kal. Iul.], as Censorinus has it. But we have the incorrect example of Censorinus — not "before the 7th of the Kalends of July" [VII. Kal. Iul.], but "before the 6th of the Kalends of July" [VI. Kal. Iul.]; and thus the beginning of Nabonassar collocated in the meridian of the 26th of February of the Year before Christ 747; finally the eclipses 19 in the Catalogue preceding by Ptolemy related are to be assigned to the hours after the Meridian of the Julian Month posterior, and no prior [days] in the same Julian day designated.

II. CONCLVSIO [Conclusion II].

The Lansbergian Tables, which exhibit the Sun at the time of Ptolemy in no Ecliptic place, in which Ptolemy at the moment of the eclipse establishes [it], this

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 P 2 1 2 1 4 1 1 0 0 e 0 1 0 3 0 1 3
 a 5 0 4 3 5 7 5 2 0
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 P 2 1 2 1 3 3 1 3 3 e 0 5 9 1 2
 h 5 0 4 4 0 4 9 9 0 0
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 R 2 1 2 1 2 3 1 2 3 e 0 1 5 3 5
 u 5 0 4 2 9 4 4 6 7 0
 d

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 2 O S 5 1 6 □ 4 0 □ 5 0 T
 4 b e 1 8 2 o
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A 2 1 2							d 1 1 3			2 4 1	
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P 2 1 2 9 4 4					1 2 4			e 1 4 5			3 3 0
h 2 3 1 2 8					1 4			7 3			8
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Parsing notes: row 27's first (Observ.) entry shows only the zodiac signs □/□ with the degree/minute cells left blank in the source; the d/e and Difference columns for

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d b s D H g G g G / G D
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n ? 2
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h 4 3 2 4 3 0 6 2 5 0
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R 5 1 0 2 1 5 2 2 4 e 0 7 4 1 2
u 4 3 2 8 3 0 0 2 5 0

3 O I 2 1 3 8 0
5 b u 1 6

s n
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L 2 1 4 □ 1 5 □ 1 6 e 0 1 1 2 3 7 3
a 1 5 7 3 9 3 0 1

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h	e		1	6	1	7	1				1	4	0									1							
i	d																												
l																													
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i																													
R		2	1	3	2	5	5				2	3	4	d	0	6	2					4	1						
u			1	6	0	8	1				0	8	8				8												
d																													
.																													
T		2	1	3	2	5	4				2	5	1	d	0	0	4					1	0						
y			1	6	0	8	1				0	2	2				0												
c																													
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		2	1	3	2	5	2				2	5	2	d	0	1	7					0	1						
			1	6	0	6	7				0	5	2																

Parsing notes: this table is extremely dense, with five-to-six sub-rows per eclipse and many columns. Sign glyphs are small and ink-bled; I have flagged the most uncertain (eclipse 22's "Kerm." month abbreviation, eclipse 33's Scorpio glyph). The seconds and minutes cells in the rightmost Time and Quantity columns frequently

run together or are partly cropped by the gutter at the page edge. The bottom of the table (eclipse 35's Tychonic sub-rows) shows the "Sed si" annotation in the Mens. column for the Phil. row. Several Observ. rows give only the Quantity (Dig.) with the position cells left blank — this matches the source layout (the observation recorded only the magnitude, not the computed position). The d/e markers (defectus/excessus) are preserved as printed. Table continues beyond this page boundary.

Liber II — De Luna. Caput VI (continued)

Comparison of the astronomical tables with observed lunar eclipses, from the time of al-Battānī to AD 1660 (continued from eclipse 35).

The table continues from the prior batch. Its columns are:

- **Eclipse order / Observation & astronomical tables** [*Ordo Eclipsium cap. 2; Observatio & Tabulæ Astronomicæ*] — the eclipse number (keyed to Caput II) and, in each sub-row, the source: the observation (*Observ.*) followed by the several table-sets (Lansbergian *Lansb.*, Philolaic *Phil.*, Rudolphine *Rud.*, Tychonic *Tych.*, and also Atlantic/*Atl.*, Danish/*Dan.* [Longomontanus], Parisian/*Paris.*, Prutenic/*Prut.*).
- **Apparent time past the meridian at the place of observation** [*Tempus Apparens post Meridiem in loco observationis*]: Month | Day | Hour | Minute.
- **The Sun's true place from the tables, and hence the place of the Sun's opposition** [*Solis locus Verus ex Tabulis, & inde locus ☉ ☉*]: Sign · Degree | Minutes | Seconds.
- **The Moon's place computed from the tables** [*Lunæ locus ex Tabulis computatus*]: Sign · Degree | Minutes | Seconds.
- **Difference between the computed and observed place** [*Differentia loci computata & observata*], with the d (*defectus*) / e (*excessus*) marker: Degrees | Minutes | Seconds.
- **The time corresponding to this difference** [*Tempus huius Differentiæ*]: Hours | Minutes | Seconds.
- **Magnitude in digits and minutes** [*Quantitas in Digitis & minutis*]: Digits | Minutes.

Parsing notes: time values are reckoned past noon, so hour-values above 12 are expected and not flagged. The d/e markers (*defectus* / *excessus*) are preserved verbatim in the difference column. Sign glyphs head each computed-place block

(zodiac symbols transcribed by name). Empty cells in the source (where a sub-row repeats the row above, or where the figure was not supplied) are left blank.

Eclipse 36 (October 6)

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I													II					
II													r.					
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O	O	6	1	3	L	2	0	A	2	0							T	1
b	c		2	6	i	5		r	5								o	2
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e	o				r			e									a	5
r	b				a			s									l.	
v	.				2			2										
.					2			2										
L		6	1	3	2	4	5	2	4	3	e	0	0	3	0	1	1	
a			2	6	2	0	9	2	1	7				8			9	
n																		
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il	d																	
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R		6	1	3	2	1	4	2	3	1	e	0	1	2	0	2	5	
u			2	6	2	7	9	2	0	6			2	7		4	0	
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o																	g	g							
u	M																	n	n	D					
r	e																	.	.	d	i				
c	n	D	H																	G	G	/	G	H	g
e	s.	.	.	I	r.	I	II	r.	I	II	e	r.	I	II	.	I	II	.	I						
T	6	1	3	2	1	3	2	2	2	2	e	0	9	4	0	1	3								
y		2	6	2	6	6	2	8	3					7	9	0									
c																									
h																									
.																									

Eclipse 37 (September)

																M									
																S	o								
																u	o								
																n	n								
																:	:								
																S	S								
S																	i	i							
o																	g	g							
u	M																	n	n	D					
r	e																	.	.	d	i				
c	n	D	H																	G	G	/	G	H	g
e	s.	.	.	I	r.	I	II	r.	I	II	e	r.	I	II	.	I	II	.	I						
O	S	5	1	2	V	1	0	P	1	0								T	1						
b	e		3	0	i	2		i	2									o	2						
s	p																	r	s	t	5				
e	t																	g	c	a	4				
r	e																	o	e	l.					
v	m																	2	s						
.	b																	2	2						

S o u r c e	M e n s.	D .	H .	S u n : S i g n . G I I			M o n : S i g n . G I I			d / e	G r. I I	H . I I			D i g . I	
				r.	I	II	r.	I	II			.	I	II		
L a n s.	5	1	2	2	2	5	2	2	6	e	0	0	2	0	0	2
		3	0	2	4		2	4								
P h il	5	1	2	2	2	3	2	5	1	e	0	8	2	0	1	4
		3	0	2		9	1	4	9				0		6	0
R u d	5	1	2	2	2	2	2	1	5	e	0	1	2	0	2	5
		3	0	2		7	1	2	4			0	7		0	5
T y c h	5	1	2	2	3	6	2	1	3	e	0	7	2	0	1	0
		3	0	2			2	0	4				8		5	

S o u r c e	M e s. .	D .	H .	I	S u n : S i g n . G I I			M o n : S i g n . G I I			d / e r .	G I I	H .	I	II	D i g .	I
					r.	I	II	r.	I	II								I	II
i s.																	
P h il .	8	8	3	2	5	2	2	1	3	e	0	1	6	0	1	5	
				6	1	5	7		1			0			8	1	
R u d .	8	8	3	2	5	3	2	0	1	e	0	9	9	0	1	1	
				6	1		7		2						8	8	
T y c h .	8	8	3	2	5	3	2	5	2	e		4	4	0	9	3	
				6	0	8	6	5	7				9			0	

M

S o
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n n
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S S
i i
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G G / G H i
r. I II r. I II e r. I II . I II . I

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7	1	2	2	3	1	2	3	5	e	0	1	5	0	3	5
	1	5	4	1	7	4	1	7				7			0
7	1	2	2	3	2	2	2	2	d	0	0	5	0	1	4
	1	5	4	0	3	4	9	9				4			0

Eclipse 42 (April)

		S			M						D							
		u			o						i							
		n			n						g							
		:			:						n							
S		S			S						d							
o		i			i						g							
u		g			g						n							
r		n			n						d							
e		·			·						g							
M		G			G			/			H							
D		I			I			I			I							
H		I			I			I			I							
I		I			I			I			I							
I		I			I			I			I							
O	A	2	8	5											T			
b	p			0											o			
s	r														t			
e	il														a			
r	.														l.			
v																		
.																		
A		2	8	5					d	0	1	3	0	2	0			
tl				0							2	0		5				
.																		
D		2	8	5	A	4	1	L	5	0	e	0	4	5	0	9	4	
a				0	r	7	0	i	2					0			0	
n					i			b										
.					e			r										
					s			a										
					2			2										
					2			2										
P		2	8	5	2	4	5	2	5	2	e	0	6	3	0	1	0	1
a				0	2	4	4	2	1	4				0		2		8
r																		0
i																		
s.																		
P		2	8	5	2	4	8	2	5	5	e	0	1	4	0	2	4	
h				0	2	5		2	9	5			4	7		7	4	

M
S o
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G / G H
r. I II r. I II . I II . I

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2	8	5	2	4	2	2	5	2																			
		0	2	6	4	2	5	3																			

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2	8	5	2	4	3	2	5	4																			
		0	2	5	8	2	0	4																			

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S o u r c e	M e s. s.	D .	H .	I	S u n : S i g n . G r. I I			M o n : S i g n . G r. I I			d / e	G r. I I		H . I I		D i g . I		
					r.	I	II	r.	I	II		.	I	II				
h il . P r u t. R u d . T y c h .		6	5		3	4	9	3	1	7			2		0			
		2	1	3							e	0	7	0	0	1	0	
		6	5												4			
		2	1	3	1	2	2	1	2	3	e	0	0	1	0	0	2	1
		6	5		3	3	1	3	3	3				2			4	7
																	4	
		2	1	3	1	2	4	1	2	3	d		3	1	0	0	2	
		6	5		3	4	2	3	1	2				0			0	

S o u r c e	M e n s.	D .	H .	S u n : S i g n · G I I			M o n : S i g n · G I I			d / G e r.	I I	H . I I			D i g . I	
				r.	I	II	r.	I	II			.	I	II		
P h il ·	3 1	1 0	1 0	2 1	2 8	2 0	2 1	3 4	3 5	e 0	6 5	1 5	0 3	1 0	1 0	
P r u t.	3 1	1 0	1 0							e 0	2 2	3 0	0 5	4 5	0 1	1 0
R u d o l.	3 1	1 0	1 0	2 1	2 9	4 4	2 1	3 5	3 2	e 0	5 8	4 8	0 1	1 5	3 5	
T y c h ·	3 1	1 0	1 0	2 1	2 8	3 1	2 1	2 8	8 8	e 0	5 5	0 0	0 0	1 0	1 0	

S o u r c e	M e s.	D .	H .	M .	S u n : S i g n . G r.				M o n : S i g n . G r.				d / G r.	H .		D i g .	
					I	II	I	II	I	II	I	II					
P h il .	1 9	9	5	1 7	5	1	1	6	3	e	0	1	1	0	2	4	1
P r u t. R u d .	1 9	9	5 8	1 0	5	3	1	8	0	e	0	1	3	0	2	0	0
T y c h .	1 9	9	5 8	1 0	4	1	1	5	4	e	0	1	2	0	3	0	0

Eclipse 47 (July)

				S		M													
				u		o													
				n		n													
				:		:													
				S		S													
S				i		i													
o				g		g													
u	M				n		n										D		
r	e				·		·		d								i		
c	n	D	H	M	G			G		/		G		H				g	
e	s.	.	.	.	r.	I	II	r.	I	II	e	r.	I	II	.	I	II	.	I
O	I	1	1	5															T
b	u	5	6	7															o
s	l																		t
e	j																		a
r																			l.
v																			
.																			
A		1	1	5							e	0	6	0	0	1	0		
tl		5	6	7												2			
.																			
D		1	1	0	L	4	5	A	3	3	e	0	3	2	0	6	4	1	
a		5	7		e	0	0	q	7	0				0			0	5	
n					o			u										1	
.					3			a										4	
								r											
								i											
								u											
								s											
								3											
L		1	1	5	2	4	3	2	4	2	d	0	0	8	0	0	1		
a		5	6	7		9	7		9	9							7		
n																			
s.																			
P		1	1	5	2	4	2	2	4	4	e	0	3	2	0	5	3		

S o u r c e	M e s.	D .	H .	M .	G r.	S u n :		M o n :		d /	G r.	I .	H .	I .	D i g .	I .	
						I	II	I	II								
a r r i s.		5	6	7		4	8	7	8				0		6		
P h i l .		1	1	5	2	4	2	2	4	2	e	0	1	4	0	1	5
P r u t.		5	6	7		3	4		4	8							8
R u d .		1	1	5	2	4	5	2	3	2	d	0	5	3	1	1	2
T y c h .		5	6	7		2	0		7	7			2	1			
		1	1	5	2	4	2	2	4	1	d	0	1	6	0	2	1
		5	6	7		2	0		1	4							1

S o u r c e	M e s.	D .	H .	M .	S u n : S i g n .		M o n : S i g n .		d /	G r. I II		H .		D i g .			
					r. I	II	r. I	II		r. I	II	r. I	II	r. I	II		
					2												
					5												
P a r i s.	7	1	9	2	4	5	2	5	2	e	0	0	3	0	1	0	
		3		5	9	0	5	0	0				0				
P h il .	7	1	9	2	5	2	2	4	3	d	0	6	2	0	1	0	
		3		5	0		5	3	8				4		4		
P r u t.	7	1	9							e	0	6	3	1	0	0	1
		3											0	3			9
																	1
R u d .	7	1	9	2	4	1	2	3	2	d	0	9	4	0	1	3	
		3		5	9	3	5	9	6				7		9	0	
T y c h .	7	1	9	2	5	1	2	4	3	d	0	9	3	0	1	1	
		3		5	2	0	5	2	5				5		9	0	

Eclipse 49 (September)

										M													
										S		o											
										u		o											
										n		n											
										:		:											
										S		S											
										i		i											
										g		g											
										n		n											
										·		·		d						D			
										G		G		/ G		H				g			
										r. I		r. I		e r. I		. I		. I		. I			
										I		II		II		II		I		II		I	
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S o u r c e	M e n s.	D .	H .	M .	G r.	S u n : S i g n .		M o n : S i g n .		d /	G r.	H .		D i g .
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P h il .	1 5	2	2	2	4	5	2	5	2	e 0	4	1	0	8 3
P r u t.	1 5	2								e 0	1 6	0	0	3 0 1 7 9
R u d .	1 5	2	2	2	5	8	2	4	3	e 0	4	3	0	7 6
T y c h .	1 5	2	2	2	4	5	2	4	4	e 0	1	4	0	3 2 5

S o u r c e	M e s. .	D .	H .	M .	S u n : S i g n . G r. I		M o n : S i g n . G r. I		d / e	G r. I		H .		D i g . I
					I	II	I	II		I	II	I	II	
P a r r i s.	3 0	6	5	1 9	3 2	1 9	1 4	1 0	3 0	5	2	0	1 0	0
P h il .		6	5	1 8	4 2	1 9	1 4	5 6	e 0	6	1 3	0 2	1 2	2 4
P r u t.		6	5						e 0	1 3	0 6	2 0	0 0	9 3 7
R u d e l.		6	5	1 8	5 6	1 9	1 0	3 3	e 0	1 7	3 0	0 3	3 1	1 6
T y c h .		6	5	1 8	2 0	1 9	1 0	2 4	e 0	2 4	4 0	0 4	4 7	

S o u r c e	M e s.	D .	H .	M .	S u n : S i g n ·		M o n : S i g n ·		d /	G r.	I .	II .	H .		D i g .	I .	
					r.	I II	r.	I II					I .	II .			
L a n s b ·			6	4	2	1	4	2	1	4	0	0	8	0	0	0	4
				1	7	1	8	7	1	0							4
P a r i s.			7	4	2	1	1	2	1	3	e	0	3	2	0	7	0
				1	7	1	8	7	4	8				0			
P h il ·			7	4	2	1	5	2	1	4	e	0	5	4	0	1	3
				1	7	3	5	7	9	2				7	0	0	
P r u t.			7	4							e	0	7	3	0	1	0
				1										0	5		5
																	4
R u d ·			7	4	2	1	3	2	1	4	e	0	1	1	0	2	2
				1	7	3	2	7	4	4				2			4
T y c			7	4	2	1	2	2	1	2	d	0	0	1	0	0	2
				1	7	3	3	7	3	1				1			2

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Eclipse 55 (October) — *begins on p. 120, continues on p. 121*

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Eclipse 55 (October) — *continued from p. 120*

S o u r c e	M e s.	D .	H .	M .	S :		M :		d /	G r.	I .	II .	H .		D i g .		
					G r.	I .	I .	II .									
P h il .			1 9	2 6	5 .	2 9	3 0	5 .	2 8	2 2			0 .	1 9	0 2	5 5	- 9 4 0
P r u t.			1 9	2 6						e	0	4	3	0	9	0	0 0
R u d .			1 9	2 6	5 .	2 8	3 3	5 .	3 5	3 .	3 .		e	0	6	3	0 1 4
T y c h .			1 9	2 6	5 .	2 8	5 6	5 .	3 2	5 .			e	0	3	1	0 6 2

S o u r c e	M e n s.	D .	H .	M .	S u n : S i g n . G r.		M o n : S i g n . G r.		d /	G r.	H .		D i g .	
					I	II	I	II			I	II	I	II
P a r i s.			1 6	3 6	3	2 4	4 2	3 1	2 0	0 3	0 0	6 0	0 0	
P h il .			1 6	3 6	3	2 4	5 2	3 1	3 8	e 0	7 6	0 0	1 2	5 0
P r u t.			1 6	3 6	2	5 4	5 8	3 2	1 8	e 1	0 8	0 0	3 6	0 0
R u d .			1 6	3 6	3	2 5	1 5	3 2	3 2	e 6	5 6	0 0	1 3	5 0
T y c h .			1 6	3 6	3	2 5	4 1	3 7	2 7	e 1	4 6	0 0	3 3	3 0

Eclipse 57 (April)

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c	n	D	H	M	G																G	/	G																H	g																				
e	s.	.	.	.	r.	I	II	r.	I	II	e	r.	I	II	.	I	II	.	I	II	.	I																																						
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A			9	2																															e	2	3			0	4	0																		
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D			9	2	A	9	3	L	1	1	d	3	4			0	7	2																																										
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P			9	2	2	9	2	2	1	4	e	6	2			0	1	0																																										
a					5	3			0	3	5	0			0																3																													
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Eclipse 58 (February)

S o u r c e	M D H M G	S i g n ·	M o n n : S i g n ·	G I II	G I II	d /	G I II	H I II	D i g I
O b s e r v e t.	1 1 6								1
	0 8								1
									3
									0
D a n ·	1 7	P i s e s 2	3 0	V i r o 2	3 4	d 1 2	0 2	4	
	8		2		0 0	0	0	0	
L a n s.	1 1 2	2 2 2	2 2 2	2 2 2	9 8	d 0 1	0 0	4 1	
	0 7 3		8 8		8	9		0 1	
								2 4	
P a r i s.	1 7	2 3 2	2 4 3	2 4 3	e 8 1	0 1	0	0	
	8		2 4		0 4	0	7		

S o u r c e	M e n s.	D .	H .	M .	S u n : S i g n .		M o n : S i g n .		d /	G r. I II		H .		D i g .	
					r. I	II	r. I	II		r. I	II	r. I	II		
P h il .		1 8	6	2	3 3	3 0	2 9	3 7	1 5	4 7	0	1 2	5 0		
P r u t. R u d .		1 8	6	1	4 3	4 6	1 8	5 6	e 2	1 5	0	5 1	0 0	1 5 5	
T y c h .		1 8	6	2	3 2	3 7	2 9	2 7	d 3	0 0	0	6	0	1 2 3 2	

Eclipse 59 (August)

S o u r c e	M D H M G	S i g n ·	M G	M		S i g n ·	S i g n ·	d /	G G	H	D i g n ·
				I	II						
O b s e r v · t. s t. v e t.	A 6 7 3 7										T o t a l.
D a n ·	7 3 7	L e o 2 3	1 2 5	1 5	A q u a r i u s 2 3	8 4 0	d 4 0	0 8 0			
L a n s.	6 6 5 8	2 3 1	2 1 2	5 2 3	2 3 1	5 8	e 0 6	0 0 1 1			3 3

Eclipse 60 (January)

										M																			
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										I		I		e		r		I		I									
										II		II		e		r		II		·		I		II		·		I	
O	I	3	1	5											T														
b	a	0	7	6											o														
s	n											t																	
e	u											a																	
r	a											l.																	
v	r.																												
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	v																												
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	t.																												
A		1	5											e	0	0													
tl		7	6											x															
.												a																	
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												t																	
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D		3	1	5	A	1	3	L	1	3	d	1	0		0	2	0												
a		0	7	6	q	1	0	e	0	0																			
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S o u r c e	M D H M G r. I II	D H M G r. I II	S i g n · G r. I II	M o n n · G r. I II	S i g n · G r. I II	d /	G r. I II	H r. I II	D i g n · I II		
										2	1
P a r i s.	3 0	1 7	5 6	2 1	1 1	5 7	2 1	2 7	e 5 3 0	1 0	3 7
P h il ·		1 7	5 6	2 1	1 1	3 3	2 1	2 5	e 4 3	1 3	0 8 5 0
P r u t.		1 7	5 6	2 0	3 3	2 0	2 0	5 6	e 4 3	2 0	0 4 0 7 1 3
R u d ·		1 7	5 6	2 1	1 2	1 4	2 1	1 6	e 4 4	3 3	0 9 6
T y c h ·		1 7	5 6	2 1	1 1	5 8	2 0	1 4	e 3 8	0 0	0 6 0 1 6 3 8

[Heading spanning the full width of the table:] From here onward the dates are reckoned in the Gregorian style, since the eclipses fall after the year 1600.
 [Dies Deinceps notabuntur stylo Gregoriano; cum Eclipses cadent post Annum 1600.]

Eclipse 63 (December)

																M										
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r	e															.	.	d	i							
c	n	D	H	M	G											G	/	G	H	g						
e	s.	.	.	.	r.	I	II	r.	I	II	e	r.	I	II	.	I	II	.	I							
O	D	9	6	d																					1	
b	e			i																						0
s	c			v																						3
e	e			e																						6
r	m			r																						
v	b			s																						
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A		9	6	1											d	0	3		0	1	0	1				
tl				2													0					0				
.																			5							
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L		9	6	1	S	4	1	G	4	6	d	0	6		0	0	1	1								
a				2	a	5	2	e	5														2	0		
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S o u r c e	M D H M G r.	D . . .	H . . .	M . . .	G r.	I I	II	M o n n : : S i g n . . G r.	S o n n : : S i g n . . G r.	d /	G r.	I I	H . . .	I I	II	D i g i t s		
																	e s.	.
P			1	3	2	4	1	3	4	2	e	4	0		0	8	0	8
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t.																		
R			1	3	3	9	5	3	1	1	e	0	1		0	0	2	
u			2	2			6		0	1			4				8	
d																		
.																		
T			1	3	3	8	3	3	5	3	d	4	0		0	8	0	7
y			2	2			4			4								4
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Parsing notes (whole batch):

- The table's seven major column-groups are as described at the head of this batch. Within the "Differentia" group the d/e marker (*defectus / excessus*) is carried in its own column and transcribed verbatim; where the source prints *exacte* (exactly) in place of a d/e marker, that word is retained.
- In eclipses 56–66 the engraver frequently sets the "Difference" degrees-and-minutes pair shifted one column to the left (so a value like 11 30 reads as Gr.=11, I=30 with the seconds cell blank); I have transcribed the digits as positioned and left the seconds cell blank where the source leaves it blank. These layout shifts are characteristic of the dense lower-page setting and are not numerical anomalies in themselves.

- Several "Sun's place" / "Moon's place" sub-rows are blank in the source (the engraver supplied only the difference, magnitude, or time). Blanks are preserved.
- Zodiac sign glyphs at the head of each computed-place block are rendered by their English sign names (Aries, Taurus, ...); the Sun's sign and the Moon's sign are opposite, as expected at a lunar eclipse (opposition).
- Eclipse numbering skips 39, 51, 52, 61, 62, 64, 65 within this batch's range — the sequence printed is 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 53, 54, 55, 56, 57, 58, 59, 60, 63, 66. The gaps reflect eclipses Riccioli did not tabulate here (cf. Caput II catalog); they are a feature of the source, not omissions in transcription.
- Eclipse 38: the Tychonic sub-row is present (with repeated date) but the engraver left the place and difference cells blank.
- Page 121 ("*Phil.*" catchword) opens with the tail of eclipse 55, continued from the foot of page 120; the two halves are presented under a single "Eclipse 55 (continued)" rubric above.

This batch continues the eclipse-versus-tables comparison table of **Caput VI** without interruption — the table runs across all three pages with no intervening prose. Catchword "67" carries over from the prior batch.

Table structure (repeated across all three pages). For each eclipse (numbered in the *Ordo Eclipsium* column, keyed to Cap. 2 of this Book), the first sub-row labelled *Observ.* gives the observed data, and each following sub-row gives the values computed from one astronomical table-set (Atl. = Atlantic; Lansb. = Lansbergian [Philip Lansberge]; Phil. = Philolaic [Boulliau]; Prut. = Prutenic; Rud./Rudol. = Rudolphine [Kepler]; Tych. = Tychonic [Tycho Brahe]; Dan. = Danish [Longomontanus]). The column groups are:

- **Ordo Eclips. cap. 2** — eclipse number (cross-reference to Cap. 2).
- **Observ. & Tab. Astron.** — "Observation," or the table-set whose computation is given on that row.
- **Tempus Apparens post Merid. in loco Observationis** — apparent time after noon at the place of observation: *Mens.* (month) | *D.* (day) | *H.* (hour) | *M.* (minute).
- **Solis locus Verus ex Tab. & inde locus** ☉ ☌ — the Sun's true place from the tables, and thence the place of the [lunar] opposition: *Sig.* (zodiac sign glyph) | *Gr.* (degree) | ' | ''.
- **Lunæ locus ex Tabul. computatus** — the Moon's place computed from the tables: *Sig.* | *Gr.* | ' | ''.

- **Differ. loci computati & observata** — difference between computed and observed place, marked *d* (*defectus*, deficiency) or *e* (*excessus*, excess): *Gr.* | ' | ''.
- **Tempus huius Differentiæ** — time corresponding to that difference: *H.* | ' | ''.
- **Quātit. in Digit. & min.** — magnitude of the eclipse: *Dig.* (digits) | ' (minutes).

Where the *Observ.* row carries the sign glyph for the whole eclipse block, the sign glyph heads the block (per the book's convention). "exacte" in the difference column means the computed and observed places agree exactly. Time-values are reckoned after noon (so hour-values may exceed 12), and the doubled-prime notation is the source's own; neither is a numerical impossibility.

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		2		4	1	6	3	5	1		6	5		2	0		
3	8	1		1	1	3	1	5	5	d	1	3	0	3	1		
		2		4	0	3	3	1	8		8	5		7	0		
3	8	1		1	3	9	1	4	9	e	9	0	0	1	0	1	5
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Parsing notes (folio 123): On this page the *Tempus huius Differentiæ* group is frequently printed with only two of its three sub-columns filled (the seconds column often blank), and on some rows the time value (e.g. "5 35", "6 10") sits in the H. and ' columns with the " column empty; I have aligned these to H./ accordingly. The eclipse numbering jumps from 89 to 92 (eclipses 90 and 91 are absent) — consistent with the work's stated feature that some eclipse numbers are skipped. Eclipse 82's *Quātit.* reads "1 vix" (scarcely 1 digit). Sign glyph for

eclipse 92's Prutenic Sun is □ (the value 29°45' places it in the prior sign, Aquarius, by the source).

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Parsing notes (folio 124): For eclipse 97 Prutenic, the *Tempus huius Differentiæ* reads "60 26" in the H./' columns — the "60" in the hour column is anomalous in context (see Numerical impossibles); transcribed as printed. Eclipse 104 carries an unusually full block, with both Danish (Dan.) and Lansbergian (Lanf.) rows present alongside the Atlantic "exactè." The numbering skips 94 (93 → 95) and 101 (100 → 102) — consistent with the skipped-eclipse-number feature. Several seconds-columns in the *Tempus* group are left blank as printed; values aligned to H./'.

Liber II — De Luna (continued)

Caput VI (continued): Comparison of Lunar Eclipse Observations against the Tables

The comparison table continues from eclipse 105 onward. The column headings are:

- **Ordo Eclips. cap. 2.** — Order of the eclipse (Cap. 2)
- **Observ. & Tab. Astron.** — Observation, and astronomical tables
- **Tempus Apparens post Merid. in loco Observationis** (Mens. / D. / H. / M.) — Apparent time after noon at the place of observation (Month / Day / Hour / Minute)
- **Solis locus Verus ex Tab. & inde locus ☿ & ♀** (Sig. Gr. / ' / ") — The Sun's true place from the tables, and thence the place of the node (☿ descending, ♀ ascending) (Sign, Degree / minutes / seconds)
- **Lunæ locus ex Tabul. computatus** (Sig. Gr. / ' / ") — The Moon's place computed from the tables (Sign, Degree / minutes / seconds)
- **Differ. loci computata, & observata** (Gr. / ' / ") — The difference of place, computed versus observed (Degrees / minutes / seconds)
- **Tempus huius Differentiæ** (H. / ' / ") — The time corresponding to this difference (Hours / minutes / seconds)
- **Quantit. in Digit. & min.** (Dig. / ') — Magnitude in digits and minutes

The leftmost rows of each block are: **Observ.** (the observation itself); **Dan.** (Danish, Longomontanus); **Lansb.** (Lansbergian); **Phil.** (Philolaic, Boulliau); **Prut.** (Prutenic); **Rud.** (Rudolphine, Kepler); **Tych.** (Tyconic). The *defectus* (d) / *excessus* (e) markers are preserved as printed.

Parsing notes: This is a citation-grade comparison table. The "Tempus Apparens" columns (Month / Day / Hour / Minute) are stated once per eclipse on the Observ. row and repeated (Hour/Minute) down each table-row. Where a cell is blank in the source it is left blank below. Zodiac signs are given as printed symbols. The d/e markers belong to the "Differ. loci" block.

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[At the foot of folio 125 the body text of the preceding page's discussion is partly visible in the gutter, very degraded and largely cut off — only fragments such as "Eclipsium ... vt vocat Cap. V ..." and "Tabulae ... Cap. V. ... Commentaria ..." are recoverable; this prose belongs to the bottom of the page and is too cropped to transcribe reliably. [?]]

Caput VII (folio 126, PDF p. 158)

CAPVT VII.

On the Excellence of the Astronomical Tables, and a Comparison among Them, drawn from the Observations of Lunar Eclipses. Wherein certain notable Conclusions are established.

I. Conclusion. None of the astronomical tables thus far named agree with all the observations of lunar eclipses; many of them with very few. This is plain from what I set out in Cap. V and Cap. VI. For in Cap. V, from no. 16 onward, I showed that the astronomical tables fall short — in representing the lunar eclipses of Ptolemy's age, going back to the years before Christ 747, exactly as they ought, place by place and digit by digit — by about twelve degrees in the Moon's place.

From this we may infer, as a corollary, that those tables cannot, without error, be used to project lunar eclipses more than about fourteen centuries back, that is, as many as have elapsed between the time of Ptolemy and the more recent compilers of tables.

[Margin: Corollarium. — Corollary.]

II. Conclusion. None of the tables already named are supported by all the observations of lunar eclipses; nor are there any that some observations do not contradict. This too is clear from a careful reading of the catalogue in Cap. VI, and now, as a particular advantage, from the tally of the individual tables in favor of each — which I shall set out, leading to the Conclusion that follows.

III. Conclusion. Standing on the bare comparison of eclipse observations — taking together both the time and the magnitude of the eclipse computed from the tables — the **Lansbergian** and **Atlantic** tables would seem preferable to all the rest, then the **Tychonic**, then the **Philolaic**; with the **Danish** and **Prutenic** following last, and last of all the **Alphonsine**. For if, from the catalogue set out above, we tally the eclipses, the Alphonsine tables are supported by 1; the Parisian by 3; the Danish by 6; the Prutenic by 6; the Philolaic by 12; the Atlantic by 15; the Rudolphine by 19; the Tychonic by 13; and the Lansbergian by 19. These are ordered in the table written below.

Tally table (folio 126)

Suffragantur (Tables favored)	Eclipses (from Cap. V & VI)	Summa (Total)
Alphonsinis	27.	1
Parisinis	20. 23. 48.	3
Danicis	13. 40. 42. 50. 77. 103.	6
Prutenicis	68. 72. 83. 85. 101. 103.	6
Philolaicis	10. 15. 19. 29. 46. 76. 81. 86. 95. 110. 117. 118.	12
Atlanticis	49. 60. 63. 67. 69. 70. 74. 75. 87. 93. 96. 97. 100. 104.	15
Rudolphinis	2. 4. 5. 16. 18. 26. 32. 34. 53. 17. 18. 26. 32.	19

Suffragantur (Tables favored)	Eclipses (from Cap. V & VI)	Summa (Total)
	34. 53. 81. 82. 192. 119.	
Tychonicis	35. 41. 44. 45. 57. 71. 80. 88. 89. 98. 99. 108. 116.	13
Lansbergianis	3. 14. 16. 22. 23. 24. 33. 36. 37. 38. 47. 50. 54. 55. 56. 58. 59. 101. 107.	19

Parsing notes: This decorative-framed tally is transcribed as a pipe-table per the table rule. The numbers in the middle column are eclipse-order numbers (from the catalogue in Cap. V & VI), not coordinates. The Rudolphine row visibly repeats a run of numbers (2.4.5.16.18.26.32.34.53. then 17.18.26.32.34.53. ...) — this duplication appears in the source as printed and is preserved verbatim; the printed Summa is 19. One entry reads "192." which is likely a compositor's run-together of "19." with an adjacent figure [?]. The Tychonic Summa is printed 13 but I count 13 listed values (35.41.44.45.57.71.80.88.89.98.99.108.116.) — consistent. [See anomaly (a).]

IV. Conclusion. Yet judgment of the tables' excellence over the others cannot be passed on the bare comparison of the aforesaid observations with the tables' computation with any certainty. For just as the tables' agreement with the observations is not a sure indication of their agreement with the heavens and with the truth, so neither is the tables' disagreement from the observations a sure argument of their disagreement from the heavens and the truth. Indeed it can happen that the tables' agreement with the observations arises — in not a few cases — not from truth but from an error in transferring the time of the meridians of the observation to the meridian of the tables: a false agreement, whether because the very observation was faulty, or one out of many, or because false figures were entered (as I have noted for ourselves, and for others), or from several of the causes enumerated in Cap. IV; or at least because, among many observations of the same eclipse, that one chanced to be consonant with the heavens which least agreed with them. Hence it can still be doubted whether the discord of the tables from the observations arises from an intrinsic defect in the astronomical tables — namely from a false mean motion of the luminaries and of the anomaly, or from the eccentricity and prosthaphaeresis founded upon it, or

from the form of geometric hypotheses (circular or elliptical) assumed in it. Or indeed from an extrinsic defect in the construction of the equations. Or, on the other hand, from an extrinsic defect — from the geographical distance of meridians wrongly assumed. Or, finally, from a defect in the observation itself.

[Margin: 3 (i.e., third margin-note marker on the page); the marginal Arabic figures 1, 2, 3, 4 run down the right column keying the numbered points of the discussion.]

It is worth the effort, then, to discuss the three above-named sources of disagreement between the tables and the eclipse observations — to treat each one a little, and to apply them to certain tables, by establishing the **distance of meridians** as my starting point.

The distance of the meridians, that is, the difference of longitude, which I have used in the Tyconic, Rudolphine, and Philolaic calculation, is the very same I reviewed in Cap. I; and I took it from my *Geographia Reformata*, relying on certain eclipses and on the intervals of journeys, so that I scarcely suspect it of even the smallest error. But the distance which Lansberge and Wendelinus [Govaert Wendelen] used in their computations I judge not so certain, and in some places perceptibly false. Therefore, for the eclipses computed by the aforesaid authors from the Philolaic tables, I judge a greater disagreement and the incurring of a larger error — and, conversely, somewhat less — than would otherwise be the case.

Let the example be, first, from Lansberge, who supposes Aracta [Arak] to be more easterly than Goesa [Goa?] by 5 hours; whereas in our ordering, which Lansberge has in his *Thesaurus* at 14, the difference is greater [?]. From his own tables computing, he finds Goesa at hour 4. 27', with the Sun apparently at the 3rd degree 53'. 43" of Leo, and the Moon at the 3rd degree 53'. 43" of Aquarius; and thus he most exactly determines the moment of opposition of the luminaries, nothing further. He pushes his own tables to that observation, that they may differ thus far: namely Aracta the more easterly than Bologna by 2 hours 12', and Aracta to Goesa by 31'; and so much from Goesa, by 5 hours; so that the whole comes to only 1 hour 43' — but minutes of hours rather, the nearer Aracta and Goesa are to each other, than Lansberge assumes. Wherefore, if from our distance of meridians we should repeat the Lansbergian calculation, we should repeat the Sun at the 3rd degree 15'. 31" of Leo, the Moon truly at the 1st degree 17'. 52" of Aquarius — this being a transgression of the moment of opposition by 24'. 9" of zodiacal minutes; and therefore the Lansbergian tables would exhibit

this eclipse earlier by 24' of time than the observation of Albategnius [al-Battānī] proves.

[Margin: the marginal Arabic numeral "4" keys the next point.]

Similarly Wendelinus supposes Hercam [?], his native land, to be more westerly than Huenna [Hven], and Vraniburgum [Uraniborg] by 1 hour, when as to me it is more westerly than Uraniborg by 31'. Wherefore, if his calculations in the eclipses observed at Uraniborg I repeat, I shall find a difference of six minutes in time. And if there be anyone who would not deign to recognize how much the more celebrated tables differ from the observations in time, the distance of meridians being supposed from our *Geographia Reformata*, neither would I begrudge undertaking this labor again — though it differs from the prior 19 eclipses, ancient ones in which a single table contains nearly the whole error of the day, as I showed in Cap. V. The rest I will examine by the same method, and from the other part of the computation it will be established which of the more recent tables more nearly represent the time of the observation. Contemplate, therefore, the.

Caput VII (continued): Difference-of-Time Table (folio 127, PDF p. 159)

[Continuation of the prose from the foot of folio 126:] ...the following little table, in which the Atlantic, Danish, Lansbergian, Philolaic, Rudolphine, and Tyconic tables are indicated (At. = *Atlanticas*; D. = *Danicas*; L. = *Lansbergianas*; Ph. = *Philolaicas*; R. = *Rudolphinas*; T. = *Tychonicas*), and the order of eclipses is held running leftward, while the minutes truly run rightward, and the second [column] of time, by which the tables here predicated discrepate from the time of observation, chosen according to the prior table — but the meridian-distance being supposed from our *Geographia Reformata*.

Difference-of-time table by eclipse order (folio 127)

Column headings (repeated across four sub-columns of two-column pairs): **Ordo** (eclipse order) · **Tabula** (table abbreviation: A./At. = Atlantic, D. = Danish, L. = Lansbergian, Ph. = Philolaic, R. = Rudolphine, T. = Tyconic) · ' · '' (minutes and seconds of time-difference). The table is printed in four vertical blocks; I transcribe them in reading order (left pair, then right pair).

Parsing notes: The "Tabula" cells use the abbreviations A. (At.), D., L., Ph., R., T. Each eclipse-order number spans the set of table-rows beneath it. The two numeric columns are minutes (') and seconds ('') of the time-discrepancy. Several

second-column zeros and small values are faint; flagged where uncertain. The leftmost two blocks are on the left half of the page, the rightmost two on the right half.

Left block A (Ordo 22–43)

Ordo	Tabula	'	"
22	L.	44	0
	Ph.	21	25
	R.	1	40
23	L.	40	18
	Ph.	13	20
	R.	6	50
24	L.	2	12
	Ph.	13	40
	R.	8	20
26	Ph.	25	28
	R.	6	45
29	L.	4	45
	Ph.	0	32
	R.	0	46
32	Ph.	43	45
	R.	29	10
33	L.	5	19
	Ph.	13	20
	R.	13	20
35	L.	23	42
	Ph.	41	5
	R.	13	0
	T.	2	14
36	L.	16	20
	Ph.	1	40
	R.	24	5
	T.	19	30

Ordo	Tabula	'	"
37	L.	15	2
	Ph.	16	40
	R.	20	5
	T.	15	0
38	L.	0	18
	Ph.	24	0
	R.	0	10
	T.	2	15
40	D.	2	0
	Ph.	18	50
	R.	18	18
	T.	9	30
41	D.	5	20
	Ph.	2	15
	R.	3	50
	T.	1	40
42	D.	9	40
	Ph.	27	44
	R.	18	0
	T.	10	12
43	D.	2	40
	Ph.	6	30
	R.	0	24
	T.	6	30

Left block B (Ordo 44–56)

Ordo	Tabula	'	"
44	D.	4	30
	Ph.	8	20
	R.	5	30
	T.	0	52
45	D.	60	0

Ordo	Tabula	'	"
	L.	14	30
	Ph.	13	10
	R.	11	35
	T.	0	50
46	D.	5	40
	Ph.	2	40
	R.	4	40
	T.	3	0
47	A.	17	0
	D.	6	40
	L.	14	0
	Ph.	1	58
	R.	11	2
	T.	2	12
48	At.	23	0
	D.	3	20
	Ph.	14	0
	R.	19	30
	T.	19	10
49	D.	6	8
	Ph.	7	20
	R.	20	15
	T.	4	0
50	D.	2	0
	L.	15	30
	Ph.	8	34
	R.	7	6
	T.	1	25
53	At.	6	0
	L.	11	29
	Ph.	8	35

Ordo	Tabula	'	"
	R.	7	6
	T.	3	25
54	D.	0	30
	L.	14	45
	Ph.	10	30
	R.	2	24
	T.	0	22
55	At.	3	0
	D.	4	0
	L.	15	0
	Ph.	2	5
	R.	13	4
	T.	6	20
56	D.	53	0
	L.	15	0
	Ph.	12	50
	R.	13	50
	T.	3	30

Right block C (Ordo 57–76)

Ordo	Tabula	'	"
57	A.	48	0
	D.	7	20
	R.	14	15
	R.	8	25
	T.	4	0
59	D.	18	0
	L.	3	10
	Ph.	14	5
	R.	8	8
	T.	1	0
60	A.	5	0

Ordo	Tabula	'	"
	D.	2	0
	Ph.	8	50
	R.	9	6
	T.	2	0
63	A.	1	0
	L.	0	30
	Ph.	4	0
	R.	5	38
	T.	0	0
66	A.	24	0
	L.	6	0
	Ph.	10	0
	R.	0	28
	T.	7	0
67	At.	2	0
	L.	7	0
	Ph.	4	15
	R.	4	54
	T.	8	0
68	L.	36	0
	Ph.	22	30
	R.	37	30
	T.	39	0
69	At.	0	0
	L.	15	0
	Ph.	7	0
	R.	0	8
	T.	2	0
70	A.	1	0
	Ph.	7	40
	R.	0	12

Ordo	Tabula	'	"
	T.	3	34
71	L.	6	0
	Ph.	1	11
	R.	1	25
	T.	3	0
72	D.	4	25
	Ph.	12	43
	R.	12	30
	T.	10	0
74	A.	1	0
	Ph.	8	4
	R.	8	10
	T.	24	0
75	D.	0	0
	Ph.	6	12
	R.	0	10
	T.	0	0
76	Ph.	15	10
	R.	18	30
	T.	15	0

Right block D (Ordo 77–98)

Ordo	Tabula	'	"
77	D.	1	10
	Ph.	8	0
	R.	10	12
	T.	9	0
80	Ph.	5	35
	R.	6	0
	T.	11	0
81	Ph.	6	10
	R.	5	50

Ordo	Tabula	'	"
	T.	12	0
82	R.	2	0
	R.	2	4
	T.	2	0
83	Ph.	9	44
	R.	21	2
	T.	10	0
84	At.	0	0
	Ph.	2	35
	R.	6	10
	T.	0	0
85	Ph.	18	50
	R.	24	24
	T.	21	0
86	Ph.	0	58
	R.	4	0
	T.	11	0
87	At.	2	0
	R.	30	55
	R.	34	45
	T.	24	0
88	Ph.	13	25
	R.	8	0
	T.	3	0
89	Ph.	13	30
	R.	11	20
	T.	2	0
92	Ph.	7	50
	R.	0	12
	T.	3	34
93	At.	2	0

Ordo	Tabula	'	"
	R.	16	0
	T.	9	0
95	Ph.	1	15
	R.	3	8
	T.	7	30
96	At.	5	0
	Ph.	22	40
	R.	16	0
	T.	22	0
97	At.	0	0
	Ph.	21	12
	R.	33	30
	T.	21	0
98	Ph.	5	25
	R.	20	2
	T.	6	0

Liber II — De Luna

Caput VII (continued)

Difference-of-time table (continued, Ordo 99 onward)

The table continues from the prior batch (catchword "99."). It lists, for each eclipse (by *Ordo*), the residual time-discrepancy (columns I and II, in minutes ' and seconds ") for each set of tables: D. = Danish [*Astronomia Danica*, Longomontanus], Ph. = Philolaic [Boulliau], R. = Rudolphine [Kepler], T. = Tychonic [Tycho Brahe], At. = Atlantic [Riccioli's own], A. = Alphonsine, L. = Lansbergian [Lansberge]. The page is laid out in two columns of table-blocks.

Left column (Ordo 99–106):

Ordo	Tabula	I (')	II (")
99	Ph.	7	41
99	R.	2	49

Ordo	Tabula	I (')	II (")
99	T.	11	0
100	A.	[?]	[?]
100	R.	9	35
100	R.	7	27
100	T.	3	4
101	Ph.	17	15
101	R.	10	24
101	T.	17	0
103	D.	12	0
103	L.	30	21
103	Ph.	7	4
103	R.	1	40
104	At.	0	0
104	D.	10	0
104	L.	14	0
104	Ph.	5	52
104	R.	1	40
104	T.	0	5
105	D.	19	0
105	L.	8	0
105	Ph.	15	10
105	R.	10	16
105	T.	3	0
106	D.	4	0
106	Ph.	7	29
106	R.	8	0
106	T.	0	0

Right column (Ordo 107–119):

Ordo	Tabula	I (')	II (")
107	D.	9	0

Ordo	Tabula	I (')	II (")
107	L.	4	0
107	Ph.	10	30
107	R.	6	16
107	T.	6	0
108	D.	28	0
108	L.	28	0
108	Ph.	21	40
108	R.	16	40
108	T.	0	0
110	D.	14	0
110	L.	2	18
110	Ph.	11	50
110	R.	9	48
117	D.	14	0
117	L.	24	0
117	Ph.	6	0
117	R.	0	0
117	T.	0	0
118	D.	26	0
118	L.	19	0
118	Ph.	3	30
118	R.	1	30
118	T.	6	35
119	D.	2	18
119	Ph.	1	21
119	R.	1	11
119	T.	3	20

Parsing notes: The body of the table prints only single-letter/abbreviated tables and two numeric columns (minutes, seconds) per Ordo block. Skipped Ordo numbers (102, 109, 111–116) are a source feature, consistent with the skipped-eclipse-number pattern. Ordo 100's first row (A. = Alphonsine) is partly ink-faded

in the gutter region and both numeric cells are unreadable — flagged [?]. Ordo 100 prints two consecutive "R." rows as shown; whether the first should read a different abbreviation could not be confirmed from the scan.

It is therefore clear from this comparison that the Tychonic tables deserve first place; next the Philolaic; after these the Atlantic; then the Rudolphine succeed; and the Danish; and finally the Lansbergian, which held first place in the earlier comparison — could not in this one keep that position. For the said tables are corroborated by the eclipses noted below.

[Margin: 5]

Another source and cause of the discrepancy could be, as we have said, the very fallaciousness of the observations, owing to the four causes noted above in Chapter Four. For sometimes the discrepancy is so great that its whole cause cannot be assigned to a false reckoning of the meridian-distance. Take as an example Eclipse 32, observed at Nuremberg by Bernhard Walther [Walther] in the year 1487 on the 7th of February, at hour 5' 47" past noon by the clock — that is, at Wraniburg [Uraniborg], by the Rudolphine and Philolaic tables, at hour 13' 51"; yet by the Philolaic tables it appears at hour 16' 3". At that moment the Philolaic tables show the Moon already past the place of opposition by minutes 19' 53"; the Rudolphine, by 13' 4". The Opposition of the Moon with the Sun would therefore have occurred more swiftly by 39' 45" by Philolaic reckoning than by Rudolphine — I say "more swiftly" than Walther noted. This great a discrepancy cannot be ascribed by any expert astronomer to geography — that is, the whole of it cannot be thrown back upon the distance of the meridians, which in the Rudolphine and Philolaic tables is 4' of time; for if 4' is the very least minimum of all that others have assumed, who set Nuremberg west of Uraniborg by 5' — the Danish and Parisian tables by minutes 5', Nor[th] by 8'; the Atlantic by 9'; the Lansbergian by 12'; and Tycho (Tom. 1, Progymn. p. 51) by nearly a quadrant of an hour, that is, 15'.

Therefore, if the time is referred from the meridian of Nuremberg to Uraniborg, following the opinion of others, the start of the reckoning would have been later, and again the Moon would have been farther advanced and grown larger; and the discrepancy of time — to me at least it would have been 43' Philolaic minutes against 30' Rudolphine — is so far from being removed, that, in order to reconcile the meridian-distance of these places with the said tables, prudent judgment rejects a great part of the discrepancy. Indeed, the observation itself appears very doubtful from Walther's own narrative, where he says: "In the year 1487, on the 8th of February, I observed the eclipse of the Moon at about the second hour past

midnight, beginning in the early morning; and while the Moon was eclipsing, the Sun's Nadir was at an altitude of 29 degrees, at the middle of the eclipse; but at that time the clock indicated three hours and 47'. And at the end of the whole observation I obtained the Sun's altitude at 24 degrees, the clock at 4 hours and 18'. The end of the eclipse was after midnight by 5' 20', past the middle hour, and so forth." Examining the time from the altitudes, and comparing them: at the middle time of the eclipse, between the Lion's Heart [Cor Leonis, Regulus] and the Sun's Nadir, there were 35 degrees; thus the Moon's latitude had been southern. Likewise the true place of the Sun's Nadir at the middle time of the eclipse ought, by calculation, to have had sign Aquarius 28°, 39' 44" — but the arc between the Lion's Heart and the Sun's Nadir was gr. 5° 24'; and within this very place of the heart it would have been at sign 4° gr. 23° 15' 44", but only so much, not so much. Thus that excellent old man, who freely admits he was not so confident in his own foresight, and dares to doubt it, brings the matter into question. He could then, by reason of the shadow's vapors, have been deceived at the beginning, and at the end, since the eclipse's beginning was perhaps not noted to the second; but at the end indeed, and at the beginning, it yields the middle at hour 3' 40" past midnight, by 3' 47", and by the clock we noted. Therefore, when everything is reckoned, the middle of this eclipse would probably have been 20' and more swifter than Walther computed at the outset, and so on. As for the rest of the discrepancy, let it be referred back to the tables themselves, meanwhile, if the following conclusion holds:

V. Conclusio. The whole discrepancy between the astronomical tables and the observations of the foregoing eclipses cannot always be ascribed to a false meridian-distance assumed in computing the eclipse; rather, it must be ascribed either in part to a fault of the observation, or of the tables, or of both at once.

Eclipses not faithfully or not concordantly reported.

[Eclipses non fideliter, vel non concorditer relatæ.]

[Margin: 7]

This has already been proved by a single example in the foregoing — that is, from number 1, and we will show it in many more; but what pertains to the faults of the observations — whether faults of execution, or faults disfigured by the writers — provides no slight indications, which it is not without value to point out.

Eclipse 29. Lansberge, in his *Thesaurus Observationum Lunarium*, Classis 1, Eclipse 17, having followed Regiomontanus, notes that the eclipse occurred at

Viterbo at hour 14' 48" past noon. But from the truer place of the fixed stars, as we narrated in Chapter 2, we find the hour to have been 14' 37"; and so, by this account, the difference of Right Ascension and Declination of the Eagle [Aquila], which Regiomontanus used, makes the time of the observation labor under an error of eleven minutes.

[Margin: Regiomontani hallucinatio. — Regiomontanus's error.]

[Margin: Lansbergii hallucinatio. — Lansberge's error.]

Eclipse 35. Copernicus, *De Revolutionibus* lib. 4, cap. 13, says that the eclipse he observed was seen at Cracow after midday at the equinoctial hours 11, and three-fifths of one hour — that is, at minutes 36'; at Lansberge in the *Thesaurus Observationum Lunarium*, Classis 1, Eclipse 19. From the same book of Copernicus, and from the very chapter, he asserts the observation was made at Cracow after midday at hour 11' 45" — namely at three-quarters of one hour — and lest you think it a typographical error, he adds further that it was at the time apparent at Goss[au] [Frombork], hour 10' 23"; this agrees with the difference of longitude which Lansberge sets, in his *Catalogus Urbium*, between Goss[au] and Cracow — namely, hour 1' 22". Therefore, either by a slip of the imagination, or by an error of memory, he used the three-quarters for three-fifths of an hour, and exceeded it by 9' in noting the moment of the observation.

Longomontanus likewise reckoned many eclipses otherwise than Tycho, as is evident from his *Catalogus*, Chapter 2 and 3, of which this is the synopsis:

Ordo Eclips.	Tycho H.	Tycho '	Longomont anus H.	Longomont anus '
41	11	32	11	25
44	13	17	13	24
46	9	58	10	0
47	16	57	17	0
48	13	8	13	9
49	9	16	9	30
50	14	48	15	2
53	6	55	7	0
55	19	26	19	16
56	16	36	16	30
57	9	29	9	25

Ordo Eclips.	Tycho H.	Tycho '	Longomont anus H.	Longomont anus '
59	7	26	7	37
60	13	56	13	56

Parsing notes: The table has four numeric columns under two named astronomers (Tycho: H. = hours, ' = minutes; Longomontanus: H., '). All cells read cleanly.

But not even Tycho himself is consistent with himself in reporting the moments of eclipses, as in Eclipse 48.

Eclipses determined by mere conjecture.

[Eclipses ex mera coniectura determinatæ.]

[Margin: 8]

Sometimes, too, the moment of an eclipse is found noted as a maximum, or as a middle, not by the phases of mere observation, but from a single phase — whether from the beginning alone, or the end — from which the middle has been deduced by mere conjecture, or by some hypothesis not sufficiently certain. Thus Ptolemy, in the first eclipse observed at Chaldea [Babylon], adds two whole hours, reckoning the total eclipse to have lasted hour 11' 45" past midday — namely three-quarters of one hour — and lest the total eclipse be reckoned to have lasted to the third initial observation at Babylon, that it might obtain the middle, since he supposed it to be by mere conjecture. 1. The eclipse lasted 6 digits, the total lasting hour 3', nearly. He reckons the eclipse's quarter to have begun by being observed at Babylon, adding hour 1'. He determined the middle. He reckoned the eclipse of three digits to have lasted hour 2'. Moreover, Eclipse 8. He determined the middle moment partly from the beginning, partly from the end, hour 1' 30"; and what he reckoned the small eclipse to have lasted was no more than hour 1' 30", nearly — and so Petavius [Petau], lib. 8, *De Doctrina Temporum*, thought worthy of particular examination. Again, Eclipse 10. He deduced the middle from mere observation handed down at the beginning, and from his own opinion thereupon, by which he supposed the total eclipses to last hour 4', nearly; thence adding hour 2' to the beginning, he set the middle, hour 4'. But Petavius, lib. 8, *De Doctrina Temporum*, p. 812, denies that this eclipse could have lasted beyond hour 5' 48"; and so he taxes Ptolemy's annotation as a [Greek: ἀλόγηρον (alogēron?, "without reckoning" — unreasoned) [?]], as we noted in the earlier *Catalogus*, Chapter 1. See the passages of Ptolemy there indicated.

Tycho too seems to have affirmed the middle from sole conjecture, as in Eclipse 42, whose end Wendelin [Vendelinus, Govaert Wendelen] disputed; and likewise, concerning Eclipse 47 and 57, with the initial middle defined by Tycho, he speaks thus: "That middle of Tycho's, indeed not seen by his own observation, but obtruded by his conjecture and calculation: for he was able to see only its beginning; the Immersion, the Emersion, he was not able [to see]; the End he was not able [to see], because all these things happened after the setting of the Moon; and so on." And elsewhere he writes thus: "(This eclipse was at least so observed, that the Moon, half-eclipsed, had entered the shadows before she set.) Nothing certain, therefore, is to be had from these assertions of Tycho." Thus far Wendelin, who, as also concerning Eclipse 17, follows the middle of the eclipse as defined by Tycho to Tycho's [conclusion]; and at the end of the eclipse he asserts, with Tycho mediating, hour 8' 16", the Moon's middle determined boldly, since he had been able to perceive nothing beyond the beginning at Uraniborg [Huenna]. With the Sun rising there, the Moon set; he says these tables had that middle at hour 8' 44" at Wraniburg [Uraniborg]. And of Eclipse 69, he says that produced from Lansberge by calculation rather than by observation, while from the observation, I say, he speaks; the end of which is not seen by himself, he could not have so established it. But Lansberge perhaps noted the immediate middle from the maximum of the eclipse, 8 digits.

The remaining indications of eclipses not accurately observed.

[Eclipsium non accurate observatarum reliqua indicia.]

[Margin: 9]

As often as the observers themselves confess that they used poor instruments — as we have not seldom indicated in the history of Chapter 2 — or that their observation differs greatly from the observation of others of no less faith and diligence among the Authors, then it is in some measure probable that there is a fault in the observation. Thus in Eclipse 43: Tycho's middle is asserted to be fallacious, as we noted concerning the Tyconic eclipse, from the observation of others. Likewise in Eclipses 16 and 56, which is the Tyconic — Eclipse 16 from the Hercanian [?] observation is refuted on account of a discrepancy of 23'. Tycho exposes a great discrepancy of observation in Eclipse 80, of which Wendelin treats on page 83 of his *Eclipses*; and in Eclipse 98, of which on the same page 101; and in Eclipse 106, of which I have spoken — concerning which, in Chapter 4 at the end, he gives the reason on account of our observation, which we preferred to the Wendelinian.

Eclipses whose discrepancy between observations and tables must be ascribed in part to a fault of the tables.

[Eclipses quarum dissidium inter Observationes, ac Tabulas necesse est ex parte adscribere vitio Tabularum.]

[Margin: 10]

There are four indications of some latent fault in the astronomical tables, when they differ greatly from observation. The first is, that the eclipse was very long, and therefore of very brief duration; as were Eclipses 8 and 82 and 89: in these the middle could not have erred by mere conjecture, with few intervening. Hence, when the Prutenic tables differ from the observation of Eclipse 89 by minutes 48', it is plain they are in error in this.

The second indication is the enormous discrepancy of the tables from the observation of a single observer — though it be reliable — if the middle, or the immediate maximum or the partial beginning, was deduced from a clearly noted observation; for then beyond half a tenth-part [?] it is improbable, as in Eclipse 9, 11, 13, and 14, which Ptolemy did not establish from conjecture, but at once both from the beginning and from the middle, with this annotation handed down: that in these (I say, in the others) similar [discrepancies], the tables being absent from observation beyond half a tenth of an hour [?] — let no one with little doubt convene that they are vicious, the meridian-distance being excluded, if they were not brought together into a part of the discrepancy.

The third indication is the closer consensus of several observations of the same eclipse, recalled to the same meridian, of which kind is Eclipse 48 in particular, which Wendelin's tables resist, and so the consensus of the other observers favors the Tyconic rather; and Eclipses 63, 71, 86, 88, 89, 92, 93, 95, 96, 102, 103, 104.

The fourth indication is, unless the meridian-distance manifests a fault in the tables, if they could in no way have observed the eclipse in the horizon, when nevertheless these eclipses are worthy of being observed: such is Eclipse 8, which Petavius, weighing it in lib. 8 of *De Doctrina Temporum* p. 799, shows could very least have been seen at Babylon, if the calculation drawn from the Alphonsine, Ptolemaic, Prutenic, or Danish tables be attended to.

Caput VII (Conclusions VI–VIII)

VI. Conclusio. From the inspected goodness of the astronomical tables within certain limits, if some eclipse-observations differ too much from the tables, a probable judgment can be made of some fault of the observation. For when in many observations of the observers, by a close consensus, the tables agree within a few scruples, the tables are nevertheless not the best for every age — and so certain limits are established within which the whole error of the observations is contained as possible. Therefore, these things being established, if some eclipse-observations differ from the tables beyond those limits, it is probable that that excess proceeds from some fault of the observations, or from a less accurate, or less faithfully recorded one.

[Margin: 11]

Now, gathering up the earlier *Catalogus* of Chapter VI and beginning from the eclipses of our own age — that is, from Eclipse 63 — the discrepancy of the tables, which differs from the observation within 5', results in minutes; or at least within 10' in the eclipses subscribed below. And so, in the eclipses 31, the Tyconic tables agree with the observation within 10'.

The following is a tally-table (printed within a ruled frame, with the heading *Eclipsium Numerus pro Tabularum, & Observationum consensu* — "The number of eclipses for the consensus of tables and observations"). It is transcribed as a pipe-table below:

Tab.	Intra 10'. temp.	Intra 5'. temp.
Atlantica	12	[blank]
Danica	8	6
Lansberg.	12	6
Philol.	28	17
Rudolph.	29	17
Tychonica	31	17

Parsing notes: The "Intra 5'. temp." cell for *Atlantica* is blank in the source (no value printed). Heading translated: "The number of eclipses for the consensus of the tables and the observations" / column heads: "Within 10' of time" and "Within 5' of time."

[Margin: 12]

But if the *Catalogus* of this Chapter VII be examined, after number 4 placed there — in which, from our reformed and corrected geography, the meridian-distances having been put down — we have set the difference of the tables from the observations in time, for the consensus of the eclipses; the number of the eclipses is found, for the consensus of the tables and observations, within 10', or at least within 5' of time; namely, as in the following table:

Tab.	Intra 10'.	Intra 5'.
Atlantica	13	[blank]
Danica	7	5
Lansberg.	6	1
Philol.	17	10
Rudolph.	27	14
Tychon.	28	15

Parsing notes: The "Intra 5'." cell for *Atlantica* is again blank in the source.
 Column heads: "Within 10'" and "Within 5'."

[Margin: 13]

From this new comparison it appears that Wendelin, in the *Idea* of his Atlantic tables, had had some foundation for approving the eclipse-observations, when they more nearly agreed with his own tables, which he chiefly effected in the eclipses that pertain to our order: 44, 46, 49, 53, 54, 55, 58, 59, 60, 72, 76. But he reproved them when they differed enormously from his own tables — as appears in Eclipses 40, 41, 43, 44, 45, 47, 50, 57, 69, 75: not only in the amount by which the followers of the Philolaic, Rudolphine, and Tyconic tables had those eclipses within 10', but in much more — these very same Tyconic [tables] within 5' — they favored, more than the Atlantic tables. Whence arises for us the following, and worthy of being known:

Continued conclusions of Caput VII

[Conclusion, continued from the preceding Conclusion.] But meanwhile, on behalf of the preceding Conclusion, let me warn that the suspected observations are deservedly thought to be of some falsity — the observations of the eclipses of our own age 68, 76, 84, 87, 96, 97, and 105 — since they are too greatly at variance with the tables. These either differ from the tables, the Tyconic in particular, or from many eclipses of our own age accurately [observed], or from the near consensus of the observers who observed them, within 10'; and even within 5'.

VII. Conclusio. In the lunar eclipses of our own age — and probably also in those that preceded, and that will follow, by representing them — the Tyconic tables obtain first place; the Rudolphine and Philolaic obtain second place at nearly equal [merit]; and the Atlantic third.

[Margin: 14]

For by my indication, indeed — which I hope to have proved by a few of these tables — those tables that are pure [accurate] within 10', or at least within 5' for the most part, or which satisfy better observations than the tables, which satisfy more observations indiscriminately, or which lie satisfying [merely], but refute many select observations.

Accordingly, although both the first comparison — and from what has been said for *Conclusion III* — the Lansbergian tables obtained first place, the Rudolphine 2, the Atlantic and Tyconic 3; yet from the second comparison, as has been said, by number 5: the Tyconic first; the Philolaic and Atlantic 3; the Rudolphine 4 — they have come out. Yet in this third comparison, and against this table, it is established that the Tyconic tables, by the consensus of the select eclipses of our age, agree with the observations within 31', or within 28' within minute 10'. But the eclipses within 17', or within 15', within minute 5'; and so the rest excel by the other tables, after these the Rudolphine and Philolaic at nearly equal number; and then the Atlantic.

VIII. Conclusio. On account of the discrepancy of the astronomical tables from the observations of our eclipses, or for the neighboring ages, the astronomical *Equation of Apparent Time* is not to be despised, [nor] commuted into the equal [time]; nor is another form of this equation to be introduced.

[Margin: 15]

For the astronomical equation, by which the time of days — civil, or natural, that is, apparent — is converted into the equal, for the examination of observations, arises and is double, and certain among astronomers is a necessary cause. The first is that which arises from the obliquity of the ecliptic, and is the difference between the true place of the Sun in the ecliptic and the right ascension answering to it, converted into time. The second is the difference between the mean motion of the Sun and the middle [motion], arising solely from the eccentricity in the circular hypothesis; but in the elliptical hypothesis it arises partly from the apparent equation, and partly from the optical equation of the Sun's acceleration on account of the eccentricity of the centers of the ellipse, distant from the center of the Earth by a hundredth part nearly; and is really

physical — namely the acceleration of the Sun about the center of the ellipse, in that the other focus, or umbilicus of the ellipse, is the point about which the Sun is moved with a middle, or equal, motion. When, therefore, by these causes it necessarily follows that this effect [arises], and sometimes — but rarely — the apparent time is made equal to the middle, or equal; sometimes, and more often, greater, or less than the equal time, the said equation is necessary, and beforehand.

[Margin: 16]

Moreover, by using the astronomical equation of time, not for fewer — indeed for several — eclipse-observations selected to represent the astronomical tables, lest the equation beforehand be passed over, or lest another form of equation not demonstrated be used; as is plain from the table of number 5, 11, and 12. For we, in the Philolaic, Rudolphine, and Tyconic calculation, have used such an equation; and the reformed first table of the first cause of equations, according to a truer obliquity of the ecliptic — but we have followed the other cause, the Bullialdine [Boulliau's], who of all explained it best, and most scientifically, concerning the astronomical equation, lib. 2 *Astronom. Phil.* cap. 5, 6, and 7.

[Margin: Bullialdi laus. — Praise of Boulliau.]

[Margin: 16]

First, therefore, by saying this, we shall remove the false opinion of those who think every form of the astronomical equation of natural days — of which kind were Christmann [Kristmannus], Vrstisius [Wursteisen], and Wendelin [Vuendelinus] — against whom see Boulliau, lib. 3, *Astronom. Novi* cap. 32; even Wendelin introduces, in *De Luna Oscillatoria*, certain prosthaphaereses.

[Margin: Error Kristmanni, Vrstisii, & Vuendelini. — The error of Christmann, Wursteisen, and Wendelin.]

Second, by Tycho's and Longomontanus's equation, with the Bullialdine [equation], we do not approve, inasmuch as it is diminished: for although the greater part of the astronomical equation arises from the first of the said causes — namely from the Difference of Right Ascension —

Liber II — De Luna (continued)

Caput VII (conclusion) — Conclusion VIII continued

[Margin: *The defects of Tycho and Longomontanus.*]

the Difference of Right Ascension and of the true place of the Sun in the ecliptic — and this alone Tycho and Longomontanus retain. They do so because it has been seen to satisfy most eclipses, and on that account they call it the *Keplerian Empirical* equation. The other cause, however, ought not to have been omitted, even though it cannot be sufficiently demonstrated from eclipses. And yet Longomontanus admits in his *Commentary on the Sun* that it is nearly always abandoned without good reason; for this reason astronomers have found fault with Kepler — that he laid down this equation as a foundation of the *Ephemerides* (see number 30).

[Margin: *Kepler's fiction.*]

Thirdly, the new form which Kepler calls *Physical* we judge to be by no means necessary; nor does Kepler himself introduce it in the *Rudolphine [Tables]* as though he thought it necessary, but only sets it forth as an experiment, so that astronomers may examine which of these three forms gives a better account of the observed eclipses, and whether it has been demonstrated truly from the two aforesaid causes, or whether it arose empirically — Tycho's from prior data, or whether it took its origin physically from the aforesaid causes — and, beyond this, [whether it can be derived] from the supernumerary days of the year, namely 5, and the 6 hours, by which the solar year exceeds 360, that is, the number of degrees of the equator. For this fiction has no other foundation than a certain ideal phantasm in Kepler's mind.

Fourthly, in agreement with Boulliau (*Astronomia Philolaica* II, ch. 7) we reject the form of the Equation of Time devised by Giovanni Battista Morin [Jean-Baptiste Morin], which is founded on the difference of the mean place of the Sun alone, or on the difference of the Right Ascension of the true place of the Sun, while nevertheless admitting the two causes of the equation of days, namely the obliquity of the ecliptic and the eccentricity of the Sun — against whom Boulliau argues much in the same place.

Fifthly and finally, we least of all approve the daring of Lansberge [Philip van Lansberge], who, as often as he saw his own Tables differing notably from the observations of eclipses, introduced an Equation of Time as great as was

necessary to make the Tables themselves agree wholly with the observations, but without any reasoning *a priori* — indeed without sufficient experiment *a posteriori*; for neither one nor the other eclipse suffices to establish so great an Equation. And he used to say that another occa-

sion would [require it], with Kepler bearing witness — and this is a *Great Affirmation, a great foundation of the work*. And yet Lansberge, at his precept 8, says: "*But let us truly warn that, if either Luminary should fail at the very beginning of Aries, 30 minutes of an hour are to be added to the time of the Mean [conjunction].*" But in the *Treasury of Lunar Observations*, Class 1, where he records lunar eclipses, in one case only — namely the eclipse of the Moon of 23 [March], which is well known to us, observed at 38 minutes past [the hour] by Cornelius Gemma [Cornelius Gemma] at Louvain, of which the beginning he observed at the hour 15.40 — there the Tables of Lansberge gave the beginning of that [eclipse] at Louvain at the hour 15.6'. On this account Lansberge there adds: "*On account of the Equation of Time in the Moon, there are to be added to the time of the apparent [conjunction] 30 minutes of an hour. Therefore the Moon at Louvain ought to fail at 15.36' past noon, as Cornelius Gemma observed most nearly.*" But it would have been more exact had he added 36 minutes; for then the agreement would have been complete — if indeed this Equation depended on his own arbitrary judgment rather than on mere [reasoning]. He used to promise [as much]. And in truth, proceeding sincerely, I acknowledge that some defect is to be admitted, partly in the observation, partly in the Tables. Certainly the *Rudolphine* and the *Tychonic* Tables — though without the Lansbergian Equation — represent the middle of that eclipse within 5 minutes of time, whence an argument can be drawn from the beginning.

Again, however, Lansberge, in Class 1, having examined the solar eclipse of the 18th [of the month] celebrated in the 6th degree of Aries, adds 30 minutes, so that the observation may agree with his own Tables; and yet in the lunar eclipse of the 37th [in his series], which is the 69th to us, although it was determined in the 4th degree of Aries, he adds nothing, because this little device of his Tables does not need it.

[Margin: *IX. Conclusion.*]

IX. Conclusion. But neither does the change of eccentricity — on which the *prosthaphaereses* of the first inequality of the Moon depend — suffice to reconcile the Astronomical Tables with the observations of eclipses.

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across the rightmost columns: *Omnes Tabulæ similiter dissident* ("All the Tables differ alike"). No minute or second value exceeds 59; all degree values fall within 0–29 of their sign. Catchword at foot: "43"; signature "R 2".

The table continues (p. 132) with eclipse orders 43–119. Same column structure.

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Parsing notes: Page 164 (p. 132) carries eclipse orders 43–119, grouped in ruled blocks. A spanning rubric between Orders 47 and 48 reads *Deinceps Dies stylo Gregoriano* ("Hereafter, the days in the Gregorian style"), marking the calendar switch. The block boundaries fall at orders 47/48, 54/55, 59/60, 68/69, 74/75, 81/82, 86/87, 93/95, 99/100, 105/106. All minute/second cells were re-transcribed cell-by-cell in a focused further reprocess and now read with confidence (no residual [?]); no minute or second value exceeds 59 and all degree values fall within 0–29 of their sign. Order 106's *Tempus differ.* pair (I = 2, II = 15) is anomalous — the time-difference is smaller than the longitude-difference (diff 9'2"), against the usual $\square 2\times$ relation — and is kept exactly as printed as a suspected source (compositor) error, to be footnoted later. Catchword at foot: "In"; the foot also shows faint gathering-tick marks at the gutter.

Caput VIII (continued) — Notes on the foregoing Catalogue

[Margin: *Explanation of the foregoing Catalogue.*]

1. In the preceding Catalogue — drawn from the history of eclipses of Chapter 2 and of the Epitome of Chapter 3, when the same eclipse was observed in several

places — I chose the time intermediate between the extremes, accommodated to the Meridian of Bologna, which is our Reformed Geography Meridian — excepting one [eclipse], or one selected Eclipse whose single time of observation I chose, having carefully examined the [observer's] diligence in the one case, and Gassendi's [Pierre Gassendi] in the other. The Apparent Time, moreover, I converted into Equated [Time] for both, by means of the Astronomical cause — namely the eccentricity of the Sun, and the obliquity of the ecliptic, 23°30'20".

2. The place of the Sun, by our Tables of Book I, I computed and constituted at the moment of the equated full Moon of the eclipse. It is established, moreover, that we have in that Book I a place of the Sun more exact than is represented by the Tyconic or Philolaic Tables, and one resting on the Rudolphine or Philolaic [Tables]; both on account of the manifest error in the Tyconic parallax of the Sun, which is too great, and likewise on account of the obliquity of the eclipse; and likewise, on account of the much more certain — because more refined — observations of the Sun made in the great Gnomon which we have in the Temple of San Petronio at Bologna. Therefore, if the Tyconic, Rudolphine, or Philolaic Tables represent the bounds of certain eclipses within a briefer span of time, it is permissible to suspect that some fallacy lurks on account of the place of the Sun being less accurately exhibited by them; and that therefore the Moon appears in a position closer to the opposition of the Sun than it really was the more remote.

3. The mean motions of the Moon and its Anomaly I have investigated rather *a posteriori* and empirically than *a priori* and by geometric demonstrations; and I have chosen them from the more certain eclipses, with the calculation repeated in turn through several [eclipses], so that they might satisfy more observations of eclipses. For which cause likewise I chose the Radices of the mean motion of the Moon and of the Anomaly written below, fixed to the Meridian of Bologna and to the last [day] of December.

Epoch of the Year of Christ 1600 completed, in the Gregorian style

	Sig.	Gr.	I	II
Mean motion of the Moon from the equinox	□	7	25	19
Motion of the simple	□	0	7	27

	Sig.	Gr.	I	II
Anomaly ☉				

Parsing notes: the radix table has two data rows; the leading "Sig." column carries ♈ (Aries) for both, then degree/minute/second values. The Moon row reads 7 25 19 20; the Anomaly row reads 0 7 27 9.

For my mean motion of the Moon, simple, is meanwhile [taken] from the equinox, an Annual [motion] of 129° 23' 2" & 30" [?] approximately, as I shall show afterward from another source. The Annual motion of the Anomaly likewise I establish at 88° 43' 7" 34" 21" — as much as Boulliau also establishes, who in Book 3 of his *Astronomia* was most diligent in this inquiry into the Anomaly; and his felicity in it was great, and in the mean motion Kepler came nearer to the truth in this our age.

4. The *prosthaphaeresis* of the first inequality of the Moon I recognize as much better derived from the circular hypothesis, which Epicyclic [reasoning] very often calls [it], and which is most nearly Tychonic, than [the one] derived from the elliptical form of Kepler or Boulliau — though this latter is not rarely very near to the celestial phenomena.

5. Resting upon these foundations, after innumerable labors of computation undertaken by myself, exercised in this practice by many friends, I constructed the New **Luni-Solar Tables**, which we give separately among the Astronomical [Tables]; and these, [tested] against the eclipses set forth in the preceding catalogue, represent [them] within 10 minutes of time, [or] within 12 minutes; while the minute of the eclipse [is represented] within 44 — but within 5 minutes of time of the 19 eclipses. From al-Battānī down to here, no Tables — that is, the Tychonic indeed, the Rudolphine, or the Philolaic (if anyone deduces it from what has been said in Chapter VII, number 12, and from the Catalogue of this chapter) — have provided this; the comparison is as follows below.

Eclipses

represented

within minutes

of Time	10'	5'	12
Tab. Tyconica	28	15	
Rudolphina	27	14	
Philolaica	27	10	
Nostra (Ours)	35	19	44

Parsing notes: the header row lists the time-band thresholds 10', 5', and 12 (the third header reads "12" as printed — i.e. 12 minutes, confirmed by §5's prose "intra 12. minuta"; only the *Nostra* row reaches that bin). The four named tables (Tyconic, Rudolphine, Philolaic, Ours) each give counts of eclipses represented within those bands; "Ours" shows 35 / 19 / 44. The final "44" appears in the third (12) column for the "Nostra" row.

6. Therefore let the estimators of these difficulties measure our Tables with fairer [judgment] than others, if in some cases they do not represent the eclipses so closely in the observations themselves, and let them not undeservedly assign part of the blame to the observations themselves, and to the configurations of the eclipses which the Meridians, still uncertain, [keep] apart from one another.

7. For — to indicate a few things by way of example: the eclipse observed at 22 [degrees] of Aria [Arabia?] will be exhibited [as] under a place more nearly our own than 23 [degrees]; observed at Antioch — perhaps therefore that Antioch is not in Syria but elsewhere, and more easterly than we supposed; nor was the observer so diligent in it, either in measuring the time, or in distinguishing the beginning of the legitimate eclipse from the penumbra [*Vmbragine*], or [from] the [full] shadow [*fumo*]. In this matter, indeed, and in all others, [we have] the use of the Telescope, and the skill acquired in our age, especially preceding [generations]; from which two fallacies a suspicion of fallacy arises from ocular estimation of the moment — namely, when the eclipse begins, or finishes, or [when there are] no instruments by which the time is measured, or [no] Horologes [clocks], or instruments [*Organa*] suitable for taking the altitudes of the stars, or [for finding] the place of the stars themselves [as] not certainly enough known in the heavens; concerning which [see] several other things [at] chapter 4.

8. Eclipses 26, 27, 32, 80. Others likewise — the Tables represent [them] nothing better; and some represent [them] a little worse. Because the sign [that there is] vice or some defect lies hidden in the Observation, or in the Meridians. In others likewise, observations, whether Tyconic, [show that those] of others, [are off by] a smaller or greater [amount] of time as the case may be, which fall within a quadrant, or even nearly the half of the better [ones], it suffices to represent [them]; see what was said above [at] this chapter, number 8 and 9.

Concerning the Ancient Eclipses, moreover, it must be discussed separately.

CAPVT IX

Concerning the Ancient Eclipses of the Moon exhibited through the Author's New Tables.

[Margin: (cropped marginal note, illegible)]

1. Now in Chapter 5 I concluded that 19 eclipses of the Moon related by Ptolemy [Ptolemy] are to be represented on those Julian days of the year which suppose the Beginning of [the era of] Nabonassar to have been on the Meridian of day 26 February of the Year of Christ — Epoch 747; and in Chapter 7, number 8, I indicated that the latitude is to be inquired into somewhat more carefully, lest anyone, by our [Tables] or [those] of other Astronomers, should impose upon the Tables a greater necessity than is just of representing the moments of those eclipses. For I do not now deny that there is a disagreement between those Observations and the Tables, [arising] in part from the [observers] themselves, [and] in part from the imperfectly examined distance of the Meridians of the [places of the] solar or lunar Tables, or both at once; and, from a Meridian-distance not altogether exactly noted, a greater [discrepancy] arises, [than] is to be noted in the Observations themselves, or it is configured more accurately in the moments, or [is noted] less accurately, [made] partly on account of the imperfect discrimination of the [observers], even as to the end, [or] because *per se* it carries an error of about 20', and more — partly on account of the crude manner of denoting the time by Clepsydras [water-clocks], or by stars; for which reason the [places] in the heaven were not perceived certainly enough. Whence it is now held as explored by the more recent Astronomers that it is sufficiently established that those eclipses are represented within about a half-hour. But some — unless one admits ampler latitudes of time — [are off more]. For it is repeated that, in the same order of eclipses as at Chapter 1 and at the places of Ptolemy, the eclipses are to be weighed individually with brief notes [*adductis*].

2. The first of the said Eclipses began at hour 1 past the rising of the Moon [*post Lunæ ortum*], and was total; and from the beginning alone, on account of the nearness of the horizontal vapors, Ptolemy observed [it]. He supposes the total eclipses to be of a duration of about 4 hours (which is not universally true), [and] he reckons the middle of the eclipse [accordingly]. The second Eclipse [was] observed lest it [be reckoned] from the beginning, or from the end, or from the true...

... [the digits] in full, when there appeared three obscured digits, was uncertain in the middle of the night. The **third** eclipse Ptolemy reports as observed only from

its beginning; he says the moon rose a little past obscured, and from the duration of the eclipse — which he determined as half [the total] — he reckoned the middle. But the difficulty of an observation made near the horizon is plain, and likewise the uncertainty as to whether the **fourth** is to be reckoned from the middle, since its beginning is noted as falling after obscured digits remain at 3. The **fifth** was observed at the very middle of the night, when the greatest degree of obscuration was seen to be 6 digits; it appears to admit a smaller error, if it is established from the moment itself, and not rather from the end, or estimated from the beginning. The same must be said of the **sixth**, observed at 3 digits a little before midnight, and of the **seventh** at 2½ digits, observed near the middle of the night.

For the **eighth**, whose beginning Ptolemy places at half an hour before sunrise, adding that the moon set still eclipsed before [the eclipse was] free of obscuration on rising — the diligence of [Petavius] is to be relied upon here [in his work] *De Doctrina Temporum*, [Liber] I [Cap.] 8, who by his own calculations affirms that the time of this observation is exceeded by the Alfonsine Tables [Tabulae Alphonsinae] by 1^h 56', by the Danish [Tables] by 41', and by the Parisian [Tables] by 33'. But Ptolemy supposes this eclipse to have lasted 1^h 30'. The smallness of the eclipse does not admit so great a latitude of error in time as do other eclipses. Our own calculation does not represent that [eclipse] within that exact phase, yet within this error, since the duration of this [eclipse] was unique, as Ptolemy himself attests (*Almagest* [Liber] 4, [Cap.] 11). Hipparchus reckoned from the eighth eclipse to the ninth 177 [years] and 13^h 45' of equal hours; Ptolemy reckoned there the same 177 years and 13^h 36'. Our Tables represent this eclipse later than the Ptolemaic by 11' 15", but later than Hipparchus by only 1' 0"; later [than the Ptolemaic] by 9" posterior to it from the observation.

[4] The **tenth** eclipse is related as having begun from sunrise; from the beginning therefore Ptolemy reckons it, and supposes the duration of totality to be 4 hours. Ptolemy assigns 1^h 12' for the meridian of Babylon, at 1^h after midnight, numbered; Ptolemy [reckons] from the ninth [eclipse] to the day 177^h; he confesses, nevertheless, that Hipparchus reckoned the hour as only 1^h 40' above 177 [days]; but Boulliau [Bullialdus], (*Astronomia Philolaica* [Liber] 3, [Cap.] 6), from the manuscripts of the Royal Library, shows that 10^h 15' should be read.

The **eleventh** eclipse — its beginning being unobservable — is supposed; while it is said to have begun to fail half an hour before its own midpoint, but because it was full in the middle of the third hour of night, Ptolemy reckons its maximum to be 7^h after midnight.

[5] The **twelfth** eclipse Ptolemy relates as observed only from its beginning (*Almagest* [Liber] 4, [Cap.] 11), and [says] that from the duration totality lasted through the middle of the night for 13^h 20', after the meridian numbered, as the preceding [eclipse] from this day [reckons] 178^h 6^h 50'. But he confesses that Hipparchus reckoned only 178 [days] and 6^h; therefore Hipparchus was 50' earlier than Ptolemy. We have therefore followed Hipparchus, lest otherwise the Tables would represent it too much, and most accurately represent the observation of Hipparchus. But in the **thirteenth** eclipse it seems we must stand rather by Ptolemy, who (*Almagest* [Liber] 4, [Cap.] 11) puts it as observed with its beginning falling after the sixth hour of night had passed.

and 40', and then [there were] other phases, since the whole moon failed, Hipparchus defined the middle at 2^h 10' after midnight. Ptolemy numbered this same time 2^h 24'. Hipparchus, however, [reckoning] from the preceding day [as] 176 [days] 1^h 20'; but if [from] the preceding [eclipse] one were to add 176 [days] of these hours, that this interval of 176^h 0^h 30' would be a little greater than the Ptolemaic. We, however, postulate this 8' earlier than the Ptolemaic time.

[6] The **fourteenth** eclipse is set down with its beginning at 2^h 20' after midnight, and its end at 5^h 10' observed, together with 7 digits obscured. The **fifteenth** eclipse the narrative reports only at its beginning, observed at 2^h ½ after moonrise, and thereafter indicates the middle when 2 digits were [obscured].

[7] Among the eclipses, however, the four that are in order 16, 17, 18, and 19: the first, that is, the **sixteenth**, is not represented by Ptolemy as observed, nor does he add that which (*Almagest* [Liber] 4, [Cap.] 6) Lansberge [Lansbergius] added concerning observations as if [drawn] from himself; this [eclipse] also Lansberge, in his *Thesaurus*, contends to have been at Alexandria at hour 8, 51' after midday, not however at 8^h 24', as Ptolemy has [it]. We likewise [place it] 22' later than Ptolemy. The **seventeenth** eclipse we likewise exhibit, [and] the **eighteenth**, which Ptolemy (*Almagest* [Liber] 4, [Cap.] 6) affirms to have been observed by himself most accurately, [we exhibit] not within 6 or 7 [minutes] — and the **nineteenth**, which he places after midnight, with all its minutes, except those which Lansberge attributes to it from himself, [is] discordant from the others in the motion of the Sun; the remaining Tables [place it] about one hour earlier than the Ptolemaic eclipse.

[8] It is permitted, however, that the Lansbergian Tables at first glance seem to be preferable to the others as regards the ancient eclipses, as can be seen in the Catalogue of [Cap.] 5. Yet because Lansberge made eclipses 8, 9, 10, 11, 12, and 13 in the other [more recent] centuries much inferior to the Tyconic [reckonings],

using the true distance from the Meridian — as is established from what was said in [Cap.] 7, num. 6 — therefore we have preferred the Tychonic [reckonings] to those, as more absolute, namely the Danish, the Rudolphine, and the Philolaic. But that a comparison may be made between them, in the following table we have set down the number of eclipses which the under-written Tables represent within hours of 5, or 10, or 15, or 20 minutes.

Within
Minutes of
an Hour.

Tables	5	10	15	20
Danish	2	3	6	6
Parisian	1	3	5	7
Philolaic	3	4	7	8
Rudolphine	2	3	6	7
Ours	3	8	8	9

[9] There now follows the Catalogue of the Ancient Eclipses with the place of the Sun and Moon, with the moment observed, with the [position] computed from our more recent Tables, [and] with the difference of the computed place of the moon added, with respect to the observed [place], and the time corresponding to this difference.

The following is a large two-part computational table (the catalogue announced at the foot of the previous page), transcribed below as a native markdown table. Its heading reads: *Eclipses of the Moon Observed in Antiquity, and Computed from the Author's New Tables. d [indicates] Defect; c indicates excess.* The upper block lists eclipses 1–15, dated "An[no] ante Ch[ristum]" (Year before Christ); the lower block lists eclipses 16–19, dated "Christi" (Year of Christ). Columns give: the eclipse order number; the apparent Bologna time after midday (Year, Month, Days, Hours, minutes — *Tempus Bonon[iense] Apparens ex cap. 3. post Meridiem*); the equated time (*Tempus Æquatam* — Hours, minutes, seconds); the true place of the Sun and thence the Moon's [opposition] (*Solis locus Verus, & inde Lunæ* \circ — Sign, Degrees, minutes, seconds); the computed place of the Moon (*Lunæ locus computatus* — Sign, Degrees, minutes, seconds); the computed difference (*Differentia comput.* — minutes, seconds, with **d/c** for defect/excess); and the time difference (*Tempus differ.* — minutes, seconds).

	Ordo Ecl.	An. ante Ch.	M. (month)	D.	H.	'	"	Tempus Æquatum	H.	'	"	Solis locus Verus	♁ Sig.	Gr.	'	"	Lunæ locus comp.	Sig.	Gr.	'	"	Diff. comput.	'	"	Tempus differ.	'	"																																																																																																																																																																																																																																																																																																																																																																																																																
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Parsing notes: Column groups follow the printed sub-headers (Ordo Ecl. | Tempus Bonon. Apparens post Meridiem | Tempus Æquatum | Solis locus Verus & inde Lunæ ♁ | Lunæ locus computatus | Differentia comput. | Tempus differ.). The Sun's true place and the Moon's opposition share a sign-column (opposition is the Sun's place ±6 signs; the Moon-sign shown is the opposite of the Sun-sign). The "Differentia" column carries **c** (excess) / **d** (defect) markers per the heading legend. Several zodiac glyphs in the cramped table are read by context against the opposition rule; where a glyph was ambiguous it is flagged below. Half-minute values (e.g., 27½, 58½, 42½, 47½, 37½, 51½, 27½) are printed with the fraction. Eclipse 6 Sun-place seconds and eclipse 11/12 hour-fractions confirmed against neighboring rows.

CAPVT X.

On the Motion of the Moon in Longitude, as hitherto established by the more eminent Astronomers, and by what method it is best investigated: where they have erred, or what may be found wanting.

[1] Long ago, in *Almagest* [Almagestum Novum] [Liber] 4, num. 19 and 24, I set forth a threefold device by which Astronomers investigate the lunar motions; and I showed that it is vainly attempted by Cycles of the lunar-solar [year], or by the commensuration of the Lunar year with the Solar, and consequently by the recurrence of paired Lunar eclipses, separated from one another by the longest possible interval of years, and standing in the same degree of Anomaly — or at least at the same distance from the Apogee, both Luminaries lying in the Apogee, or one in the Apogee and the other in the Perigee — which conditions, and others, Ptolemy requires (*Almagest* [Liber] 4, *Magna Constructio* [Cap.] 2), as is declared and demonstrated by Boulliau [Bullialdus] (*Astronomia Philolaica* [Liber] 3, [Cap.] 2).

[Margin: The sum of the method.]

These [conditions], however, being given, or at least the chief of them: **First**, from foreknowledge of the apparent place of the Sun in degree, and likewise [the place] observed at the time, it is to be converted into Equal time, reduced to the same Meridian. **Secondly**, that moment is to be gathered to which the motion of the Sun belongs, both Mean and True, with its own Anomaly; for thence the place of the Moon is known from the opposite place of the Moon, in which it truly was at the moment of the observed Eclipse. **Thirdly**, with the Anomaly and the lunar Prosthaphaeresis, by some best hypothesis used in the meantime, the Mean place of the Moon is to be found, adding to the Equation [aequatio] the True [place] in its place in the prior six signs of Anomaly, [and] subtracting in the others. **Fourthly**, the Difference of the Mean motions, or of the places of the Sun and Moon, is to be set in agreement by the Hourly Tables [Tabulae Horariae] from the Sun to the Syzygy, which they everywhere have; and to this time the Equal [time] of Mean Opposition observed is to be added, if the mean Motion of the Sun exceeds the Lunar [motion]; if it falls short, [it is to be subtracted], and the moment of the Mean Opposition of both will be had. **Fifthly**, it is to be reckoned diligently in the interval between both Mean Oppositions, not only in Years, but also in days, in Hours, and in Scruples [Scrupula, i.e. minutes]; having regard to

the number of days added in Bissextile Years, in the form of the Julian Year, and 10 days subtracted in the form of the Gregorian Year, in 1582 — and that time is to be reckoned, whether it be in the observed [Julian] or in the Gregorian style. **Sixthly**, the reduced interval of time in Days is to be multiplied per Lunation 4267, and the sum is to be divided by Days 126007; for the number of complete Lunations will come forth, which by that interval is made. **Seventhly**, by the found number of Lunations, that same number of Days, Hours, and the Scruples due to one Mean Lunation are to be divided between the two Eclipses of the Moon, and there will come forth the Days, Hours, and Scruples due to one Mean Lunation, or to the Mean Synodic Month, [from] the middle. But these precepts will be made clearer by the following Example, [in] [Cap.] 9, [and] the rest of the precepts, [namely] how to collect from the Synodic Month, the rest of the [lunar] motions.

[2] By this method, which Ptolemy indicated somewhat obscurely (*Almagest* [Liber] 4, [Cap.] 2 and 7), Hipparchus found, from Eclipses observed by the ancient Babylonians and from the more recent ones observed by himself, Days 126007 and an equal hour, that he completed 4267 Lunations, as I have said. But the Anomalistic Months, that is, the whole restitutions of the inequalities, [number] 4573. The Periodic Months, or Zodiacs, [number] 4612, less by degrees $7\frac{1}{2}$, [as] Hipparchus dividing therefore Days 126007 per 4267, found the Mean Month in Scruples of Days, and in...

[Margin: Hipparchus's opinion.]

D.	I	II	III	IV	V
29	31	50	8	9	20

This is in Horary Scruples [minutes]:

D. 29. Hor. 12. 44. 3". 15'''. 44^{iv}.

So Ptolemy relates (*Almagest* [Liber] 4, [Cap.] 1), adding [that] the Mean motion in Longitude from Hipparchus is to be repeated, both in Longitude, [so that] it differs sensibly in nothing from the truth; the Anomaly, however, and the Latitude, [differ] somewhat from the truth. Yet Ptolemy uses ([Cap.] 3) the Mean Lunar Month written below in scruples of days, but converted by us into Horary scruples [minutes]:

D.	I	II	III
29	30	8	20

That is, 29 Hor[ae] 12. 44'. 3". 20'''.

Therefore from Hipparchus the number of Lunations to the Anomalistic Months is, as 4267 to 4573, or in brief, as 1.21 to 269. Whence the Diurnal mean motion of Anomaly follows:

	Gr.	I	II	III	IV	V	VI
Hipparchus	13	3	53	56	17	51	59

But Ptolemy (*Almagest* [Liber] 4, [Cap.] 7) affirmed it should be corrected thus, as it would be:

	Gr.	I	II	III	IV	V	VI
Ptolemy	13	3	53	56	17	51	59

[3] But the most learned Gottfried Wendelin [Wendelinus], whose Letters to me I acknowledge as showing how profoundly he has immersed himself in the Lunar Theory, in his *Idea* of the Atlantic Tables, p. 29, says that in precisely 797326 days are completed 27000 Lunations; and that thence is born one Luration:

[Margin: Wendelin's opinion.]

D.	H.	I	II	III
29	12	44	3	12

But the Apocatastasis, that is, the Restitution of the Lunar Anomalies, [he] holds it thus to be, as the Luration [of] 16831 absolutely [completes] the Anomalistic Months [of] 18028. Finally the Months [of] 6890 complete the Draconic Orbits, or the Latitudinal Revolutions [of] 7477. Wendelin himself [makes] the proportion not quite as Hipparchus [makes it]. As the Lunations [of] 27000 [are] to the Days 797326, so are the Hipparchian Lunations 4267 to the Days of the Hipparchians 797326 ¹²⁶⁰⁰⁷. Not, however, does he set forth any pair of binary Eclipses, by which it might be established that he used this same mean motion, as did Tycho, neither Longomontanus, nor Kepler, nor Lansberge. It is permitted that Longomontanus, in the *Astronomia Danica*, in the commentary on the Moon, which is had in [Liber] 2, [in the] Theory of the Theorics, adduces three pairs of Astronomical Lunar Eclipses, three of the Hipparchians, and three of the Ptolemaics, and 23 [pairs], partly observed by Tycho, partly by himself; and these, when he confers them with his own Tables, do not show that same method by

which he was used to investigate thence the motion of the Moon, [and] scarcely [agrees] with the ancient [pairs] which Hipparchus acquired in his last [pair]; the pair which is in [Liber] 2 in the Catalogue of [Cap.] 1 is in order 13; nor [is] Lansberge in his *Thesaurus* of observations after the comparison of many Eclipses with his own Tables [the same], showing by what way the Mean places of the Moon are derived. Only do we have from himself, and from the Danish, and Rudolphine Tables, the Mean Synodic Month, and the Diurnal motion in the Zodiac, as below.

	D.	H.	I	II	III	IV	V	VI
Danish	29	12	44	3	8	39	46	48
Rudolphine	29	12	44	3	10	51	0	0
Lansberge	29	12	44	3	12	0	0	0

[Margin: Synodic Month.]

	Gr.	I	II	III	IV	V	VI
Danish	13	10	35	1	1	45	52
Rudolphine	13	10	35	1	14	30	43
Lansberge	13	10	35	1	12	0	25

[Margin: Diurnal [motion].]

The opinions of the rest see in *Almagestum Novum* [Liber] 4, [Cap.] 5. To these His Reckonings remain. Two there are who survive to us, the most celebrated Astronomers, who by some example manifestly [seek] to lay open the method, or [from] the Eclipses by which they used the way in explaining the motion of the Moon, namely Copernicus, and Boulliau [Bullialdus].

[4] For Copernicus, [the value] which he reckons the Synodic Month to be is D. 29 H. 12. 44'. 3". 10'''. 48^{iv}; whence he deduced 6. nempe [namely], from three Eclipses of the Moon observed by Ptolemy, and collated with the same [number] observed by himself. For he errs in the computing days. For he says that in the Year of

Hadrian 17 the Eclipse of the Moon was made [and] observed by Ptolemy; in the Twentieth, the [day] of the [Egyptian] Month Pauni having passed, but in the Year of Christ 133, the hundred-and-thirty-third, on the sixth day of the month of May, or the day before. But Ptolemy (*Almagest* [Liber] 4, [Cap.] 6) by no means has it that it was made [and] transacted on the 20th of Pauni, for thus it would not have followed that it was begun, but rather completed, on the 21st: but [Ptolemy says] on the day of Pauni, the second [day] before [Egyptian], on day 20, which the 21st followed. Wherefore even thus far day 20 would have been wanting.

[Margin: Copernicus's chronological lapse.]

[5] Similarly Copernicus erred, but uniformly, in referring the second and third Eclipse: he says, namely, that the second Eclipse was made in the Year 19 of Hadrian, two days of the [Egyptian] Month of Choiac having passed, in the Year of Christ 134, on the 13th, the Calends of November [13 Cal. Nov.], namely on 20 October. But Ptolemy (*Almagest* [Liber] 4, [Cap.] 6) does not have that [day] passed; but [says] Choiac on the second-following [day], the third; nor yet was its beginning current before [it had] passed two [days]; the beginning was at the Meridian of the day, after midday the Eclipse was. Likewise the third [Eclipse] Copernicus says was made in the Year 20 of Hadrian transacted, on the 19th day of the Month of Pharmuthi, in the Year of Christ 135, the [day] before having passed, [Cap.] VI of May. Yet Ptolemy says (*Almagest* [Liber] 4, [Cap.] 6) the 19th [day] of Pharmuthi, which the twentieth follows; therefore even here day 20 would have been wanting, from the Meridian of the day 19, on the 18th. But Copernicus admits the Hipparchian proportion of Lunations, and of the Days of which I spoke under number 2, & [from] the Ptolemaic Eclipse the second, to the Eclipse observed by himself in the Year of Christ 1522, the 5th of September, computed [from] the Egyptians 1388, [and on] this day, 302.

[6] Ismael Boulliau [Bullialdus], the diligent and subtle searcher of Astronomical truth, (*Astronomia Philolaica* [Liber] 3, *Astronomiae Philolaicae* [Cap.] 4) adduces the Hipparchian Doctrine of Lunations 4267; made in the interval of days 126007, that is, [he] uses [Cap.] 5, also from the interval of the Egyptian Annus [Year] of years 1788, of days 65; that is, altogether days 65368 5; he completed 22102 Lunations, and so thereafter. But [the time] which Boulliau refers from this Eclipse of the Moon made in the Year 547, Messori, Hora 5, namely 39', the apparent [time], and the other observed at Uraniborg [Uraniborg] in the Year of Christ 1587, [on] September the 6th, [old style] 9^h 28'; added, [it] was at Nabonassar Annum 2336, day 16. Paophi, Hor[ae] 9. 28' after midday, whence he collects the predicted interval of Years of Egypt 1788; that is, [from] Hor. 3. 51'. &

Lunations 22102; by which dividing the predicted interval, [he] collects the Synodic Month.

D.	H.	I	II	III	IV	V
29	12	44	3	12	41	18

[7] The same [Boulliau], in the same [Cap.] 5, [Liber] 3, brings forward another Eclipse observed at Nabonassar [Annum] 548, on the 9th [of] Mechir, at Hour [of] Uraniburg 11. 59' after midday, the apparent [time]; and another likewise [noted] by Tycho [Brahe] in the Year of Christ 1588, on the 2nd of March, old style, at hour 15. 8'; which [Boulliau] collects to have been the day of Pharmuthi 14; whence [he] collects the interval of the Egyptian Years 1788, of days 65, hor. 3. 5'. & hence Lunations likewise 22102. The Month likewise Synodic:

D.	H.	I	II	III	IV	V
29	12	44	3	5	11	45

[8] At last Boulliau (*Astronomia Philolaica* [Liber] 3, [Cap.] 6) brings forth the exact determination of the Lunar motion, which at the end of the chapter he affirms to be constructed [from] Tables of the mean Lunar motions. He adduces, however, two Lunar Eclipses; one observed at Nabonassar 366, on the 26th day [of] the Month of Thoth, at the Hour [of] Uraniburg reduced [to] 16. 5', after the Meridian; the other observed at Paris, [and] by Hortensius at Amsterdam, [and] by Gassendi in the Year of Christ 1635, on the 3rd of March, [the] Hour at Uraniburg reduced [to] 9. 18'. 5"; and [he affirms] this to have been the Egyptian Year [of] Nabonassar 2383, [on] the day of Pharmuthi 16. Hor. 9. 18'. 5"; whence [he] collects the interval of the Egyptian Years 2017, of days 199. Horae 16. 20'. 5"; that is, of days [from] Nabonassar 736404. hor. 16. 20'. 5"; but the Plenilunium [Full Moon] being reduced [to] true and to the middle, [it] has only 9.1^h 29'. & hence...

Liber II — De Luna (continued)

Caput X (continued)

hence [the number of] 24,937 lunations. By dividing that interval by these, one obtains the synodic month; and by dividing the zodiac by the synodic month, one obtains the Moon's mean diurnal motion away from the Sun [motus medius Lunæ diurnus a Sole]. By adding the Sun's mean diurnal motion, one gets the Moon's mean diurnal motion in the zodiac [motus medius diurnus in Zodiaco],

reckoned from the equinox; and from the annual motion, the diurnal motion likewise — as below.

Mo nth	D.	H.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Syn odic	29	12	44	3	9	37	9	59	15	15
	| | Sign | Gr. |	I. |	II. |	III. |	IV. |	V. |	VI. |	VII. |	VIII. |	
	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
	11 | 26 | 41 |	31 | 0 | 46 |	13 | 26 |	Diurnal |	| | | | |	| | | | |	Annual |	4 |		
	9 | 37 | 22 |	23 | 59 |	41 | 11 |	41 | 14 |	Diurnal in the zodiac |	| | 0 | 13 |	10 |			
	35 | 1 | 13 |	2 | 27 |	27 | 50 |	Annual |	| | 4 | 9 |	23 | 1 | 24 |	19 | 57 |	4 | 22 |	0	

Parsing notes: the two small mean-motion tables share the heading-band columns Sign/Gr./I.–VIII.; the row labels run "Motus à Sole / Diurnus / Annuus" then "Diurnus in Zodiaco / Annuus." The sign-degree alignment of the first numeric column was hard to resolve against the heading; values are transcribed left-to-right as printed.

[Margin: 9 — Boulliau's diurnal motions.]

§9. I am surprised, however, that Boulliau settled on these motions [as derived] from two pairs of eclipses, when the Moon was in widely different positions of anomaly, rather than [from] others established on equal anomaly. For in eclipse no. 6 and no. 7 [in his catalogue], the Moon's anomaly occupied very nearly the same degree — namely, for the eclipse of no. 6 the Moon's anomaly was Sign 1, gr. 0, and gr. 2 [for the other], very nearly, while the numbers themselves [of those eclipses] are 6 and 7. But in eclipse no. 8, in the first [pairing] the Moon's anomaly was Sign 7, gr. 19; in the second, Sign 11, gr. 14 — so it was by no means at the same distance from the apogee, as it ought to have been. Hence the mean month drawn out from those two earlier eclipse-pairs is seen to be vitiated by the error of this very disparity. As for Copernicus, by contrast: while Ptolemy's precept enjoins that the two eclipses [of a pair] adhere by number 5 [to equal anomaly] — he therefore chose, in each [pairing], a Moon whose anomaly was Sign 1, gr. 6, gr. 3, very nearly.

[Margin: 10]

§10. Finally, one could wish that the mean motion of the Moon had been confirmed by several eclipse-pairs rather than by one or another, [so that] the

aforesaid astronomers' [values] might have been borne out, and the matter set forth in plain numbers; or at least [that] they had adduced a reason why they preferred to rely upon a binary [pair] of eclipses — and indeed upon what prerogative this [or that] binary [rested]. This same [wish] applies in the matter of the epochs: we have desired the motion [to be such] that the radix of the motions deduced from one eclipse should come out the same as the one [deduced] from another, and so on.

CAPVT XI.

De Mense Lunari Synodico per plures Eclipses investigando.

[On determining the synodic lunar month by means of several eclipses.]

[Margin: 1]

§1. I shall illustrate by a single example the precept handed down in the preceding chapter. I therefore select the eclipses of the Moon no. 8 and no. 92 [in the catalogue], not only because they answer very well to the astronomical tables, but also because in both the Moon obtained nearly the same degree of anomaly — namely Sign 7, gr. 4. There [in §16] it will be [shown]. I reduce, then, the moments of the equated time to the meridian of Bologna: the former [eclipse falls] in the year before Christ 383, December 22, hour 16, 13' 10" after noon — equated; and these [moments] then stood thus in our tables for the luminaries:

	Sign	Gr.	I.	II.
Sun's mean motion [Solis medius motus]		8	26	4
Its anomaly [Eius Anomalia]		0	22	36
Moon's mean motion [Lunæ medius motus]		2	23	6

	Sign	Gr.	I.	II.
Its anomaly [Eius Anomalia]		7	18	52
Difference of the means [Differentia mediorum]			2	57

The Moon at that time, then, stood somewhat short of the place of the mean opposition by gr. 2, 57' 50"; from the Moon's anomaly, so situated, an interval of 5 hours 29' 17" agrees [as the correction], which if you add to the time of the true full moon, you will have the time of the mean full moon, equated, for the year before Christ 383, December 22, hour 22, 37' — equated to Bologna.

[Margin: 2]

§2. In the year 1628, January 20, Gregorian style — but the 10th of January, old style — at one hour past noon at Bologna, hour 10, 9' 20" in equated time, there was an eclipse of the Moon, and the luminaries [stood] thus:

	Sign	Gr.	I.	II.
Sun's mean motion		9	29	40
Its anomaly		6	21	33
Moon's mean motion		5	26	51
Its anomaly		7	18	4
Difference of the means			2	49

Wherefore, in this eclipse no. 92 the Moon was likewise somewhat short [of opposition], by gr. 2, 49' 15", than the exact place of the mean opposition would require; from the Moon's anomaly, an interval of 5 hours 7' 30" agrees, which if you add to the moment of the true full moon, the mean full moon for the year 1628, January 10, at the hour observed at Bologna [namely] hour 10, [yields] hour

15, 16' 50". From the moment of the mean full moon no. 92 to the moment of the mean full moon no. 8 — counting, that is, the days 562, which there ought to be for so many bissextile years [intervening]. For from the year 383 [before Christ] to the year of Christ 1609, the days [number] 73,4128; add to these 562, and besides the aforesaid 18 hours 16, 54' 13", [and] the interval [stands] thus, days 73,4805, hour 16, 54' 13".

[Margin: 3]

§3. Now, if from Hipparchus's observation, confirmed and accepted by Copernicus, Wendelen, Boulliau, and others, the astronomers prove [it], as I said in the preceding chapter — a binary [pair] containing 4267 lunations, and the interval [being] days 126,007 $\frac{3}{4}$ — it follows that 4267 lunations [span] our days 73,4805, hour 16, 54' 13"; [and that] there are contained [in that span] 24,839 lunations, by dividing which the same days 73,4805, hour 16, 54' 13" of interval [give], the synodic month comes out [as]:

D.	H.	I.	II.	III.	IV.	V.
29	12	44	3	12	10	

Nevertheless, having examined several pairs of mean ecliptic full moons, I find the synodic month — [the one] that corresponds to a far greater number of eclipses — to be [this]:

D.	H.	I.	II.	III.	IV.	V.
29	12	44	3	10	50	30

[Margin: 4]

§4. So as not to grudge the reader the aforesaid pairs and the comparisons, we shall exhibit three Tables. In the first is the time of the equated full moons — the true ecliptic ones at the meridian of Bologna, together with the Sun's and the Moon's mean motion, and the Moon's anomaly simply — with the order of the eclipses preserved, as we have always used from the chapter's beginning; see chapters 2 and 3. The equated time is the same; see chapters 8 and 9.

In the second [Table], the same [eclipses] being repeated, is set down the difference between the mean motions of the Sun and the Moon, and the time in hours by which the Moon answers to the said difference; and [whether] this is to be added to the equated time of the true full moon, or to be subtracted [from it] insofar as the mean motion was short of, or beyond, the point of the mean

opposition with the Sun — whence the time of the mean full moon results; and that is had in the same second Table.

In the third [Table], finally, are indicated the comparisons of the ancient eclipses [each] with a more recent one, in which the Moon turns in the same degree of anomaly, very nearly — as will be plain by running back up to the first form of the Tables, or at least to the same distance from the apogee.

But because, for investigating the synodic month, there is need of a fair interval of days between the ancient and the recent full moon, I have therefore noted [them] according to the form of the old Julian year, lest the subtraction of the 10 days in the Gregorian form should be obscured to anyone [for the eclipse of] the year of Christ 1582.

I. TABULA.

[Table I.]

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Parsing notes: this large columnar table is partly obscured by gutter shadow and show-through; the four sexagesimal blocks (D./H./I./II. of the time; then Sun's-mean, Moon's-mean, and simple-anomaly, each Sign/Gr./I./II.) are tightly set. Several minutes/seconds entries are ambiguous against the rule-lines and adjacent-leaf show-through; readings are best-effort. Eclipse-order column skips numbers (1–4, 6–8, 10–15, 17–19, 22, 35, 41, 43–44, 47, 49–50, 54–55, 60, 74–76, 88, 92, 95, 98, 100, 104, 106, 108, 110, 119). Row 106 (1643) and row 95 (1631) appear to lack a complete final anomaly block in the scan. The doubled day-figures in some rows (e.g. row 50 "2 15 1 1") reflect tightly-set H./I./II. blocks.

II. TABULA.

[Table II.]

										Time of the mean full moon [T em pus Plen ilun ij Med ij] — Be for e Ch r. ye ar [A nt e Ch r. M. D. H. I. II.	
Orde of ecl ips e [O rd o Ecl .]	Di ffe re nc e of th e m ea n m oti on s [Di ffe re nti a Med ior u m M ot uu m] — Gr.	I.	II.	Time of this differ ence [T em pus hu ius Differ enti æ] — H.	I.	II.	Ad d or Su btr act [A dd e vel De m e]				

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1	6	32	45	13	27	30	d	72 1	M ar ch	18	17	42	30
2	3	21	53	7	23	10	d	72 0	M ar ch	8	12	19	40
3	0	46	10	1	21	18	d	72 0	Se pt.	1	7	20	8
4	0	2	51	0	6	7	d	62 1	Ap ril.	21	15	15	8
6	0	6	34	0	14	10	a	50 2	No u.	19	9	12	55
7	6	37	36	12	49	45	d	49 1	Ap ril.	24	20	7	5
8	2	57	50	5	29	27	d	38 3	De c.	22	22	22	37
10	0	28	51	1	1	50	a	38 2	De c.	12	6	56	55
11	6	0	59	12	27	0	d	20 1	Se pt.	22	17	52	30
13	6	57	27	12	58	50	d	20 0	Se pt.	12	1	42	10
14	5	8	30	9	4	0	d	17 4	Ap r.	30	3	36	20
15	2	21	15	4	9	30	d	14 1	Ia n.	27	4	41	0
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17	2	12	31	4	38	20	a	13 3	M aij	6	14	12	40
18	3	7	25	6	25	12	d	11 4	Oc t.	20	2	51	58

19	5	34	57	0	8	40	d	13 6	M art	5	4	27	40
22	3	12	22	6	0	10	d	88 3	Iul ij	22	23	11	26
35	2	11	51	3	52	50	d	15 09	Iu nij	2	7	6	55
41	3	32	35	5	3	15	d	15 76	Oc t.	7	6	9	22
43	1	16	53	2	25	0	a	15 77	Se pt.	26	15	14	12
44	6	24	43	13	44	0	a	15 78	Se pt.	15	12	54	15
47	1	46	0	3	13	50	d	15 81	Iul ij	15	13	46	27
49	6	7	12	13	6	26	d	15 87	Se pt.	6	22	23	11
50	6	45	2	12	39	25	d	15 88	M art	2	2	21	50
54	0	51	24	1	32	0	d	15 92	De c.	8	8	53	56
55	2	35	29	5	21	54	d	15 94	Oc t.	18	13	41	0
60	0	38	8	1	25	10	d	15 99	Ia n.	30	1	37	14
74	0	17	10	0	30	48	d	16 10	De c.	19	16	44	8
75	2	33	5	4	56	2	a	16 12	M aij	4	15	14	17
76	2	47	6	5	44	10	d	16 12	Oc t.	28	21	25	20
88	6	37	50	12	25	50	a	16 24	Se pt.	16	20	58	56
92	2	49	15	5	7	30	a	16	Ia	10	15	16	50

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95	1	16	36	2	45	15	d	16	Oc	29	14	27	30
								31	t.				
98	0	30	19	1	45	20	d	16	Fe	21	7	24	40
								35	br.				
10	2	58	51	6	4	0	d	16	Fe	10	17	19	51
0								36	br.				
10	6	56	47	12	27	0	a	16	Ap	4	1	9	40
4								42	r.				
10	3	3	35	5	24	20	d	16	Se	17	12	49	48
6								43	pt.				
10	6	18	39	11	28	56	a	16	Ia	21	6	22	37
8								46	n.				
11	0	55	46	1	34	0	d	16	Ia	10	8	31	5
0								47	n.				
11	4	14	20	8	41	20	d	16	De	9	23	1	57
9								57	c.				

Parsing notes: "Adde vel Deme" column abbreviated d (deme = subtract) / a (adde = add). The first heading-band reads "Differentia Mediorum Motuum / Tempus huius Differentiæ / Adde vel Deme / Tempus Plenilunij Medij." The "Ante Chr. Anni / M. / D. / H. / I. / II." sub-columns of the last block carry the year, month, day, and clock-time of the mean full moon. Several seconds-entries ambiguous from show-through.

III. TABULA

Comparationes graduum mediorum in eodem ferè gr. Anomalix.

[Table III. — Comparisons of the mean degrees [of eclipses falling] in nearly the same degree of anomaly.]

Order & [Ordo &]	[value]
1	41
1	55
1	100
2	43
2	60

Order & [Ordo &]	[value]
2	98
3	35
4	98
6	95
7	75
7	104
8	32
8	92
8	108
10	54
11	49
12	35
12	74
13	106
15	36
15	110
17	44
18	55
18	76
19	47
22	88

Parsing notes: Table III pairs each ancient eclipse (left, "Ordo &") with one or more recent eclipses (right) sharing nearly the same anomaly. The header reads "Comparationes [graduum] mediorum in eodem ferè gr. Anomaliæ." The single repeated left-hand order-number groups the recent counterparts beneath it. Right-hand column values are the order-numbers of the matching recent eclipses.

CAPVT XII.

How, from the Synodic Lunar Month, the Remaining Motions of the Moon in Longitude Are Derived. (For the motion in anomaly and in latitude we shall treat separately below; here we treat only of the motion in longitude reckoned from the Vernal Equinoctial point.)

1. Rule concerning the Lunar Year and the Epact.

Multiply the Mean Synodic Month — which for us is 29 days, 12 hours, 44 minutes [I], 3 seconds [II], 10 thirds [III], 50 fourths [IV], 30 fifths [V] — by twelve, and you obtain the Mean Lunar Year of 354 days, 8 hours, 48 minutes [I], 38 [II], 10 [III], 6 [IV]. Take the residue and complement of this against the Julian Solar Year (that is, against 365 days), and it is called the Epact of one common year. For us this comes to 10 days, 15 hours, 11 minutes [I], 21 [II], 49 [III], 54 [IV]. Moreover, in accumulating the Epact over several years for each individual leap year, the Epact is augmented by one day. Yet always, once the accumulated Epact reaches a whole lunation, that whole lunation is subtracted, as often as it can be subtracted. A specimen of all this you have in the following Table, together with the Embolismic Lunar Year of thirteen lunations.

Annus Lunaris [Lunar Year]	D.	H.	I	II	III	IV
Commu nis [Comm on]	354	8	48	38	10	6
Emboli smicus [Emboli smic]	383	21	32	41	20	57

Epacta Annoru m [Epact of Years]	D.	H.	I	II	III	IV
Commu nis [Comm on] 1	10	15	11	21	49	54
2	21	6	22	43	39	48
3	2	8	50	2	18	50
Bissexti lis [Leap year] 4	14	0	1	24	8	43

2. Rule concerning the Periodic Lunar Month.

The 360 degrees of the Zodiac resolve into 7,776,000,000 thirds [III]. Our Synodic Month, however, resolves into 153,086,191 horary thirds [III]; and when these are multiplied by the Zodiac (as resolved above) they yield 1,190,401,316,160,000 thirds [III], to be reserved for the Number-to-be-Divided. Now the Mean Motion of the Sun in the Synodic Month, by our Tables, is 29 degrees, 6 minutes [I], 24 seconds [II], 17 thirds [III]; and when this is resolved into thirds and the Zodiac (resolved above) is added, the result is 8,047,057 thirds [III]. Therefore divide the aforesaid Number-to-be-Divided by these horary thirds, and there results the Periodic Month of the Zodiac, namely 141,631,117 thirds [III] — that is, 27 days, 7 hours, 43 minutes [I], 5 seconds [II], 17 thirds [III].

3. Rule concerning the Daily Motion of the Moon in the Zodiac.

The Zodiac, combined with the Mean Motion of the Sun corresponding to the Synodic Month, is — as we said in point 1 — 8,047,057 thirds [III]. Multiplied by the horary thirds of a single day [184,000 thirds], it makes 1,480,498,488,000 thirds [II/III?]; and this divided by the thirds of the Synodic Month already given above (153,086,191) yields the Daily Mean Motion of the Moon in the Zodiac, 1,846,101 thirds [III] — that is:

Gr.	I	II	III	IV	V	VI
13	10	35	1	17	15	49

4. Rule concerning the Daily Elongation of the Moon from the Sun.

Subtract the Mean Daily Motion of the Sun in the Zodiac — which for me is 59 minutes [I], 8 seconds [II], 19 thirds [III], 48 fourths [IV], 35 fifths [V], 35 sixths [VI] — from the Mean Daily Motion of the Moon, and at once you will have the Daily Elongation of the Moon from the Sun, namely:

Gr.	I	II	III	IV	V	VI
12	11	26	47	28	40	14

5. Rule concerning the Horary and the Annual Motion of the Moon in Longitude.

The Horary motion can be obtained by dividing the Daily motion by 24; more easily, however, by aggregating the Daily motion doubled, plus a half of the Daily, but exchanging the titles of the degrees into minutes [I] and of the minutes [I] into seconds [II], and so on. Behold the Example in our Daily figure:

☽	Gr.	I	II	III	IV	V
Diurnu s [Daily]	13	10	35	1	17	16
Duplu m [Double]	26	21	10	2	34	32
Semidi urni [of the Half- daily]	6	35	17	30	38	38
Aggreg atum [Sum]	32	56	27	33	13	10
Ergo [Theref	II	III	IV	V	VI	VII

☽	Gr.	I	II	III	IV	V
ore]						
Horari	32	56	27	33	13	10
us						
[Horary						
] &	II	III	IV	V	VI	VII
minuti						
vnius						
[and of						
one						
minute]						
	32	56	27	33	13	10

6. The Annual motion is more securely obtained from the Daily, once the motion of the Months has first been investigated by means of the daily reckoning over 28, or 30, or 31 days; or, more compactly, from the several Daily motions until you arrive at the day 30 or 31 of motion. In this manner:

Lunae
motus
Mediu
s in
Zodiac
o
[Mean
Motio
n of
the
Moon
in the
Zodiac

] 1	Sign.	Gr.	I	II	III	IV	V
(day)							
1	0	13	10	35	1	17	16
2	0	26	21	10	2	34	32
10	4	11	45	50	12	52	40
30	1	5	17	30	38	37	10

Lunae
 motus
 Mediu
 s in
 Zodiac
 o
 [Mean
 Motio
 n of
 the
 Moon
 in the
 Zodiac

]	Sign.	Gr.	I	II	III	IV	V
31	1	18	28	5	39	54	16
60	2	10	35	1	17	14	0
120	4	21	10	2	34	28	0
240	9	12	20	5	8	56	0
360	2	3	30	7	43	24	0
365	4	9	23	2	49	50	20

Parsing notes: in the "60" row the Sign value reads 2 and Gr. 10; the "360" row Sign reads 2 and Gr. 3 — both partially compressed at the gutter, transcribed as printed.

CAPVT XIII.

On the Motion of the Lunar Apogee and of the Anomaly.

1. From what was said in Book 4 of the *Almagestum Novum* [Almagestum Novum], Chapter 21, it is plain by what method Ptolemy [Ptolemy] and Copernicus [Copernicus] investigated geometrically the motions of the Lunar Anomaly, by means of triads of ancient Lunar eclipses — recent ones likewise. There it is also indicated that more than three eclipses were employed by Longomontanus [Longomontanus] and Boulliau [Boulliau]. Now I repeat what I said above concerning Hipparchus's [Hipparchus] Epilogism of Lunations: that 4267 Lunations answer to 4573 Anomalistic Months. That is, in the shorter numbering, 251 Lunations correspond exactly to 269 Anomalistic Months in the

longer numbering; whereas in [the longer numbering, those which Wuendelinus took up]

[continuation] —which Vendelinus [Vendelinus] in his *Idea Tabularum Atlanticarum* takes up, the Lunations of 1683 agreeing with 18,038 Anomalistic Months.

3. But because Ptolemy in Book 4, Chapter 2 and Chapter 7 desired a more accurate determination than the proposition handed down from Hipparchus, Boulliau in Book 3 of the *Astronomia Philolaica* [Astronomia Philolaica], Chapter 6, by means of many eclipses and their intervals re-examined geometrically, concluded that over an interval of 73,6404 days, 16 hours, 20 minutes [I], 5 seconds [II], whole Anomalistic Revolutions amounting to 26,724 were completed, plus 114 degrees, 35 minutes [I], 34 seconds [II]; and from these, resolving them into sexagesimal degrees, there results:

Ano
malia
Luna
ris
Motu
s
medi
us
[Mea
n
Moti
on of
the
Luna
r
Ano
maly]

	Sign.	Gr.	I	II	III	IV	V	VI
Diur nus [Dail y]	0	13	3	53	56	18	57	45
Annu us [Ann	2	28	43	7	34	20	51	43

Ano
malia
Luna
ris
Motu
s
medi
us
[Mea
n
Moti
on of
the
Luna
r
Ano
maly] Sign. Gr. I II III IV V VI

ual]

[Margin: Boulliau on the \curvearrowright Anomaly.]

2. We, having weighed the profundity and diligence of this man in the aforesaid investigation, and his motion drawn from the observation of Lunar Eclipses as if upon a Lydian touchstone, approving as nearly as possible to the truth, do for that reason derive the remaining motions from here — namely the Horary, the Monthly, and so on.

4. Furthermore, the Daily Mean Motion of the Lunar Apogee is obtained by subtracting the motion of the Lunar Anomaly from the motion of the Moon in the Zodiac — the Daily from the Daily, the Annual from the Annual, the Horary from the Horary, as below:

) Motu s med. [Mea n Moti on]	Sig.	Gr.	I	II	III	IV	V	VI
Annu s in Zod. [Year in Zodia c]	4	9	23	2	49	50	20	0
Ann. Ano mal. [Ann ual Ano maly]	2	28	43	7	34	20	51	43
Annu us Apog ei [Ann ual of Apog ee]	1	10	39	55	15	29	28	17
Diur nus [Dail y]	0	13	10	35	1	17	15	49
Diur nus Ano m.	0	13	3	53	56	18	57	45

) Motu s med. [Mea n Moti on]	Sig.	Gr.	I	II	III	IV	V	VI
[Dail y Ano maly]								
Diur n. Apog ei [Dail y of Apog ee]	0	0	6	41	4	58	18	4
Hora rius [Hor ary]	0	0	32	56	27	33	13	10
Hora r. Ano m. [Hor ary Ano maly]	0	0	32	39	44	50	37	24
Hora r. Apog. [Hor ary Apog	0	0	16	42	42	35	46	[?]

›									
Motu									
s									
med.									
[Mea									
n									
Moti									
on]	Sig.	Gr.	I	II	III	IV	V	VI	
ee]									

Parsing notes: the final cell of the "Horar. Apog." row (VI column) is compressed and partly illegible; transcribed as printed where readable.

CAPVT XIV.

On the Motion of the Lunar Latitude, or of the Nodes.

1. As was said in Book 4 of the *Almagest*, Chapter 22, we set out the Method by which the Astronomers investigated this motion. Hipparchus indeed investigated it, and Ptolemy demonstrated it, in Book 4, Chapter 1 of the *Almagest*. But Ptolemy in that same place asserts that the Lunar latitude completes 5923 whole circles in 5458 Lunations; whereas Ptolemy himself, in that same place and chapter, says it falls far short of the truth, as he admits at point 9. *In the latitudes, however, an error of motion will previously creep in — for us, using the proportion handed down by Hipparchus — because the Moon may have traversed its own little circle six hundred and fifty times, but always under the shadow* (according to the mean state in plenilunium and the like). And after a few words he adds: *In the latitudes, indeed, certain matters were not exactly perceived, since truer observations were afterwards not attained by us.* It behooves all (assuming they are moved by love of truth, not by mere obstinacy) to take up these speculations — not only to amend the Ancients with a more certain and newer method, but even to add to one's own; nor is it base to retract one's own things if a truer view present itself, and even to recall others, professing the same with great and indeed divine candor.

[Margin: A love of truth.]

Having premised these things, I choose two Eclipses, which in the Catalogue of Chapter 2 are no. 7 and 16, in each of which the Moon was eclipsed.

2. Copernicus, in Book 4, Chapter 4 and 13, since he had two Eclipses observed — one of the ancients, the other in his own time, in each of which the Moon was descending equally from the same region [plaga], and nearly about the same Node, and at the same distance from the Apogee — chose two in which the Moon was deficient in different regions, since around opposite Nodes the eclipses arrived at their full point in the second sign; for besides the whole revolutions he described a semicircle. Such were [the Eclipses], which at our point [number] 2 [are] no. 1 and 4, and 35 [?]; among these, however, he reckons the Years 1683, days 88, hours 22 minutes [I], 35 seconds [II], in which time he says the latitude-motion of the Moon had overrun beyond whole revolutions by 179 degrees, 51 minutes [I]; and from this he establishes the daily motion. The latitudes [of these] he gives 13 minutes [I], 45 seconds [II] and 35 minutes [I]; for the prior eclipse, in the first eclipse of the month Phamenoth; but Claudius Ptolemy in Book 4, Chapter 1 does not say of the month Thoth but of the month Phamenoth, on day 27, the following 28; whence it signifies that the interval of 27 days was not yet fully completed; and so in this interval of Eclipses an error of one whole day customarily slips in. Then, since the prior Eclipse occurred in the Year before Christ 174, on day 30 of April, as is plain from our Canon and Chronological Apparatus, at the hour 9 minutes [I] 45 seconds [II] of Cracow [Craconia] after noon — while in truth it had been in the Year of Christ 1509, day 2 of June, hour after noon 9 minutes [I] 45 seconds [II], at Cracow at 11 hours 46 minutes [I]: in determining the interval one finds, in Julian Years 1683, days 88, hours 21 minutes [I] and 41 seconds [II] — so that this interval is false, which is not noted in our numbers, but is expressed in these words: *The time between each one [is] reckoned, [and] there were Years one thousand six hundred and eighty-three, days eighty-eight, hour 22 minutes [I] 35 seconds [II]. We dismiss the rest with Copernicus.*

[Margin: Motion of latitude from Ptolemy.]

[Margin: Latitude from Copernicus.]

[Margin: A lapse, however, in the Chronology.]

3. Gottfried Vendelinus [Gottfried Vendelinus], in his *Idea Tabularum Atlanticarum*, asserts that in 6890 mean Lunations there are completed 7477 absolute Draconic Orbs — that is, returns of the Apocatastasis of Latitude — and thence he gathers the Daily motion of the Latitude:

Gr.	I	II	III	IV	V	VI
13	13	45	39	32	7	36

Sig. G.	I	II	III	IV	V	VI	VII	VIII	IX
ude]									
Ann	4	28	42	46	6	44	25	49	38
uus									
[Ann									
ual]									

Parsing notes: this combined "Nodi / Latitud. Diur. / Annuus" block is printed with a long row of sexagesimal columns (I–IX); values transcribed left-to-right as printed; some interior digits are compressed at the column rules.

5. But it would be proper, or expedient, to choose two Eclipses at the same distance from the Apogee, and of the same quantity. Therefore, in the Year before Christ 720 — as is had from Chapter 3 and 9 — the Chaldeans observed a Lunar Eclipse of 6 digits, Northern, or a little less; the precise quantity is noted by Kepler in the *Astronomia Optica*, most evident of all, observed on account of the equality of the obscured part there illustrated; and it was the mean Full Moon at Bologna [Plenilunium Bononiae] on September 1, the third hour after noon, but equated [reduced to mean time], 7 minutes [I] 25 seconds [II]. The Luminaries then stood thus:

	Sign.	Gr.	I	II
Verus locus Solis [True place of the Sun]	5	0	54	9
Eiusque Anomalia [And its Anomaly]	3	5	14	0
Luna Verus locus [True place of the Moon]	11	0	54	9
Eiusque Anomalia [And its Anomaly]	5	13	18	16

	Sign.	Gr.	I	II
Medius Lunae motus [Mean motion of the Moon]	11	2	7	17

6. The Semidiameter of the Earth's Shadow, corrected according to the Sun's Anomaly, and likewise the Southern Latitude of the Moon (for the center of the Lunar disc was on the very periphery of that Shadow), was 47 minutes [I]. Hence the inclination of the Lunar orbit to the Ecliptic is supposed at Gr. 4, 58 [I], or as a maximum Gr. 5; for the solution, a right-angled spherical Triangle is to be solved.

[Margin: Latitude from observation.]

Diagram. A spherical triangle bearing the vertex labels E, L, N (with an additional L at lower left), an arc curving from the upper-left point E down to the lower-right point N. It illustrates the right-angled spherical triangle used to resolve the Moon's latitude and the inclination of the lunar orbit to the ecliptic.

- E (upper left): vertex of the triangle (node of the lunar orbit)
- L (left, beneath E): point on the ecliptic
- N (lower right): the Moon's position
- (arc): the inclined lunar orbit / latitude arc from E to N

— at which is given the Angle N, of Gr. 5, by the Tychonic [computation]; and to it the opposite Lunar latitude EL is Gr. 47 minutes [I], therefore the base EN — that is, the Lunar Ecliptic [arc] reduced from the nearer of the Nodes — by the laws of Trigonometry falls out at Gr. 9, 3 minutes [I], 50 seconds [II], 51 thirds [III]. But according to the mean motion the true place of the Moon was in Aquarius at Gr. 23, 5 minutes [I], 59 seconds [II].

7. We also, with Father P. Grimaldi [Grimaldi] at Bologna in the Year 1645, on September 27 by the Gregorian style, but the 17th by the old style, observed a Lunar Eclipse of 6 digits from the North, an Hour after noon, but equated [to mean time] 7 minutes [I] 25 seconds [II], 28 seconds [II]. The Luminaries then stood thus:

	Sign.	Gr.	I	II
Solis Verus	6	4	20	17

	Sign.	Gr.	I	II
locus [True place of the Sun]				
Eius Anomalia [Its Anomaly]	2	28	56	14
Lunae Verus locus [True place of the Moon]	0	4	20	17
Eius Anomalia [Its Anomaly]	6	6	3	17
Luna medius motus [Mean motion of the Moon]	0	3	16	32

8. The Semidiameter of the Shadow, corrected, and therefore likewise the true Latitude of the Moon (inasmuch as in this Eclipse of 6 digits, point 48 [is] in the aforesaid Triangle, [namely] side EL, with which point [and] angle N, at the summit Gr. 3, results the Lunar Ecliptic [arc] from the Node) was Gr. 9, 13 minutes [I], 10 seconds [II]. Hence the place of the Node was in Pisces at Gr. 25, 7 minutes [I], 17 seconds [II]; but according to the mean motion of the Moon it was in ♋ [Pisces] at Gr. 24, 3 minutes [I], 21 seconds [II].

1. Rule concerning the Annual Motion of the Node.

9. The Interval of these Eclipses was 862,736 days, hour 1, 26 minutes [I], 28 seconds [II]; this time, resolved into horary minutes, is altogether 1,242,341,365; and this time, according to the Analogy at number 4, indicates the Southern Node retrograding in the order of signs through 126 degrees of the absolute Zodiac, and retroceding from the grade of Aquarius 24 degrees, 5 minutes [I], 22 seconds [II],

it strikes Gr. 219, 0 minutes [I], 38 seconds [II]. There are resolved, then, 126 degrees of the Zodiac, together with the degrees 329, 0 minutes [I], 38 seconds [II], in the second

164,470,931 seconds [III]. By these, drawn through the minutes of a single Year [525,600], it makes the number of seconds of the Zodiac as 86,445,921,333,100; this number, divided by the interval given above (1,242,341,365), leaves the Annual Motion of the Lunar Node, 69,583 [???], that is, 5 minutes [I], 19 seconds [II], 43 thirds [III], 55 fourths [IV] — not unlike the Tyconic, who has 5 minutes [I], 19 seconds [II], 43 thirds [III], 4 fourths [IV]. Divide here this motion by the days of the Year, 365; and there will come forth the Daily motion of the Node, 3 minutes [I], 10 seconds [II], 38 thirds [III], 40 fourths [IV].

[Margin: Annual motion of the Node.]

[Margin: Daily motion of the Node.]

2. Rule concerning the Motion of Latitude.

10. Add the Daily motion of the Node to the Daily motion of the Moon's latitude from the beginning of Aries — concerning which in Chapter XII, number 3 — and there will be the Daily Mean Motion of Latitude. Add likewise the Annual motion of the Node to the Annual motion of the Moon — concerning which in the same place, number 6 — and there will be the Annual motion of Latitude, as below:

Latitu
dinis
)
Motus
Mediu
s
[Mean
Motio
n of
the
Moon'
s
Latitu
de]
us

	Sign.	Gr.	I	II	III	IV	V
Diurn	0	13	13	45	39	57	16

Latitudinis

)

Motus Medius

s

[Mean

Motion of

the

Moon's

Latitude]

s

de]

Sign.

Gr.

I

II

III

IV

V

[Daily]

Annus

4

28

42

45

53

43

20

us

[Annual]

al]

CAPVT XV.

On Establishing the Epochs of the Lunar Motions.

1. If from a single Eclipse, selected as the most evident of all, the Radix be established, the time of that Year's full moon at the beginning or end of that Year is to be reduced to mean time, and the true place of the Moon to its [mean] place — that is, to the mean motion; and this is to be done either by adding, or by subtracting the mean motion that corresponds to the interval between the time of the observed Full Moon and the beginning or end of that Year — so that the Epoch of the Lunar motion may be had at the end or beginning of that Year.

For example, in the Year 1610 of Christ, an Eclipse was observed on December 29, and the apparent hour was 16 after noon, but equated [to mean time] 16 hours 13 minutes [I] 10 seconds [II]; at which moment the mean motion of the Moon was Sign 8, Gr. 3, 47 minutes [I]. The true place was diverse from the place opposite the Sun by Sign 3, Gr. 8, 22 minutes [I], 25 seconds [II]; and the Anomaly was Sign 6, Gr. 2, 28 minutes [I], 15 seconds [II]; with the Equation 18 minutes [I] 38 seconds [II] to be subtracted from the true place of the Moon. From the true

moment, then, to the end of the Year there remained Days 1, hour 7, 46 minutes [I], 40 seconds [II], to which by the mean motion of the Moon there correspond Gr. 17, 26 minutes [I], 47 seconds [II]; and of the Anomaly there correspond Gr. 17, 17 minutes [I], 56 seconds [II]; which being added to the mean motion of the Ecliptic moment, there rises up, for the Year 1610 complete:

	Sign.	Gr.	I	II
Radix ☽	3	26	0	34
Anomaliae [of the Anomaly]	6	20	46	11

3. But if, in order that the Observations of several Eclipses may be had sufficiently accurate, it is expedient that the Radix of the same Year be inquired from several such observations, [and] that one which is found diverse — that finally ought to be chosen which dissents least from the rest of the observations. Hence it never happens that many establish their Epochs which they constituted from a single Eclipse — namely, Ptolemy in Book 4, Chapter 8; Copernicus in Book 4, Chapter 7; Vendelinus in his *Idea Tabularum Atlanticarum*, page 35; and Boulliau in Book 3 of the *Astronomia Philolaica*, Chapter 7. But which, and how many Eclipses, those who rested their Lunar Epochs upon them — Tycho, Longomontanus, Kepler, Lansberge [Lansbergius], and Petavius [Petavius] — do not disclose; they indicate only that they derived [them] from several, just as [they derived] the mean motions, so likewise the Epochs of motion. Of these certainly all eclipses are adduced in the Catalogue of Chapters 8 and 9; yet from the diverse Radices of the Year 1600 Gregorian complete, and from the Epoch of the Year 1 of Christ at its inception, we have obtained, on account of the diversity of the Observations

[Margin: Lunar Radices.]

the number, yet at last, after very many labors of calculation, we have decided to follow the radices of the nodes and of the lunar epochs written above, the ones drawn from the greatest number of eclipse-observations, as coming nearer to satisfying [the data]; and therefore we select them for the meridian of Bologna at the meridian [i.e. midnight] of the last day of December.

[Margin: Radices ☽ (node) and Anomaly.]

Radix	Ω Sign	Gr.	I	II	Ano maly Sign	Gr.	I	II
Chris t	4	2	3	35	6	22	4	24
1600	7	25	19	20	0	7	27	9

§4. As for the epochs of the lunar nodes, since (as stated in Caput XIV, num. 8) on 1643 September 17, at the hour after midday at Bologna, the equated time being 7h 25' 28", the ascending node was in Pisces at 24°3'21" — provided the place of the Moon's mean motion at that time, and hence at the end of the year 1644, is correct: there are one bissextile year [intervening], and besides the 94 days from December 16 at 44'32" — from which, by the mean motion of the node, the aforesaid place in Pisces being subtracted, the radix of this node remains at sign 10, 0°29'33"; and this is the radix of the boreal [northern] node:

Sign.	Gr.	I	II
10	0	29	33

To this, adding the motion of 44 Julian years, which equals sign 4, 29°39'33", gives the Radix for the Gregorian year 1600:

Sign.	Gr.	I	II
9	10	42	2

§5. But from other eclipses, as is found [in the determination of] the year of the node's motion at gr. 19, etc., so that the Radix for the year 1600 of Christ, Gregorian, satisfies a greater number [of eclipses], it is:

Sign.	Gr.	I	II
9	11	22	50

And hence the Radix at the beginning of the years of Christ:

Sign.	Gr.	I	II
8	28	51	22

CAPUT XVI.

Observed solar eclipses — those, however, selected which are suitable for the lunisolar motions; and the diameters of the luminaries to be established; together with astronomical calculations added here and there.

[Margin: Ord.] [Margin: Total.]

Although universal chronology requires that certain years be marked and characterized, and therefore that many solar eclipses be observed, these are nevertheless of use for chronology. Yet astronomers describe far fewer than were observed, or — as for the quantity and quality of these — with more certainty as to time. We therefore select those eclipses which are observed in such ways, with the more certain methods, both diligent and trustworthy. In the calculations, moreover, [we select] those that astronomers subjoin in their explanations of the differences of meridians, [more reliable] than those which they themselves suppose; for otherwise the parallaxes of longitude would have to be reckoned [anew] whenever the calculation is transferred to a different polar altitude.

[Margin: Ord.] [Margin: Total.]

1. In the year 585 before Christ, on May 28, the most celebrated solar eclipse occurred, as predicted by Thales [of Miletus] to the Ionians. It was seen near the Hellespont and Sardis, in Lydia, and everywhere it was total, between Cyaxares king of the Medes and Halyattes king of the Lydians — as Eudemus relates in Clement, Stromata I, and Herodotus, book I. There, after they had long fought with equal Mars [i.e. an undecided battle], the day was suddenly turned into night;

it would have been so [total], but others say the totality occurred near the Hellespont, where the eclipse-digits of the Sun were 9 [and] 36, vel 48 [?]; the Alexandrians of Egypt affirm [it]. Cleomedes, book II, cap. 3; and Theon of Alexandria in his book 6 on the Almagest, cap. 11. Pliny, book 2, cap. 12, designates the fourth year of the 48th Olympiad; and Bünting, Scaliger, and Salianus [reckon it] in the year of the world 1469. Kepler in the Optics, nor does Lansberge in the Thesaurus Observationum gainsay [the fact], assigns the third year of the 48th Olympiad. For from the new moon, as immediately preceding the solstice, the year [is] third — and the third year [thus] begins from the said Olympiad. Lansberge adds that it was Nabonassar's year 163, [and] the day [was] a Tuesday; and from his own Tables of Tycho, [computing] the eclipse [as] of

digits 12, 10' near the Hellespont, and near Sardis at 4°38' p.m.; at Alexandria, however, of digits 10, 12. We, however, from the Great Tables of Tycho, find this eclipse coming out in the same year and on the 28th day of May, at the hour near Sardis 5, 26' posited [as] the Anomaly of the Sun at gr. 1, 3, and the Moon nearly 170. Cauius therefore badly advances the eclipse for the year 607; and Petavius (whom Jacob Billy follows in his Tab. Lodoiceis) for the year 597, July 9; for both, on their own Tables, place it almost at the highest [point of] early morning, and the digits at 9, 22, near Sardis; nor does the time-requisite for totality of the eclipse agree at all. And it is conceded that the beginning of the eclipse [is] right at early morning, lasting hardly an hour, 1, 16' after sunrise; whereas Petavius, who computes the eclipse at hour 5, 45' after noon, contradicts — though Petavius himself relates that the eclipse [occurred] in that year; I know it [from] Petavius, lib. 10, on the Doctrine of Time, cap. 1, [who treats] much about the opinions current at this eclipse-time of the learned, examining [them]; but the more common [is] of the year 585; we have, however, from the Prutenic Tables, digits 11, 30', [and] from the Parisian [Tables] near the same digit, 11, 30. Therefore I, from the most certain Tables, [find] that it can be reckoned at the year 585, p.m., yet I half-doubt it before sunset; but it can happen for another reason, on account of too great a distance of meridians, or a defect of the Parisian [Tables]. From the Tables, since others do not cease [to dissent], that which represents this [eclipse] at hours before sunset, even in the same year 585, by reason of its totality. Rudolphine [Tables], near Sardis, [give] the sum at p.m. 5, 17', 4". Of digits 12, 1', 36" — [this] was the truer Anomaly of the Sun at gr. 359 [and] 3, and the Moon at gr. 170.

[Margin: Total.]

2. In the year 310 before Christ, when Agathocles king of Sicily was transporting his fleet into Africa against Carthage — namely in the third year of the 117th Olympiad, as Diodorus Siculus relates, lib. 20, and Justin, lib. 22 — "so great a darkening of the Sun occurred that it was indeed plainly night, the stars being visible everywhere," says Diodorus. It was nearly total at hour 8 in the morning. Bünting, following Salianus, [reckons it] from the Prutenic Tables [for] August 15, [hour] 8, [digit] 15; p.m. near Syracuse, [digits] at gr. 11. Petavius, from the Parisian [Tables], h. 8, 2' [and] digit 11, 10'. The Anomaly of the Sun [is] at gr. 74, near the Moon 201.

[Margin: Total.]

3. In the year 217 of Christ, when Gordian the younger was emperor, [as] Capitolinus relates: "so great a solar eclipse occurred that it was believed to be

night, nor could anything be done without lamps lit." Kepler in the Optics asserts it total. The Prutenic [Tables] give the digits less than 11; Petavius [gives, at] Rome, h. 4, 51' p. merid., the digit 10; Lansberge in the Thesaurus, [April] 11, h. 4, 51', 2" after noon, Rome computes — but he says it was seen total, because the little particle of the Sun is hidden by the eclipse, and was near the Horizon. The Anomaly of the Sun was at gr. 306, [and] the Moon 204.

[Margin: Total.]

4. In the year 334 of Christ, when Optatus and Paulinus were consuls, as Firmicus relates, lib. 1, cap. 2: "The Sun in mid-day at the very time of the lunar eclipse [solar?] suffered a certain darkening, so [great that] life seemed about to fail mortals; and, this denouncing [?], a sudden eclipse [appeared]" — and it was seen at Byzantium too. This eclipse cannot be disentangled from the Prutenic [Tables]; and Maulerus [Mästlin?] notes it in the Isagoge, cap. 11, and Petavius, lib. 8, cap. 14, [says] Petavius computes that eclipse [for] July 17, h. Rome 11, 13' p.m., with the digit 10, 14'. Lansbergius, h. 11, 9', [computes] it near the Moon, [whose] appearance was [in] no way [such], lucid; which we call an annular eclipse, in the Almagest. The Anomaly of the Sun was at gr. 39, [and] the Moon 296.

[Margin: Annular.]

5. In the year 484 of Christ, on January 13, an eclipse occurred, "which day was turned into night, [so that] profound darkness fell, and the stars were seen," notes Reinerus in his Catalogue of Eclipses; from the life of Proclus, described by Marinus [in] Greek, which is asserted

he observed the eclipse at h. 6, 51' p.m.n. of the digit 4; as in the library of the Most Serene Grand Duke of Tuscany [Magni Hetruriae Ducis], p. 81. Adding to the directions the Prutenic [Tables] promised the digit 8. Tycho himself, from his own Tables in the Progymnasmata, gives the digit 5. Mästlin, observing at Tübingen, h. 7, 36' ex Prutenic computed h. 7, 40', [digit] 8. Lansberge at Tübingen reckons h. 7, 44', [digit] 9. But Magin from the Prutenic [Tables] at Venice [gives] h. 7, 57', [digit] 8, [hour] 10, 27'.

25. In the year 1591, July 30, new style, Tycho at Uraniborg observed the solar eclipse h. 3, 33' p.m., the digit $2\frac{1}{2}$; let the digit be esto Prutenic [as] 4, 6', [digit] 1.

26. In the year 1595, October 3, new style, Tycho at Uraniborg observed the diminution of the Sun [at] h. 1, 8' p.m., digit 3, 50 [?]. At Tübingen, Mästlin saw the digit $2\frac{1}{2}$. Gratian Kepler [at] Graz, digit 3. Magin at Venice computes by the Prutenic [Tables] h. 1, 16' [and] digit 4, 14'. But Origanus from Frankfurt and

Oderam computes by the Prutenic [Tables] h. 2, 4', [and] digit 5, 18'; but Tycho [gives] h. 1, 16', [digit] 3.

27. In the year 1598, March 7, new style, at Uraniborg, the pupil of Tycho observed the solar eclipse [of] minutes 44' before midday, digit 9, [minutes] 10', vel alii [or others] 40'. Tycho himself, at Wandsburg, noted the beginning [at] h. 9, 12' p. mid. of the night. At Torgau in Meissen, however, Doctor Jessenus, in the palace of the Prince, observing this central eclipse, prominent everywhere [at the lunar margin], as Kepler relates in the Optics, p. 299, and 419. Lansberge computes [for] Torgau h. 10, 28' p.m.n. and nearly annular by reason of the Anomaly of the Sun [at] gr. 248; its diameter 30', 54"; and the diameter [of the Moon] 32'. [Margin: Annular.] But Goesius himself, observing the beginning [at] h. 2, 11' ante meridiem, with such darkness that the night [scene?] seemed at once to threaten. Frankfurt and Oderam, Origanus observed, the inter-minute 28' [and] 46" of the eleventh hour, [and] digit 9; although by Prutenic calculation Lansberge reckons h. 5, 28', [digit] 10, 55'; Magin at Venice by the Prutenic [Tables] reckons h. 9, 45', [digit] 11, 33', etc. in [the same] tome on Directions for the same Uraniborg ex Alphonsine [Tables] h. 11, 44', [digit] 8, 20'. Ex Prutenicis h. 9, 50', digits 11, 26', ex Tychonicis h. 11, 7', [digit] 10, 6'.

28. In the year 1600, July 10, new style, at Uraniborg [it] is placed [in] tom. 1, Progymn. Tycho [gives] the solar eclipse of digits 5, h. 1, 44' p.m. But at Benatek [Benátky] in Bohemia, Tychonici saw it h. 1, 46', digit 5. At Tübingen, Mästlin [gives] more digits than 6. At Prague, Kepler [gives] digits 7, as he has it in the Optics, p. 422, and 430. Magin by Prutenic [Tables] reckons at Venice hour 2, 14', but at Uraniborg h. 1, 47', [and] digits hic 4, 50', ibi 7, 19'. Origanus from Frankfurt by Prutenic [Tables] h. 2, 10', digit 5, 39', [hour] 5, 19'.

29. In the year 1601, December 24, new style, Lansberge [reckons] the solar eclipse [observed by] Goesius h. 1, 50' p.m. [Margin: Annular.] But the southern margin of the Sun was illuminated from the austral [southern] margin of the Moon [margin scrupule? ½ margin]; the Sun, [and] the boreal [northern] Moon coincided so far that the whole Moon was seen within the orb of the Sun — so was it observed in the Thesaurus. Where he computes the hour 1, 51', and the Anomaly of the Sun [at] gr. 176, cum diametro [with diameter] 35', 53"; the Moon's [at] gr. 7, cum diametro 30'; vel optice [or optically] 28', 30". Kepler at Prague observed the eclipse of more than [digit] 8, h. 2, 1', 53", vt [as] in the Optics, p. 359, and 413. In the Appendix, however, [and] the Progymnasmata note the diameter of the Moon [as] not according with the observation. Longomontanus, lib. 1 Theoric., cap. 9, relates that he observed the Piscatorian-

distant thousands of miles [?]; beyond [the place at] Nidrosia [Nidaros/Trondheim], it would have been seen, total[ly], everywhere encircling the Moon, equal [on all sides], the prominence being as if a sesquidigit; and such an eclipse-type, presented to itself [as] Andrea Foxio, [from] which Bergis [Bergen?] contends that the diameter of the Moon in the eclipse is contracted optically; the Sun, however, [appearing] larger — concerning which [is] our judgment, lib. 3 Almag. Novi, p. 376. Lansberge at Bergen, h. 1, 52', and expresses the [calculated] diameters [of] this phase, as Gassendus [does] in his Epicures [Epicurus exposition?] p. 893, where he gives the diameter of the lunar minutes more, [by] four [?] quarters, [referring] excellent greater vision in the Optics, of [the eclipse's] amplification of light, [or] of the attenuation of the luminaries; Magin at Uraniborg by Alphonsine [Tables] h. 3, 32', digits 7, 36'; Prutenice h. 1, 52', [digit] digits 9, 19'. Tychonice h. 2, 36', [digit] digits 9, 53'. Origanus from Frankfurt by Prutenic [Tables] h. 1, 57', [digit] 9, 56'; but Tychonice h. 2, 46', [digit] digit 9, 52'.

1 (Solar, continued). ...they would have [been so], but others say the totality occurred near the Hellespont, with the eclipse-digits of the Sun at 9, [and] 36, vel 48 [?]; the Alexandrians of Egypt affirm [it]. Cleomedes, lib. 2, cap. 3, and Theon of Alexandria in his sixth [book] on the Almagest, cap. 11. Pliny, lib. 2, cap. 12, designates the fourth year of the 48th Olympiad; and Bünting, Scaliger, [and] Salianus [place it] in the year of the world 1469. Kepler in the Optics — nor does Lansberge in the Thesaurus Observationum gainsay [it] — assigns the third year of the 48th Olympiad. For from the new moon, as most nearly preceding the solstice, the year [could be terminated as] third, and the third year is [thus] begun from the said Olympiad. Lansberge adds that it was Nabonassar's [year] 163, the day a Tuesday; and from his own Tables of Tycho [computes] the eclipse [as] of digit 12, 10' near the Hellespont, and near Sardis at 4°38' p.m.; at Alexandria, however, [of] digit 10, 12. We, however, from the Great Tables of Tycho, [find] this eclipse coming out in the same year and on the 28th day of May, at the hour near Sardis 5, 26', the Anomaly of the Sun posited at gr. 1, 3, and the Moon nearly 170. Therefore Cauius badly advances the eclipse to the year 607, and Petavius (whom Jacob Billy follows in the Tab. Lodoiceis) to the year 597, July 9 — for both, by their own Tables, place it almost at the highest [point of] early morning, and the digits at 9, 22, near Sardis; nor does the time required for the totality of the eclipse agree. And it is conceded that the beginning of the eclipse [is] right at early morning, not lasting beyond an hour, 1, 16' after sunrise; but Petavius, who computes the eclipse at h. 5, 45' after noon, contradicts — though Petavius himself relates that the eclipse [is] of that year. I know [it from] Petavius, lib. 10, on the Doctrine of Time, cap. 1, [discussing] much about the opinions of the learned

current at this eclipse-time, examining [them]; but the more common [view, of] the year 585: from the Prutenic Tables, [digits] 11, 30'; from the Parisian [Tables] near the same, digit 11, 30. Therefore I, by the most certain Tables, [reckon it] for the year 585, p.m., yet I half-doubt [whether it was] before sunset; but it can happen for another reason, on account of too great a distance of meridians, or a defect of the Parisian [Tables]. From the Tables, since others do not cease [to disagree], that which represents this [eclipse] at hours before sunset of the Sun, even in the same year 585, [is preferable] by reason of its totality. The Rudolphine [Tables] near Sardis exhibit the sum at p.m. 5, 17', 4". Of digit 12, 1', 36" — [this] was the truer Anomaly of the Sun at gr. 359, 3, and the Moon at gr. 170.

[Margin: Total.] [Margin: Total.]

6. In the year 840 of Christ, on May 5, on the Vigil of the Ascension, there was a solar eclipse: maximal, so that the stars were seen; "and a horrible color in [earthly] things [appeared] mutated; yet nothing differs from this in truth than appeared; for the Moon, first interposing [itself, took] the light of the Sun, partly restored [it], and then the whole [light was] recovered" — as the Anonymous author relates, whom Ludovicus Ph. Hammonius cites, lib. 5, cap. 19; and the Chronicon Floriacense; Petavius too [says it happened] in Germany, h. 11, 22' p.m.n. The Anomaly of the Sun [is] at gr. 324, near the Moon 173. [Margin: Total.]

7. In the year 878, October 29, which was the year 29 of Ludovicus Balbus [Louis the Stammerer], on the 4th [day] of the office of the Calends of November [i.e. Oct. 29], the Sun was obscured for half an hour, "and the stars appeared in the sky, and all night seemed to threaten" — as Petrus Bibliothecarius [Anastasius Bibliothecarius?] and the Annals of the Franks, or of Fulda, note. Petavius from Kepler in the Optics [gives] the eclipse [as] total; h. 1, 44', [digit] 9, 22'. The Anomaly of the Sun is at gr. 64, near the Moon 335; and it has the year 8. [Margin: Total.]

8. In the year 890 of Christ, but [after] the death of Alexander the Great 1214, and [in] the Dhul-Qarnain 1202, [on] the 1st of August, Albateginus [al-Battānī], as Petavius relates, lib. 30, observed the solar eclipse: of digits more than 8, [lasting] more than one hour of the Hour [equinoctial hour]. Petavius computes [it] from the Parisian [Tables] h. 0, 46' p.m. and digit 9, 22'. The Anomaly of the Sun is at gr. 84, near the Moon 8. [It] near merid., and Aractae.

9. In the year 893 of Christ, on the 23rd day of January, or [counting] from the death of Alexander 1224, [the] Dhul-Qarnain 1212, Albateginus — as Petavius relates, lib. 30 — observed the solar eclipse [in] Syria [Aractae] [at] h. 1, 40' near

midday, and [the Sun] obscured by the eclipse to a minimum [of one] third [of its disk]; Lansberge computes the digits [as] 9, 40', and h. 2, 15' ante merid., near Aractae. [Margin: Total.]

10. In the year 1187 of Christ, September 4, so great a solar eclipse occurred that "the stars appeared throughout the day as if at night," like the Lychosthenes [reading?]; and the [first] light came [back] on the 4th of the Calends of September. [Margin: Total.]

11. In the year 1197, on the day before the Nones of September, Gregorius Tholosanus [Pierre Grégoire of Toulouse], lib. 21, de Republica, cap. 27, notes so great a solar eclipse, and that the stars appeared. [Margin: Total.]

12. In the year 1239, Gassendus [Gassendi] from the Martyrology of Digne, in the Ephemeris, p. 895, copies these words: "In the year MCCXXXIX, on the 3rd, Nones of June [June 3], on the day of Venus [Friday], the Sun was obscured, so that the day was turned into night around midday, and the stars appeared," and "the same [eclipse] was conspicuous, and engraved upon a stone in a public square." [Margin: Total.]

13. In the year 1415, Gassendus [reports] from the History of Dignensis [Digne] above: "In the year of the Lord MCCCCXV, on the day of Venus [Friday], there was a solar eclipse around the end [of] the [day], and the stars appeared most clearly." This Reinholdus in the Theoricon, and Pulcis [Plautius?] from the Polish History of Matthias Mechouiensis [Maciej of Miechów], as Origanus [does] in the Preface, Tom. 2, Ephem., relates [it occurred] at Constance, year 1415, June 7, h. 4, in the morning — not only were the stars seen, but, just as by night, sudden caligo [murk] covered the lands; Lansberge computes 12, 11', and at hour 6, 5' after midday, the median morning. The Anomaly of the Sun is at gr. 355, and near the Moon 204. [Margin: Total.]

14. In the year 1478, July 29, Bernhardus Walther observed at Nuremberg the eclipse of the Sun, [its] beginning [at the position] from the setting-point gr. 54, 30'; the end gr. 41, 30'. [Margin: Total.]

15. In the year 1485, March 16, by the testimony of Lycosthenes: "Lights were lit at noon, [it was] so dark, indeed candles were lit, etc." Walther observed at Nuremberg the eclipse of the Sun [of] digits nearly 11, [beginning at] h. 4, 27' after noon; the Alphonsine [Tables] give the digits 12, and Kepler in the Opt. p. 131, contends that it was total — although Lansberge from his own Tables [gives] h. 4, 45'; Nuremberg computes [the] digit 10, 50', and the Anomaly of the Sun [at] gr. 170. [Margin: Total.]

16. In the year 1497, January 18, Bernard Walther saw at Nuremberg the eclipse of the Sun, [its] end h. 3, 24' p.m.

17. In the year 1539, April 18, at Milan was seen the solar eclipse, of digit 9, vt refert [as] Cardanus relates.

18. In the year 1544, January 24, Gemma Frisius, cap. 18, [reports]: "the astronomer relates [the] observed solar eclipse [at] Louvain, h. 8, 53' circiter [about] p.m.n., the digit, more than 10 in the lower part [of the Sun's disk]"; let the Ephemerides above des-

designated [it], following Kepler in the Optics, p. 296, [says] "the day began to darken, and the birds, which by the first light had flitted gaily, fell silent, [the Sun] obscuring itself"; the digit 11. Reinholdus, however, computes it h. 7, 18' p.m.n. of Louvain; digitos[que] 11, 1. The Anomaly of the Sun [at] gr. 217. The Moon 237, [which] not infrequently brings about totality of the eclipse; yet it could have been seen greater, because it was in the morning, and near the Horizon [there were] vapors. [Margin:...]

19. In the year 1545, on the 5th of the Ides of June [June 9], the deficiency of the Sun was observed by Gemma Frisius, h. 4 p.m. and the digit $4\frac{1}{2}$; ex ipsius [from his own] Radio Astronomical, cap. 15, and 17. [Margin: Total.]

20. In the year 1560, August 21, in the region of Coimbra [Conimbrica] around midday was seen the horrible total solar eclipse, of the space [duration of] one hour and more, vt refert [as] the eyewitness Clavius relates in cap. 4, Sphaerae, where he narrates: "the Sun in our time [was] truly so widely[?] obscured: there shone certain nocturnal greater [stars]; nor [was there] anyone who, in such a [thing], could see to put [his hand], so clearly were the stars in the sky apparent; [and even] the very birds [mirabile dictu! wonderful to say] in the air fell to the earth [in] terror, descending in such foul [horrida] obscurity." There was present Fr. Emmanuel Vega, from whom (as Scheiner [says] in Rosa Ursina, lib. 3, cap. 7) [he] narrates that it lasted for nearly three hours, [with] women wailing, and uproarious shouting as at the impending [downfall] of the world; nor were the stars ever seen so clearly, since [it was] the work of the lights [that they were] not recognized — [as] of certain men in Rome, although Ignatius Danes [Danti?] bears witness; the same [thing happened] at Rome, which Ignatius Danes [relates] at gr. 30, near merid. itself. Tables, however, [give it] observed for itself; for the Anomaly of the Sun, Vienna in Austria observed 10' before midday. But from the Chronicon of Mercator, [at] Vienna in Austria the eclipse was at h. 3, 52' p.m. [for] the highest digit, 5. Paulus Fabricius and Tilemannus Stella — Joannes Stadius in

his Ephemeris of this year says it was [at] Brussels h. 1, 48' p.m. and Lansberge in the Thesaurus observed the digit 6, 31'. At Coimbra, however, [he] computes the digits 12, 4'; but he saw the more long-lasting [phase], because the Sun emerges into the [light] Radios, until it is seen [as] of digit 12, 28', which appearance is usually attributed to the patrocium [defense] of their own Hypotheses. Tycho himself, who admits total eclipses, writing upon this eclipse of Clavius as if wondering, and incredulous, vt narrat [as] Lansberge relates in the Astronomia Optica, p. 285. The Anomaly of the Sun was at gr. 64, the Moon however at gr. 136. [Margin: Total.]

21. In the year 1567, April 9, Clavius [at] Rome (he himself says in cap. 4, Sphaerae): "the Sun, [though] not totally deficient, yet the remaining [part] failing, [showed] a certain bright circle around it." Tycho, in his letters [to] Clavius, vt refert [as] Kepler relates in the Optics, p. 297; the Astronom-Optica narrates that it was seen, [reduced] to a digit at midday; planè [plainly], but in the Progymn. computes the digits 8, 20'; near totality, but from the south. [Margin: Annular.] Mästlin observed at Tübingen the same [eclipse, its] beginning h. 10, 25' p.m.n., from the south. Mercator at Duisburg saw Clivia [Cleves?]; the beginning h. 10, 25', p.m.n., the start [at] h. 5; Cornelius Gemma at Louvain saw the beginning [at] h. 10, 12'; the highest [phase] h. 11, 40', near totality at h. 5; the time [being] as it were toward evening, 11, 40', [digit] 35; but the stars [were] in no way seen. Nonetheless, Kepler above, vt habet [as] he has [it] in the Optics, p. 302, [says] for this Table not to exhibit the annular eclipse, [though] anyone discerns in the eclipse the [Sun's] illumination, as if seen [as] of an aethereal hue in contact with the illumination of the Sun, the radii of the Sun being refracted in the air around the lunar [body], yet Lansberge from his own Annular-eclipse Tables collects [it], eandem ex Prutenic [the same from the Prutenic Tables] in the Epicures [exposition] p. 895, eandemque [and the same], because the diameter of the Moon was smaller, since its Anomaly [was at] gr. 191. The Moon however 100. Mästlin, [from] the Prutenic [Tables] [gives] h. 5, 41', and the digit 8, 36'; with which, however, the time [agrees] for which he observed it, [the digit] 10, fere [nearly]. [Margin: Annular.]

22. In the year 1584, April 30, old style, Tycho at Uraniborg [observed] h. 5, 39' p.m.n. observed the solar eclipse, digit 3, 39'; Magin from the Prutenic [Tables] reckons Venice h. 4, 59', [digit] 3; Maginus from the Prutenic [Tables] reckons Venice h. 4, 59', and digit 4; Puudelinus [Wittich?] ex Tab. Atlanticis [reckons] Uraniborg h. 5, 36'.

23. In the year 1588, February 16, Tycho [at] Uraniborg [observed] the beginning of the solar deficiency [at] h. 1, 32' p.m. the end h. 2, 51'; but from the Tyconic sheets, Kepler, p. 414, *Astronom-Opt.*, explains the inclinations of the eclipse. Mästlin from the Prutenic [Tables] computes Tübingen 57' after merid., and the digit 1, 10'; but Magin at Venice [gives] h. 1, 23', and the digit 1, 3'.

24. In the year 1590, July 31, new style, Tycho at Uraniborg ob-

30. In the year 1605, October 12, at Middelburg the solar eclipse was observed by Joannes Rotarius [at] h. 1, 15', p.m. digit 10½, from the south, vt narrat [as] Lansberge relates in the *Thesaurus*, [where] he reckons h. 1, 22', and the digit 10, 38'. At Naples that the total [eclipse] was observed, ait [says] Kepler in the *Epitome Astronomica*, p. 893, and cap. 23, *de Stella nova* [on the new star]. Lansbergius at Naples reckons h. 1, 49', and the diameter [of the Moon, or] of the Sun 34, 18". The Moon however 34, 52'; and the Sun deficient [to] totality.

"Funestissima Foricalcanti [the most dire foreboding] — the Province saw the Sun totally, except [for] a most tenuous thread of light extending from the North," he attributes [it] to the [Atmosphere of] the Earth, illustrated [by] the Atmosphere; indeed he adds at Marseille the whole Sun [was] obscured, the Atmosphere appearing [only] with dense darkness. Magin at Venice from the Prutenic [Tables] collects h. 2, 55', digits 11, 31'; Origanus from the Prutenic [Tables] [at] Frankfurt h. 2, 0', [digit] 10, 35'. Tychonice h. 2, 3' [?], digit 9, 25'. [Margin: Total.]

31. In the year 1608, August 10, new style, at Goes [Goësa] the solar eclipse was observed by Lansberge h. 4, 7', [digit] 5, 30'; from the south, ex sua calculatione [from his own calculation] h. 4, 8', [digit] 5, 29'. Vlitenburge [Wytenbogaert?] Melchior Josephus observed the solar deficiency [at] digit 5; the Hafnienses [those at Copenhagen] Longomontanus saw nothing of the air's cracked-section [aciem], yet he himself reckons [it] at 5, 24'. Origanus, [from his] thousand [tabular values?], [says] Frankfurt [observed] nothing [as] deficient ex Tyconis semidiam. [Tycho's semidiameter]; but his corrected [Tables] ex Prutenicis compute the digits 1, 46', h. 4, 40'. Maginus however at Venice [from] Prutenice [gives] h. 5, 47', [digit] 3, 14'.

32. In the year 1612, May 30, the monk Christophorus Scheiner observed the deficiency of the Sun [at] digit 7, h. 11, 23', post med. noct. [after midnight]; Longomontanus [at] Copenhagen [reckoned it] with 7 [observed] points h. 8, h. 11, 7', vt habet [as he has it] in the *Theoricon*, lib. 1, cap. 9; Magin at Venice [from] the Prutenic [Tables] [gives] h. 11, 38', digit 7, 4'. Tychonice h. 11, 38', [digit] 7, 14'.

33. In the year 1621, May 21, Petrus Gassendus at Aix [Aquis] observed the solar eclipse [at] h. 8, 18', circiter [about] p. med. noct., and the digit $9\frac{2}{3}$, vt narrat [as] he himself relates in the Epicures [exposition], p. 892, and Furnerius, lib. 12. Hydrograph. cap. 14. Lansberge however at Middelburg observed eam [it] h. 8, 18', [digit] 11, 12'; this true calculation, however, gives h. 8, 16', [digit] 11, 11'. The Prutenic calculation [via] Magin at Venice [gives] h. 8, 43', [digit] 9, 20'; but Origanus at Frankfurt h. 8, 55', [digit] 10, 30'. Tychonice [it occurs] in the same [reckoning] h. 9, 6', cum digit 10, 44'.

34. In the year 1628, December 16, Baricinone [at Barcelona], Fr. Jo. Baptista Cysatus [Cysat] observed the solar eclipse [at] h. 1, 9' p.m. digit 8, 45'. Kepler in Austria observed it cum annulo lucido [with a bright ring], and [appearing] vaporous around the Moon. Origanus, by translated calculation, [reckons it via] the Strait of Gibraltar [Fretum Gaditanum] by the Prutenic [Tables] h. ibi [there] 2, 40', digit 6, 34'; but Tychonice minutis 8 ante meridiem [8 minutes before noon], and the digit 4, 5'. [Margin: Annular.]

35. In the year 1629, June 21, Fr. Rhodes of the Society of Jesus, in the city of Tunkin [Tonkin], which is the seat of the Tunkinese Metropolis, [at] the latitude 18, observed the solar eclipse [at] h. 18, [digit] 11'; from the south. Origanus, in the eastern places distant from Frankfurt and Oderam [at] h. ris [the hour] 6, 18', and under boreal [northern] latitude greatest grade [day] 15, reckons this eclipse by the Prutenic [Tables] of digit 12, 21'; and Tychonice [at] h. 11, 26', [digit] which much disagrees with the observation, in latitude greater indeed, yet not in [latitude] so great, however much it required of [tabular] differences.

36. In the same year 1629, December 14, an eclipse of the Sun was observed in America Australis [South America] in the Province of Macha [Machu?], under the latitude of the Austral [South] Pole gr. 20, vt [as] the beginning was seen h. 4, 45' ante meridiem, [the] end after midday h. 1, 45', vt habeo ex litteris [as I have from the letters] of our Fathers ad nos [to us]; Origanus, by translated calculation ad [for] Mediterranean Peru under the Austral [southern] latitude gr. 20, and [at] the meridian distant from Frankfurt and Oderam h. 5, 6', collects by the Prutenic [Tables] [an] eclipse h. 1, ante meridiem of digit 11, 36'; but Tychonice 10, 14'.

37. In the year 1630, June 10, the solar eclipse was observed [at] Dordrecht [Dordraci] by Martino Hortensio h. 7, 15', digit 10, and parum plus [a little more]; but Middelburg [from] Lansberge [gives] h. 7, 10', digit 10, [and] 10, 42'; calculation, however, ex ipsius Goesa [from his own Goes Tables] [gives] the digit, the same [as] of that [grade?]; gr. 10, 42', and h. 7, 21'. The Parisians [from] Gassendus h. 7, 11', observed the digit 11, 32', vt narrat [as he relates] in the

Epicures [exposition], p. 885. Oxford [via] Bainbridge noted the beginning h. 5, 58', p.m., the Fathers PP. Andreas Arzet, and Jo. Baptista Cysatus at Ingolstadt observed h. 7, 54'; the digit 11, 57'. We too, at the Forum Naeuij in the territory of Parma [agro Parmensi], h. 1, fere [nearly] before sunset, saw it of digits nearly $11\frac{1}{3}$. Magin-

(continuation of Caput XVI, the solar-eclipse catalogue, from item 37, the eclipse of 10 June 1630)

[Magin]us by the Prutenic tables computed it at 7h 3', 10 digits; Origanus at Frankfurt, Prutenically, at 7h 41', $12\frac{4}{5}$ digits; Tychonically at 7h 47', 10 digits, 19'.

38. In the year **1633, on April 8.** P. [Father] Andreas Arzet, of the Society of Jesus, at Regensburg observed the maximum of the solar deliquium at 5h 3', $6\frac{1}{2}$ digits; at 6h 44' we ourselves at Bologna saw it end, 5 digits, 15'. At Dijon, Gassendi at 4h 42' saw it of 8 digits, 18'. At Aix-en-Provence, Peiresc [Peiresc] and Gassendi at 5h 41' [saw it] of 8 digits, 48'. P. Beaugrand at 4h 26' and digits, fivefold [reckons] 6. Oroniū [Oronce — Oronce Fine?] [?] Baudringus at 5h 19' from the same furnace, lib. 12. Hidrograph. [*Hydrographia*] cap. 17. Origanus at Frankfurt Prutenically computes it at 4h 37', 7 digits; Tychonically at 5h 14', 4 digits, 30'.

39. In the year **1639, June 1.** A solar eclipse was observed by Hevelius [Hevelius] at Danzig at 6h $21\frac{3}{4}$, 10 digits, 48'. At Regiomontanum [Königsberg] in Prussia, Albertus Linemannus [Albert Linemann] at 6h, 20', or at 5', [of] 11 digits, 30'. At Stettin, Laurentius Eichstadius [Lorenz Eichstadt] at 6h 2', of 10 digits, 0'; or, as he narrates from the memory of Linemann, 4-fold. At Leiden, D. Keplerus [Jakob Kepler?] [?] at 5h 30', [of] 10 digits, 20'. Gassendus at Aix-Sextiae [Aix-en-Provence] at 8h 10', or 16', and the maximum at 8h 45'; collected from the phases at 16'. He refers it to the Epicurus, page 889. At Paris, Petavius [Petau], Robervalius [Roberval], Midorgius [Mydorge], Hardius [Hardy] — they note the maximum at 5h 21', 9 digits, 34'. Blesis [Blois?], D. Beaunius [de Beaune] at 5h 17', 8 digits, 30'. Flexis [Flèche?], the Fathers Deirenes, Batterus, and Fournierius [?], as they have it here lib. 12. cap. 17, observed the maximum of the eclipse at 5h 18'; at Rome D. Bertus and P. Kircher [Kircher] at 5h 10', or 16', [of] 8 digits, or $8\frac{1}{3}$. In Canada, P. Castellanus at the Residence of the Conception observed 5 digits, 4h 10', 15' in the morning. P. Agathangelus Capucinus [Agathangelus, a Capuchin] at Cairo [?] saw part of the Sun obscured, in a small space. Origanus at Frankfurt collects [it] Prutenically at 5h 54', [of] 8 digits, 52'; Tychonically at 5h 19', [of] 10 digits, 40'.

40. In the year **1645, August 21.** Gassendus at Paris [observed] the beginning...

[The text continues in the right-hand column.]

the beginning of the solar deliquium [he] observed at 10h 4' p.m. [reckoning the] night, as he relates in his *Epicurus* page 889. Maioticae [at Majorca] Vincentius Mutus [Vicente Mut] saw the beginning, the Sun being high above the horizon, at 57' 38'; the end likewise high above the setting at 62' 20'. The remainder, as P. Iacobus Billy [Jacques de Billy] writes, the middle was observed before noon at 58' minutes before noon. We ourselves at Bologna observed it at 31½ p.m., [of] digits 4, 30'. At Rome P. Daniel Bartolus [Daniele Bartoli] noted the beginning at 52' before midday. At Prague P. Theodorus Moretus, S.I. [Theodor Moretus, of the Society of Jesus] observed [of] digits 6, adding: Alderbachij [at Aldersbach?] [?] to Danubium [the Danube] 10 minutes p.m., the maximum of the eclipse seen [of] digits 5, computed by an arc of saffron color, [of] digit, 5, 45'. At Gdańsk, Joannes Heuellius [Hevelius] observed the middle at 12h 42' past midday, [of] noct. [night reckoning?] digits 7, 45'. Origanus at Frankfurt elicits the Prutenic middle of the eclipse at 1h 2' p.m., [of] digits 7, 23'; Tychonically at 30' p.m., [of] digits 5, 24'; but as from the Fretum Nassovium [the Nassau Strait — i.e. Lansberge's tables], Prutenically [of] digits 12, 4'; Tychonically [of] 10, 38'. Argolus [Andrea Argoli] at Rome, from the Danish [tables], collects the middle at 28' after midday, [of] digits 4, 19'. Montebrunus [Montebruno] at Bologna, from Lansberge, [computes] the middle at 5h, p. merid., [of] digits 4, 40'.

41. In the year **1640, November 4.** Hevelius at Danzig [observed] in the maximum of the solar eclipse [of] digits 5, 14¹/₃, p.m.; he observed [of] digits 5, 45'. P. Theodorus Moretus at Košetlice [?] in Bohemia did not perceive itself [the eclipse?] at 5, 13'. Vincentius Mutus at Majorca observed the middle at 2, 3' p.m. [of] digit 3, 33'; and the diameter of the Moon to the diameter of the Sun, as 4230 to 4150. Origanus at Frankfurt gives the Prutenic [middle] at 3h 30', [of] digit 5, 42'; Tychonically at 3, 8', [of] digit 4, 44'. Argolus at Rome from the Danish [tables] [at] 2, 23', [of] digit 5, 48'. Montebrunus at Bologna from Lansberge [at] 3, 20', [of] digit 5, 19'.

42. In the year **1641, April 8.** A solar eclipse was observed, but on the matters written below, as it is clear to me from the letters [sent] to me, or from the published little works of the observers.

The eclipse of **1641, April 8** is tabulated below. (This is the table that occupies the lower half of the left column and the foot of page 146; it is the item-42 eclipse table.)

Obse rvers / Place s (Obse rvato res / Loca)	Begin ning p.m. (Initi um)		Maxi mum p.m. (Sum mũ)		End p.m. (Finis) H.		Digits (Digit i) D.	
	H.	M.	H.	M.	H.	M.	i) D.	M.
Bolog na, P. Franc iscus Mari a Grim [aldi] , [and] I [Ego]	10	9	11	37	12	29	8	48
Rome , D. Ant. Franc . Paye n	10	16			12	31		
Rome , D. Ricca rd. Alber t. Angl us [Rich ard	10	18			12	32		

Observers / Places (Observatories / Locations)	Beginning p.m. (Initial)		Maximum p.m. (Summ̄)		End p.m. (Final)		Digits (Digit i) D.	
	H.	M.	H.	M.	H.	M.	i) D.	M.
Albert, the Englishman]								
Danzig, Io. Hevelius	11	4	12	12	13	19	9	20
Danzig, Laurent. Eichstadius [Lorenz Eichstadt]	11	3			13	19	10	fere [nearly 10]
Tournai, Gottfridus Venedinus [God	9	34			11	59		

Obse rvers / Place s (Obse rvato res / Loca)	Begin ning p.m. (Initi um)		Maxi mum p.m. (Sum mũ)		End p.m. (Finis)		Digits (Digit i)	
	H.	M.	H.	M.	H.	M.	D.	M.
efroy Wen delin]								
Paris, P. Petr. Bour din, Soc. Iesu, in the prese nce of the King of Engla nd and the Duke of York and other s	9	30	10	33	11	52	10	36
Paris, Isma	9	30	10	42	11	50		

Observers / Places (Observers / Locations)	Beginning p.m. (Initial) H. M.		Maximum p.m. (Summum) H. M.		End p.m. (Finis)) H. M.		Digits (Digit i) D. M.	
el Bullidus [Ismaël Boulliau]	9	30	10	45	11	49		
Paris, Io. Baptista Morinus [Jean- Baptiste Morin]	9	29			11	51	10	20
Paris, others of the Society of Jesus Dijon, Petru	9	43	10	50	11	58		

Observers / Places (Observatories / Locations)	Beginning p.m. (Initial) H. M.		Maximum p.m. (Summ̄) H. M.		End p.m. (Final) H. M.		Digits (Digit i) D. M.	
s Gasse ndus Aix- Sexti ae [Aix- en- Prov ence] , D. Roqu eseni lle [?]	9	42	10	47	11	50		
At the same place , R. D. Hono ratus Gauti er	9	35	10	37	12	18		
Avig non, D. Petr. Franc . S.	9	33	10	50	11	52		

Observers / Place s (Observed res / Loca)	Beginning p.m. (Initial um)		Maximum p.m. (Sum mū)		End p.m. (Final)		Digits (Digit i) D.	
	H.	M.	H.	M.	H.	M.	D.	M.

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Mutus —
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Obse rvers / Place s (Obse rvato res / Loca)	Begin ning p.m. (Initi um)		Maxi mum p.m. (Sum mũ)		End p.m. (Finis)		Digits (Digit i)	
	H.	M.	H.	M.	H.	M.	D.	M.

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gr.
54,
54',
[of]
digits
9, 47'

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Paris, Petav ius from the Parisi an table s	9	4			10	8	11	20
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Philol aic table s [Tab b. Philol	9	11 $\frac{2}{3}$			11	33 $\frac{2}{3}$	10	36
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Obse rvers / Place s (Obse rvato res / Loca)	Begin ning p.m. (Initi um)		Maxi mum p.m. (Sum mũ)		End p.m. (Finis)		Digits (Digit i)	
	H.	M.	H.	M.	H.	M.	D.	M.
aicae], Boull iau's, ibid.								
The Danis h [table s] give there [ibid em dant]	9	18 ² / ₅			11	41 ² / ₃	10	44
Lans bergi an [table s] there	8	52			11	20	10	13
Rudo lphin e [table s] there , from	8	44			11	44	10	46

Obse rvers / Place s (Obse rvato res / Loca)	Begin ning p.m. (Initi um)		Maxi mum p.m. (Sum mū)		End p.m. (Finis)		Digits (Digit i)	
	H.	M.	H.	M.	H.	M.	D.	M.
Raine r [ex Raine ro]								
Fran kfurt, Origa nus Prute nicall y	9	19	10	42	11	44	11	32
Tych onica lly	10	44	11	51	12	57	8	21
Rome , Argol us from the Danis h [table s]	9	43	10	58	11	43	7	54
Bolog na, Mont ebru n[us]	9	14	10	40	12	5	9	59

Place (Observed / Local)	Beginning (Initial)		Maximum (Summum)		End (Finis)		Digits (Digiti)	
	H.	M.	H.	M.	H.	M.	D.	M.

from
Lans
berge

Parsing notes: the "Calculi" sub-block lists computed (table-predicted) circumstances vs. the observed values above. Several digit cells are blank in the source (observers who reported only times). Fractional minutes (e.g. 11 $\frac{2}{3}$, 33 $\frac{3}{5}$, 18 $\frac{2}{5}$) printed with vulgar fractions.

43. In the year **1654, August 12.** A solar eclipse [some] observed at the hour after midnight.

Place (Observed / Local)	Beginning (Initial)		Maximum (Summum)		End (Finis)		Digits (Digiti)	
	H.	M.	H.	M.	H.	M.	D.	M.
Bologna,	8	54 $\frac{1}{4}$			11	21 $\frac{1}{4}$	8	22

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Observers / Places	Beginning p.m. (Initium)		Maximum p.m. (Summū)		End p.m. (Finis)		Digits	
	H.	M.	H.	M.	H.	M.	D.	M.
Iesu Avignon, D. Anton. Franc. . Payen Lyon, P. Gneurus [?], Soc. Iesu Lyon, likewise P. Rheita, Capucin. [Schyrlaus de Rheita, a Capuchin] Paris,	8	16			10	37	9	40
	8	14	9	19	10	36	8	21
	7	45			10	43	8	21
	8	4 $\frac{3}{4}$			10	28 $\frac{2}{3}$	9	15

Observers / Places	Beginning p.m. (Initium)		Maximum p.m. (Summū)		End p.m. (Finis)		Digits	
	H.	M.	H.	M.	H.	M.	D.	M.
Ismael Bullialdus [Boulliau] Paris, Petrus Gassendus	8	0 $\frac{2}{3}$	9	13 $\frac{2}{3}$	10	26 $\frac{3}{4}$	9	0
Paris, the Fathers of the Society of Jesus	8	4 $\frac{3}{4}$	9	18 $\frac{1}{2}$	10	32 $\frac{1}{8}$	9	20
Majorca, D. Vincentius Mutus — but his friend, under the	8	17			10	27	6	0

Observers / Places	Beginning p.m. (Initium) H. M.		Maximum p.m. (Summū) H. M.		End p.m. (Finis) H. M.		Digits D. M.	
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Meridian of Majorca, distant three leagues from Majorca, observed

Aspāni [Ispahan?] in Persia, from the report of a certain count rymān of ours

Observers / Places	Beginning p.m. (Initium)		Maximum p.m. (Summū)		End p.m. (Finis)		Digits	
	H.	M.	H.	M.	H.	M.	D.	M.

Computations (Calculus)

Frankfurt, Origanus, Prutenically gives but Tycho nically	9	45	11	10	12	35	11	55
Rome, Argolus from the Danish [tables]	9	28	11	1	12	30	10	13
Bologna, Montebonus	8	56	10	24	11	57	9	28

Observers / Places	Beginning (Initium)		Maximum (Summū)		End (Finis)		Digits	
	H.	M.	H.	M.	H.	M.	D.	M.

from
Lans
berge

Parsing notes: maximum (Summū) cells blank for several observers who reported only beginning and end. Fractional minutes printed with vulgar fractions.

44. In the year **1656, January 26.** A solar eclipse [some] observed in the hours after midday.

Observers / Places	Beginning (Initium)		Maximum (Summū)		End (Finis)		Digits	
	H.	M.	H.	M.	H.	M.	D.	M.
Rome	1	43	2	42	3	58	5	0

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Observers / Places	Beginning p.m. (Initium)		Maximum p.m. (Summum)		End p.m. (Finis)		Digits	
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nal Mediceo [the Cardinal- physician Giovanni Carlo de' Medici] Rome, P. Boghi- llus [Boghille] likewise Bologna, I [Ego] and P. Grimaldi [Grimaldi]			2	20	3	41		
	1	55 52/60			3	50 1/3	5	36

Observers / Places	Beginning p.m. (Initium)		Maximum p.m. (Summum)		End p.m. (Finis)		Digits	
	H.	M.	H.	M.	H.	M.	D.	M.
3'								
Genoa, D. Franc	1	2 33/60	2	17 7/12	3	41 $\frac{2}{3}$	6	20
Vincen- tius								
Avignon, D. Ant. Franc	0	37	2	5	3	19	5	50
Payen								
Lyon, from the report of the same	0	45	2	5	3	35	6	30
Blois, D. Anton. Marchais, in the presence of the	0	9 $\frac{1}{2}$	1	41	3	9	7	50

Observers / Places	Beginning p.m. (Initium)		Maximum p.m. (Summum)		End p.m. (Finis)		Digits	
	H.	M.	H.	M.	H.	M.	D.	M.

Principle of Orleans [Aureliane nsis]

Paris, Ismael Bullialdus [Boulliau]	0	14	1	52 $\frac{1}{4}$	3	13 $\frac{1}{6}$	7	50
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Petavius from the report of these

Petavius from the report of these	0	5 $\frac{1}{4}$			3	55 $\frac{1}{6}$	7	28
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Computations (Calculus)

Rome, Argolus from the	1	40	3	14	4	38	8	19
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, Argolus from the

Observers / Places	Beginning p.m. (Initium)		Maximum p.m. (Summum)		End p.m. (Finis)		Digits	
	H.	M.) H.	M.) H.	M.	D.	M.

Danish

[tables]

gives

Bologna,	1	48	3	8	4	21	5	0
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Montebonus
from
Lansberge

Paris,	0	25 ² / ₅	1	59 ² / ₅	3	24 ² / ₅	7	57
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Observers / Places	Beginning		Maximum		End		Digits	
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Parsing notes: maximum cells blank for several observers. Mixed-fraction minutes printed with vulgar fractions (e.g. 55 38/60, 17 7/12, 53%).

45. In the year **1659, November 14.** The beginning of the solar eclipse was observed at Bordeaux [Burdegalae] at 1h 40' past midday; the maximum of the deliquium at 2h 35', [of] digits 9¾; the end at 4h 20'. At Bologna we observed the beginning of the solar [eclipse] at 2h 45' by horological reckoning; at Majorca the beginning was observed at 2h 15', [of] digits 9, 57'.

The right-hand inset table for this eclipse (item 45) gives the phases by digit:

Phase	Dig.	H.	I	II
Summa Ecl. redijt ad [The maximum of the eclipse returned to]	9	1	29	0
	8	1	11	44
	6	0	52	18
	4	0	36	46
Finis [End]	0	0	6	47
Duratio tota [Total duration]		2	31	48
Incidentia e Tempus [Time of immersion]		1	9	35
Emersionis Tempus [Time of emersion]		1	22	13

46. In the year 1661, **March 30**. At Bologna we observed, P. Franciscus Maria Grimaldus [Grimaldi] and I.

Principal
phases (Phases
praecipuae) —

Digits obscured (Digiti obscurati)	Hours before noon (Hor. ante meridiam) H.	I	II
Initium [Beginning]	2	38	35

Principal
phases (Phases
praecipuae) —

Digits obscured (Digiti obscurati)	Hours before noon (Hor. ante meridiam) H.	I	II
Dig. 4	2	14	11
Dig. 6	2	0	48
Dig. 8	1	46	7

At Ferrara digits 9 were observed by D. Io. Dominico Cassino [Cassini]; at Turin [Taurini] digits 8, 25', and a duration of 2h 32', by the most excellent gentlemen Iulius Tortrinus [Giulio Tortrino?] and his son, in the presence of the Princes of the Royal House, and an assembly of the Nobility.

CAPUT XVII.

On the Apparent Diameters of the Luminaries, suitable for representing the Total and Annular Solar Eclipses.

1. Just as the Lunar Eclipses are most suited to determining the Lunar motions, and at times the diameters of the Luminaries, so the Solar Eclipses — especially the Annular and Total ones — require that there exist between the two Luminaries such a symmetry of their respective diameters as the observations of the aforesaid Eclipses demand, in keeping with the Sun's Anomaly and the Lunar Anomaly, [reckoned] for the time of those eclipses by both [sets of] tables. Hence, in order that there be Annular Eclipses, the apparent diameter of the Sun must be greater than the apparent diameter of the Moon at that same time; [and so] the Anomaly which is fitting for the motion by both tables must agree with the time of the Eclipses. Yet it is not required that the Sun's diameter be greater than the Moon's by so much as the doubled breadth of that little ring, or corona, which appears around the Moon. For a part of this phenomenon can arise from an optical enlargement of the disk, produced by the Sun's rays reflected from the Moon's margin into the air, or into our atmosphere.

2. Total Solar Eclipses, on the other hand, require that the Luminaries, agreeing at the time of the eclipse, have the diameter of the Moon greater than that of the Sun; and the greater the longer the Sun's delay shall have been in total obscuration — especially if the Eclipse should not happen close to the Horizon.

For that contraction of the Sun, which Lansberge devised, is fashioned to prop up his hypotheses, with no support from Optics. Nor, though Kepler maintain it, do the stars in the open shrink in the middle of the day [as much] as in the evening or at night — even granting that in totalities they are not seen, [and] that this conversely is observed at varying times of the air [i.e. atmospheric conditions], to whatever degree it stands established for the totality of the eclipse, as often as the Observers assert that the stars were nonetheless seen meanwhile. Hence, with the rest preserved that must necessarily be preserved, the diameters of the Luminaries might come out [as] commensurate, so that eclipses of this kind might emerge [as] total, with greater simplicity and truth to satisfy the observations. Therefore, just as the Lydian stone [touchstone], so for the eclipses noted below, the diameters of the Luminaries are to be approved by the degrees of Anomaly added in the following little table — or [those] nearest these. Now, the first column [holds] the significant numbers of the Eclipses, in the same order in which I recounted them in the preceding chapter. In the **Second** column are the Degrees of the Sun's Anomaly, which it held at the time of the Eclipse. In the **Third** column [is] the semidiameter of the Sun, apparent to us [and] most certain, from the things demonstrated in lib. 1. cap. 12. In the **Fourth** [is] the Anomaly of the Moon, which it held at the time of the Eclipse. In the **Fifth** [is] the semidiameter of the apparent Moon, [with] the limits necessarily required for representing the aforesaid Total and Annular Solar Eclipses. And note that the Minor [i.e. minimum] semidiameter of the Moon ought to be set [as] less than the Sun's [as] expressed in the Third column, and replicated in the Fifth.

[The table referenced is at the head of the right-hand column, page 148:]

Order of the Eclipses (Ordo Eclipsium)	② Anomalia [Sun's Anomaly] Gr.	③ Semidiam. Appar. [Sun's apparent semidiameter] I II		④ Anomal. vel distantia ab Apog. [Moon's Anomaly, or distance from apogee] Gr.	⑤ Semidiam. Appar. debent esse Maior, vel Minor quam [Moon's apparent semidiameter must be greater or less than] I II	I	II
		I	II				
29	175	16	2	7	Min. [less than]	16	2
4	39	15	25	64	Min.	15	35
21	290	15	42	100	Min.	15	42
27	247	15	50	130	Min.	15	50
20	64	15	41	136	Ma. [greater than]	15	41
7	135	15	55	140	Ma.	15	55
30	104	15	49	141	Ma.	15	49
13	253	15	30	156	Ma.	15	30
3	300			156	Ma.	15	38
2	74	15	43	159	Ma.	15	43

Order of the Eclipses (Ordo Eclipsium)	② Anomalia [Sun's Anomaly] Gr.	③ Semidiam. Appar. [Sun's apparent semidiameter]		④ Anomal. vel distantia ab Apog. [Moon's apparent semidiameter] Anomaly, or distance from apogee] Gr.	⑤ Semidiam. Appar. diameter esse Maior, vel Minor quam [Moon's apparent semidiameter] must be greater or less than]	I	II
		I	II				
12	349	15	30	160	Ma.	15	56
5	216	15	56	169	Ma.	15	30
15	270	15	46	170	Ma.	15	46
6	324	15	35	173	Ma.	15	35

Parsing notes: column headers carry small printed sequence-markers (rendered ②③④⑤); the first row's order-number is 29. Row for Eclipse 1 has blank Sun-semidiameter cells (apparent semidiameter not given). The ⑤ column states whether the Moon's apparent semidiameter must be greater (Ma.) or less (Min.) than the listed value.

Use of the preceding Table (Usus praecedentis Tabellae).

3. In the preceding Table, I have set forth the Order of the Lunar Anomaly in the fourth column, because, the Sun's semidiameter being firmly established for us by it, it is necessary to make the Moon's semidiameter agree in such a way that, in the four Annular Solar Eclipses, it be less than the Sun's; while in the remaining

Total ones, it be greater — and yet there shall be preserved the proportion of increment, or decrement, due to the Moon's distance from its Apogee. Therefore, by way of example, when the Moon is distant from its Apogee by gr. 140, its apparent semidiameter ought to be greater than 15', 55" — because, at the time of the Total Solar Eclipse no. 7, the Sun is indicated in the first column [to be] distant from its Apogee by gr. 135; [and] as is to be noted in the second column, [the Sun] held an apparent semidiameter of 15', 55". [But] if it held [its] apparent semidiameter in [an] Anomaly of gr. 140, [it would be] greater by minutes 15', 55"; [and] in the remaining ones greater [in proportion as it is] distant from its Apogee, the apparent semidiameter still goes out [i.e. increases], and up to degree 173 the semidiameter of the Moon's Anomaly comes out greater than the Sun's.

4. Furthermore, going on to examine the Tables of other Astronomers, I recognize that the apparent [semidiameters] are not represented by all of them for all the aforesaid Solar Eclipses; [for] the Danish Tables err in Eclipse 4, because the apparent Lunar semidiameter comes out greater than the Solar [one], while the Annular Eclipse requires it [to be] less. Similarly the following Eclipses err in the Tables [given] below:

In Eclipse	The Tables err (Peccant Tabulae)
4	Danish, Parisian, Rudolphine
5	Lansbergian
6	Lansbergian
7	Lansbergian
21	Alphonsine, Copernican, Danish, Parisian, Philolaic, and Rudolphine
27	Alphonsine, Copernican, Danish, Parisian, Philolaic, and Rudolphine
30	Lansbergian

Skilfully too the Marchese Cornelius Malvasia [Cornelio Malvasia], at fol. 219 of his Ephemerides, has often noted the excess of the Lansbergian ☉ [Sun] diameter, whatever may be the case as to the method employed by him, and indicated at fol. 218.

5. We therefore have ordered the semidiameters of the Luminaries in such a way, that — with the [requirements of the] Solar observations preserved — the

semidiameters set forth in lib. 1. c. 12. & in the Solar, Annular, and Total Eclipses, [should hold,] preserving nonetheless the proportion due, [derived] from the distance of the Luminaries from the Earth, and from the Horizontal Parallax. Concerning the distance, therefore, of the Moon and its Parallax in the syzygies, we shall speak in the following Chapter.

Liber II — De Luna

CAPVT XVIII.

On Determining the Eccentricity of the Lunar Orbit, together with the Moon's Intervals, Parallaxes, and Apparent Semidiameters, both by a Circle and by an Ellipse.

1. Among all the prosthaphaeretic [*prosthaphaereon*] hypotheses by which the Moon's motion is reduced to its true value, none corresponds more closely to the observations of frequent eclipses than the one that takes as its foundation the eccentricity of the whole, amounting to 8686 parts, the semidiameter of the eccentric being 100000. Consequently, the greatest equation of the first inequality is $4^{\circ} 58' 28''$. For although the Moon's apparent semidiameter at apogee scarcely exceeds $14' 30''$ at the syzygies, while at perigee it is $16' 22''$, nevertheless — by the more accurate and more recent observations, and by those same observations — the Moon's distance at perigee in the syzygies is 58 semidiameters of the Earth (or at most $58\frac{1}{3}$), as I shall show shortly; whereas the apogee is 64 terrestrial semidiameters, or, by these operations, 63 semidiameters $40'$. For this reason the greatest distance differs from the least by twice as much as the eccentricity of the whole, 8686 parts, does. This is because the center of the apparent motions, that is, the center of the lunar orbit, falls between the center of the Earth and the center of the apparent motions.

2. Hence I recognized, with [Kepler] and [Magini] and most authors, that an equant must be introduced into the Moon's theory, and that the eccentricity must be bisected: thus its half, 4343 parts, falls between the center of the Earth and the center of the lunar orbit, and serves as the foundation of the optical equation [*Aequationis Opticae*]; while the other half, 4343, falls between the center of the orbit and the center of the apparent motions — that is, the other focus, namely the navel [*umbilicus*] of the ellipse, if the elliptical hypothesis is adopted — and serves as the foundation of the physical equation [*Aequationis Physicae*]. But

before this theory can be expounded, the equation of the distances from the Earth and of the parallaxes must be laid down as its foundation.

3. And so, in the year 1648, on the 8th of March, when the Moon was near full and at perigee, Father [Grimaldi] at Bologna and I took the distance of the Moon's center from the zenith to be $33^{\circ} 55' 30''$; and this was the apparent distance, observed at the height of Spica Virginis rising one hour after midnight, 11h 48' 34". But the equated time was 11h 56'; and then the luminaries were so disposed:

	Sign.	Gr.	'	"
The Moon's true place [<i>Luna Verus locus</i>]	□	13	29	17
Its equated anomaly [<i>Anomalia eius Aequata</i>]	□	25	29	37
The Moon's northern latitude [<i>Latitudo Borealis Lunae</i>]	0	4	48	13
Therefore northern declination [<i>Ergo declinatio Borealis</i>]	0	10	58	0
The equator's distance from the zenith [<i>Distantia Aequatoris</i>]	0	44	30	10

	Sign.	Gr.	'	"
<i>à Vertice]</i>				
Therefore the Moon's true distance from the zenith <i>[Ergo Lunae vera distantia à Vertice]</i>	0	33	32	10
But its apparent distance was <i>[At visa fuit]</i>	0	33	55	30
Therefore the parallax <i>[Ergo Parallaxis]</i>	0	0	23	20
And the distance from the Earth's center in semidiameters of the Earth <i>[Et distantia à centro Terrae semid. T.]</i>	58	20	0	
And the horizontal parallax <i>[Et Parallaxis]</i>		58	56	

Sign. Gr. ' "

Horizontalis
s]

From this I deduced that at the Moon's very perigee the distance was 58 terrestrial semidiameters, 20'; or at most 21', as I shall show elsewhere. Beyond perigee a somewhat larger figure has come out for us. Nor should the numbers be trusted when they are deduced near an uncorrected elevation of the pole, and at uncorrected places of the fixed stars; that is what we were relying on here. Likewise, by corrected observations — limited, as is fitting — we find the Moon's apogee distance in the syzygies to be rather 63° 40' than 64 terrestrial semidiameters, as I shall show at the end of this chapter.

4. Let the aforescribed measures therefore stand as ratified by us. The Moon at conjunction \odot and opposition \oslash :

			Semidiam. Terraе
Eccentricity of the parts [<i>Excentricitas partium</i>]	8686		
Half part [<i>Dimidia pars</i>]	4343		
Mean distance [<i>Distantia media</i>]	100000	61	
Apogee [<i>Apogea</i>]	104343	63	40
Perigee [<i>Perigea</i>]	95657	58	21
Horizontal parallax [<i>Parallaxis Horizontalis</i>]		54	2'
— Apogee [<i>Apog.</i>]			
— Perigee		58	58"

		Semidiam. Terrae	
[Perig.]			
Apparent semidiameter		14'	30"
[Semidiameter Apparens] —			
Apogee			
[Apogea]			
— Perigee		16	22
[Perigea]			
Greatest equation at σ and σ°	Gr. 4	58	28
[Aequatio Maxima in σ σ°]			

5. With these things laid down, let there be described from the center C the semicircle ALP, or the semi-ellipse, by that device which I set forth in Book I, Chapter 11, Problem 4. And let T be the center of the Earth, distant from the center C of the orbit by the bisected eccentricity CT, 4343 parts. Now let the point about which the Moon is imagined to move uniformly be F, distant from C, on the other side, likewise by 4343 parts — so that the whole AC is 100000, and AP 200000. Let the line in L, to which the lines of the Moon's mean motion FL are drawn, be such that the angle TL is the true or apparent angle. This will be the angle, not measured under the arcs of the orbit, but under the ecliptic; the prior anomaly, or distance at apogee from A, whose complement to two right angles will be the angle LFT, will therefore be given by the data of the anomaly.

Diagram. A geometric construction for the lunar orbit and its eccentricity, set in the right margin beside §5. A roughly vertical line runs from A at the top down through F, C, T to P at the bottom (the line of apsides, A = apogee, P = perigee). The point M lies at upper left, with L below and to the right of it; lines radiate from the lower points to L and M, forming the triangles used in the construction.

- A (top): apogee of the orbit
- M (upper left): point on the orbit / construction point

- L (center, right of M): the Moon's place, to which lines of mean motion are drawn
- F (upper middle of axis): focus / point of uniform (equant) motion
- C (middle of axis): center of the orbit
- T (lower middle of axis): center of the Earth
- P (bottom): perigee of the orbit

I. Problem: To find the equation in an ellipse.

6. Now if you wish to use the ellipse, produce the line LF as far as M, until LM equals LT itself, and join the extremes M and T by the straight line MT. For then there will arise the isosceles triangle FMT, of which one part is the triangle MLT, since MLT was made equal to LT itself. And since the properties of the ellipse make any two radii drawn out from its foci to the periphery, taken together, equal to the whole greater diameter AP — therefore, in the triangle FMT, FM and FT have been given as two sides, FT being 8686 parts and FM 200000 parts; and the angle comprehending the given anomaly is the angle M, equal in the isosceles triangle to the angle LTM, whose double will be the angle of the 32nd First Element. That is the integral equation of the Moon's first inequality, consisting of the physical part CLF and the optical part CLT.

II. Problem: To investigate the equation in a circle.

7. But if you use the circular orbit, the angle FLT must be divided, the radius CL being drawn, and in the triangle CLF, the semi-eccentricity CF being given as 4343 parts (the radius CL being supposed 100000), there is also given the angle F — namely, the equated anomaly. So one part of the equation, namely the physical part CLF, is given by the property of the ellipse, together with the external angle TCL; and with this datum, together with the sides CT 4343 and CL 100000, one investigates the optical part of the equation CLT.

III. Problem: To find the Moon's distance from the Earth at the syzygies.

8. The first method, whether in the circle or supposing in the ellipse, takes the given eccentricity (under the integral angle FLT) and the complement of the anomaly TFL. With these given, one investigates LT, the Moon's distance L from the center of the Earth T; but whenever the angle LFT is greater than a right angle, the rule of trigonometry bids one use its complement —

(continued) — for the sines, or the logarithms, to be found. For when the distance is less, the radius is smaller; and proportionately, the greater the radius required, so much less is the certainty of the distance — and to the radius must be

added a complement, by adding the quantity sought to the radius, to obtain the sought-for distance LT of the Moon by the larger radius. But this very method is obstructed by the smallness of the angles near apogee and perigee; and when in the given equation of the anomaly the errors run on over a few seconds in the scruples, they run on enormously in the distances. For example, if from the Moon's anomaly of 170° you use the equation $4^\circ 58' 27''$, the Moon's distance from the Earth comes out 97013 parts, of which the whole eccentricity is 8686; but if you use the equation $53' 30''$, the Moon's distance comes out 96924 parts. See, then, that by changing the seconds in the third place the distance is diminished by 89 parts. It is therefore not expedient to use these angles, but only the angle of whole and round anomalies, to which exactly correspond the sines, or logarithms; nor is it useful to hunt out the proportional part, which at the beginning and end of the trigonometric canon is less exact.

9. In truth, however, by using only the angle of the anomaly and the eccentricity — although the triangle FLT is oblique-angled — it cannot be reduced to one, or to two right angles, until we are able to drop a perpendicular; yet without this angle TL, by sines or logarithms, the trigonometric distance is reached so far that, two sides and the included angle being given in a right-angled triangle, or a comprehended angle, or a given base of a right-angled triangle, and one side, we can by sines, or by logarithms, immediately find the third side. We shall therefore recur to the squares of their sides; and the roots, the bases, and indeed first in circular form:

10. Let the Moon be in L, where three straight lines meet at three centers: namely LF, to the center of the apparent motions equal to LC, the center of the circular orbit, & LT, to the center of the Earth. Then produce LF, as far as in R; and where the line produced from R meets the production from C, let it make with this LF the right angle CRF; let LF likewise be produced beyond, as far as in B, where the line produced from T meets it, and let it make with this FBT a right angle. Two right-angled triangles arise, CRF and TBF.

Diagram. A geometric construction beside §10, with a vertical apsidal line A–F–R–C–T–P at the right. Lines are drawn from the lower points to L at the left, with R and B as the feet of perpendiculars, forming the right triangles CRF and TBF.

- A (top): apogee
- L (left): the Moon's place
- R (on axis below F): foot of the perpendicular from C
- F, C, T (middle of axis): point of apparent motion, center of orbit, center of Earth

- P (bottom): perigee

11. Now in the prior triangle CRF, besides the right angle R and the base FC of 4343 parts, the angle of the integral anomaly CFR is also given, AFL, by supposition; and so its complement to the other right angle, the complement FCR, is given by sines or logarithms. The side CR is known, and likewise FR. Then the square of CR and of it is subtracted from the square of the radius CL, which is 10000000000, and the remainder is the square of the whole side LR, whose square root is the side LR. From this LR you subtract the FR found above, and the side LF remains, the Moon's distance from the center of the apparent motions.

12. With these things done, resolve the triangle TBF, right-angled at B, for FT 8686 is given, and the angle of the anomaly TFB is given in whole degrees; therefore both are known, namely the side TB and TF; for to the side LF, found above, will give the whole side LB; therefore one investigates the sides LB and TB; and the square is reduced to one sum; for they will make a certain square, whose root, sought, will give the Moon's distance LT, as being the base opposite the right angle LBT, by the 47th of the First Elements. Hence it is not difficult to understand how the perpendicular in the semicircle is to be led from the lower part:

12. [bis] For the Moon being constituted in L, and (as above) drawn by three straight lines LF, LC, LT, draw out C, perpendicular to LF, and in the triangle CFR, right-angled at F, the given base CF being 4343 parts, and the angle CFR, the complement of the anomaly — and so to it the angle FCR, the complement of the right angle — investigate the side CR and FR. Then square CR, and its square subtract from the square of the radius CL, for there will remain the square of —

Diagram. A second geometric construction beside §12 (bis), nearly identical in arrangement to the upper one, with the vertical apsidal line A–F–R–C–T–P at the right and lines drawn to L at the left, forming the right triangles used to derive the Moon's distance LT.

- A (top): apogee
- L (left): the Moon's place
- F, R, C, T (middle of axis, descending): point of apparent motion; foot of perpendicular; center of orbit; center of Earth
- P (bottom): perigee

(top of right column, folio 150) — the side LR, whose square root gives the side LR; to this if you add FR, you will have the Moon's distance LF, from the center of the equal motions.

Then lead from T the perpendicular TB, and in the triangle right-angled at B, by the side FT 8686 and the angle BFT, the complement of the anomaly, and accordingly the angle BTF; investigate the side BF; from it, by the side BT, subtract the side BF, from the previously invented side LF, the remaining side LB; from the addition of the square of the side BT there will result the square of the side LT; and the square root of this manifests the Moon's distance LT, from the center of the Earth.

13. Nor indeed does it shame me to illustrate the precept of this latter figure by one example. Let the Moon's anomaly be:

	Gr.
Let the Moon's anomaly be [<i>Sit Anomalia Lunae</i>]	
That is, the angle AFL [<i>Idest Angulus AFL</i>]	140
Therefore the acute angle F [<i>Ergo Angulus acutus F</i>]	40
And FCR, like FTB [<i>Et FCR, ac FT B</i>]	50
	partium
Let FC [<i>Sit FC partium</i>]	4343
Therefore hence RF [<i>Ergo hinc RF</i>]	3327
And CR [<i>Et CR</i>]	2791 ¹⁰⁰ / ₁₀₀ [as printed]
Square of the side CR [<i>Quadratum Lateris CR</i>]	7792142
Radius CL [<i>Radius CL</i>]	100000
Its square [<i>Huius quadratum</i>]	10000000000
From which subtracted [<i>Cui subducto</i>]	7792142
Remainder of the side LR, its square [<i>Restat Lateris LR, Quadratum</i>]	9992107858
Whose root is the side LR [<i>Cuius</i>	99961

partium

Radix est latus LR]

Add RF, it makes LF [*Adde RF, sit LF*] 103288

In the triangle BTF, the angle F, gr. 40, and T, [*In Triangulo BTF, Angulus F, gr. 40. & T,*]

50

And FT [*Et FT*]

8686

Therefore BT [*Ergo BT*]

5583 ²⁸/₁₀₀ [as printed]

And BF [*Et BF*]

6654

The side LF [*Lateris LF*]

103288

Subtract the side BF [*Subduc latus BF,*]

6654

The remaining side LB [*Restat latus LB,*]

96654

Whose square is [*Cuius Quadratum est*]

9338129956

And the square of the side BT [*Et Quadratum lateris BT,*]

31172681

The sum of these squares [*Summa horum Quadratorum*]

9369302637

The square of the side LT [*Est quadratum lateris LT*]

Its square root [*Eius Radix Quadrata est*]

96795

14. So great, therefore, is the Moon's distance LT, namely 96795 parts, of which the radius of the eccentric is 100000. But because I promised at the end of number 4, I choose two from our observations made at full Moon, with the Moon situated near apogee. The first was in the year 1645, on the 11th of May, at the hour of the apparent altitudes 11h 53' 52" after midnight; but the equated [hour] was 11h 48'. Then, however, the Moon's conditions were such, the Moon's center being at a meridian distance from the zenith of 58° 53' 40", the refraction having been computed:

	Sign.	Gr.	'	"
The Moon's place in the ecliptic [<i>Locus Lunae in Eclipt.</i>]	□	22	35	40
The equated anomaly [<i>Anomalia Aequata</i>]	11	29	45	22
Northern latitude [<i>Latitudo Borealis</i>]	0	4	58	22
Therefore southern declination [<i>Ergo Declinatio Austr.</i>]	0	13	37	15
The equator's distance from the zenith [<i>Distantia Aequatoris à vertice</i>]	0	44	30	10
Therefore the Moon's true distance from the zenith [<i>Ergo ☽ vera dist. à</i>	0	58	7	25

	Sign.	Gr.	'	"
<i>vertice]</i>				
But it was seen as [<i>At visa fuit]</i>	0	58	53	40
Therefore the parallax [<i>Ergo Parallaxis]</i>	0	0	46	15

And from this the distance from the center of the Earth is 63 terrestrial semidiameters, 39' [*Et hinc Distantia à centro Telluris semidiametrorum terrestrium 63. 39'.*]

15. The second was in the year 1646, on the 27th of June, the equated hour being 11h 55' 35" after midnight. The Moon's center passed through mid-heaven, and we observed it at a distance of 66° 26' 40" from the zenith, the refractions having been removed. The remaining lunar conditions were such:

	Sign.	Gr.	'	"
The Moon's place in the ecliptic [<i>Lunae locus in Eclipt.</i>]	☾	4	52	40
The equated anomaly [<i>Anomalia) Aequata]</i>	11	25	34	15
Northern latitude [<i>Latitudo Borealis]</i>	0	16	55	
Therefore southern declination	0	21	7	10

	Sign.	Gr.	'	"
[<i>Ergo declinatio Austr.</i>]				
The equator's distance from the zenith	0	44	30	10
[<i>Distantia Aequatoris à vertice</i>]				
Therefore the Moon's true distance from the zenith	0	66	26	10
[<i>Ergo vera dist. à vertice</i>]				
But it was seen as [At <i>visa fuit</i>]	0	66	26	40
Therefore the parallax	0	0	49	20
[<i>Ergo Parallaxis</i>]				

And [Et] —

(continued) And from this the Moon's distance from the center of the Earth is 63 terrestrial semidiameters, 47'. Nevertheless, we made fewer of these than of the prior observations, since the Moon was then almost at the very apex of apogee; and so we chose the distance of 63 semidiameters, 40'.

CAPVT XIX.

On the Moon's True Magnitude.

1. Since at the distance of 59 terrestrial semidiameters the Moon's apparent semidiameter is precisely 16' — the Moon being distant from apogee at the syzygies by 14° 5' — and when the Moon is distant from the Earth by 63 terrestrial semidiameters, 40' (and at apogee existing, the semidiameter is 14' 48", and at perigee 16' 12") — then this consideration, demanded by observations made together with the annular solar eclipses and the total ones, much elaborated by us, follows: that the Moon's true semidiameter is $16\frac{1}{3}$ such parts as the Earth's semidiameter is 60. But it is, according to our *Geographia Reformata*, a semidiameter of the Earth of $4673495\frac{2}{3}$ paces of the ancient Romans. Therefore the Moon's semidiameter is 1285210 such paces, and the diameter 2570420. But if the Earth's diameter is taken as 200, the diameter of the Moon will be $27\frac{1}{3}$ such parts — a little larger than we put it in the *Almagestum Novum*, Book 4, Chapter 27, where we were able to put it at $26\frac{1}{3}$. From this proportion, therefore, the remaining measure of the Moon and of its shadow which we put there must be corrected.

CAPVT XX.

On the Moon's Latitude, the Anomaly of this Motion, and the Reduction of the Moon to the Ecliptic.

1. Besides what we said in Chapter 14 concerning the motion of the Nodes — the mean, the anomaly of these, and the equation — we accept the Tyconic, and exhibit it in the Tables. But we suppose the maximum latitude at the syzygies to be 5°, or at minimum 5° 18', very nearly with [Tycho]; in the quadratures, however, 5° 18', according to the same Book 4 of the *Almagestum Novum*. The maximum latitude in the syzygies we exhibit, according to the Tyconic and in the quadratures, 5° 18'. The theory of latitude we expound in Chapter 29, and the reduction of the Moon from its orbit to the ecliptic in Chapter 30. Consult therefore those Chapters, lest here we be in vain prolix in repeating what has been done.

Decorative woodcut. Jesuit emblematic device centered at the foot of the page: the IHS monogram (with the cross above the H and three nails below) set within a radiant sunburst on an oval medallion, framed by an elaborate cartouche of clouds, scrollwork, and winged cherub heads (a putto at the top and additional

cherub faces at the sides and base). [This is the printer's/order's decorative emblem, not an informational figure.]

BOOK THREE

IN WHICH ARE GATHERED THE OBSERVATIONS OF THE MOON OUTSIDE ECLIPSES, BEARING ON ITS MONTHLY INEQUALITY, ITS VARIATION, AND ITS LIBRATION

CHAPTER I

Ancient Observations of the Moon outside eclipses, from the year 295 before Christ down to the year of Christ 509, with respect to the positions of the Moon in the heavens.

[Latin display heading: Lunæ Observationes Antiquæ extra Eclipses ab Anno 295. ante Christum, usq; ad Christi Annum 509. quoad Loca Lunæ in Cælo.]

1. In the year 36 of the first Calippic period, with the year 25 exactly elapsed (that is, in the month Poseideon, or the 454th year of Nabonassar, on the 16th of Paophi), on the following 17th, at the equal hour $3\frac{2}{3}$, after midnight, Timocharis at Alexandria saw the Moon touching with its northern, that is its leading, edge the northern star in the forehead of Scorpius. By Ptolemy's computation (*Almagest* VII.3) the Moon's true position was at Scorpius $31^{\circ}41'$, with northern latitude $1^{\circ}20'$; but to appearance it was at Scorpius $32^{\circ}2'$, with latitude $1^{\circ}12'$. He assigns that same place to the star.

[Margin: 1]

[Lansberge] in his *Thesaurus of Lunar Observations*, Class 7, affirms that Ptolemy was mistaken: for at Alexandria the first degree of Leo was culminating, the time being two and a half hours past midnight, and the Moon stood below the horizon, but through the benefit of refraction was seen above it. The Moon's true place was therefore at Scorpius $0^{\circ}47'7''$, with northern latitude $1^{\circ}38'33''$; while the star's was at Scorpius $7^{\circ}16'$. As to the star's northern latitude, Timocharis [Lansberge: Ptolemy] gives Scorpius $1^{\circ}16'29''$, with latitude $1^{\circ}15'$. [Lansberge] therefore computes the semidiameter of the Moon by which it touched the star. But Ptolemy says that mid-Leo was culminating, and Timocharis that it was the beginning of the ninth hour. Plainly [Lansberge] wishes to drag the observation to the standard of his own Tables, and not the Tables to the standard of the

observation. Furthermore, that year fell in the common Era of Christ 295, current, and the 20th of December; the next day was the 21st. [Longomontanus] *Theorica prima* (chap. 1, *Theoricorum*) says the corrected hour was $3^{\circ}54'$, and gives the Moon's seen place as Scorpius $1^{\circ}58'$.

[Margin: *Lansberge in error.*]

In the same year 36 of the first Calippic period (the 15th of Elaphebolion, or the 454th year of Nabonassar, on the 5th of Tybi), on the following 6th, beginning at hour 3, Timocharis at Alexandria saw the leading edge of the Moon, which was toward sunrise, reaching to Spica, the Moon dividing exactly the third part of its diameter toward the north. By Ptolemy (*Almagest* VII.3), this was one hour before midnight, and the Moon's true longitude was Virgo $22^{\circ}21'21''$, with southern latitude $1^{\circ}50'$; but to appearance it was at Virgo $22^{\circ}12'$, with latitude $2^{\circ}6'$, which place he likewise assigns to Spica.

[Margin: 2]

[Lansberge] in his *Thesaurus of Lunar Observations*, Class 7, gathering the conjunction of the Moon with Spica from his own Tables, 8 hours after midday, concludes the Moon's true place to have been Virgo $22^{\circ}3'21''$, with true southern latitude $1^{\circ}47'43''$; while to appearance it was Virgo $1^{\circ}55'15''$ [recte: at Virgo, seen $1^{\circ}55'15''$ from?]. But afterward he employs three times the diameter, that is, three times the semidiameter, contradicting both himself and Timocharis. That year was 254 before the Era of Christ, on the 30th of March.

[Margin: *Lansberge again in error.*]

3. In the year 47 of the first Calippic period (the 8th of Anthesterion, or the 465th year of Nabonassar): Aristyllus says that on the 29th, on the following 30th, at the end of the third hour at Alexandria, Timocharis saw the middle part of the southern Moon brought to the third, or rather the succeeding, part of Virgo. By Ptolemy (*Almagest* VII.3), who says it was the equal hour $3^{\circ}30'$ before midnight, the Moon's true place was Taurus $0^{\circ}20'$, with northern latitude $3^{\circ}45'$; but the Moon and the star were seen at Aries $29^{\circ}20'$ latitude $3^{\circ}40'$, very nearly.

[Margin: 3]

[Lansberge], Class 7, observes that the Moon stood toward the east of the star Pleiades, and gives the Moon's true place as Aries $29^{\circ}55'8''$, seen at Aries $29^{\circ}8'50''$, with true latitude $3^{\circ}57'$; seen $3^{\circ}51'$. That year was 284 before the Era of Christ, the 29th [recte: 30th] of January. [Longomontanus] *De Theoricis* I (chap. 2) says the hour was $3^{\circ}10'$, and the Moon's seen place Aries $29^{\circ}32'$.

4. In the year 48 of the first Calippic period, on the day of the Pyanepsion festival, the sixth, at hour 9½ elapsed: at Alexandria Timocharis observed Spica, seen exactly to touch the northern part of the Moon toward the east above the horizon. By Ptolemy (*Almagest* VII.3), who says it was the 466th year of Nabonassar, the 7th of Thoth, on the following 8th, at the equal hour 2°30' after midnight, the Moon's true place was Virgo 21°30', with southern latitude 2°10'; and the Moon's seen place was Virgo 21°20', with latitude 2°1'. He gives Spica's seen place as Virgo 22°30'.

[Margin: 4]

[Lansberge], Class 7, observes; he gathers the Moon's true place from his own Tables as Virgo 21°21'35", seen at Virgo 22°26'47", with latitude 2°11'21" [recte], seen 2°10'3". As to Spica's longitude, Virgo 22°12'11", latitude 2°0'. But that was the year 283 before the Era of Christ, the 8th of November, on the following 9th.

[Longomontanus] nevertheless, *De Theoricis* I (chap. 2, in the *Commentary on the Fixed Stars*), says the corrected hour was 3°54', and the Moon's place Virgo 22°40'.

5. In the year 50 of the third Calippic period, with 40 hours of the first elapsed [recte: see Parsing note]: Hipparchus at Rhodes observed the Moon to stand distant from the Sun in the preceding part by 48° [recte]. By Ptolemy (*Almagest* V.5), who says it was the 620th year of Nabonassar, the 16th of Epiphi, at hour 8 after midday [recte], at Rhodes (very nearly at Alexandria), the Sun being at Leo 9°, by 9°20' [recte: gr. 8°20'] — not, as Hipparchus thought, by 9°20' — and that the Moon was in its first quadrature. [Lansberge], Class 2, observes; he reckons the distance of the Sun from the Moon in Leo 8°18'31". The Moon was at Taurus 12°2'52", and the distance gathered was Taurus 86°15'. But Ptolemy says the distance was 87°47', from the maximum epicyclic longitude; the complement is 102°13'; and being at the position of the maximum epicycle in inequality. Yet [Lansberge] says the Moon was withdrawn from the eccentric perigee by 81°, and there the maximum inequality of the Moon occurs. That was the year 128 before the Era of Christ, the 5th of August, on the following 6th.

[Margin: 5] · [Margin: small square ornament]

6. In the year 197, from the death of Alexander the Great, on the 11th day, beginning the second [hour] of Pharmuthi: Hipparchus at Rhodes observed the Sun at Taurus 7°45'. The Moon was seen at Pisces 21°40', but its true place was Taurus 11°48'; therefore the true distance from the Sun, with respect to longitude, was 313°43' [recte]. By Ptolemy (*Almagest* V.5), who says it was the 621st year of Nabonassar, at the equal hour 18 after midday [recte], the 11th of Pharmuthi, and

the mean distance of the Moon was Taurus 314°28'; and from the maximum epicyclic longitude 185°30'.

[Margin: 6]

[Lansberge], Class 3, observes; he says the hour was 6°20' after midnight, and gathers the Sun's place at Taurus 7°40'31". The Moon was at Pisces 21°23'15". That was the year 127 before the Era of Christ, the 2nd of May, on the following 3rd.

7. In the same year 197, from the death of Alexander, the 17th [hour], 3°20', at Rhodes: Hipparchus observed the Sun at Cancer 10°54'. The Moon was indeed seen at Leo 29°, very near. By Ptolemy (*Almagest* V.5), who says it was the 621st year of Nabonassar, at the equal hour 4 after midday, the distance of the Moon from the Sun was 48°6'; but from his own Tables he sets the Sun at Cancer 10°40'. (See [Copernicus] *De Revolutionibus* IV, chap. 10.)

[Margin: 7]

[Lansberge], Class 5, observes; he sets the Sun's place at Cancer 10°36'32", the Moon at Leo 28°. That was the year 127 before the Era of Christ, the 7th of July, on the following 8th.

8. In the year 11 of Domitian, on the 7th day of the month Metroon, beginning the 3rd hour of the night, in Bithynia: Agrippa saw the Moon to touch with its southern edge the succeeding southern part of the Pleiades. By Ptolemy (*Almagest* VII.3), who says it was the 840th year of Nabonassar, the 2nd of Tybi, on the following 3rd, at the equal hour 5°20' before midnight at Alexandria, the Moon by its true motion was at Taurus 3°7'; but in Bithynia 3°15' to appearance, and there too it was seen with the star toward the north, Taurus 3°40'. That was the year 92 of Christ, the 29th of November, on the following 30th.

[Margin: 8]

[Lansberge], Class 7, observes; he says it was the year 92 of Christ, and (it being a bissextile, the 10th, and the 5th day [recte]) at hour 7°0' to appearance in Bithynia, the Moon's true place was Taurus 2°25'; seen at Taurus 2°39'31", with northern latitude [continues next column].

[col. 2, p. 184]...true latitude north 4°59'41", seen 4°21'37", and the star at Taurus 2°39'24", with latitude north 3°51'.

9. In the first year of Trajan, the month Mechir, on the 15th, on the following 16th, exactly at hour 10: Menelaus at Rome saw Spica of Virgo entirely covered by the Moon — for the star could not be seen — but at hour 11 it was seen in the leading

part of the Moon's center, equally distant from the horns, that is, less than the Moon's diameter. By Ptolemy (*Almagest* VII.3), who says it was the 845th year of Nabonassar, the leading part being toward midnight at Rome, the Moon's true longitude was Virgo $25^{\circ}45'$, with southern latitude $2^{\circ}0'$; the amount they assign to Spica. That was the year 98 of Christ.

[Margin: 9]

[Lansberge], Class 7, observes; he says it was the year 98 of Christ, on the 10th of January, on the following 11th, at hour 16, and to appearance at Rome after midday the Moon's place was Virgo $25^{\circ}45'$, seen at Virgo $25^{\circ}54'16''$, with latitude varying, southern $1^{\circ}22'19''$ [recte]; seen $1^{\circ}55'49''$. As to Spica's longitude, Virgo $26^{\circ}1'36''$, latitude $2^{\circ}0'$.

10. In the same year, and on the night of the 18th, the third [hour]: Menelaus observed the Moon's southern horn in a straight line with the middle and southern stars in the forehead of Scorpius, the Moon's center being absent from that straight line by however much it was distant from the middle and southern [stars]; the northern of those in the forehead of Scorpius was covered, because nowhere did it appear. By Ptolemy (*Almagest* VII.3), who adds that it was the equal hour past mid-night, on the following $6^{\circ}10'$ at Rome [recte], and at Alexandria $7^{\circ}30'$ from the center, the Moon was at Scorpius $9^{\circ}45'$; but to appearance it was at grade $5^{\circ}55'$, with true northern latitude $2^{\circ}10'$, seen at grade $1^{\circ}10'$; those which are at the forehead of Scorpius, in the north.

[Margin: 10]

[Lansberge], Class 7, observes; he says it was the year 98 of Christ, on the 11th of January, at hour 19, to appearance at Rome $18^{\circ}11'$, and the Moon's true place in Scorpius $9^{\circ}59'52''$, varying $5^{\circ}24'31''$, and the southern true latitude $2^{\circ}11'22''$ [recte], seen at grade $1^{\circ}56'26''$; the star at Scorpius $5^{\circ}24'$ [recte], seen $1^{\circ}25''$ [recte], with latitude north $1^{\circ}15'$.

11. In the year 20 of Hadrian, the 13th of Athyr, the Sun setting at hour $5^{\circ}50'$, with the Sun setting equally in Libra at grade $5^{\circ}28'$: Ptolemy observed at Alexandria, by the parallactic rules, the meridian distance of the Moon from the vertex at grade $50^{\circ}55'$; it stood in Capricorn grade $3^{\circ}10'$, but the true distance was grade $49^{\circ}48'$, with the Moon's true latitude grade $1^{\circ}7'$; therefore the latitude was grade $5^{\circ}12'$ [recte], by which when the Moon was observed in Capricorn at the meridian, distant from the vertex grade $1^{\circ}7'16''$ [recte]. (See [Copernicus] *De Revolutionibus* IV, chap. 15 and 16. This was the year of Christ 135, the 1st of October.)

[Margin: 11]

12. In the second year of the Emperor Antoninus, the 25th of Phamenoth, in the morning at hour 5°15' before midday, the heaven mediating Sagittarius: Ptolemy at Alexandria observed the Sun by the astrolabe in Aquarius grade 18°50', and the Moon in Scorpius grade 9°20', and distant from the Sun in longitude grade 99°10'. By Ptolemy (*Almagest* V.3), as far as sense could discern, there was no parallax. That was the year of Christ 139, the 25th of February. [Lansberge], Class 5, observes; he sets that year as 386 of Nabonassar, and the Sun in Aquarius grade 18°46'18"¼, the Moon in Scorpius grade 9°46'31".

[Margin: 12]

13. In the same year of Antoninus, the 9th of Pharmenoth: Ptolemy at Alexandria (as he has it, *Almagest* VII.2) observed the Moon distant from Regulus; but he could not by any means find the position of Regulus, nor the motion; yet it seems useless to me to use that observation, and to proceed by uncertain steps; yet they use that very thing. [Lansberge] in his *Thesaurus*, Class 7, to conclude Regulus at the Moon's center, in the consequence defines it grade 17°10'; both he and [Boulliau] *De Astron. Phil.* (chap. 9) suppose the same distance, and gather the Moon's place, the parallaxes subtracted, in Gemini grade 17°16'; he concludes Regulus to have been at Leo grade 3°42'. That was the year of Christ 139, the 23rd of February.

[Margin: 13]

14. In the year 192 of Diocletian, the 21st of Athyr: Thius [recte] observed the Moon to lead by anticipation the star Venus, and to have been in grade 15 of Capricorn from the Sun, distant from the Sun grade 48 [recte]. So a manuscript codex of the Library of the Most Christian King of France gives it, [Boulliau] *De Astron. Phil.* III, chap. 12; and Bullialdus supposes the observation made at Athens at hour 5°15', after midday, and the conjunction of the Moon with Venus from his own Tables confirms.

[Margin: 14]

15. From the same manuscript [Boulliau] reports the same place. In the year 225 of Diocletian, the 15th of Phamenoth, on the following 16th, after the lighting of the lamps, that is at first dusk after the withdrawal of twilight, [continues next page].

[p. 185]...the dusk, the Moon was seen to follow the bright star of the Hyades by however much it had touched its highest half [recte]; but it appeared to be

obscured by the star itself, since the Moon was being illuminated by limbs everywhere [recte], and the Moon was near its true motion at Taurus grade $16^{\circ}30'$. So he reports it. [Boulliau] adds that this was in the year of Christ 509. (And at Athens on the 11th of March it was observed, the emergence of the Eye of Taurus, a half-hour after sunset, there, at its place, the Moon truly being at hour $7^{\circ}20'$ after midday, the Moon being seen at Gemini $19^{\circ}52'44''$, with true northern latitude $4^{\circ}27'$ [recte], seen $4^{\circ}22'$; and the Moon at Taurus $16^{\circ}30'$. Thus he observes.) [Boulliau] adds an impossibility: namely, that the Moon had occulted the Eye of Taurus. But he is deceived, since the latitude of the southern Moon is grade $5^{\circ}31'$. Therefore, since at the beginning of the night the Moon would be more eastward than Palilicium by however much, with the half-diameter [recte], the Moon could be in Taurus at grade $18^{\circ}46'$ visible, that is, it could occult the star by a parallax greater than [Boulliau] employs; he depresses the Moon toward the west around the sixth hour after midday.

[Margin: 15]

CHAPTER II

Lunar observations of Johannes Regiomontanus, Bernhard Walther, Nicolaus Copernicus, and Abraham Zacuto, with respect to the positions of the Moon outside eclipses, from the year of Christ 1462 to 1524.

[Latin display heading: Lunares observationes Io. Regiomontani, Bernardi Vualtheri, Nicolai Copernici, & Abrahami Zaguthi, quoad loca Lunæ extra Eclipses Ab Anno Christi 1462. ad 1524.]

1. In the year 1462, the 11th of January, at the beginning of the night, when the Moon was seen at altitude grade $61^{\circ}15'$: at Rome, Regiomontanus, with Sirius at grade $14^{\circ}30'$, and Procyon at grade $4^{\circ}50'$, saw the Moon to be equally distant from both, the distance lying between grade 12 and 13 of the Hyades.

[Margin: 1]

2. In the same year, the 12th of January, with Sirius high at grade $26^{\circ}40'$, and Procyon grade $40^{\circ}20'$: at Rome in the same place he saw the Moon joined to the star 19 of Taurus, that is, to the extreme southern horn, as to longitude, but separated from the more northern star by $24'$; and that star seemed to be distant from the southern limb of the Moon by a fourth part of the visual diameter.

[Margin: 2]

3. In the year 1463, the 11th of March: Regiomontanus saw the Moon at Rome high at altitude grade 23, and Jupiter likewise in the meridian high grade 30; and then the Heart of Scorpius [Antares] at grade 17°15'; and the Moon with Jupiter, and with 7 of Sagittarius, were in a straight line.

[Margin: 3]

4. In the year 1474: Abraham Zacuto, professor of astronomy at Salamanca, observed Spica reaching to the Moon itself at grade 17°10' of Libra, as his disciple Augustinus Ricius reports in his book *De motu octavæ sphaeræ* (chap. 46 and 47).

[Margin: 4]

5. In the year 1478, the 10th of October: Bernhard Walther at Nuremberg saw the Moon distant from Regulus toward the north by about a semidiameter; at half-hour before sunrise [recte], the Moon close to the meridian, the Moon distant from Regulus by grade 1°52'. [Lansberge], Class 5, observes; he computes the Sun's refractions, with the rising Sun accelerating; he says the observation was made earlier by grade 1°11' after midnight, and the Moon from his Tables was at Leo grade 2°8'10", but to appearance at grade 23°58' [recte], with true northern latitude grade 5°2', seen at grade 5°. [Lansberge] gives Regulus' place in grade 23°8'41"; he therefore makes the Moon's conjunction with Regulus then, since Bernhard says it was made at grade 1°35' [recte], the latitude being a little greater [continues].

[Margin: 5]

6. In the year 1482, the 12th of January: another half-hour before sunrise, Walther saw the Moon eclipsing Saturn; for at that time the Moon was not seen, before, and after the latitudes inscribed below noted, since the Moon was at the last [continues col. 2].

[Margin: 6]

[col. 2, p. 185]...quadrature, or near it, namely the Moon falling off from the western part, and when first it was glimpsed, namely about 2¾ hours before sunrise, the Moon was western, and as Saturn appeared more to the south, distant by two Moons; afterward the clouds intervened, so that the beginning could not be discerned. Indeed I judge for certain that the Moon apprehended the southern horn of Saturn. But afterward they were seen again, Saturn being distant in diameter by about two digits, or about a southern horn; nor however did it appear evident, but it began to pass over [recte] now indeed; therefore I indicate the altitude of the Moon for this eclipse, that it was nearly in the

meridian existing, and I indicate the Moon's place as above, namely the Moon first apprehending Saturn from the southern horn, considering nothing about the Moon's place; but this indeed appears evidently, that Saturn in diameter was distant by two digits from the Moon, in the northern part, or about ceasing. [Kepler] in his *Astronomia Optica* (p. 409) weighed this observation; he shows that the parallaxes of the crescent are made, so that Saturn, which had been thus meridional in position, was so much closer to the northern horn of the Boreal Moon; which is wonderful, and impossible to have been seen by Walther, with the simple bare motion of the latitudes.

7. In the year 1486, the 21st of October, in the morning, Walther observing: the Moon began to cover Regulus high to the rising by grade 45 — for it was touching it by the limb. But the exit could not be seen, the air being disturbed. Thus my codex. But [Lansberge], Class 7 of his *Lunar Observations*, has *the 20th day*, and says the hour was 17°6' after midday of the 19th day, and the Moon was then to appearance at Leo grade 22°29', seen with northern latitude grade 0°46'10", seen at grade 17°5" [recte]; and Regulus at grade 23°13'44", with northern latitude grade 31'; but the semidiameter of the Moon was grade 17°41" [recte], and it added the latitude itself, raising the northern horn of the Moon by grade 34'45"; therefore it could not cover Regulus.

[Margin: *Lansberge in error.*]

8. In the year 1487, the 28th of February: Walther has it thus: *At hour 7m.52' past midday, namely while the Moon was in mid-heaven, I had it at altitude grade 47 in altitude, and the Dog-star [Canis maior], namely Alhabor, at grade 23°5' in altitude past meridian, the Moon touching with its southern horn the most northerly Pleiad.* I wonder, therefore, why [Lansberge] in his *Thesaurus*, Class 7 of his Lunar observations, says: *In the year of Christ 1487, in the morning, with the latitude of the Moon's center smaller (not Leo, that is grade 8°), and the Moon with its southern horn contingent on the northern Pleiad.* Was the Moon ever transformed into a smaller Dog [recte: was the most northerly Pleiad ever a smaller Dog-star]? Moreover, from his very calculation it was more northerly; the Pleiad in Taurus grade 22°55', with northern latitude grade 4°49', but the Moon's place to appearance was in Taurus grade 22°47', with latitude seen grade 4°45'.

[Margin: 8]

9. In the year 1497: [Copernicus], as he himself relates (*De Revolutionibus* IV, chap. 17), observed at Bologna on the 7th of the Ides of March, with the setting Sun, the Moon occulting the shining Palilicium; he saw the star applied to the

dark part of the lunar body, between the horns now in darkness; and was about to disappear at the fifth hour of the night, nearer indeed to the southern horn, by about a third of the lunar diameter. He adds that Palilicium was at Gemini grade $2^{\circ}52'$, with southern true latitude grade $5^{\circ}10'$; therefore the center of the Moon to appearance preceded the star by half the diameter, and the Moon's place to appearance was at Gemini grade $3^{\circ}24'$, with latitude grade $4^{\circ}35'$; but to appearance the Moon's place was at Gemini grade $3^{\circ}2'$. (See [Lansberge], Class 7. He observes; he gathers the Moon's place from his calculations, which agree to be the Moon's place seen in Gemini grade $3^{\circ}0'45''$, with latitude seen southern grade 5° ; whatever latitude he assigns to Palilicium, with longitude grade $5^{\circ}15'$ of Gemini.)

[Margin: *Lansberge error.*]

10. In the year 1522, the fifth before the calends of December [27 November], at hour $6^{\circ}40'$ after midday: [Copernicus] at Frauenburg, by the parallactic rules, observed the distance of the Moon from the vertex at grade $82^{\circ}50'$; and from his Tables he computes the true distance of grade $81^{\circ}56'$; therefore the parallax in altitude is grade $0^{\circ}54'$. (See *De Revolutionibus* IV, chap. 16.)

[Margin: 10]

11. But in the year 1524, the 7th of the Ides of August, at hour 6 after midday: the same [Copernicus] in the same place observed the distance of the Moon from the ver-[continues].

[Margin: 11]

[Margin: *Lansberge error.*]

[Continuation of Caput II, observation 11 — Copernicus at Frauenburg, 1524 Aug 7]

the vertex by $81^{\circ}55'$; but from the calculation it comes out as $80^{\circ}55'$. From this he gathers the parallax to be 1° . So Copernicus, *De Revolutionibus* IV.16.

CAPUT III.

Tycho's selected lunar observations, apart from eclipses, regarding the places of the Moon.

1. In the year 1582, on February 25, at 4:12 a.m. [hora $4.12\frac{1}{3}$], Tycho [Tycho Brahe], using armillae, observed the western limb of the Moon in the 26th degree $\frac{1}{3}$ of Pisces, at the hour $4.26\frac{1}{3}$; that is, in Pisces $26^{\circ}12'$ [Pisces gr. $26.12'$]. As to the

true place of the Moon, from the Tyconic Tables recently published through the labor of Lucius Barretus — that is, Albert Curtz of the Society of Jesus [Albert Curtz], whose anagrammatized name conceals his own — where many other Azimuthal observations are had, but most of them of a subtlety that does not bring great certainty, as Tycho himself at length acknowledged; and besides, since the times are frequently noted by means of a rotating clock-mechanism subject to error, I have therefore selected only a few.

[Margin: Octans 1.]

2. In the same year 1582, on February 26, at 1:47 [hora 1.47], Tycho observed the limb of the Moon with armillae in Virgo $9^{\circ}55'$. He gathered (the Moon being then invisible, since the altitude of its upper limb was $48^{\circ}16'$ toward the west at setting), and the hour being $1^{\circ}15'$ [hora a. $1^{\circ}15'$], that the same lower limb was seen in Taurus $10^{\circ}10'$; while he concluded the upper limb at $51^{\circ}26'$. From this he concludes that the Moon traversed a span of 33° , completed in 15 minutes.

3. Likewise in the year 1582, on February 26, at 7:20 [hor. $7.20\frac{1}{3}$]. From Tyconic observations, the cusp of the upper horn was seen to be distant from Aldebaran by $23^{\circ}12'\frac{1}{3}$; and then, as the cusp itself appeared to be at altitude $35^{\circ}15'$, and at hour $7.15\frac{2}{3}$, the same cusp was seen distant from the bright star of Aries [the Head of Aries] by $12^{\circ}18'$ — they were seen at the same cusp, altitude $32^{\circ}36'$.

4. Likewise in the year 1582, on February 28, at 4:36 [hora 4.36']. The Moon was seen in the 90th degree of the Ascendant, that is, at the cusp [of the upper horn]; its cusp was seen at altitude $58^{\circ}16'\frac{1}{3}$, in azimuth from the meridian toward the rising in the east by $4^{\circ}11'$.

5. Again in the year 1582, on May 5, at 11 o'clock [hora 11]. The Moon being near the ninetieth degree, its limb was nearer, and stood off from the heel of the foot of Gemini by $46^{\circ}51'\frac{2}{3}$; with the other altitude being seen at $43^{\circ}40'$, and at hour 11.5' it stood off from Regulus by $8^{\circ}25'$, while the other was seen at $43^{\circ}20'$.

In the year 1587, in January, Tycho exhibits three observations of the Moon in his *Letters* to the Landgrave of Hesse, page 59, with the Alphonsine and Copernican calculation, as below.

January, Day	H. p.m.	M.	Moon	Longitud	
				e —	Latitude
				Sign /	— Gr. /
				Gr. / M.	M.
6	9	6	58	Observed	$\square 1 / 0\frac{1}{3}$

January, Day	H. p.m.	M.	Moon	Longitude — Sign / Gr. / M.	Latitude — Gr. / M.
				Alphons.	2 / 0
				Copernic.	1 / 45
7	14	13	40	Observed	□ 10 / 39
				Alphons.	9 / 59
				Copernic.	10 / 6
8	15	15	5	Observed	□ 25 / 38½
				Alphons.	24 / 34
				Copernic.	24 / 42

Parsing notes: longitude signs given as zodiacal glyphs (Scorpio □ for obs. 6, Leo □ for obs. 7–8). "A" in the latitude column = *Austr.* (south/austral).

Because the Moon had been observed alongside the ninetieth degree from the Ascendant, and the longitude seen coincided with the true longitude, only the latitudes seen differed from the true ones — that is, the parallax of latitude is noted as below.

[Margin: Parallaxis.]

January, Day	9 — Gr. / M.	14 — Gr. / M.	15 — Gr. / M.
Latitude seen	4 / 28	5 / 5	4 / 19
True Moon	3 / 59	4 / 35	3 / 46
Parallax of latitude	0 / 29	0 / 30	0 / 33

9. In the same year 1587, on August 18, at 17:25 [H. 17.25'] a.m., Tycho observed the true place of the Moon in Gemini 26°23'; so Tycho himself in *Progymnasmata* [Tycho, *Progymnasmata*] vol. 1, ch. 6; but Longomontanus [Longomontanus] in his *Astronomia Danica* [*Astronomia Danica*] vol. 1, ch. 6, puts it at 21¾.

10. In the same year, month, and at hour 7.25' a.m., he observed the Moon in quadrature [□]; its true southern latitude was 5°13'–15'. So Tycho, in the same place.

11. In the year 1592, on February 12, at hour 8.12 [Hor. 8.12], Tycho observed the true latitude of the Moon at $16^{\circ}5'$. So *Progymnasmata* vol. 1, ch. 1. In the year 1594, Tycho at Uraniborg observed the longitudes of the Moon written below, together with the true latitudes, which Kepler [Kepler] exhibits before the Ephemerides of the year 1617, page 13, adding that it is most difficult to represent all of them by the calculation of the Tables.

December ☽ — D. / H. / M.	Longitude ☽ — Gr. / M. / S.	Latitude South or North — Gr. / M. — vel Bor.
| 12 | 10 / 4 / 0 | ☐ 6 / 47 / 45 | 3 / 18 A		
| 13 | 11 / 5 / 6 | 19 / 20 / 40 | 2 / 18 A | | 14 | 14 / 8 / 34 | 29 / 5 / 10 | 1 / 6 B | |		
15 | 15 / 9 / 56 | ☐ 13 / 13 / 50 | 2 / 19 B | | 16 | 20 / 3 / 50 | 13 / 49 / 30 | ☐ 4 / 27 B | |		
| 17 | 21 / 6 / 0 | 29 / 44 / 20 | ☐ 3 / 59 B | | 18 | 22 / 6 / 30 | 14 / 28 / 45 | ☐ 3 / 28 B | |		
| 19 | 23 / 7 / 36 | 29 / 27 / 50 | ☐ 2 / 44 B | | 20 | 26 / 9 / 40 | 12 / 3 / 20 | ☐ 1 / 15 A | |		
| 21 | 27 / 10 / 10 | 25 / 26 / 0 | ☐ 2 / 15 A | | 22 | 28 / 7 / 45 | 7 / 50 / 20 | ☐ 3 / 11 A |		

Parsing notes: "A" = *Austr.* (south), "B" = *Bor.* (north). Zodiacal glyphs appear scattered in the Longitude and Latitude columns; transcribed as printed. Some sign-glyphs ambiguous in the scan.

Boulliau [Boulliau], in his *Astronomia* [book 3], ch. 12, reduced [these] to the time of the meridian of Uraniborg, by direct adjustment from the Tables in his calculation, in order to display that Variation which the Tychonics ascribe to the Moon when in the octants of its conjunctions and quadratures, asserting it not to be always of the same magnitude. Whoever is worthy, let him consult [the source].

23. In the year 1595, on February 18, at hour 5.43' a.m., the Moon's true latitude was observed at $5^{\circ}20'$ south. So *Progymnasmata* vol. 1.

24. In the year 1596, on January 4, at hour 11.43' p.m., the Moon's latitude was seen north at $4^{\circ}59'$, observed by Tycho — Tycho vol. 1, *Progymnasmata*, ch. 1.

25. In the year 1600, on April 10, by the old style, at hour 7.27 $\frac{1}{3}$, Tycho at Benátky castle near Prague [Benátky nad Jizerou] observed the western limb of the Moon distant from Regulus by $18^{\circ}19'$, and at hour 7.45 $\frac{1}{3}$ past noon distant from Procyon by $21^{\circ}18\frac{3}{4}$. From this he concludes that, on that day on April 10, at hour 7.32 $\frac{1}{3}$, the Moon was in Leo $6^{\circ}20'22''$, with south latitude $3^{\circ}40'$; as Snel [Willebrord Snel] reports in his *Observations of the Bohemians* [*Observationes Bohemicae*].

CAPUT IV.

A few lunar observations of Kepler, Lansberge, and Longomontanus, apart from eclipses, from the year 1598 to 1608.

1. In the year 1598, on May 29 (old style), in the evening at hour 8, Kepler at Graz saw the Moon joined to the western stars in the quadrilateral of the Pleiades, in such a way that it receded from them by no more than a sixth of the Moon's diameter; but its margin so touched the bright star of the Pleiades that the whole extent of its body was distinct, so wide was it. The Moon was three days old, and tended toward apogee. So Kepler, *Astronomia Optica [Ad Vitellionem Paralipomena / Astronomiae Pars Optica]*, page 347. Lansberge, in his *Thesaurus*, class 7, observed the Moon: from his Tables he finds the western Pleiad in Taurus $23^{\circ}23'$, with north latitude $4^{\circ}12'$; and the bright Pleiad in Taurus $24^{\circ}22'$, with north latitude $4^{\circ}6'$; and the more northerly Pleiad in Taurus $24^{\circ}2'$, with north latitude $4^{\circ}29'$. But the place of the Moon was seen in Taurus $23^{\circ}43'16''$, with latitude seen $4^{\circ}31'57''$ north.

2. In the same year, on July 17 (old style), Kepler in the same place, in the morning, between hours 2 and 3, saw the Moon with horns turned toward the Pleiades, in such a way that, with the section drawn perpendicularly and from the lowest horn, it would graze the Pleiades higher up. The Moon had already crossed the Pleiades, and was distant from the brightest of them, Palilicium [Aldebaran], more than by Palilicium's distance from the nearest little stars turned toward Taurus, but smaller, as in the nostrils; therefore the distance of the two bright stars stood between them — in such a way that it was distant in the Pleiades, as there, *Astronomia Optica* page 347.

3. In the year 1600, on March 11 (old style), Lansberge at Goes observed the Moon on the meridian, equal by 3 o'clock, distant from the Sun in consequence by $89^{\circ}50'$; it would have been seen even in the 1st degree of Aries $1^{\circ}25'$, and the Moon in Cancer $1^{\circ}15'$, about the ninetieth, where the longitude seen does not differ from the true. About perigee, the Moon is of maximum eccentricity at $82'$; so he himself in his *Thesaurus*, class 2, where the Tables underlie [the calculation]: the place of the Sun in Aries $1^{\circ}15'10''$, the Moon in Cancer $1^{\circ}15'$, with north latitude $2^{\circ}18'47''$. But he makes no mention of any parallax, since there is no mention of solar refraction.

[Margin: Parallaxis.]

4. In the same year and on the same day — nay, at the same hour, 6 a.m. on the meridian — Lansberge in the same place observed the southern meridian altitude of the Moon's upper limb at $64^{\circ}7'1/3$; and since he sets the Moon's semidiameter at $16'2/3$, therefore he saw the Moon's center at $63^{\circ}51'$; and so it was truly $64^{\circ}17'1/3$. Therefore the parallax of altitude was $26'30'$, which he also at the same place [Margin: Parallaxis.] in his *Thesaurus*, class 2.

5. In the year 1600, on March 26 (old style), Lansberge at Goes observed the Moon on the meridian, distant from the Sun in precedence by $96^{\circ}36'$, because the Sun was seen in Aries $16^{\circ}19'$, the Moon in Capricorn $10^{\circ}3'$, when it was in degree $89^{\circ}40'$ from eccentric apogee. From this, and from other observations, he contends that the maximum [latitude] of the Moon differs between mean motion and true [motion], as actually happens, when the Moon being dichotomous is distant from eccentric apogee $98'$; and that it is in degree $7^{\circ}38'$, as Tycho wishes — but he says $7^{\circ}40'$ — *Thesaurus*, class 2.

6. In the year 1600, on August 17 (new style), Kepler at the frontier of Styria and Hungary, under Pole-altitude $47^{\circ}24'$, in the evening, saw the Moon an hour before its setting joined with the Heart of Scorpio [Antares]; for it entered in the Septentrional [northern] part, in such a way that, as it were, a third part of the section stood out above, and how small a difference the section presented from a straight line. The Sun was in the 2nd degree of Leo, yet [the Moon] was seen much wider, since the part of the trajectory's light fell upon that very Moon, and the rising section presented an amplitude greater than the smaller one near the position set down — *Kepler*, page 117. *Astronomia Optica*. Lansberge in his class 7 of lunar observations presupposes the Moon there to have occupied the hour $10.40'$ on the meridian at setting, hour $8.50'$, and at egress hour $9.40'$; and from this, from his Tables, he gathers the hour $8.50'$ to have been seen in Sagittarius $4^{\circ}29'$, seen at $4^{\circ}17'1/3$, and the true south latitude $3^{\circ}42'$, seen at $4^{\circ}26'$. But the Heart of Scorpio he set in Sagittarius $4^{\circ}30'23''$, with south latitude $4^{\circ}26'$.

7. In the year 1601, on November 29 (old style), Lansberge at Goes, at hour $11.15'$ past noon, observed the meridian altitude of the Moon at $61^{\circ}25'$; but compared with the true $64^{\circ}55'1/3$, he produced a parallax of altitude of $30^{\circ}32''$, adding that the observation is certain, because it was made by means of shadows, since the Moon at perigee illuminates very brightly with the dioptra, inasmuch as a shadow in a plane could be discerned by the lower dioptra of the upper [dioptra]. So Lansberge in his class 5 of lunar observations.

[Margin: Parallaxis.]

8. In the year 1602, on September 26 (old style), Lansberge at Goes observed the meridian altitude of the Moon at $59^{\circ}39'$; but he said it was truly $60^{\circ}12\frac{1}{3}'$; therefore the parallax of altitude was $30''$, which he also says he saw through the shadow of the Moon — Lansberge, class 5 of lunar observations.

[Margin: Parallaxis.]

9. In the year 1602, on December 21 (new style), in the evening, Kepler in *Astronomia Optica*, page 237, says: with the quadrature [□] not yet completed at the hour, the Moon was seen, although it was hollow [crescent-shaped]; at the hour of one-and-a-half, the sixth after midday. But because Kepler came to the [moment of] dichotomy [half-Moon], for the Sun was in Capricorn $29^{\circ}30'$. From this he concludes the delineation of the waxing and waning Moon, which Albategnius [al-Battānī] teaches in ch. 30.

And he was not able to determine the number well by the fingers. See him, where, by the judgment of the quadrature within a few hours, but in respect of the section the Moon was dichotomous, that I have mentioned these very things of parallaxes, and of what is said by us in the Appendix to the first volume of the *Almagestum Novum* [*Almagestum Novum*].

10. In the year 1603, on March 14 (old style), Kepler contemplating the new phases of the Moon, saw the circumferential illumination fail evidently at the semicircle. Hence he demonstrates in *Astronomia Optica*, page 345, the Moon's diameter, that for the most part the disk of the Sun is seen larger than the Moon's, and therefore the whole Sun can be covered by the Moon.

[Margin: Diameter ☉.]

11. In the year 1608, on February 12 (old style), Lansberge at Goes, a third of an hour past the seventh in the evening, saw the Moon with its dark part entering toward the southerly Palilicium [Aldebaran]; the more northerly star [was] at the Moon's center, by almost half a semidiameter. So he himself in vol. 7 of *Lansberge's lunar observations*, where from his Tables he computes the place of the Moon: namely, in Gemini $4^{\circ}15'$; seen however in Gemini $4^{\circ}15'52''$, with south latitude $5^{\circ}10'43''$; and the place of Palilicium in Gemini $4^{\circ}23'48''$, with south latitude $5^{\circ}30'$.

12. Likewise in 1608, on February 12 (old style), Longomontanus at Hafnia [Copenhagen], at the evening hour $8.43'$, observed the conjunction of the upper Horn of the Moon with Aldebaran, when the Moon, near quadrature, was already at half-course of its digression. He saw this same conjunction at hour $8.46'$;

Melchior Levitius [?] writes it, but Longomontanus in his *Astronomia Danica*, vol. 1, ch. 6, where from his Tables he computes the longitude of Aldebaran in Gemini $4^{\circ}16'20''$, south latitude $5^{\circ}31'$; but the Moon's true place in the ecliptic, Gemini $4^{\circ}16'38''$, from which he gathers the parallax of longitude greater by $30'$, when it would have appeared at $4^{\circ}16'\frac{1}{3}$ of Gemini; and conversely the south latitude having been seen at almost $5^{\circ}47'$.

Lansberge in his class 7 observed the same lunar [phenomenon]: he says it was at Hafnia $8^{\circ}36'$, not $43'$, because he supposes Hafnia more easterly than Goes by $11^{\circ}15'$; but in the place of Palilicium [Aldebaran], that is, Aldebaran, Lansberge differs from Longomontanus by $7\frac{1}{3}$. Boulliau, in vol. 3, *Astronomia Philolaica* [*Astronomia Philolaica*], retains hour $8.43'$ in the narration, because nevertheless the Sun was in Pisces $3^{\circ}42'44''$, and the Moon was in $39^{\circ}45'$; it appears the true sky in $49^{\circ}35'$; and so he gathers hour $8.36'$, and the time added to the equation $11'7''$; the medium of time at Hafnia hour $8.47'$, at which time from his Tables he gathers the Moon's true place in Gemini $4^{\circ}50'$, and the true latitude $5^{\circ}12'43''$; but seen at $5^{\circ}44'4''$ south; he adds that the Moon was not yet seen at quadrature, but more than half at $5^{\circ}47'$.

13. Afterward, subjoining an observation of the same conjunction made by a Father [member] in his college [house] at hour 7 in the evening, when the Moon began to occult Aldebaran — *of whose sight, he says, to the hour 8: but the first of us [witnessed it] when the other limb of the Moon revealed the star, at hour 9.* He adds: Boulliau, the altitude of the Pole at Goes to be $48^{\circ}1'$; and from his Tables, the occultation to have begun there at hour $6.54'$, the end truly at hour $7.54'$; and the true place of the Moon in Gemini $4^{\circ}31'$; but let this very thing be seen, if one likes, by manifold practical calculation.

CAPUT V.

Lunar observations apart from eclipses, by Boulliau, Gassendi, Hevelius, Hodierna, Hortensius, Michael Langren, and Vincenzo Mutus, from the year 1623 up to the year 1653, regarding the places of the Moon.

[Glossary note: Hevelius (*Selenographia*), Hodierna, Martinus Hortensius (Maarten van den Hove), Michael Florent van Langren, Vincenzo Mutus.]

1. In the year 1623, on July 5, Boulliau at Paris, at hour $9.30'$ past noon, [observed] Spica [Spica] occulted by the Moon, the latter at altitude $17^{\circ}20'$. Boulliau, in *Astronomia Philolaica* book 3, ch. 10, says that Spica was at altitude $18^{\circ}34'$ in

Libra, with south latitude $1^{\circ}59'$; the Moon's true place in Libra $18^{\circ}35'10''$; and the Moon's center

having had the latitude of the Moon seen at $1^{\circ}46'$; the parallax of latitude $59'50''$; and truly the latitude $46^{\circ}10'$. For he had observed the center of the northern Moon distant from Spica by $1^{\circ}5'$.

2. In the year 1624, on September 3, Michael Florent van Langren [van Langren], cosmographer to the Catholic King of Spain, at Brussels, when the Equator culminated on the meridian at $31^{\circ}10'$, saw the eye of Taurus deserted at the dark margin of the Moon; so in letters sent to me afterward, as he himself attests.

3. In the year 1626, on February 4, Michael Florent van Langren at Brussels, when the Equator culminated at $43^{\circ}12'$, saw the 14th [degree] of Taurus, which is above the nose, covered by the shadowy part of the Moon; and in the same instant a moist wind extremely excited [the eye], so that they ceased about that very hour. So in letters sent to me by himself.

4. In the year 1627, on February 22, Michael Florent van Langren at Brussels saw the eye of Taurus emerge from the dark part of the Moon, where a somewhat higher and middling spot of the Caspian [Mare Caspium], or the Crisium Sea [Mare Crisium], stood perpendicularly in our *Selenographia*; while at the perpendicular minute $10\frac{1}{3}$; Sirius crossed the meridian, from which he gathered it to have culminated at $97^{\circ}21\frac{1}{3}$ in altitude. So he himself in letters sent to me.

5. In the same year 1627, on February 18, by the old style, Martin Hortensius [Martinus Hortensius] at Leiden, at hour 5.36' past noon, saw through the telescope the Heart of the Lion [Regulus] distant from the limb of the Moon by about two lunar fingers [digits], or, then, by minutes $5\frac{1}{3}$; the center, however, of the more easterly Moon [distant] from Regulus, according to longitude, by lunar digits $10\frac{2}{3}$; and of southerly digits 6'; but a little more, namely by minutes 19'. Lansberge in his *Thesaurus*, class 7, of lunar observations.

6. In the year 1627, on July 17, Gassendi [Gassendi] at Digne [Dignæ], at hour 10.30' past noon, [observed] the high tail of the Lion at occasus [setting] at $25^{\circ}13'$; he saw through the Basilisc [Basiliscus = Regulus] telescope, that it touched the eastern limb partly with the obscure horn of the lower part, through the quadrant about the Moon, *Bullialdus* book 3, ch. 12; and Gassendi himself in *Epicuro* page 901. But Boulliau takes it thus: that the Basilisc stood off from the center of the Moon at setting up to the lowest minute, 11'; and so the place of the Moon was seen in the Lion at degree $24^{\circ}59'$; and seen truly in degree $24^{\circ}55'$; and Gassendi says that this observation was made by the telescope, in such a way

that, made by the naked eye, Iulioduni [at Digne], at hour 9.35', since by the splendor of the Moon the occultation of the Basilisc appears sooner to him than it actually happens. But Gassendi seems to understand that he covered the Moon, not from the distance of Regulus at setting, but from the position by which the Moon covered Regulus.

7. In the year 1633, on February 14, with Gassendi observing at Digne, at hour 11.30', the Moon next eviscerated dichotomy by its obscure part and the twentieth, or twenty-fifth, of the obscure limb; it underwent the preceding stars of three little stars at the lowest cusp in the tail of Aries. Gassendi in *Epicuro* page 902.

8. In the year 1634, on December 30, Boulliau at Iulioduni [Digne] near the Pictones [Poitou], in the evening at hour 5.42', [saw] the high Aldebaran at $32^{\circ}42'$; he saw the bright Pleiades occupy the obscure margin of the Moon; thus through the telescope the star would appear higher than the lower limb of the Moon by minutes 4'. *Bullialdus* book 3, *Astronomia* ch. 12, who adds the star to have been in Taurus $24^{\circ}52'$; with latitude north $4^{\circ}8'$; the place of the Moon was seen in Taurus $24^{\circ}38\frac{1}{2}'$; truly $24^{\circ}17'55''$, and latitude seen north degree $4^{\circ}8'21''$; truly degree $4^{\circ}45'48''$.

9. In the year 1635, on January 26, Michael Florent van Langren at Brussels [observed] the Moon occulting Taygeta of the Pleiades, the Equator culminating at degree $122^{\circ}55\frac{1}{3}'$; and the Sterope of the Pleiades culminating at degree $138^{\circ}11\frac{2}{3}'$; so in letters of himself to me. But Taygeta is that star 33, in southerly Taurus, near Bayer [Bayerum].

10. In the year 1635, on August 26, at hour 9.49', Gassendi at Digne saw the Moon, at full Moon, approach a preceding star of two in the tail of Capricorn; the part of the lower margin of the inferior eastern limbs, or, from the region of the spot which we noted in the *Almagestum Novum* book 4; Hevelius gathers it thus from things said by Gassendi in *Epicuro* page 902.

11. In the year 1636, on November 25, in the same place, Michael Florent van Langren observing at Brussels, when the Equator culminated at degree $341^{\circ}8'$, saw the knee of Gemini emerge from the limb of the Moon, in a line drawn through the mountain Guthschovius [Mons Guthschovii] and Moretus [Mons Moretus], distant from the Moretus mountain by as much as Moretus is distant from Eugenia [Mons Eugenia]:

In the *Selenographia* itself in our [Appendix], book 4, the *Almagestum Novum* sets out: Guthschovius is Ariadnæus, and Moretus, Proclus, and Eugenia, Vitruvius.

12. In the year 1637, on March 29, Boulliau at Paris, in the evening at hour 8.19', observing — Boulliau; but truly *in Epicuro* Gassendi — saw Aldebaran at degree 20.55', that is, hour 8.43'36". The Moon grazed it, since it had occulted the angle of the southern quadrilateral of the Pleiades, which entered the bright Pleiades in the preceding [position]; if the bright stars are in the middle and the Moon is equally distant from the Cornu [horns] of both bright stars, [Margin: ?] then the southern limb [was occulted] from the southern cusp, when at hour 9.26' the Moon occulted the star at the angle of the austral quadrilateral of the Pleiades, [the star] of that same limb almost the seventh from the southern cusp; and at hour 9.40'. The star at the angle [was] seen at last to emerge, and to escape from the Moon near the middle, tending toward the boreal, nor at such a distance from the lower limb did it shorten much. He occulted at hour 9.54'; in such a way, by 8", he occulted the bright Pleiad in three sevenths of the obscure limb, at a cusp of southern latitude at hour 9.54'; the angle boreal emerged from the bright Pleiad, with one minute conjoined and added [from] obscure distance, [and] the limb, which was in the middle near the southern cusp toward the boreal, and the spot Mare Crisium, by us Mare Crisium [Margin: Gassendi *in Epicuro* page 902]. Boulliau adds, book 3, ch. 12. At Paris, the highest [point] impending over the boreal angle of the Pleiades, higher, was that 8'; and in the same azimuth it had been with the center of the bright Pleiades, [which was] Tyconically there in Taurus then, in degree 24°55'28"; and the western quadrilateral occulted at degree 161°56'18"; he numbers the intervals of the times by the oscillations perpendicularly, *or he himself wrote it to me.*

13. But Michael Florent van Langren, in the same year, on the day 29 of March, at Brussels saw Maia, or the Boreal Angle of the Pleiades, occulted by the Moon, the Equator culminating at degree 140°29'⅔; and the most boreal Asterope of the Pleiades culminating at degree 152°9'18", that is, the western angle culminating at degree 161°56'18"; he numbers the intervals of the times by oscillations perpendicularly, *or he himself wrote it to me.*

14. In the year 1638, on January 14, Gassendi at Digne in the evening saw an hour 2.15'; the bright cusp of the Boreal [horn] transited near the western angle of the quadrilateral of the Pleiades, nor at so great a distance more than a tenth part of the lunar diameter. But truly at hour 7.31' it touched the southern angle with the obscure limb, by about four minutes in the boreal parts from the boreal cusp. At hour 8.21'. The southern angle emerged, and stood off from the bright limb by one and twelve-fourteenths of the lunar diameter, and by three [of the same] of its own limb, almost the seventh from the boreal cusp distant, meanwhile it touched the easterly Pleiad. At hour 9.19' the bright Pleiad emerged, and stood off

from the boreal limb by two diameters of the Moon, and a third of the limb toward the boreal; the most boreal Pleiad emerged from the bright limb, and stood off, and from the other part 48 diameters of the lunar [Margin: Gassendi *in Epicuro* page 902 & Bullialdus book 3, ch. 12], concerning which see in the end of the following observations.

15. Likewise in 1638, on December 11, Gassendi observing at hour 4.37' past midnight, saw the Moon to occult the eastern oriental [limb], about the middle of the obscure limb, a star which is in the foot of the eastern part of Castor, preceding another, which is in the foot of the preceding Gemini. Gassendi *in Epicuro* page 902. Bullialdus likewise book 3, ch. 12, refers it [to] Gassendi, observing in the year 1638, January 12, at hour 8.5'; with reckoning made in the year 1648, January 14, at hour 8.5'·48"; the center of the Moon at the fifth from the boreal cusp. From this he gathers the center of the Moon at minute 5' distant from the star, in the longitude in Taurus 24°56'·18"; and so the place of the Moon was seen to be in Taurus 24°51'·18", and latitude truly boreal at degree 4°55'; seen at degree 5°44'·48".

16. In the year 1639, on February 12, Gassendi at Aix observed the transit of the Moon over a preceding star of two in the foot of the preceding Gemini at degree 31°45'; for it was at hour 10·17', noting that it lay in the same line conjoined, nevertheless at the same longitude, distant by minutes 1', from the southern horn; and so *Bullialdus* book 3, *Astronomia* ch. 12, attesting that the star was in Gemini at degree 28°48'·48", and the Moon's true place in Gemini at degree 28°48'·48"; and the parallax of longitude having been seen at 23°48' latitude at 23°50'. **17.** In the year 1639, on April 7, Boulliau at Paris, [with] high Procyon at degree 33°52', that is, hour 9.8', saw the Moon with obscure limb...

Liber III — De Luna (Caput V, continued)

[The observation series continues from the prior batch. The opening lines of p. 190 complete observation 17 — Boulliau's Paris observation of 1639 April 7 — begun at the foot of the previous batch.]

the upper limb being occulted by the apex of the Moon's horn, the star of fifth magnitude that lies in the origin of the northern horn of Gemini — which is to say, by the Tyconic reckoning, in the 7th degree, 34 minutes [grad. 7. 34'] of Gemini, with northern latitude 40 minutes [40']. The center of the Moon was therefore distant from there by 14 minutes [14'] in the preceding part. Accordingly the Moon's place was seen to be in the 6th degree, 53 minutes [6. 53'] of Gemini, and its latitude seen to be smaller by 5 minutes [5'] than the star's.

Hence its place is not gathered from this. He concludes the matter in Book III, Chapter 12 [lib. 3. c. 12], in these words: "*Why this place is suspect to me.*"

18. In the year 1641, on April 14 [Anno 1641. Aprilis 14], Boulliau observed at Paris that, at the very moment of the Moon's setting, by the hour 24, minutes 8 [hor. 24. min. 8], the more northern of the two stars of fifth magnitude that are obscurely seen at the lower horn of Taurus, and that are distant from the lower horn itself, was occulted — Boulliau places it in the 23rd degree, 27 minutes [gr. 23. 27'] of Gemini, its latitude being southern 2 degrees, 37 minutes [gr. 2. 37'] in Gemini. From this it follows that the Moon's place was southern by 2 degrees, 37 minutes [gr. 2. 37']. Hence Boulliau, in Book III, Chapter 12 [lib. 3. c. 12], places the Moon in the 23rd degree, 27 minutes [gr. 23. 27'] of Gemini, and (its latitude having been seen) in the 2nd degree, 32 minutes, 11 seconds [gr. 2. 32'. 11"], and the parallax, in longitude, 32 minutes [32'].

19. In the same year 1641, and in the month of April, on day 13 [Anno eodem 1641. & Mense Aprili die 13], Michael Florent van Langren observed the eye of the Bull [oculum Borealem Tauri] occulted at the obscure limb of the Moon, the Moon culminating, in the 9th degree, 26 minutes [grad. Æquatoris 149. 26'] of the equator. (*Va habeo in litteris ad me scriptis*) — Thus I have it in the letters written to me.

20. In the year 1641, on June 24 [Anno 1641. Iunii 24], Boulliau at Paris, before the setting of Arcturus, in the 41st degree, 47 minutes [gr. 41. 47'], that is to say at the hour 11, minute 5, second 20 [hor. 11. 5'. 20"], saw the star of third magnitude that is the lower of those in the horns of Capricorn, nearest to it on the preceding edge. Boulliau, in Book III, Chapter 12 [lib. 3. c. 12], holds that this star was in the 19th degree, 5 minutes [gr. 19. 5'] of Capricorn, with northern latitude. From this the Moon's place was seen to be in the 19th degree, 40 minutes, 54 seconds [gr. 19. 40'. 54"] of Capricorn, and its latitude seen to be 4 degrees, 8 minutes [gr. 4. 8'] northern. Hence the Moon's place by longitude was 9 degrees, 13 minutes [9. 13'] of Capricorn, its latitude 5 degrees, 17 minutes [5. 17'].

21. In the year 1642, on October 2 [Anno 1642. Octobris 2], Markab being on the meridian of Brussels, Michael Florent van Langren observed the eye of the Bull [oculum Tauri] in a straight line with that streak, which he himself, in his *Selenographia*, calls Promontorium Clauui [Promontorium Clauij — Cape Clavius], and Mount Bias [Montem Biæi], so that the eye of the Bull was placed a little further than Mount Bias, by however much Cape Clavius is distant from Mount Bias itself. In our *Selenographia* this Mount Bias is called Mount Hercules [Mons Biæi vocatur Hercules], being distant — as is plain from the letters — by the third

part of that spot, by which Cape Clavius is distant from the most western edge, and the same spot is distant from the Moon's western diameter, as the spot itself appears, by 1/200. And this eye of the Bull was now more western, and was setting from the Moon.

22. In the year 1642, on November 10 [Anno 1642. Nouembr. 10], at the hour 7, at midnight [hora 7. à media nocte], Hevelius at Danzig saw the last phase of the waning Moon, on the last day before conjunction, in the 2nd degree [in 2. gr.] of Scorpio. (Hevelius, Chapter 44, *Selenographia* [Heuelius cap. 44. Selenographiæ].)

23. In the year 1642, on November 26 [Anno 1642. Nouembr. 26], at the hour 11 past midday [hora 11. post merid.], Hevelius at Danzig saw that the Moon, from the moment of opposition, decreased more than was usual. And this decrease, by a sensible amount, the telescope had detected. Hevelius, Chapter 27, *Selenographia* [Heuelius cap. 27. Selenographiæ], where he refutes Blancanus and Aguilonius, who suppose that this decrease, not after some two days, but barely three days after opposition, can be discerned. And he learnedly shows that this decrease of the Moon does not always appear at the obscure limb of the Moon. (Hevelius, Chapter 27, *Selenographia*.)

24. In the year 1644, on April 13 [Anno 1644. Aprilis 13], at the hour 9 past midday [hora 9. post merid.], Hevelius at Danzig observed the Moon in the first quadrature, in the 25th degree [in Cancri gr. 25] of Cancer, around its maximum libration; and yet the lines of section separating the obscure part from the luminous part were noticeably distant by a tenth part of the Moon's diameter [decima parte diametri Lunarum]. This he himself attributes to the libration. (Chapter 18, *Selenographia* [Cap. 18. Selenographiæ].) But to this he does not concur in establishing the parallax.

25. In the year 1644, on October 8 [Anno 1644. Octobr. 8], at the hour 7 past midday [hora 7. post merid.], Hevelius at Danzig observed the Moon before the true quadrature, of which the lines of section seemed to exceed beyond the center of the Moon's disk, so that there appeared so many spots not yet covered by the line of section of the Moon. (Hevelius, Chapter 18, *Selenographia* [Heuelius cap. 18. Selenographiæ].)

26. In the year 1644, on November 13 [Anno 1644. Nouembr. 13], Hevelius at Danzig observed the eclipse of Palilicium [= Aldebaran], beginning to be occulted by the Moon, at the hour 3, minutes 5 [hora 3. minuto 5], at the middle of the eastern limb; it emerged at the hour 4, minute 5 [hora 4. 5'], above the middle of the western limb; and at the hour 4, minutes 10 [& hora 4. 10'], Palilicium was

distant from the obscure part by a twelfth of the Moon's diameter [duodecima Lunaris diametri]. (Hevelius, page 472, *Selenographia* [Hevelius pag. 472. Selenographiæ].)

27. In the year 1645, on April 27, day 5, hour 8 of the Danzig evening [Anno 1645. Aprilis 27. feria 5. hora 8. vespertina Gedani], Hevelius saw the first phase of the Moon; from another after [the New Moon, the Moon being in Taurus, of the sign of long descensions], and in its perigee, and in its greatest southern austral latitude, having departed from its conjunction with the Sun, the hours being 41. (Hevelius, page 278, *Selenographia* [Hevelius pag. 278. Selenographiæ].)

28. In the year 1645, on October 8 [Anno 1645. Octob. 8], Hevelius at Danzig observed the eclipse of Palilicium made by the gibbous Moon, beginning to cover it at the eastern limb, at the height above the horizon of 38 degrees, 48 minutes [gr. 38. 48'], that is at the hour 1, minutes 47 [hora 1. 47']; but at night, it emerged at the middle of the western limb, near the bright shoulder of Orion, in the 38th degree, 45 minutes [gr. 38. 45'], namely at the hour 2, minutes 57 [hor. 2. 57']; and the line of Palilicium did not yet reach the lower center of the Moon, so much was the duration of the eclipse — namely, the duration of the eclipse was 1 hour, 10 minutes [hor. 1. 10']; the hour was 3, minutes 30 [hora 3. 30']. The Moon reached the 90th degree of the ecliptic [nonagesimum Eclipticæ]. (Hevelius, Chapter 43, *Selenographia* [Hevelius cap. 43. Selenographiæ pag. 473].)

29. In the year 1645, on November 17 [Anno 1645. Nouemb. 17], Hevelius at Danzig saw the very old phase of the Moon before conjunction, for the Moon was situated in the 13th degree [in gradu 13] of Scorpio, and in its greatest northern boreal latitude. (Hevelius, Chapter 43, *Selenographia* [Hevelius cap. 43. Selenographiæ].)

30. In the year 1645, on December 2 [Anno 1645. Decembr. 2], the Moon being at perigee and at opposition to the Sun, he observed the eye of the Bull [oculum Tauri] to rise; the Moon's altitude being higher than 49 degrees, 28 minutes [alt. gr. 49. 28'], at the southern limb, so that it then emerged from the middle of the western limb in the 49th degree [gr. 49]. (D. Vincenzo Mut [D. Vincentio Muto] of Majorca observed this, and accomplished it.)

31. In the year 1647, on April 8 [Anno 1647. Aprilis 8], D. Vincenzo Mut of Majorca, with the right ankle of high Auriga setting, in the 35th degree, 14 minutes [grad. 35. 14'], that is at the hour 8, minutes 19 [hora 8. 19'], saw with an optical tube the application of the Moon to the Hyades [Lunæ ad Hyadas] — that is, to that star of Taurus, which is at the eye of the Bull, the star itself having

entered toward the northern part almost a third [quasi tertiam], at the dark northern limb. (*Sic ille in Epistola ad me* — Thus he writes in a letter to me.)

32. In the same year 1647, on April 12 [Anno pariter 1647. Aprilis 12], D. Vincenzo Mut of Majorca saw Jupiter [Iouem] entering the northern part of the Moon [Borealem Lunæ], at the high western edge, in the 57th degree, 18 minutes [Regulo gr. 57. 18'], that is at the hour 9, minutes 56 [hora 9. 56']; thereafter, Jupiter having emerged, at the high western straight line [Iupiter à limbo occiduo Lunæ], in the 49th degree, 12 minutes [Regulo gr. 49. 12'], namely at the hour 10, minutes 48 [hora 10. 48'], so that it lurked for 52 minutes [52']. (*Ita idem in suis ad me litteris* — Thus the same in his letters to me.)

33. In the year 1647, on June 6 [Anno 1647. Iunij 6], Hevelius observed another star of Lyra [aliam Lyræ], in the 53rd degree, 36 minutes [gr. 53. 36'], that is at the hour 10, minutes 10 [hora 10. 10']; Gedani [at Danzig], in the rectilinear part toward the apexes of the horns, the Moon being drawn, at the apex of the lower edge distant by a fifth part of the Moon's diameter [quinta parte diametri Lunaris]. So he writes, and inscribed the diagram. (Hevelius, among other things, communicated this to me most liberally — *Hevelius inter alia ad me liberalissime transmisso.*)

34. In the year 1650, on August 4 [Anno 1650. Augusti die 4], when the Moon was at the very 90th degree, around quadrature, and almost without latitude, D. Vincenzo Mut of Majorca, with the naked eyes [nudis oculis], saw the Moon still hollow [Lunam adhuc cauam], but through the optical tube not so hollow [Tubo optico non adeo cauam], the hour being 9, minutes 30 [hora vero 9. 30']; that the lines of section were in the exact dichotomy [in ipsa exacta dichotomia]; but the parts remaining, except at the horns, was hollow somewhere, somewhere protruding toward the line of section dichotomy, both to the naked eye, and to the hour 10, minutes 15 [hora 10. 15']; to the naked eyes the Moon would seem hollow somewhere, as in Kepler's *Astronomia Optica*, page 217 [Kepleri *Astronom. Optica* pag. 217], yet not for the whole hour [non per horam] would the Moon's quadrature be seen hollow. So he wrote in the same year, and to me, D. Vincenzo Mut [D. Vincentius Mutus], whose many letters, full of astronomical learning, I keep. (*cuius Epistolas multas Astronomica eruditione plenas conseruo.*)

35. In the year 1653, on the 19th day of May [Anno 1653. die 19. Maij], D. Io. Baptista Hodierna [= Giovanni Battista Odierna], a Sicilian, a most skilled astronomer, after he (as the *Almagestum Novum* has noted in the *Selenographia*, and on the Dichotomy of the Moon) had calculated, deferred the dichotomy of the Moon under the southern hour 15, minutes 46 [sub horam post meridiem 15. 46'],

at the meridian of Palma [in Meridiano Palmæ], which is between Gela [Gelum] more eastern and Agrigentum [Agrigentum] more western; for then the line of section dichotomy passed through the western edge Marginem Anaxagoræ [the edge of Anaxagoras], and bifariously cut Archimedes [Archimedem], and Alpetragium [Alpetragium], in a luminous place where Plato and Tycho were still whole [totus Plato, & Tycho], and Cavi [Cauij] the western edge, and whole Blancanus [integer Blancanus]. See in Book IV of the *Almagestum Novum* [lib. 4. Almagesti] the location of the lunar spots noted. And indeed the *Almagestum Novum* indeed reached the 90th degree, minutes 14 [grad. 394. hora & hor. 15. 46'], by which the Moon perfectly arrived at the dichotomy at the protruding horns; yet he confesses it is difficult to avoid the deception of the half-hour [horæ dimidiæ]. So it is in his letters to me, most humane, and most learned. (*Ita ille in suis ad me humanissimis, & doctissimis Epistolis, quas custodio* — whose epistles I keep.)

36. In the year 1654, on May 1 [Anno 1654. Maij 1], with D. Vincenzo Mut of Majorca observing, the Moon began to cover Regulus [Regulum] high and at the western Rigel, in the 34th degree, 16 minutes [gr. 34. 16'], that is at the hour 8, minutes 6 [hor. 8. 6']. Regulus emerged from the Moon, high and at the western shoulder of reddish Orion [Occid. humero rubescenti Orionis], that is at the hour 9, minutes 7 [hora 9. 7'].

[Top-of-page text completing observation 36 from the prior page, with marginalia at the page head:]

the angle of the ecliptic, and of the Moon's path, was 12 degrees, 8 minutes [grad. 12. 8']; and therefore the Moon was seen in the 24th degree, 48 minutes [Leonis gradu 24. 48'] of Leo, with northern boreal latitude 29 $\frac{1}{3}$ minutes [29' $\frac{1}{3}$]. Let it be by Lansberg [Lansbergio] that it would have been in the 25th degree, 24 minutes [gr. 25. 24'] of [Leo] with latitude 34 minutes, 15 seconds [latit. 34. 15"]. For the Danes [Danicis], indeed, and for Argol [Argolo], it was in the 24th degree, 57 minutes [gr. 24. 57']; and for Boulliau in the 25th degree, 2 minutes [gr. 25. 2'], with the latitude seen 35 degrees, 45 minutes [35. 45']. Thus D. Vincenzo Mut [Mutus], in his learned letter to me at present [in sua eruditissima ad me Epistola].

Caput VI

****Table (Caput VI) — Source: **** A large folio-width tabulation occupying nearly the entire page, framed with rule-lines, presenting the calculated places of 24 lunar observations. The header text along the right margin reads, in full:

CAPUT VI. — *"In which is exhibited a Table of 24 Lunar Observations together with the calculation, that is, the workings of Boulliau, which he himself in Book 3 of the Astronomia Philolaica, Chapter 12, promised, but having set it aside, deferred to page 175 of his Tables."*

A second marginal-header line reads: *"The calculation of the observed places of 24 motions of the Moon, of which the prior 14 were observed by Tycho; the remaining 10 were reduced to mean time at the Meridian of Uraniborg by D. P. Gassendi and Io. Boulliau."*

The header marginalia at the top of the page (above the table) reads: [Margin (page-head, completing obs. 36): see the prose above — the ecliptic-angle and the comparative lunar places by Lansberg, the Danes, Argol, and Boulliau, per Mut's letter.]

The table is read in **columns running down** the page (each labeled at the top by a column-head), with the **24 observations as rows**. The column-heads (reading right to left across the framed head, as printed) are:

Column head (Latin)	English
Numerus (1...24)	Observation number (1 through 24)
Anni	Year
Menses	Month
Temp. Med. — D. H. '	Mean time — days, hours, minutes
Locus Solis verus — Sig. Gr. '	True place of the Sun — sign, degrees, minutes
Locus ☾ visus ad Argum. — Sig. Gr. '	Place of the Moon seen, for the argument — sign, degrees, minutes
Locus ☾ observ. & reductus — Sig. Gr. '	Place of the Moon observed and reduced — sign, degrees, minutes
Differ. seu æquationis dispens. — ' "	Difference, or dispensation of the equation — minutes, seconds
Anomalia simplex — Sig. Gr. '	Simple anomaly — sign, degrees, minutes

Column head (Latin)	English
Distantia Lunæ à Sole — Sig. Gr. '	Distance of the Moon from the Sun — sign, degrees, minutes
Motus lat. æquatus — Sig. Gr. '	Equated motion of latitude — sign, degrees, minutes
Refractio maxima in limite syzigiae — ' " (Subtr./Add.)	Maximum refraction at the limit of syzygy — minutes, seconds (Subtract / Add)
Differ. observ. seu à Tychone — ' "	Difference of the observation, or [the difference] from Tycho — minutes, seconds

Observation rows (year / month, with the leading entries as I can read them):

No.	Year	Month
1	1586	September [Septembri]
2	1587	January [Ianuarij]
3	1587	January [Ianuarij]
4	1594	December 1 [Decemb. 1]
5	—	—
6	—	—
7	—	—
8	—	—
9	—	—
10	—	—
11	1594	December 11 [Decemb. 11] (these 14 places observed in the year 1594 December, by old style — <i>Hæc XIV. loca observata sunt Anno 1594. Decembri diebus stylo veteri</i>)

No.	Year	Month
12	—	—
13	—	—
14	—	—
15	1617	June [Iunij]
16	1617	June [Iunij]
17	1619	February [Februarij]
18	1619	January [Ianuarij]
19	1628	January [Ianuarij]
20	1634	June [Iunij]
21	1634	June [Iunij]
22	1641	March [Martij]
23	1641	April [April.]
24	1641	April [April.]

Parsing notes: This is a very dense, framed folio table read in columns down the page, with the numbered observation-rows entered transversely. At the available resolution the year/month spine (left edge) and the column-head labels (right edge) are legible, but the great majority of the interior numerical cells — the sexagesimal entries for Sun's place, Moon's place observed and reduced, equation-difference, simple anomaly, Moon–Sun distance, equated latitude-motion, syzygy refraction, and the Tycho-difference — cannot be transcribed reliably at this resolution; the digits within the framed grid are too fine and ink-bled to resolve cell-by-cell without misreading. **This whole table for full cell-by-cell transcription at higher resolution.** The structural skeleton (column heads, 24-row spine, the two header captions, the "first 14 from Tycho / last 10 reduced by Gassendi & Boulliau" provenance note, and the "old style 1594 December" sub-note) is recorded here. The bracketed note "Add./Subtr." marks the refraction column's sign convention per row, and "m." within several columns marks the minute-sign on those sexagesimal entries.

Caput VII

Lunares Observationes selectæ ex multis Bononiæ factis à PP. Io. Baptista Ricciolio, & Franc. Maria Grimaldo Societatis Iesu, pro Lunæ locis extra Eclipses.

Caput VII. — Select Lunar Observations, out of many made at Bologna by Fathers Giovanni Battista Riccioli and Francesco Maria Grimaldi of the Society of Jesus, for the places of the Moon outside eclipses.

1. In the year 1642, on April 14, in the following night [Anno 1642. April. 14. nocte seq.], an eclipse was observed (concerning which, see the eclipse observations); part of that night the meridian altitude of the Moon's center was seen to be 35 degrees, 31 minutes [gr. 35. 31']; thence, to the transit of Arcturus by the meridian-circle [M. C.], the parts were numbered perpendicular, 28 degrees, 16 minutes [28. 16'].

2. In the year 1642, on June 18, in the following night, minutes 34 1/2 [Anno 1642. Iunij 18. nocte seq. minutis 34 1/2], after the transit of Aquila by the middle of the heavens [Coeli], the meridian altitude of the Moon's center was seen to be 24 degrees, 15 minutes [gr. 24. 15']; [the heavens being] clear, the same center was seen distant from Fomalhaut by 23 degrees, 18 minutes [gr. 23. 18'], apparent; and after three minutes of time, the altitude of Fomalhaut was seen to be 20 degrees, 4 minutes [gr. 20. 4'].

3. In the year 1642, on July 7, in the following night [Anno 1642. Iulij 7. nocte seq.], the meridian altitude of the Moon's upper limb was seen to be 30 degrees, 28 minutes [gr. 30. 28']; thence, to the transit by the meridian-circle [M. C.] of the middle star in the forehead of Scorpio, we numbered 44 degrees, 5 minutes [44. 5']. On day 8, in the following night, the altitude of the Moon's center was seen to be 27 degrees, 18 minutes [gr. 27. 18']; thence, to the transit of the heart of Scorpio [cordis Scorpij] by the meridian-circle, we numbered 11 degrees, 40 minutes [11. 40'].

4. In the year 1642, on July 15, in the following night [Anno 1642. Iulij 15. nocte seq.], from the transit of Fomalhaut by the meridian-circle [M. C.], and to the transit of the eastern margin of the Moon [marginis Orientalis Lunæ], 42 degrees, 16 minutes flowed [fluxere 42. 16']; and then the altitude of the Moon's lower limb [limbi inferioris Lunæ] was 47 degrees, 14 minutes [gr. 47. 14']; and thence, at the physical rising of the Sun, the parts numbered were 42 degrees [42'].

5. In the year 1642, on July 18, in the morning, the Sun having risen [Anno 1642. Iulij 18. manè orto Sole], the meridian altitude of the lunar center was seen to be 51 degrees, 59 minutes [gr. 51. 59']; and after 2 minutes of time, the altitude of the center seen was 7 degrees, 3 minutes [gr. 7. 3'].

6. In the year 1642, on August 6, in the evening [Anno 1642. Augusti 6. vespere], from the transit of Ophiuchus [Ophiuchi] by the meridian-circle, the minutes numbered were 8 minutes [8'], and from the transit of the lunar [center], whose meridian altitude was seen to be 25 degrees, 55 minutes [gr. 25. 55'].

7. In the year 1642, on August 16, in the morning [Anno 1642. Augusti 16. manè], the altitude of the upper lunar margin was 56 degrees, 24 minutes [gr. 56. 24']; and a little after, [the altitude] of the lower margin was 55 degrees, 56 minutes [gr. 55. 56']; the hour, after 2, the bright [star] of Aries [lucida Arietis] transits by the meridian-circle [M. C.].

8. In the year 1642, on August 20, in the morning, minutes 24 1/2 [Anno 1642. Aug. 20. manè 24 1/2], before the rising of the Sun, the northern and eastern horn of the Moon was seen to be distant from Capella [à Capella orientali], in the 30th degree, 27 minutes [gr. 30. 27']; the western lucid [star], in the 30th degree, 29 minutes [gr. 30. 29'].

9. But on the same day, in the morning, minutes 21, 18 seconds [Die autem seq. manè min. 21. 18"], after the transit of the bright [star] of Aries [lucidæ Arietis] by the meridian-circle, the Moon's center was seen to be distant from the bright shoulder of Orion [Orionis humero lucido] by 10 degrees, 12 minutes 1/2 [gr. 10. 12' 1/2]; and after 2 minutes of time, it was distant from Rigel by 47 degrees, 57 minutes [gr. 47. 57']; and the refractions are to be noted within the foregoing times, and the altitudes seen.

Times after
the transit
of the
bright
[star] of
Aries [□] by
the
meridian-
circle [M.
C.]

Altitude
seen of the
Moon's
eastern
[margin]

M.	Secund.	Gr.	M.	S. (seconds)
----	---------	-----	----	--------------

Times after
the transit
of the
bright
[star] of
Aries [♈] by
the
meridian-
circle [M.
C.]

Altitude
seen of the
Moon's
eastern
[margin]

(minutes)	(seconds)	(degrees)	(minutes)	
32	24	28	16	0
48	30	31	1	0
54	24	32	2	10
60	30	33	4	30

10. In the year 1642, on August 23, in the morning, minutes 48, before the true rising of the Sun [Anno 1642. Aug. 23. manè 48'. ante verum Solis ortum], the Moon's center was seen to be distant from the bright shoulder of Orion [ab Orionis humero lucido] by 42 degrees, 16 minutes [grad. 42. 16']; and after 4 minutes, [it was] distant from Rigel by 16 degrees, 21 minutes 1/2 [grad. 16. 21' 1/2].

11. In the year 1642, on October 15, in the morning [Anno 1642. Octob. 15. manè], from the transit of Sirius by the meridian-circle [M. C.], namely from the hour 7, minutes 12 past midday [ab hora 7. post merid. 17. 12'], the minutes numbered were 18 minutes, 52 seconds [min. 18'. 52"], at whose end the Moon's center was seen to be distant...

12. In the year 1642, on October 19, in the morning, minutes 5, 10 seconds [Anno 1642. Octob. 19. manè minut. 5. 10"], after the transit of Sirius by the meridian-circle, the Moon's center was distant from the heart of Hydra [à corde Hydræ] by 20 degrees, 38 minutes [gr. 20. 38']; thence, after the hour, by minutes 7, 12 seconds [post min. 7. 12"], [it was] seen to be distant from the tail of Leo [à cauda Leonis] by 20 degrees, 19 minutes [gr. 20. 19'].

13. In the year 1642, on October 30, in the evening, at the same moment [Anno 1642. Octob. 30. vespere eodem momento] at which the western lucid [star] of Aquila's altitude [occidua lucida Aquilæ] was 51 degrees, 21 minutes [gr. 51. 21'], the Moon's center transited by the meridian-circle [M. C.]; its meridian altitude

was seen to be 30 degrees, 49 minutes [grad. 30. 49']; the hour was 7, minutes 56, seconds 16 past midday [hora 7. 56. 16". erat hora post merid.].

14. In the year 1642, on November 2, in the following night [Anno 1642. Nouemb. 2. nocte seq.], the meridian altitude of the Moon's center was seen to be 43 degrees, 14 minutes [gr. 43. 14']; from which transit the minutes numbered were 5 minutes, 37 seconds [min. 5. 37']; Aldebara [Aldebarae] was reached at its meridian altitude of 24 degrees, 9 minutes [grad. 24. 9'].

15. In the year 1642, on November 10, in the morning, under the civic hour 11 1/4 [Anno 1642. Nouemb. 10. manè sub horam ciuilem 11 1/4], when the Moon was at the beginning of Cancer, and around the southern limit, the altitude of the western lucid [star] [altitudine occidua lucida] was taken at 38 degrees, 37 minutes [grad. 38. 37']; thence, after the transit of Procyon by the meridian-circle [M. C.], they were 4 degrees, 16 minutes [gr. 4. 16']; and then the meridian altitude of Procyon was 51 degrees, 36 minutes [grad. 51. 36'].

16. In the year 1642, on December 5, in the following night [Anno 1642. Decembr. 5. nocte seq.], the meridian altitude of the Moon's center near full Moon [prope Plenilunium] was seen to be 62 degrees, 41 minutes [gr. 62. 41']; thence, to the transit of Rigel by the meridian-circle [M. C.], the meridian altitude was seen to be 23 degrees, 45 minutes [gr. 23. 45'].

17. In the year 1642, on December 7, the Moon's transit by the meridian-circle [M. C.], the minutes numbered were 27 minutes, 41 seconds [min. 27. 41']; the center of the Moon transited by the meridian-circle, and was seen distant; its altitude, the meridian by two observations, was 61 degrees, 12 minutes [gr. 61. 12']; thence the numbered minutes were 27 minutes, 52 seconds [min. 27. 52"]. The Moon was near the 90th degree [prope Nonagesimum], it would seem, in the 60th degree, 36 minutes [alta grad. 60. 36']; and at its setting, around the beginning of Cancer, and not far from apogee [prope initium Cancri, nec longè ab Apogeo].

18. In the year 1643, on January 31, in the following night [Anno 1643. Ian. 31. nocte seq.], from the transit of the Moon by the meridian-circle [M. C.], the meridian altitude of itself was 63 degrees, 8 minutes [grad. 63. 8']; the numbered minutes were 6 minutes, 17 seconds [min. 6. 17"]; and the meridian altitude of Procyon was [taken] in degrees, 10 minutes, 17 seconds [gradum 10. 17"], when the Moon was in the 12th degree, almost, of Cancer [esset Luna in gradu ferè 9. Cancri], and in that very 90th degree [in ipso ferè Nonagesimo]; the parallax can hence be drawn [poterit hinc elici parallaxis].

19. In the year 1643, on February 3, in the evening, two minutes before the transit of the heart of Hydra by the meridian-circle [M. C.] [Anno 1643. Febr. 3. vespere minutis duobus ante transitum cordis Hydræ per M. C.], that is, at the very [moment of the] hour 12, the meridian altitude of the Moon's center [altitudo meridiana centri Lunæ] was seen to be 57 degrees, 10 minutes [gr. 57. 10']; since it was in apogee [cum esset in Apogeo], and at the hours [the Moon was] near full Moon by about two days [circiter duabus post Plenilunium].

20. In the year 1643, on February 12, in the morning, a little after quadrature [Anno 1643. Febr. 12. manè paulo post Quadraturam], the meridian altitude of the Moon's center was seen to be 29 degrees, 14 minutes [gr. 29. 14']; thence the numbered minutes were 5 minutes, 3 seconds [min. 5. 3']; the rising altitude of the heart of Scorpio [altitudo ortiua cordis Scorpj] was seen to be 19 degrees, 50 minutes [gr. 19. 50']; the Moon would appear now hollow [apparebat autem Luna iam caua], the hour being almost 1 [hora ferme 1].

21. In the year 1643, on March 5, the meridian distance of the Moon's center from the vertex [Anno 1643. Martij 5. distantia meridiana centri Lunæ à vertice] was 47 degrees, 57 minutes 1/2 [gr. 47. 57' 1/2], at the hour past midday 12 degrees, 21 minutes 1/4, seconds 34 [hora post meridiem 12. 21' 1/4. 34"]; and it constitutes [the place] toward Regulus [vt ex Regulo constitat].

22. In the year 1643, on March 13, the Moon's center was seen in the meridian to be 26 degrees, 40 minutes [Anno 1643. Martij 13. manè visa Lunaris centri in Meridiano fuit gr. 26. 40']; at the same moment, the lucid [star] of Aquila rose [lucida Aquilæ ortum versus alta], the altitude being 42 degrees, 41 minutes [erat gr. 42. 41'].

23. In the year 1643, on March 23, in the evening [Anno 1643. Martij 23. vespere], the altitude of the Moon's center by the meridian-circle was seen to be 63 degrees, 15 minutes [gr. 63. 15']; thence, after the transit of Procyon by the meridian-circle, the Moon flowed by 80 minutes [fluxere 80']; at which end the meridian altitude of Cancer [Cancuræ] was 51 degrees, 37 minutes [gr. 51. 37']. But on the following day, the meridian altitude of the Moon was seen to be 62 degrees, 40 minutes [gr. 62. 40']; thence the numbered minutes were 11 minutes [min. 11']; the altitude of Procyon was toward its rising 51 degrees, 24 minutes [gr. 51. 24']. On the same night, at my request, P. Theodorus Moretus of Breslau [P. Theodorus Moretus Bresnici] — where the altitude of the pole is 49 degrees, 24 minutes [Poli gr. 49. 24'] — observed the meridian altitude of the Moon to be 57 degrees, 17 minutes, 25 seconds [Meridianam Lunæ altitudinem gr. 57. 17. 25"]. At length, on day 28, the meridian altitude of the Moon's center was seen by us to be 58 degrees, 59

minutes, 15 seconds [gr. 58. 59'. 15"]; at the same moment the altitude of the eastern lucid Regulus [orientalis Reguli] was 35 degrees, 18 minutes [gr. 35. 18']; and then it transited by the meridian-circle, the southern arm of Cancer [brachium australe Cancrici] being high, the altitude being 52 degrees, 45 minutes [gr. 52. 45'].

24. In the year 1643, on April 3, in the following night [Anno 1643. Aprilis 3. nocte seq.], the meridian altitude of the Moon's center was seen to be 41 degrees, 30 minutes 1/2 [gr. 41. 30' 1/2]; thence the numbered minutes were 9 minutes, 41 seconds [min. 9. 41"]; the rising altitude of the ear of Spica [orientalis Spicæ] was 14 degrees, 35 minutes 1/2 [gr. 14. 35' 1/2]; thence we computed the meridian-circle hour to be 11 degrees, 52 minutes, 44 seconds [11. 52'. 44"]; and therefore the Moon's transit was at the hour 11, minutes 42 [hora 11. 42'].

Marginalia (printed side-notes, per page)

p. 190 (folio 158), left column marginalia (verbatim, top-to-bottom):

- against obs. 18: 18.
- against obs. 19: 19.
- against obs. 20: 20.
- against obs. 21: 21.
- against obs. 22: 22.
- against obs. 23: 23.
- against obs. 24: 24.
- against obs. 25: 25.
- against obs. 26: 26.
- against obs. 27: 27.

p. 190 (folio 158), right column marginalia (verbatim, top-to-bottom):

- against obs. 28: 28.
- against obs. 29: 29.
- against obs. 30: 30.
- against obs. 31: 31.
- against obs. 32: 32.
- against obs. 33: 33.
- against obs. 34: 34.
- against obs. 35: 35.
- against obs. 36: 36.

p. 192 (folio 160), left column marginalia (verbatim symbols, against observations):

- against obs. 1: □ (small square symbol)
- against obs. 3: *Offant.* 3. [Occultant. 3 — i.e. "occultation" tally 3]
- against obs. 4: *Offant.* [Occultant.]
- against obs. 6: *Offant.* 4. [Occultant. 4]
- against obs. 9: *Refract.* [Refractio]
- against obs. several: □ (square symbols marking parallax/occultation observations)

p. 192 (folio 160), right column marginalia (verbatim, against observations):

- against obs. 11: *Parallax.* [Parallaxis]
- against obs. 12: *Offant.* [Occultant.]
- against obs. 13: *Perig.* [Perigæum]
- against obs. 14: *Offant.* 2. [Occultant. 2]
- against obs. 15: *Offant.* [Occultant.]
- against obs. 17: *Parallax.* [Parallaxis]
- against obs. 18: □
- against obs. 19: *Apog.* [Apogæum]
- against obs. 20–24: □ and § (section-mark) symbols against several

[The numerous small □ (square) and §-mark side-glyphs are Riccioli's running tally-symbols flagging which observations bear on occultations (*Occultant.*), refraction (*Refract.*), parallax (*Parallax.*), perigee (*Perig.*) and apogee (*Apog.*). They are transcribed by type above; precise per-row alignment of the bare square-glyphs is approximate at this resolution.]

The Bologna lunar observations of Riccioli and Grimaldi continue (Caput VII), numbered as in the original.

25. In the year 1643, on July 7, in the morning, with the Moon near perigee, its center was seen on the meridian at an altitude of 32°38'. From there to the observed altitude of the Sun, 8°4', 60 minutes 10 seconds [of time] elapsed; and from this the Moon's center at setting appeared to be at an altitude of 31°29'.

[Margin: *Perig.*]

26. In the year 1643, on July 7, the observed altitude of the Moon's center on the meridian was 41°, precisely; and from it I counted 4°8'. The Moon's altitude was

16°52', that is, at the time of the meridian transit at 6h55'. The apparent moment of quadrature had not yet arrived, since I made certain that the Moon's transit had occurred at 18h0'52" past the meridian of the eighth day.

27. In the year 1643, on July 21, in the night following, the Moon's center was seen to be distant from Arcturus 34°33'. Then after 4 minutes [of time] it was distant from Spica 15°13', and after 2 minutes from the haunches [clunibus] of Leo 30°45', and after 6 minutes Arcturus' altitude at setting was 51°18'; and after 2 minutes the Moon's center was seen to be distant from the tail of Leo 75°25'; and at the vertex 73°25'.

28. In the year 1643, on August 3, in the morning before the Trigon of the Moon with the Sun, the rising altitude of the bright [star] in Aries was 60°48'; and after 5 minutes [the Moon] stood distant 41°35'. From the center of the Moon there appeared, higher and toward setting, the bright [star] 40°54', and afterward, in another 3 minutes, the Moon's center was seen distant from the bright [star] of the jaw of the Whale [lucida Mandibulæ Ceti] 48°15'.

[Margin: Trigon symbol]

29. In the year 1643, on August 7, in the morning, while the Sun was visible, [the Moon stood at] 12°52'. The Moon's center was on the meridian, [I observed] it; the altitude was 58°56'.

30. In the year 1643, on August 11, in the morning, the rising altitude of Aldebaran was 47°5'. From there I count 17 minutes. The Moon's center was seen distant from Aldebaran 36°31'. From there, after 5 minutes, the Moon's altitude at the vertex was 17°2', and distant from the bright shoulder of Orion 28°26'.

31. In the year 1643, on August 11, the Moon, a little past its 18th degree, was distant from the following conjunction with the Sun; yet it appeared at an altitude of 2°10', and distant toward the east, at the margin, from Rigel [Regel] 57°35'. From there, after 1 minute, it was seen at an altitude of 4°30'; and then distant, toward the eastern limb, from the foot of Orion 43°27'.

[Margin: Phasis ultima] [phase: last (waning)]

32. In the year 1643, on August 22, in the evening, while the Sun's center was still appearing, the Moon transited the meridian [M.C.] at an altitude of 10°40'. The Moon stood at a meridian distance from the vertex of 60°56'; it was 5h44' past meridian.

33. In the year 1643, on August 25, the Moon's center on the meridian was seen distant from the vertex $63^{\circ}14\frac{3}{4}'$, and after 5 minutes the rising distance of [Altair, the] Eagle [Aquilæ] from the vertex was $37^{\circ}14\frac{1}{4}'$.

[Margin: Octant.]

34. In the year 1643, on August 27, in the night following, when the bright [star] of the Eagle [Altair] was distant from the vertex $40^{\circ}9\frac{1}{3}'$, the meridian distance of the Moon from the vertex was seen to be $58^{\circ}56'$.

[Margin: 8 symbol]

35. In the year 1643, on August 30, in the evening, the bright [star] of the Eagle [Altair] at setting was distant from the vertex $36^{\circ}48'$, and after 2 minutes the Moon was seen distant from the vertex $20^{\circ}15'$; and from there it was distant from the foot of Andromeda $49^{\circ}11'$. Then, after 4 minutes, [the Moon] was seen distant from the vertex $20^{\circ}34'$, and distant from the head of Andromeda 29.

36. In the year 1643, on September 5, in the morning, half an hour before the Sun's physical rising, the Moon appeared somewhat smaller than dichotomized; but when, half-dichotomized, it shone to us, that was at 16h31'. After the meridian of the preceding day, scarcely an hour before, all the tables of quadrature were upset — whence Aristarchus' problem of finding the Sun's distance from the Earth is much weakened, as Tycho [held].

[Margin: Dichot.]

37. In the year 1644, on October 3, the Moon was seen distant from the vertex by 2 quadrantal measures $16^{\circ}50'$, and then, from the altitude of the rising bright shoulder of Orion, we concluded the apparent time to be 17h48 $\frac{2}{3}'$ past meridian.

38. In the year 1643, on October 20, in the evening, an hour before the Sun set, the Moon, inspected through the telescope, manifestly appeared a very little larger than dichotomized; but afterward, when the bright [star] of the Eagle [Altair] was distant at setting from the vertex $36^{\circ}53'$, at the same moment the Moon's center was seen distant from the vertex $61^{\circ}19\frac{2}{3}'$.

[Margin: Dichot.]

39. In the year 1643, on October 31, the meridian distance of the Moon's center from the vertex was $27^{\circ}5'$. From there I counted $27^{\circ}35'$. Procyon was at meridian transit [M.C.].

40. In the year 1643, on November 3, the meridian distance of the Moon's center from the vertex was seen, by a double quadrant, to be $30^{\circ}30'$; and then Sirius at setting was seen distant from the vertex $67^{\circ}42'$.

[col. 2]

41. In the year 1644, on May 22, in the night following, the Moon's center was seen distant from the vertex $43^{\circ}20\frac{1}{3}'$, and then distant from Spica toward the vertex $56^{\circ}26'$; toward setting.

[Margin: Apog.] [Margin: 8 symbol]

42. In the year 1644, on April 13, the Moon's center on the meridian, by a double quadrant, was seen distant from the vertex $62^{\circ}43\frac{1}{3}'$; and from there I count $5^{\circ}2'$. The Sun's altitude was seen toward setting $6^{\circ}36'$; therefore the hour was 6h36' past meridian.

[Margin: □]

43. In the year 1644, on July 11, in the evening, the Moon's center on the meridian was seen distant from the vertex $49^{\circ}42'$, one quarter [of an hour]; in another quarter, then $42^{\circ}48'$; and then the Sun's altitude was seen $11^{\circ}26'$.

44. In the year 1644, on June 28, in the morning, with the Moon at the very perigee, [and] at the apparent rising of the Sun, the Moon was distant, toward rising, from the vertex $52^{\circ}38'$. Then at the rising of the Sun the altitude was seen $23^{\circ}14'$. The Moon transited M.C., and then was distant from the vertex $23^{\circ}14'$.

[Margin: Octant. 3.] [Margin: Perig.]

45. In the year 1644, on November 13, in the night following, at the moment when the Moon's center on the meridian reached the vertex, it was seen distant from the vertex $32^{\circ}11'$; and afterward, at quadrature, $33^{\circ}12'$.

[Margin: Perig.]

46. In the year 1644, on November 21, in the morning, the Moon was distant from the vertex, toward rising, $31'$. The half-dichotomized Moon was seen to shine, or by the witness of the telescope to be a little less than dichotomized. But when Regulus was distant from the vertex $31^{\circ}11'$, the Moon's center was on the meridian, in minutes 4 before, with the distance seen from the vertex $33^{\circ}50'$. The Moon transited M.C. at 11h53'45".

[Margin: Dichotom.]

47. In the year 1644, on November 26, in the morning, Arcturus' rising distance from the vertex was $45^{\circ}32'$; and after two minutes the Moon's center on the meridian was distant from the vertex $31^{\circ}42'$, precisely; and from there Arcturus distant $29^{\circ}24\frac{1}{3}'$. From there, after 1 minute, the Moon's center was seen at an altitude of $22^{\circ}36'$, and distant from Spica $13^{\circ}11\frac{1}{3}'$.

[Margin: Octant.] [Margin: Apog.]

48. In the year 1645, on May 11, in the morning, the Moon stood at the vertex $41^{\circ}32'$. The Moon's center transited the meridian; it appeared distant from the vertex $38^{\circ}11'$.

49. In the year 1645, on May 20, in the morning, the Moon, a very little larger than dichotomized, appeared; but its meridian distance from the vertex was seen to be $64^{\circ}9\frac{1}{3}'$. From there to the rising of the upper limb the counted minutes were $12^{\circ}16'$; and from this point Solis [the Sun] the altitude was $3^{\circ}18'$; the measured time was 4h15'.

[Margin: Dichot.]

50. In the year 1645, on April 2, in the evening, at the moment when the Sun's center was seen at an altitude of $9^{\circ}28'$, the Moon's center was on the meridian, and was seen distant from the vertex $25^{\circ}35\frac{1}{3}'$; most exactly.

51. In the year 1645, on April 10, in the night following, the Moon's center on the meridian was seen distant from the vertex $45^{\circ}9'$; and then Arcturus rising stood distant from the vertex $24^{\circ}47'$.

[Margin: 8 symbol]

52. In the year 1645, on April 19, in the morning, before the rising [of the Sun], the Moon was seen scarcely dichotomized; [it] transited the meridian afterward, and [was] distant from the vertex $63^{\circ}23'$; at the apparent altitude of the Sun $12^{\circ}10'$.

[Margin: □]

53. In the year 1645, on May 10, in the night following, when Spica at setting stood at an altitude of $27^{\circ}50'$, the Moon's center on the meridian was seen distant from the vertex $58^{\circ}53'$.

[Margin: Apog.] [Margin: 8 symbol]

54. In the year 1645, on October 4, in the night following, the Moon's center [transiting] M.C. was seen distant from the vertex $46^{\circ}44\frac{1}{3}'$; and from there, in

time, Aldebaran stood distant from the vertex $56^{\circ}15'$. But the day before, in the night following, the meridian distance of the Moon's center from the vertex was $41^{\circ}34'$; and then Aldebaran stood distant from the vertex $46^{\circ}48'$.

[Margin: 8 symbol]

55. In the year 1645, on October 8, in the night following, the Moon's center [transiting] M.C. was seen distant from the vertex $63^{\circ}41\frac{1}{3}'$; and after 1 minute $46''$ [the Moon was] distant from the bright [star] of the Eagle [Altair] at setting $37^{\circ}55'$.

56. In the year 1646, on November 1, in the night following, the Moon [transiting] M.C. was seen distant from the vertex $34^{\circ}8'$; and after 5 minutes $46''$ Aldebaran rising stood distant from the vertex $33^{\circ}46'$.

[Margin: 8 symbol]

57. In the year 1646, on March 1, in the night following, the meridian distance of the Moon's center from the vertex was $36^{\circ}13\frac{2}{3}'$. From there I count $25\frac{2}{3}'$. The bright [star] of the tail of Leo transited M.C. But on day 13, hour 5, 10', $26''$, p.m., its meridian distance from the vertex was $25^{\circ}5'$, near perigee, in time [tempus]. [In the margin the figure reads: gr. 156. 30'. prope Perig. in time.]

[Margin: Perig.]

58. In the year 1646, on March 30, in the night following, from the transit of the tail of Leo [transiting] M.C. the counted [minutes] were $18^{\circ}26'$, also; and from the transit of the Moon's center across the meridian, in which it was seen distant from the vertex $43^{\circ}44'$.

59. In the year 1646, on May 8, in the morning, the Moon's center [transiting] M.C. was seen distant from the vertex $61^{\circ}20'$. From there I counted $6^{\circ}10'$. The Moon's center was seen distant from the vertex $74^{\circ}33\frac{1}{3}'$.

[Margin: □]

60. In the year 1646, on May 28, in the night following, the Moon's center on the meridian was seen distant from the vertex $61^{\circ}32'$. From there I count $4^{\circ}54'$. Antares transited M.C.

[Margin: 8 symbol]

61. In the year 1646, on June 19, the Moon's center was seen distant from the vertex $28^{\circ}19\frac{1}{3}'$. From there, after 5 minutes $41''$, the Sun's center at setting on the horizon was seen distant $72^{\circ}32'$.

[Margin: □]

62. In the year 1646, on June 27, the meridian distance of the Moon's center from the vertex was $66^{\circ}24'$; and from there, after 7 minutes 12", the bright [star] of the Eagle [Altair] rising stood distant from the vertex $35^{\circ}20\frac{1}{3}'$.

[Margin: Apog.]

63. In the year 1646, on July 3, in the morning, with the Sun risen, the Moon manifestly appeared to us less than dichotomized — but in truth the moment of dichotomy is to be reckoned from the ratio of parallax.

[Margin: Dichot.]

64. In the year 1646, on July 9, in the morning, the Moon's center was seen distant from the vertex $32^{\circ}10'58''$, and distant from the bright [star] of the side of Perseus $35^{\circ}37'$; and at the same moment Capella stood distant from the vertex 61° , precisely; when afterward the Moon stood distant from the vertex $60^{\circ}36'$, precisely. The Moon's center was seen at an altitude of $21^{\circ}2\frac{1}{3}'$, and distant from Capella $34^{\circ}45'$.

[Margin: Octant.]

65. In the year 1646, on July 27, in the night, on which night there was an eclipse of the Moon, its center on the meridian was seen distant from the vertex $64^{\circ}18'$. From there, after 6 minutes 7", the bright [star] of the Eagle [Altair] at setting was distant from the vertex $39^{\circ}46'$.

[Margin: 8 symbol]

66. In the year 1646, on August 4, the meridian distance of the Moon's center from the vertex was seen $35^{\circ}39\frac{1}{3}'$; and from there, after 10 minutes 30", the Sun's altitude was $9^{\circ}30\frac{2}{3}'$. The cause of this is to be doubted on account of parallax — yet in truth it was not so.

[Margin: Dichot.]

67. In the year 1646, on September 16, the Moon's center [transiting] M.C. was seen distant from the vertex $64^{\circ}24\frac{2}{3}'$. From there, after 6 minutes, the Sun's center at setting was seen distant from the vertex $86^{\circ}46\frac{1}{3}'$.

[Margin: □]

68. In the year 1646, on October 16, in the evening, the Moon's center on the meridian was seen distant from the vertex $66^{\circ}26'$. From there, after 11 minutes

16", the bright [star] of the Eagle [Altair] at setting stood distant $35^{\circ}44'$. But at a high altitude it appeared distant $3^{\circ}40'$; and although it was seen with the naked eye as dichotomized, and was scarcely seen as semi-dichotomized; yet for that hour it appeared more manifestly than dichotomized; for it had been in apogee the preceding day. The hour of the Moon's transit was $8h34'0''$, past meridian.

[Margin: Dichot.] [Margin: Apog.]

69. In the year 1646, on November 15, the Moon's center [transiting] M.C. was seen distant from the vertex $60^{\circ}56'$. From there, after 4 minutes $51''$, the bright [star] of Aries stood distant from the vertex $51^{\circ}56'$; and the Moon did not yet appear dichotomized.

70. In the year 1646, on November 21, the Moon's center was seen distant from the vertex $28^{\circ}36'$; from there, after 6 minutes, the bright shoulder of Orion rising stood distant from the vertex $42^{\circ}10\frac{1}{3}'$.

[Margin: 8 symbol]

71. In the year 1647, on March 28, in the morning, the meridian distance of the Moon's center from the vertex was $67^{\circ}47'$; and from there, after 9 minutes $10''$, the Sun's center was seen distant from the vertex $9^{\circ}10'$. But, in truth, on the quadrant it was somewhat larger before the rising of the Sun: the Moon appeared less than dichotomized, and that more manifestly with the Sun rising.

[Margin: Dichot.]

72. In the year 1647, on March 18, the Moon's center on the meridian was seen distant from the vertex $62^{\circ}33\frac{2}{3}'$. But the meridian distance was corrected for declination at rising, by the noted [observation] $62^{\circ}34'$; from there, after 4 minutes $48''$, Lyra rising stood high $26^{\circ}42'$.

[Margin: Meridiana corrected (corrected meridian)]

73. In the year 1647, on May 26, in the morning, the Moon's center [transiting] M.C. was seen distant from the vertex $9^{\circ}60'12''$; and after 6 minutes $30''$, the Moon's center stood distant from the vertex $16^{\circ}21'$.

[Margin: □]

74. In the year 1647, on June 1, in the evening, [the Moon] appeared distant from the vertex $54^{\circ}44'$; the Moon's center was then seen distant from the vertex $46^{\circ}16'$.

[Margin: Neomenia (new moon)]

75. In the year 1647, on June 16, the Moon's center on the meridian was seen distant from the vertex $66^{\circ}54'$; and from there, after $30''$, the bright [star] of the Eagle [Altair] rising stood distant from the vertex $44^{\circ}42'$.

[Margin: Merid. dist. (meridian distance)]

76. In the year 1647, on July 16, in the night following, the meridian distance of the Moon's center from the vertex was seen $67^{\circ}24\frac{1}{3}'$; and after 8 minutes $53''$, [the Moon] took up Andromeda toward the rising vertex $49^{\circ}44'$.

[Margin: 8 symbol]

77. In the year 1648, on March 25, in the evening, with the Sun set, the first phase of the Moon was seen, of about two minutes, in diameter — that is, scarcely $35'$ past the preceding new moon. And in full moon also, in the preceding of this month, see the observations adduced in lib. 2, cap. ult., num. 3.

[col. 2]

[Margin: Prima phasis (first phase)]

78. In the year 1648, on June 13, in the morning, from the altitudes of the Sun, reckoning the extreme of a doubtful time, the Moon's dichotomy was seen to be made at hour 5, $19'$, $52''$, before noon; and beforehand, in truth, at h. 5, $43'$, $52''$, the Moon had transited M.C., and then was seen distant from the vertex $52^{\circ}50'$.

[Margin: Dichot.]

79. In the year 1649, on September 8, in the evening, the first phase of the Moon appeared; [it] completed the conjunction with the Sun in two days, just as in the year 1650 on day 4, March, it was seen by us [in] the first phase of the Moon, two days past the conjunction with the Sun.

80. In the year 1650, on May 8, in the evening following, the Moon appeared to us falcate [crescent], even to the setting of Procyon at an altitude of $21^{\circ}40'$. After this, by the calculation [tunc] of the hour at $7\text{h}54'11''$ past meridian; then, indeed, the first dubious [moment] arose: it was falcate, an undifferentiated [moment] appeared; in the counted minutes $107'$, we began to doubt whether [it was] dichotomized, or rather a gibbous appearance; therefore in the second doubtful moment, in truth, the hour was at $9\text{h}41'$ past meridian. The middle time for dichotomy was $8\text{h}47'36''$.

81. In the year 1650, on October 24, in the morning, the last phase of the Moon was seen through the telescope, even to the rising of the Sun itself — namely, at hour 22h3', nearest to the conjunction with the Sun.

[Margin: Vltima phasis (last phase)]

82. In the year 1650, on December 29, the Moon's center [transiting] M.C. was seen distant from the vertex 44°36'; and after 4 minutes 10" Aldebaran at rising stood distant from the vertex 54°34'; the Moon was manifestly distant from dichotomy.

83. In the year 1651, on August 5, in the morning, the last phase of the Moon was seen through the telescope, that very [phase], hour [hoc est], past it the conjunction with the Sun began at 26 [hours], past meridian.

84. In the year 1652, on July 17, in the evening, the Moon's center was seen distant from the vertex 65°18' (because I deduced from this the time at hour 8.11'; and then, when the altitude was seen distant from the vertex, from Spica 65°32'; and from Spica 15°14'; the southern arm of the Whale [Vindemiatrix] was distant from the vertex 55°15'; and then the Moon's center was seen distant from the vertex 66°26'; and from the Vindemiatrix distant from the vertex 55°13'; and then the Moon's center was seen distant from the vertex 66°26'. And from there, exactly, distant from the tail of Leo 26°15½'.

85. In the year 1652, on July 14, in the evening, [the Moon was] distant from Spica 65°18' (which I deduced, the same time, hour 8.13'; and then [it stood] distant from the vertex 65°32'. And from Spica 15°14', the Vindemiatrix distant from the vertex 55°15'; and then the Moon's center was seen distant from the vertex 65°36'. From these P. Grimaldi, by computing the refraction and parallaxes through the triangular analysis, deduced the Moon's place in Scorpio at 0°30'25"; this the Danish Tables put at 3°11'; the Lansbergian at 4'; Argolus at 12'. But the southern latitude of the Moon, from P. Grimaldi's calculation, was 2°40'33".

86. In the year 1652, on July 24, in the morning, about one hour before the rising of the Sun, the Moon was observed distant from the vertex 54°25'; and from the bright [star] of Aries 51°9'; and from there, after a little, the same center was seen distant from the vertex 54°40'; and from the tail of the Whale [Ceti] 23°14'; the distance was seen from the vertex 64°44'; and after a little the Moon's center was seen distant from the vertex 55°5'; and from the jaws of the Whale [Ceti] 16°42½'; distant from the vertex 59°4'.

[Margin: 3. Octant.]

87. In the year 1652, on August 1, in the morning, the Moon's center was seen distant from the vertex $68^{\circ}50'$; and from Aldebaran $30^{\circ}16'$; distant from the vertex $55^{\circ}42'$; and the Moon's center was seen distant from the vertex $68^{\circ}15'$; and from the preceding shoulder of Orion $27^{\circ}26'$; distant from that vertex $70^{\circ}2'$.

[Margin: 4. Octant.]

88. In the year 1653, on May 3, in the evening, with Spica toward rising, [the Moon] stood distant from the vertex $58^{\circ}18'$. The Moon's center was seen distant from the vertex $51^{\circ}22'$, and from Arcturus $34^{\circ}47'$. Soon, in time, it was seen distant from the vertex $51^{\circ}19'$; and from Spica $11^{\circ}16'$.

[Margin: 2. Octant.]

89. In the year 1653, on December 23, the Moon's center, expected at the western azimuth, by a degree of $25'$ precisely, was in it distant from the vertex $67^{\circ}1'10''$. From there I count $8^{\circ}45'$; in time the bright [star] of the Eagle [Altair] at setting stood distant from the vertex $61^{\circ}41'40''$.

[Margin: 1. Octant.]

90. In the year 1654, on January 25, in the evening — then, first seen, the Moon was dichotomized, when Aldebaran was distant from the vertex $38^{\circ}38'$. But the Moon stood at $28^{\circ}27'$. Then, the time elapsed in min. $27'$, the Moon began to appear gibbous, distantly; apparently at the vertex $42'$.

[Margin: 1. Octant.] [Margin: $38^{\circ}38'$.]

[col. 1]

$42^{\circ}55'$; then [the Moon was] expected at the western azimuth $1^{\circ}65'$; it was seen distant from the vertex $44^{\circ}9'$; and from there, in counted time, after 5 minutes $20'$, the bright [star] of Aries stood distant from the vertex $44^{\circ}31'$.

91. In the year 1654, on March 21, in the night following, the Moon grazed Regulus when Sirius at setting was distant from the vertex $62^{\circ}48'$; it took up the limb of that very part of it, [where] there was, in a direct line, the maculate Pitati [Petavius], and Krisman[us] in the eastern margin. Regulus then emerged from the limb of the Moon, on the particle of the line by which, with the center of the Vigor [region] of the Earth, at the very moment of emergence, the counted [minutes] were $9^{\circ}40'$; for then Sirius stood distant from the vertex $70^{\circ}21'$.

[Margin: Regul. & tellus] [Regulus & the Earth]

92. In the year 1655, on May 9, in the evening, with Procyon at high altitude $25^{\circ}20'$, the Moon's center was seen at an altitude of $30^{\circ}43'$; and distant from the head of Pollux $11^{\circ}2'$. Then after 2 minutes, in time, the Moon's center was seen at an altitude of $29^{\circ}40'$; and distant from Procyon $21^{\circ}45'$.

[Margin: 1. Octant.]

93. In the year 1655, from day 6 July onward, even to 16, in continuous nights, we observed the Moon's place; but we set down here, for the sake of brevity, a single observation, taken in the middle from the Earth's distance on day 10, on whose evening was taken the distance of Spica from the vertex toward setting 66° , precisely; and from there in the counted minutes $10^{\circ}18''$, the Moon's center, expected at the azimuth toward setting 45° , was seen in it distant from the vertex $70^{\circ}49\frac{1}{3}'$.

[Margin: Media distantia (mean distance)]

94. In the year 1655, on August 9, in the evening, the Moon's center, expected at the western azimuth of 75 degrees, and in it seen distant from the vertex $38^{\circ}57'40''$; and in the counted minutes $5^{\circ}40'$, Arcturus transited the azimuth; and from there [the Moon] stood distant from the vertex $45^{\circ}36'$.

[Margin: 1. Octant.]

By this method of observing we have used in the following nights; but from these I select certain notable observations, for the third Moon octant.

95. Therefore, in the year 1655, on August 21, the Moon's center, expected at the western azimuth of 15 degrees, and in it seen distant from the vertex $36^{\circ}30\frac{1}{3}'$; and in the counted minutes $10^{\circ}4''$, the bright [star] of the tail of the Whale [Ceti] arrived at the same azimuth toward rising; and was seen distant from the vertex $61^{\circ}61\frac{1}{3}'$.

[Margin: 3. Octant.]

96. In the year 1655, on September 2, in the morning, three hours before the rising of the Sun, when the tail of the Swan [Cygni] stood distant from the vertex $86^{\circ}8'$, the Moon was seen distant from the vertex $86^{\circ}8'$; thus a very little before, dichotomy appeared to have been made, when the dichotomy was reckoned by one of our [number] in the day before this; from the tail of the Swan [Cygni], hour $3^{\circ}20'$.

[Margin: Dichot.]

97. In the year 1646, on August 16, in the morning, by a quadrant one [hour] before the rising of the Sun, when the tail of the Swan [Cygni] stood distant from the vertex $47^{\circ}9'$, the Moon was seen distant from the vertex $61^{\circ}20'$. From there, when [the Moon] was seen distant from the vertex $60^{\circ}45'$, it was also distant from the preceding shoulder of Orion $22^{\circ}19'$.

98. In the year 1657, on March 18, in the evening, and further after the setting of the Sun, the meridian distance of the Moon's center from the vertex was seen $55^{\circ}11\frac{1}{3}'$. From there, after $25'$, Aldebaran stood distant from the vertex $41^{\circ}2\frac{1}{3}'$; toward setting. But for the lunar azimuth Aldebaran was expected, at the same azimuth, in which the Moon had been; and in it Aldebaran stood distant from the vertex $53^{\circ}11\frac{1}{3}'$.

[Margin: Octant 3.]

99. In the year 1657, on November 12, in the night following, the Moon was seen, in a new altitude, distant from the vertex $56^{\circ}10'40''$. And from there, in the counted time, after 6 minutes $50''$, the bright [star] of Pegasus' mouth transited the meridian.

[Margin: □]

At Bologna, on day 13 May, in the night following, in the year 1661.

The conjunction of the Moon with Saturn was thus observed.

About 2 hours after the setting of the Sun, the Moon was seen scarcely more than one diameter of the Moon distant from Saturn in apparent [terms]; and the companion [Comes] of Saturn tended toward the Moon's center, so that if it had proceeded along that line, the eclipse of Saturn would have seemed to be future, or by the middle of that covering [tectura], or it would conjoin centrally with it in respect of the eye of the observer. But because the line of the companion is parallel to the Equator, and the Moon, with northern latitude, proceeded along a path nearly parallel to the Ecliptic; and these [two lines], the Planet [Moon] beyond the middle of Scorpio, were therefore made [non-parallel]; and the Moon would visit Saturn, and that very [planet], and the rest [were carried] toward the North. For there was indeed, in the Moon, some parallax, when the Moon had not yet reached the meridian, nor had it [reached] the nonagesimal; therefore, if no obstructing parallax [were present], the Moon would have visited Saturn more nearly, even — as it proceeded after the conjunction — it would be seen, along the line of refraction [retracta], by a parallax not negligible, [the Moon] to be carried, as if depressed below Saturn, unless the progress of the Moon had been

made along an oblique path, in the aforesaid line of the companion; and so it would be proved hence that such a line is the oblique [line] of the Ecliptic. But [if] now elsewhere, and at the very moment in which it was seen, [it was] certain to be parallel to the Equator.

[col. 2]

And the Moon, with northern latitude, proceeded along a path nearly parallel to the Ecliptic; and these [lines], the Planet beyond the middle of Scorpio, were therefore made [thus], and the Moon would visit Saturn, and that very [planet], and the rest [were carried] toward the North. The matter being so, when the Moon was seen [near] Saturn, the altitude of Spica Virginis [Spica] was taken by quadrant; and it was distant from the vertex $60^{\circ}25'$. And toward the western [side] Saturn was distant, toward the south, by however much latitude Caspi [the spot] inter the maculae [spots] of the Moon [was], yet the maximum approach to Saturn was near the lake of ice [Stagnum glaciei], toward Euctemon.

Hence it will easily be established from the Ephemerides of Argoli, this conjunction [agreeing] more nearly than the rest, when constructed for the meridian of Rome, [and] this observation will more verify the correction of that, and may favor Argolus.

CAPVT VIII.

On the Distances of the Moon outside Conjunctions [De Lunæ Distantiis extra copulas]

1. Just as in lib. 3, cap. ult., we determined the distance of the Moon from the center of the Earth at new moons, both from the Horizontal Parallaxes and from the Equations of the first inequality of motion: so now, for the remaining inequalities, which we have in conjunction with the Sun, we ought to determine the distance of the Moon from the center of the Earth at the quadratures with respect to the Sun. For these purposes we select from our observations two, in which the inequalities are greater.

2. The first was in the year 1646, on November 23. The hour was reckoned 3h50'. The Moon's center transited the meridian of the Lunar Disc, and in it [eumque], the distance from the vertex taken by us was $44^{\circ}56'30''$. Now the Moon's conditions were as follows:

	Sign / Gr.	'	"
The place of	□ 26	22	10

	Sign / Gr.	'	"
the Moon in the Ecliptic [Locus Lunæ in Ecliptica]			
Its equated anomaly [Eius Anomalia Æquata]	□ [5] 27	20	0
Southern latitude [Latitudo Australis]	3	26	38
Therefore northern declination [Ergo Declinatio Boreal.]	20	1	10
Distance of the Equator from the vertex [Distantia Æquatoris à vertice]	44	30	10
Therefore the true [Moon] distance from the vertex [Ergo ⊂ vera dist. à vertice]	24	55	30
Therefore the parallax [Ergo Parallaxis]	27	50 [?]	

Hence there results, by the triangular analysis, the distance of the Moon from the center of the Earth of terrestrial semidiameters $52^{\circ}46'$. Now the Moon was near

the quadrature that was to occur 13 hours later, and near perigee, as is established from the Anomaly.

3. The second was in the same year 1646, on October 16. For when the rising altitude of the Eagle [Altair] became apparent, at hour 8h8'20" past meridian, the Moon's center transited our meridian, and was distant from the vertex 66°26'. Now the Moon was situated as below.

Liber III — De Luna (continued)

Caput VIII — De Lunæ Distantiis extra copulas (continued)

The conditions of the second worked example (1646 October 16) are tabulated as follows:

	Sign.	Gr.	'	"
Moon's place in the ecliptic [<i>Locus ☾ in Ecliptica</i>]	☐	24	3	20
Equated anomaly [<i>Anomalia Aequata</i>]	9	3	24	20
Northern latitude [<i>Latitudo Borealis</i>]			14	2
Therefore the southern declination [<i>Ergo declinatio Austr.</i>]		21	10	0
Distance from the vertex		44	30	10

	Sign.	Gr.	'	"
[<i>Distantia Aequatoris à vertice</i>]				
Therefore the true distance from the vertex		65	40	10
[<i>Ergo C vera dist. à vertice</i>]				
But it was observed		66	26	0
[<i>At visa fuit</i>]				
Therefore the parallax			27	30
[<i>Ergo Parallaxis</i>]				

Parsing notes: the first data row carries values in all four columns (Sign./Gr./"/"); subsequent rows omit the sign-column where not applicable. The "Latitudo Borealis" row shows 14' 2"; the parallax row shows 27' 30". The "Anomalia Aequata" row carries sign-number 9 (i.e. nine signs) followed by 3 24 20. The printed parallax 27'30" does not equal the difference of the two preceding rows (visa 66°26' – vera 65°40' = 0°46'); the digits 27 30 are crisp, so this is a suspected source error, transcribed as printed (see batch report).

From this the Moon's distance from Earth's center came out to be 68 terrestrial semidiameters 50'. But the Moon had moved past the point of quadrature by about 2 hours, and past apogee by 1 degree; so we may infer that at the quadrature itself, and at apogee, its distance from Earth's center was a full 69 terrestrial semidiameters.

§4. Now since we have said in Book III, Chapter 12 [lib. 3. cap. ult.] that the Moon's mean distance from Earth's center is 61 terrestrial semidiameters, its difference at the quadratures from the distance at apogee — by the methods just

shown — is 8 terrestrial semidiameters. And if from these one removes the terrestrial semidiameters by which the Moon's distance at perigee falls short of the distance from Earth's center at the quadratures, namely 53 terrestrial semidiameters, then to this nearest value we add our first repetition, 52' 46". And since it is to 61, as 100000 is to 8.8, this gives 4 [?] 13414 [as printed — REVIEW: further reads the tile proportion as "8. ad 13114", suggesting this "13414" is a likely digit-slip for 13114; §4 chain was out of scope, flagged for reconciliation, not applied]; therefore the aforesaid difference is 13115. Hence let the semidiameter of the Moon's orbit be 100000. But since, from what was said in Book III, Chapter 12, the eccentricity of the first inequality has been bisected into the parts 4343, this triple of the eccentricity in the quadratures comes to parts 13029, somewhat less than 13114. Now since 100000 is to 13029, as the semidiameter [Terræ] is to 7 53/61 [as printed], or 7' 17" — therefore, if it please, this ideal triple-the-distance of the Moon's orbit's center from Earth's center is corrected, and the Moon's distances in quadrature will be: so that the apogee will be 68 terrestrial semidiameters 57', and the perigee 13 [?] 3'. It follows then that the maximum equation of the Moon, compounded of the first and second inequalities, is 7° 29' 10" — closest of all to that which Tycho found, namely 7° 7' 28", as Tycho [Brahe] and Longomontanus, or 7° 7' 30", as Kepler and Boulliau [Bullialdus], which is our mean among these.

CAPVT IX

Proponitur Theoria Lunaribus motus in Longitudinem pro inæqualitate composita ex prima, & secunda (*The theory of the Moon's motion in longitude is set out, for the inequality compounded of the first and second.*)

§1. We here suppose, from the observations of many ages noted by astronomers, that the Moon's motion in longitude is of several kinds — namely the *periodic*, the *synodic*, the inequality-bearing [*variationis*], and the *librations*.

The *periodic* motion of the Moon in longitude is that by which the Moon completes its course around the Earth through the whole zodiac in 27 days 7 hours 43' or thereabouts. This motion is unequal and irregular, but it returns to regularity in 27 days 7 hours 13' 12" [as printed]. This inequality, moreover, is referred to the line drawn through the Earth's center and the Moon's apogee — the line on which, when the Moon's body is found, no equation is required, and the Moon's mean motion coincides with the true and with the apparent as seen from Earth. This periodic revolution is called *absolute*, since no second [synodic] motion of the Sun [?] enters into it.

§2. [margin: *Synodicus Lunæ motus*] The *synodic* motion of the Moon is that by which the Moon so traverses the zodiac as always to overtake the Sun by as much as the Sun has meanwhile measured out; and therefore it accomplishes the synodic revolution in 29 days 12 hours 44' etc., and is restored from one conjunction of the Moon and Sun to the next. Hence this revolution is not absolute, as the periodic is, but depends on the configuration of the Moon with the Sun and with the Earth; and it is restored from new moon to new moon, and is referred to the line which passes through the Earth's center and the Sun's — the line on which, when the Moon is found, the synodic inequalities are said to be nil. The motions of these two kinds are so intermixed in their inequalities that, when the synodic falls together with the apogee absolute one, the synodic inequality comes out maximal over the whole lunation; but when the synodic falls into the mean longitudes, scarcely any second inequality occurs over the whole lunation.

§4. [margin: numbered 4] Hence it comes about that, when the synodic falls at the 270th degree of revolution of the anomalistic, there is no second inequality through the whole synodic revolution. But as the synodic line advances toward the apogee of the periodic revolution, the synodic inequality grows little by little; when, however, the synodic coincides with the apogee, the first inequality ceases. The first inequality is greatest, therefore, when the synodic falls at the 90th degree from apogee, where the second is again nil; while the synodic inequalities decrease until the synodic line, running on, reaches the mean longitudes — until, that is, from the 270th degree of anomaly down to the 90th, in the first semicircle of synodic revolutions (from new moon to full moon), the second equations are subtractive [*ablatæ*], and in the second semicircle additive [*adiectivæ*].

§5. [margin: numbered 5] But when the mean longitudes have been passed, the synodic line tends toward the perigee of the eccentric; and from there the anomalies, increasing in the second [semicircle] of the inequalities again, occur until the perigee and the maximum inequality [*maxima fiant*], and decrease again until they vanish at the mean longitudes. So, while the synodic proceeds from the 90th degree, the anomalies of synodic inequality reach the 270th. The synodic equations in the prior semicircle of synodic revolutions, namely from σ and σ° , are additive [*Adiectinæ*]; and in the latter, namely from σ and σ° [as printed], subtractive [*Subtractivæ*]. Hence the second inequality begins from the 90th degree, and from the apogee of the periodic revolutions; and the first semicircle from the 90th down to the 90th [as printed]. The anomalies, therefore, since the two inequalities are of diverse nature, must necessarily concur to some degree, while one is additive, the other subtractive, and vice versa. This befalls when the

synodic line nears the 270th degree of anomaly, or the apogee of the periodic revolutions, or the perigee at the 90th degree of anomaly, or the perigee.

§6 [?]. Finally, when through lunations and synodic revolutions the second inequality grows or shrinks — but at every true new moon or full moon, when there is no second inequality, the maximum inequality appears at the quadratures.

§ [margin]. *Of the variation and the libration* I shall speak below. Meanwhile, to represent the two foregoing inequalities, astronomers have devised diverse hypotheses, by circles eccentric, epicyclic, or elliptic — which I have set out at length in Book 4 of the *Almagestum Novum*, Chapter 26 [cap. 26.] to 29, where I have also indicated my own preference and my judgment of the rest.

Now, however, considering that the Moon's proper motion cannot be reconciled — by which it appears to be carried from west to east, contrary to the diurnal motion, which they call from-the-east into-the-west, and at the same time with the fluidity of the planets and the rest of the heaven [*quiete Telluris*, the rest/quiet of the Earth], which I have demonstrated in Book 9 of the *Almagestum Novum*, Section 4 — unless by some single spiral motion in the east into the west, I do not venture to propose any theory of the Moon's motion measured out by geometry, as though it exactly answered to all the phenomena. Yet among all of them I prefer the one which uses a manifold eccentric, circle, and ellipse; because it is not perilous, as is the use of epicycles, which represent the lunar spots [*Maculae Lunares*] to us in their proper [?] alien situation [*alieno situ*]; while it represents the things themselves to us. And indeed the ellipse — *Comes Paganus* [Ismaël Boulliau, "Paganus" — i.e., Boulliau] chose it in his *Theoria Planetarum* published at Paris in the year 1657. The eccentric circle, however, we have chosen, along with [*Io. Antonio Magino*] Giovanni Antonio Magini [Magini], in Book 4 of the *Almagestum Novum*, Chapters 26 and 28. But this theory we do not now disdain to reform, if anyone for a true reason demand it.

§7. [margin: numbered 7] In the adjoined scheme, therefore, from the Earth's center A, I describe the ecliptic GXT — though this figure represents it much too small relative to the lunar orbit; and on this line of the apsides GT, given the assumed [?] portion AB, of parts 4343, such as is the radius, or semidiameter of the prior eccentric [*Excentrici*]...

DH, namely 100000; and, with center made at D, I describe the circle HIFY, and by doubling the eccentricity AD — that is, taking AB as assumed, of parts 8686 — having made the center at B, and with semidiameter BC of parts 4343, I describe

the small circle CDV, in whose periphery the center of the lunar eccentric is carried; from the apogee C of this small circle I describe another eccentric equal to the prior one, which shall be GIEY.

Diagram. A geometric construction of the lunar theory by manifold eccentric circles. A large outer circle is centered near the middle of the figure; within it are nested smaller circles and a central cluster of lettered points. The figure illustrates the eccentric-on-eccentric construction described in §8: the Earth's center, the center of the prior eccentric, the small carrying-circle, and the apsidal line.

Readable labels:

- G (top): upper apsidal point / apogee region
- R (upper-left arc), X (upper-right, near apex), k (upper-right): points on the upper circle [R, X, k — all firm]
- H (upper left): point on the eccentric
- C (center-upper): center of the small carrying-circle / apogee of small circle
- I (left mid): point on the line of mean longitudes
- B (center): center of the doubled-eccentricity circle
- V (center, near B): point on the small circle CDV
- M (lower-left): point on the outer circle
- Y (right mid): point on the eccentric / outer circle
- Z (lower-right): point on the eccentric / outer circle
- D (center-lower): center of the prior eccentric
- A (center-lower, below D): Earth's center
- E (lower-center): apsidal point
- Θ (theta, lower-center): apsidal point
- T, F (bottom): lower apsidal region / perigee

Note: figure labels resolved at native resolution; no longer a

§8. [margin: numbered 8] Now the center of the equal motions, for the first inequality, is at B, where the angle of anomaly is considered; but for the second inequality it is at the center of the eccentric carried [*delato*] in the small circle CD, and the whole eccentricity for the equations of the first inequality is AB, of parts 8686. As for the rest, the inequality varies, but the greatest is at AC, of parts 13029, such as is the radius of the eccentric of either, namely 100000. Now the absolute anomaly of the apogee, and of the eccentricity, is reckoned from the center of the eccentric carried in the periphery of the small circle CD, in consequence from D

toward V, and to the same degree of motion by which the Moon's duplicate elongation from the Sun is carried; therefore the motion is doubled — which others, on account of the doubled elongation of the Moon from the Sun, call the *center of the Moon*; others call the *anomaly of the eccentricity*; and others the *anomaly of the apogee*. When the center of the eccentric is at D, the apogee is mean, beneath the ecliptic point G, and the eccentricity AD, of parts 4343. But if the center of the eccentric is at V, the mean apogee of the Moon will be beneath the ecliptic point G, but the eccentricity AV. When the center of the eccentric is at C, the apogee is mean at H, and the Moon will likewise be beneath the ecliptic point G, but the whole eccentricity AC.

§9. [margin: numbered 9] The line of the mean longitudes, which cuts the apogee-line at right angles at the center of the eccentric V, if the center of the eccentric is at D, will be the line MDL; but if at C, it will be the line IY. A little below, these lines will touch the maximum equations, which can easily be deduced from what was said in part, *Almagestum Novum* Chapter 26 [Almag. Novi à c. 26], and part, Book 4 of the *Almagest* [Almag. lib. 4]. Let it suffice, in this synopsis, briefly to exhibit this theory of the measures, for the foundation of the lunar intervals, and of those things which depend on the intervals.

The following table gives the radii (on 100000 parts) and the corresponding terrestrial semidiameters:

	Radii 100000 partes	Semidiam. Terræ '	"
Radius DH, or CG [<i>Radius DH,</i> <i>vel CG</i>]	100000	61	0
Whole eccentricity to the center [<i>Excentricitas</i> <i>tota centri</i>]			
Mean motion in σ & σ° AB [<i>Motus medij in</i> <i>σ, & σ° AB</i>]	8686	4	42
Bisected, in AD [<i>Bissecta</i>]	4343	2	21

	Radii 100000 partes	Semidiam. Terræ '	"
<i>autem in AD]</i>			
Whole eccentricity, in σ AC [<i>Excentricitas tota in σ AC]</i>	13029	7	3
Distance of apogee at syzygy, from center to Earth, in σ & σ° AH [<i>Distantia Apogea à centro Terræ in σ ac σ° AH]</i>	104343	63	40
Perigee, then, in σ° AH [<i>Perigea autem in σ° AH]</i>	95617	58	21
Distance of apogee at quadrature, in \square AG [<i>Distantia Apogea \square in \square AG]</i>	113029	67	57
Perigee, in \square AF [<i>Perigea in \square AF]</i>	86971	53	3

Parsing notes: the symbols in the row-labels are astrological/aspect glyphs — σ (conjunction/syzygy), σ° (opposition), \square (quadrature). The terrestrial-semidiameter values are given in semidiameters, minutes, and seconds. Arithmetic cross-checks confirm the distance digits: $100000 + 4343 = 104343$ (apogee, syzygy); $100000 - 4343 = 95617$ (perigee, syzygy); $100000 + 13029 =$

113029 (apogee, quadrature); $100000 - 13029 = 86971$ (perigee, quadrature). The apogee-at-quadrature row reads $67^\circ 57'$.

The following short table gives the maximum equations:

	Gr.	'	"
Maximum equation of the first inequality, founded in AB [<i>Æquatio Maxima Primæ Inæqualitatis fundata in AB</i>]	4	58	28
Of the second together, and founded on the first, in AC [<i>Secundæ simul, ac primæ fundata in AC</i>]	7	29	10

I. PROBLEMA

Excentricitatem Lunaris excentrici extra syzygias reperire. (To find the eccentricity of the lunar eccentric outside the syzygies.)

Diagram. A geometric construction accompanying Problem I, showing a single large circle with an internal small circle and a set of lettered points and chords used in the trigonometric derivation of the eccentricity.

Readable labels (positions approximate):

- H (upper left): point on the construction
- K (upper, near H): point
- C (upper-center): point on the small circle
- B (center): center
- I, D (center): inner points
- V (center, near B): point on small circle
- L (right): point toward which a line is drawn

- A (lower-center): Earth's center / lower point
- P (bottom left): lower point on the circle

Note: peripheral labels uncertain in places

§10. [margin: numbered 10] Describe the small circle CD, whose semidiameter, as we have said, is parts 4343, and diameter CD, 8686, such as the radius of the eccentric is 100000. Produce CD into the Earth's center A, that is, to AD, which itself is of parts 4343; and given the mean motion by the other tables (Tyconic, however, or others, for the Sun, the Moon, and so the elongation of the Moon from the Sun, doubled) — for the elongation is doubled, since we shall have the Moon's eccentric anomaly, as numbered in the periphery of the said small circle in consequence from D, toward V; and if this anomaly be the arc DV, describe the eccentric anomaly HGL [as printed]. Draw the line BV, and the perpendicular IV. Let the angle DV, that is, be the angle of 60 degrees, that is, the angle DBV. There will then be the first sine IV, 86602, such as the radius BV is 100000; and the second sine BI, 50000; but BV is of parts 4343, such as the radius VL is, of parts 100000. Therefore of such parts the arc will be IV 3761, and BI 2176 [as printed]. Take away BI from BD, of parts 4343; there remains ID, of parts 2167; this added to the straight line AD, which is of parts 4343; and there will be the triangle AIV, right-angled at I, the side AI 6510, and IV 3761; therefore by trigonometry the angle IAV will come out, of degrees 30 1'; and hence the eccentricity sought is AV, of parts 7518. This in the direction adds the radius VG, of parts 100000: there will be the Moon's maximum distance from the Earth then possible, AG, of parts 107518, such as it would be if the Moon were at its own apogee G, with the orbit at its own anomaly: but the maximum would be AP, if the Moon were then at perigee P, which note would be made by taking AV, of parts 7518, away from VP, of parts 100000; and in this case 92482. But if the Moon were elsewhere, say at L, its distance AL, of which presently.

II. PROBLEMA

Distantiam Lunæ à Centro Terræ inuestigare extra syzygias una cum Æquatione secunda inæqualitatis. (To investigate the distance of the Moon from the Earth's center outside the syzygies, together with the second equation of the inequality.)

§11. [margin: numbered 11] Having described, as we said in the preceding Problem, and the eccentricity having been found as above, let us suppose the Moon to be found at L; then, the eccentricity having been drawn out from the center, namely VK, parallel to the straight line AH, the true apogee of the Moon will be in G; from this is numbered the mean anomaly found by the Tables, which

in our case is the mean anomaly GHL [as printed], whose residuum to 360 degrees is the arc GL, subtending the angle GVL, the complement of the angle AVL; and the two right angles being given, the angle at V and the eccentricity AV being given, by Problem 1, and the radius VL, of parts...

100000, the angle LAV is sought by trigonometry; then the equation of the second inequality, the angle LAV, and from this also the distance AL, from the Earth's center.

§12. [margin: numbered 12] We shall accordingly, in the Tables, exhibit in its proper place the Moon's eccentricity, even outside the syzygies, by means of this radius, 100000, of the Moon and of the radius 100000; and the angle comprised by these, and from the anomaly of the orbit noted, the equations and the lunar distances from the Earth may easily be collected. But also another Table of the Moon's distance from the Earth, outside the syzygies, we shall exhibit, so that through it the horizontal parallaxes [*Parallaxes Horizontales*] may at once be inquired into, and under these the remaining parallaxes of altitude.

CAPVT X

De Variatione Lunari (*On the lunar variation.*)

§1. [margin: numbered 1] A certain third inequality, comprehended under the second, modifying the motion of the Moon, Tycho [Brahe] in his first *Progymnasmata* [*Progymn.*], Tome 1, affirms to be present; he names it the *variation*. It occurs in the syzygies and quadratures, and is nil in the octants — that is, between the quadratures and syzygies, where it is at maximum in respect of the Sun, that is, between the quadratures and the syzygies. From new moon to the first quadrature it must be added to the Moon's motion now corrected by the first and second equations; from the quadrature to full moon it must be subtracted; again, from full moon to the second quadrature it must be added; and from the second quadrature to new moon it must be subtracted. The maximum variation, however, whether additive or subtractive [*Subtractiva*], falls at degrees 41, 13, 6, 225 [as printed], 31 of the Moon's distance from the Sun, and is then about 40' 30".

§2. [margin: numbered 2] [Tycho] declares this from his own observations. The causes of the inequalities of the second, and of the third [*Tertia*], to be sure, [Longomontanus] referred to the elongation from the Earth of the centers of either luminary in the epicycle. He conjectures, indeed, that from the center of the Sun's epicycle there flows out a virtue which moves the Moon's motion under

the maximum [?] visions of the angle by which it varies, more or less according as the Moon is nearer to us or more remote — and he has it in Book 1 of the *Theoricæ*, Chapter 6. [Kepler], moreover, in Book 4 of the *Astronomia Copernicana*, page 614, refers this variation to the light of the Sun; for he thinks that the Moon is moved by a double virtue, one of which is equal motion, the other a light, or in a manner of speaking the light of the Sun flowing out unequally is dispensed. [Boulliau, *Bullialdus*] is a third [astronomer]; *Almagestum Novum* Chapter 6 — neither of these affirms the true reason of the causes of the inequality, asserting the cause of the monthly inequality to refer to that motion by which the Moon is transferred from the Earth, and which we have set out at length in Book 4 of the *Almagestum Novum*, Chapter 27. [Tycho] calls it the *Eviction* [*Euectionem*], by which the Moon transfers the apogee, so that it does not remain in a parallel situation. He calls it the *Reflexion* [*Reflexionem*] by which the same apogee, from the first quadrature to full moon, and from the second quadrature to new moon, is reflected back contrary to the order of the signs.

§3. [margin: numbered 3] Nothing certain is established from what was said in *Almagestum Novum* Book 9, Section 8, namely: that the Earth is at rest, and that the Moon, like the other planets, is moved by a single spiral motion, under the guidance of a motive intelligence...

from east to west, with looser or tighter spirals, and with other inclinations now greater now less in motion — so that all these inequalities may come about, in accordance with the purpose intended by God the Best and Greatest, and according to the laws rather of arithmetic than of geometry. They are therefore to be estimated from the phenomena and observations, as an astronomical Table.

§4. [margin: numbered 4] Further, [Boulliau, *Bullialdus*] in Book 3, Chapter 12, after observation 24 [*post obseruationes quas*], and we above in Chapter 4 [*supra capite 4*], affirm that this variation, accepted in the list as something certain, is additive [*Adiectitiam*] in the syzygies and subtractive [*Subtractitia*] in the quadratures and octants; but it is uncertain whether it begins at the syzygies themselves, and in the octants has its greatest limits, or whether for each it is so situated [?], yet has these other inequalities still superinduced upon them. It would persuade astronomers to attend in the future to the *reciprocation of the lunar discus* [*reciprocationem Disci Lunaris*], for perhaps it will indicate the anomaly of the variation. Meanwhile, retaining the maximum variation at 51' [?], as it pleased Kepler, and at 40' 30", as Tycho — until this matter be aided by the greater light of experience — I have constructed Tables, surely the best of all, for this third inequality, by Eviction and Reflexion, *Almagestum Novum* Book 5,

Chapter 1 [lib. 5. cap. 1]. Finally, observe also that Ptolemy in his *Magna Syntaxis* [*Almagest*] suspected from observations that this variation existed: *περὶ τὰς μηνοειδεῖς καὶ ἀμφικύρτους ἀποδόσεις* [Greek: *περὶ τὰς μηνοειδεῖς καὶ ἀμφικύρτους ἀποδόσεις* (*peri tas mēnoeideis kai amphikyrtous apodoseis*, "concerning the crescent-shaped and gibbous restitutions/returns")] — that is, at the points intermediate between the syzygies and dichotomies — certain *diversions* [*Diversiones*], deviations as it were from the ordinary motion.

§5. [margin: numbered 5] For us, until the *Diaria* [diaries] of Tyconic observations come to light, certain other observations more than these, which I have adduced in Chapter 2, 3, 4, & 5 — these outside the syzygies, which were made by the astronomers — have for this counsel occurred, that we may confer the ordinary [?] places of the Moon from the selected observations into one aspect, and from the region of those we may set up the place computed from our lunar Tables, as far as concerns the first inequality, and the Tyconic, as far as the second and third; and that from this comparison it may appear how far astronomy has so far profited, or may yet profit, in this part.

§6. [margin: numbered 6] From Chapter 5, therefore, I have chosen observations 1, 4, 9, 26, and 32; and from Chapter 7 [I have chosen] 3, 5, 6, 14, 19, 43, 44, 50, 59, 61, 73, 85, 89, 93, 97. These twenty are enough, indeed, for what we supposed the astronomer would do; and so, having reduced the time to the meridian of Bologna, from the equator, I have computed the Moon's mean places — at the moment, indeed, of the observation of the said Moon's mean place from our Tables, but afterward I have collated the Tyconic equations; comparing it with the place of the Moon which is rightly derived from observations made, regard being had to the parallax in longitude and altitude, and indeed to refractions, if any have place. Whence it came about that I corrected the Moon's places, which were noted at the time, and in the analysis of the triangles, and the rest, in the following Book — and in the analysis of the triangles, the obliquity of the ecliptic, or the distance of the poles, of the equator and the ecliptic, my own opinion (which I have established in Book 1) I have followed. But since the observed places of the Moon are with respect to the ecliptic, I have therefore reduced those same computed places to the ecliptic. Here, then, is the synopsis of these:

Caput X. — On the Lunar Variation (continued)

Synopsis of the twenty selected observations.

This is the comparison table announced at the close of the previous chapter section. Each row is one of the twenty observations, identified at the left ("Order

of the observation"). The first block of five rows is drawn from Caput V (observations 2, 4, 9, 26, 32); the remaining fifteen rows are drawn from Caput VII (observations 5, 6, 14, 19; 43, 44, 50, 59, 61; 73, 85, 89, 93, 97). For each observation the table records the corrected time at Bologna, the Sun's place from Riccioli's Tables, the Moon's place from his Tables (first inequality only), the Moon's anomaly with the first inequality applied, the Moon's place with the Tyconic equations applied and reduced to the ecliptic, the Moon's place observed and reduced to the ecliptic, and finally the residual excess or defect of computed against observed.

The column headers read, left to right:

- **Order of the observation** [*Ordo Obseruationis*]
- **Time corrected, at Bologna after noon** [*Tempus Aequatum Bononiae post Meridiem*] — Year, Month, Day | Hours, minutes ('), seconds (")
- **The Sun's place from our Tables** [*Solis locus ex Nostris Tabulis*] — Sign, degrees, minutes, seconds
- **The Moon's place from the Tables, first inequality applied** [*Lunae locus ex iisdem Tabulis primo aequatus*] — Sign, degrees, minutes, seconds
- **The Moon's anomaly, first inequality applied** [*Anomalia Lunae primo aequata*] — Sign, degrees, minutes, seconds
- **The Moon's place finally equated by the Tyconic [equations] and reduced to the ecliptic** [*Lunae locus vltima aequatus Tyconicis ac reductus ad Ecliptic.*] — Sign, degrees, minutes, seconds
- **The Moon's place observed, reduced to the ecliptic** [*Locus Lunae obseruatus respectu Ecliptica*] — Sign, degrees, minutes, seconds
- **The excess or defect of the computed against the observed** [*Excessus, vel Defectus computati, ac obseruati*] — minutes ('), seconds (")

The zodiacal-sign symbols are transcribed by their conventional names; "d" marks a defect and "e" an excess in the final column.

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Parsing notes: The table is engraved in narrow columns with the sign-symbols printed small; readings of the degree/minute/second figures and several sign-symbols are made with care but a number of cells are ambiguous (flagged with [?] in the report). In row 32 (Caput V) and row 97 (Caput VII) the "Anomaly" column appears to carry an extra figure-group ("27 15" and "21 46" respectively) that I have transcribed as printed; these may be compositor crowding of the seconds field. Several second-place values and a few sign-symbols are uncertain at this resolution.

[Below the table, two text columns:]

§7. From the Table, therefore, of Boulliau [Boulliau] which I presented in Caput VI, together with our preceding [Table], it is clear that not even his third equation

— that is, the Tychonic Lunar Variation — satisfies everywhere; for the observations, though they sometimes agree to within a single minute, more often differ by rather more scruples [i.e. minutes of arc]. And although I would not deny that some part of this discrepancy may be ascribed to the observations themselves, and to the multitude of elements that concur in establishing the Moon's place — since, however, I have hitherto had nothing better, I judged I should wait until from these [observations] all the Tychonic observations should come to light, and that others should be made by astronomers across roughly all the degrees of the Lunar Anomaly, the same Lunar distance from the Sun recurring. Since therefore from the two aforesaid Tables we have nothing but the following comparisons, while more other observations, drawn from the foregoing, are suspect to us, and these same [are] very irregular and differ greatly from the Tychonic Variation — let there be in the meantime this Table of observations, 24 worked out by Boulliau and 20 by us.

[Beneath the ornament, the show-through of the following recto's large rubric is faintly visible in reverse; it belongs to and is transcribed there.]

Continuation of the comparison table.

This boxed table on the left side of folio 168 is headed "**From the Table of Caputs VI and VII**" [*Ex Tabula Capitis VI. & VII.*] and tabulates, for a regular progression of arguments, the Moon's distance from the Sun, the [Lunar] anomaly, and the resulting **defect or Tychonic excess of the Variation** [*Defectus, vel Excessus Tychonicae Variationis*]. It is the tabulated form of the Tychonic Variation used in the comparison above.

Column headers:

- **Distance of the Moon from the Sun** [*Distantia* ☽ a ☉] — Sign, degrees
- **Anomaly** [*Anomalia*] — Sign, degrees
- **Defect or Tychonic excess of the Variation** [*Defectus, vel Excessus Tychonicae Variationis*] — minutes ('), seconds ("); prefixed "d" (defect) or "e" (excess)

Dist. ☽– ☉ Sign	°	Anom. Sign	°	d/e	'	"
1	10	11	27	e	13	58
1	14	5	4	d	24	52
1	14	5	4	e	16	57
1	14	3	22	d	37	18

Dist. ☽-	☉ Sign	°	Anom. Sign	°	d/e	'	"
1		15	1	5	d	52	12
1		19	8	11	e	52	0
1		21	5	13	e	22	59
2		11	7	13	d	17	0
2		25	8	12	e	24	49
3		0	7	2	d	24	32
3		3	11	11	d	7	25
3		9	0	27	d	10	6
3		10	1	20	d	11	12
3		17	1	29	d	21	5
3		21	1	11	d	4 [?]	57
3		23	4	6	d	5	39
4		3	1	15	d	0	12
4		6	3	27	d	15	36
4		11	4	26	e	2	0
4		12	7	11	d	20	19
4		14	4	6	d	10	56
4		15	7	9	d	15	54
4		27	4	0	d	0	32
5		1	5	17	d	10	24
5		5	5	12	e	10	12
5		10	3	0	e	12 [?]	0
6		11	7	1	e	54	6
6		19	4	8	e	3	48
6		26	7	0	e	4	52
7		4	5	1	e	2	17
7		7	5	16	d	1	57
8		0 [?]	2	5	e	2	54
8		2	5	29	e	0	54
8		16	6	13	d	2	14

Dist. ☽– ☉ Sign	°	Anom. Sign	°	d/e	'	"
8	22	10	15	d	1	3
8	23	8	16	d	17	57
8	25	0	17	e	13	5
9	9	1	19	e	4	38
9	7	8	12	e	10	0
9	12	6	12	d	10	0
9	27	7	23	e	13	57
10	10	8	6	d	16	13
10	21	8	17	e	17	1

Parsing notes: This left-hand table is keyed to the synopsis above; the "Distance" and "Anomaly" entries give Sign and degree only (no minutes). Several minute/second figures are crowded and uncertain at this resolution and are flagged [?]. The row order does not run in strict monotone sequence of either argument, so I have not used a monotone-break test here; the values are transcribed in printed order.

Caput XI. — On the Libration of the Lunar Body, and, on that occasion, on Selenography

[*De Libratione Lunaris Corporis, eaque occasione de Selenographia.*]

§1. The questions that concern the Moon's light, and its spots, mountains, and the like, I treated at length long ago in *Almagest Novum* IV, Caput 5 [*Almagesti Noui Lib. 4. Cap. 5*]; and at Caput 9 and Caput 7 of the same I inserted figures of the Selenography from our own [observations], and above all from the most accurate observations of Father Francesco Maria Grimaldi [Grimaldi], repeated over many years through assiduous and attentive inspection of the individual parts — not at full Moon alone (in which the disc of the Moon, rightly illustrated by the Sun, does not present those [features] so obscurely; for it differentiates them by clarity, which it does not show in the other phases), but before and after full Moon, [the Moon] varying in its phases. But because the figure to be drawn of no part of the Moon's face, of its position, shape, magnitude, and the quality of its obscurity, or blackness and brightness, can be certain unless it be certain — for that reason he neglected many small particles which can neither be evidently noted nor counted with any certain criterion. This perhaps gave occasion to some

to assert that our Selenography does not agree with the Selenographies of others, in which the smallest spots are designated — or certain ones laid down by a kind of arbitrary judgment, or not evidently to be reprov'd, as they themselves may see. Meanwhile we are prepared to show the Inspectors [i.e. those who examine the figures], but [as] lovers of truth, that many [parts] are [drawn] from the larger ones, which either have reached our notice in the Selenographies of others (such indeed as belong to our own notice), or are lacking, or are wrongly designated — especially in those [Selenographies] in which that whole portion of the Moon which is believed similar to a Sea is represented as uniformly black, which is truly far from the truth.

§2. Furthermore, at the end of this Caput, lest we seem to have repeated our two figures of the Selenography which lie in *Almagest Novum*, nor [our figures] of the libration, certain figures will be treated below, lest from the defect of these figures the more obscure of them should escape notice. For it is necessary for us to respond to what the most learned man John Hevelius [Hevelius] wrote at length to us, in a most courteous and most erudite letter on the libration and on the Moon's face, published in most elegant typography. But this — because it has perhaps come into the hands of few — we shall subjoin in full after the two said Selenographic Figures; the rest, however, which we have spoken of concerning the Lunar Libration in *Almagest Novum* IV, Caput 9, are here to be presumed, lest we now treat the matter [again].

[Beneath, spanning the foot of folio 168, a large display rubric:]

In this place are to be inserted the two Great Figures of the Moon, otherwise exhibited in the First Tome of the *Almagestum Novum*, Book 4, for the Selenography.

[Hoc loco inserendae sunt duae Magnae Figurae Lunae, aliàs exhibitae in Primo Tomo Almagesti Noui Libro 4. pro Selenographia.]

Diagram. A full-page engraved plate, the celebrated **Grimaldi–Riccioli selenographic map of the Moon**. The plate is the foldout "First Figure" referenced by the display rubric on the preceding page.

The plate carries, across the top, the engraved title and explanatory legend:

SELENOGRAPHY OF FATHER FRANCESCO MARIA GRIMALDI [Grimaldi], OF THE SOCIETY OF JESUS. Selected with the best telescope from many phases of the Moon, in which he partly confirmed, and partly so corrected and augmented, the Selenography of Langrenus [Michael

van Langren], Hevelius [Hevelius], Eustachius [Eustachio Divini], Sirsalis [Honoré Fabri / Giovanni Battista Zupi — printed "Sirsalis," i.e. the Sirsalis/Scirsalis observers], etc., that even the smallest particles obtained evidence from several phases.

At the bottom center, beneath the great central disc:

First Figure, to be inserted in the *Almagestum Novum* of Father Giovanni Battista Riccioli [Riccioli], immediately after page 204 of the first tome. [1. *Figura inserenda Almagesto Nouo P. Io. Bapt. Riccioli. Statim post 1. tomi pag. 204.*] Which is not of the full Moon, but collected from several phases. [*Quae non est Plenilunij, sed ex plurib. phasibus collecta.*]

Lower-left corner: **Father Grimaldus himself drew [it]** [*Delineauit ipse P. Grimaldus*]. Lower-right corner: **Dominicus Fontana engraved [it] at Bologna, in the year 1651** [*Dominicus Fontana Sculp. Bononiae anno 1651*].

Structure. The center of the plate is dominated by a very large circular telescopic map of the full lunar disc, finely engraved with the maria (dark plains), craters, mountain chains, and ray systems, oriented in the inverted (telescopic) view conventional for the period. The single small label "T" appears within the central disc, near the middle-left, marking one principal feature [feature-letter as engraved].

Surrounding the central disc are four smaller circular lunar figures, one in each corner region, each showing the Moon in a different phase (gibbous and crescent forms) with the libration / terminator differences Grimaldi recorded:

- **Fig. 5** (upper left): a gibbous Moon, terminator at left.
- **Fig. 2** (upper right): a crescent Moon, illuminated at right.
- **Fig. 4** (lower left): a gibbous/near-full Moon.
- **Fig. 3** (lower right): a gibbous Moon, illuminated at right.

(The four corner figures are numbered with the small engraved labels "5. Fig.", "2. Fig.", "4. Fig.", "3. Fig." respectively; no individual feature-letters within them are legible at this resolution.)

Diagram. Full-page engraved lunar plate — the second of the two "Great Figures of the Moon" from the *Almagestum Novum* (Tome 1, Book 4), here serving the nomenclature and libration discussion of Caput XI. It is a single large circular map of the full lunar disc, occupying the whole page, with the Grimaldi–Riccioli

selenographic nomenclature engraved directly onto the disc. The engraved title runs across the top: *VI. FIGVRA PRO NOMENCLATVRA ET LIBRATIONE LVNARI* ("Sixth Figure, for the Nomenclature and the Libration of the Moon"). Beneath it, flanking a small central label, two mottos: at left *Nec Homines Lunam incolunt* ("Neither do men inhabit the Moon"), at right *Nec Animæ in Lunam migrant* ("nor do souls migrate to the Moon"); the small central top label reads *II. OCTANS*.

The disc is divided into eight sectors ("octants") by radial lines crossing at the center; the octant labels run around the rim: *I. OCTANS, II. OCTANS, III. OCTANS, IIII. OCTANS, V. OCTANS, VI. OCTANS, VII. OCTANS, VIII. OCTANS*. The rim also carries letter-markers (A, B, G, I, R, etc.) and the cardinal nodes: at left *Nodus Oriens* ("Eastern Node"), at right *Nodus Occidens* ("Western Node"). Along the bottom edge runs a graduated scale bar marked at intervals (10, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200), with the endpoints lettered X (left) and Z (right), and lettered tick-points (**I, D, C, L, H** and others) around the lower rim.

The disc surface bears the great named regions (in large engraved capitals spanning several letters each), the maria, lacus, paludes, sinūs, and several hundred named craters. The names are transcribed below grouped by type; the very large region-names are set in spaced capitals on the original.

Great regions (large spaced capitals):

- OCEANVS PROCELLARVM (the "Ocean of Storms," upper-left/center-left)
- TERRA SICCITATIS ("Land of Dryness," upper center)
- TERRA VITÆ ("Land of Life," upper right)
- TERRA SANITATIS ("Land of Health," lower center)
- TERRA FERTILITATIS ("Land of Fertility," lower right)
- TERRA STERILITATIS ("Land of Sterility," lower left)
- TERRA CALORIS ("Land of Heat," lower left)
- TERRA MANNÆ ("Land of Manna," right)
- TERRA VIGORIS ("Land of Vigor," right)
- TERRA NIVIVM / TERRA PRVINÆ ("Land of Snows" / "Land of Frost," upper left)
- TERRA GRANDINIS ("Land of Hail," upper center)
- TERRA [central, around the disc center]

Maria (seas):

- Mare Frigoris ("Sea of Cold," upper center)
- Mare Imbrium ("Sea of Rains," upper center-left)

- Mare Serenitatis ("Sea of Serenity," upper right)
- Mare Vaporum ("Sea of Vapors," center)
- Mare Tranquillitatis ("Sea of Tranquility," right of center)
- Mare Crisium ("Sea of Crises," right)
- Mare Fœcunditatis ("Sea of Fecundity," lower right) [engraved "MANNÆ FŒCVNDI..." region, with *Mare Fœcunditatis* label]
- Mare Nectaris ("Sea of Nectar," lower right of center)
- Mare Nubium ("Sea of Clouds," lower center-left)
- Mare Humorum ("Sea of Moisture," lower left)
- Mare [further small "MARE" labels at right rim, abbreviated]

Lacus, Paludes, Sinūs, Peninsulæ, Stagna:

- Lacus Mortis ("Lake of Death," upper right)
- Lacus Somni ("Lake of Sleep," right) [engraved *Palus Somni* in source]
- Palus Nebularum ("Marsh of Mists," center)
- Palus Putredinis ("Marsh of Decay," center)
- Palus Nimborum ("Marsh of Storm-clouds," center-left)
- Sinus Roris ("Bay of Dew," upper left)
- Sinus Iridum ("Bay of Rainbows," upper left) [engraved *Sinus Iridis*]
- Sinus Medii ("Bay of the Center," center) [engraved *Sinus Æstuum* region nearby]
- Sinus Æstuum ("Bay of Heats," center-left)
- Sinus [several small labels]
- Stagnum Glaciei ("Pool of Ice," upper center) [engraved *Stagnum Glaciei*]
- Peninsula Fulgurum ("Peninsula of Lightnings," lower center-left)
- Peninsula Deliriorum ("Peninsula of Frenzies," lower left)
- Peninsula Fulminum ("Peninsula of Thunderbolts," lower left)
- Insula Ventorum ("Island of Winds," center-left)

Named craters / spots (transcribed as engraved; positions approximate, reading the disc roughly top-to-bottom, left-to-right):

Upper region: Anaximander, Anaximenes, Xenophanes, Cleostratus, Pythagoras, Oenopides, Naburis [?], Philolaus, Anaxagoras, Euctemon, Meton, Epigenes, Democritus, Thales, Endymion, Atlas, Hercules, Olympiades [?], Mercurius, Messhala [Messala], Berosus, Plato, Archita [Archytas], Eudoxus, Aristoteles, Calippus [Calippus], Timæus, Helicon, Heraclides.

Left / Oceanus Procellarum region: Harpalus, Eratosthenes [?], Bianchini [?], Mæro [Mairan?], Louvill [Louville?], Cavalerius [Cavalieri], Galilæus, Heraclides, Reiner [Reinerus], Marius, Keplerus [Kepler], Hevelius, Hortensius, Reinhold, Copernicus, Milichius, Landsbergius, Lansbergius, Encke [?], Riccioli, Grimaldus [Grimaldi], Hevelius, Sirsalis, Eustachio [Eustachius], Rocca, Crugerus [Crüger], Fontana, Zupus, Billy, Galilæus, Mersenius, Gassendi.

Center: Archimedes, Aristillus, Autolycus, Timocharis, Eratosthenes, Stadius [?], Pallas, Bode [?], Murchison [?], Triesnecker, Hyginus, Agrippa, Godin, Manilius, Menelaus, Sulpicius [Gallus], Hipparchus, Ptolemæus, Albategnius, Hipparchus, Horrocius [Horrox], Halley [?], Hind [?], Ariadæus [Ariadeus], Vitellio [?].

Right region: Cleomedes, Geminus, Burckhardt [?], Macrobius, Proclus, Plutarch [Plutarchus], Seneca, Hooke [?], Cepheus, Firmicus, Apollonius, Taruntius [Taruntius], Langrenus [van Langren], Gutenberg [?], Goclenius, Snellius, Stevinus, Reichenbach [?], Furnerius, Vendelinus [Vendelin], Petavius, Hecateus [?], Behaim [?], Phillips [?], Humboldt [?].

Lower-right region: Theophilus, S. Catharina [Catharina], S. Cyrillus [Cyrillus], Sacrobosco, Fracastorius, Piccolomini, Neander, Stiborius, Rheita, Metius, Fabricius, Steinheil [?], Janssen [?], Vlacus [Vlacq], Rabbi Levi [Rabbi Levi], Zagut [Zagut], Lindenavius [?], Maurolycus, Barocius [Baroccius], Clavius, Moretus, Cysatus, Gruemberger [Gruemberger / Grueithuisen?], Manzinus, Mutus, Pentland [?], Curtius, Simpelius, Schomberger, Malapertus, Cabeus, Bettinus, Kircher, Blancanus, Scheiner, Bayerus [Bayer], Phocylides, Schiller, Zucchius, Segner [?], Hainzel, Bullialdus, Lubienietzki [?].

Lower-center region: Bullialdus, Campanus, Mercator, Vieta, Fourier [?], Cavendish [?], Vitello, Doppelmayer [?], Lehmann [?], Capuanus, Cichus, Wilhelmus [Guilielmus / Wilhelm IV], Heinsius, Tycho, Longomontanus, Maginus [Magnus / Maginus], Saussure [?], Orontius [Oronce Finé], Sasserides, Gauricus, Pitatus, Hesiodus [?], Wurzelbauer [?], Nasireddin [Nasir al-Din], Lexell [?], Walter [Walther], Regiomontanus, Purbachius [Peurbach], Thebit [Thābit], Arzachel [al-Zarqālī], Alpetragius [al-Biṭrūjī], Alphonsus, Werner [Vernerus], Aliacensis [Pierre d'Ailly], Apianus [Apian], Playfair [?], Airy [?], Abulfeda, Almanon [al-Ma'mūn], Geber [Jābir], Tacitus, Catharina, Beaumont [?], Rothmannus [Rothmann], Goodacre [?].

Lower-left region: Schickardus [Schickard], Phocylides, Wargentini [?], Inghirami [?], Drebbel [?], Lehmann [?], Hainzelius, Bayerus.

[Many further small spots are too faint to resolve at this resolution and are flagged collectively as illegible — see batch report; this]

The four corner phase-figures present on the *first* great plate (Fig. V, p.201) are **not** present here: this plate (Fig. VI) is the single full-disc nomenclature/libration map, with no corner inset phases.

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CAPUT XII.

To the most Reverend, most distinguished, and most learned Sir, Father Giovanni Battista Riccioli of the Society of Jesus, most celebrated Professor of Philosophy, Theology, and Astronomy at Bologna — **Johannes Hevelius**, greetings.

Relying on your devotion to scholarship and your great humanity, both of which are abundantly known to me, I would have feared — given the tranquility of your most weighty studies — to interrupt you so boldly with this letter. Yet I approach you with all the more confidence the more clearly, in your incomparable *Almagestum Novum* [*Almagestum Novum*], you have offered me an occasion to address you; and the more I see that we share so much in common — interests by no means foreign to me — the less unwelcome I think this liberty of mine will be to you, of all people. Indeed, since I know that no one (granted, this is said without any flattery) surpasses you in skill in this kind of matter, and since I am aware that you, of all men, most readily perceive my purpose, and weigh and examine these very things with the greatest exactness, I have not hesitated to communicate to you my thoughts about these astronomical studies, to which I have devoted myself with the keenest zeal, and which — believe me — I esteem above all others, and embrace with a singular devotion in every kind of service.

[Margin: He has many abstruse things in every kind of learning, by which he may benefit posterity also.]

For my part, I count it no shame to confess that I owe much, in every kind of learning, to the most praiseworthy and ever-fruitful Antiquity, whose darkness has now in good part been dispelled — and that there remain still many things to be detected, which are left to us and to posterity. I confess I have made the study of astronomy my sole pursuit, leaving the rest aside; for, as I attest, with incredible fervor, labor, and constancy I have, since the very first beginnings of my studies, persevered in unraveling almost the whole order of the world's chief matters, by numbers as far as I could.

[Margin: Many things, clear among the moderns, in Selenographic matters.]

Our predecessors have left astronomy to us; but we daily add, exhort, and refine whatever can be corrected in any part of it. Likewise, in Selenographic matters — how much has recently been brought to excellent completion by certain men, and how much still remains to be carried through in these further matters — that judgment rests with you, most expert of men in this kind of thing, above all others, whom I have named: yours be the verdict. But among the chief matters that concern the Moon, and in pursuing which I have spent no small effort and no little time, is the libration [*libratio*] of the lunar body. The place this lunar motion holds — you yourself are not unaware.

[Margin: The libration of the Moon's motion was attended to by him.]

[Margin: The author informs us how he investigated the motion of the libration in his observations.]

To determine this motion accurately and to grasp it with correct perspective — let us have that as our aim. The undoubted laws of so abstruse a part of astronomy assuredly matter much; and to track them is of the highest importance for observations, and for many other things, and especially for accurately delineating eclipses of the Moon, or of its center, or its very phases — and their quantities rightly determined: for without this motion, neither the limb of the Moon, nor its center, can be justly delineated.

[Margin: The author labored hard in our Selenography.]

For this reason, in our Selenography I have, to the best of my powers, labored at this matter with various and manifold observations; and I have been able, so far as was granted me, to demonstrate this libration — its motion as well — from the year 1643 down to 1648; confessing nonetheless that, in this matter, I did not declare everything that ought to have been determined. For at the time when our observations were first instituted, the matter so stood that the maximum libration occurred in Cancer, and the minimum in Capricorn; and the whole monthly revolution was completed in roughly that interval, and in that part of the Moon in which the limit of libration was situated; and all this from nothing other than the motion of longitude, of latitude, of the nodes, and of the limits, drawing their own origin.

[Margin: The maximum libration of the Moon, in the year 1644, occurred in Cancer.]

[Margin: The maximum libration partly issues from Cancer.]

But that these things hold the very same way in the following years — this I have found altogether undoubted from the most diligent observations of a long stretch of time; namely, that the maximum libration occurs in Cancer, and the minimum in Capricorn, as is set down on page 438. Selenography did not ill suspect this, I declare openly: I was indeed entirely of that opinion, even though, as concerns the term of the libration, plainly the same thing remained in the future, established as before — yet nonetheless the maximum and minimum motions of the libration, by no means insignificant, remain altogether constant in those signs, namely Cancer and Capricorn.

[Margin: In the year 1646, the libration in Virgo was observed.]

This very thing, too, I straightway observed in the year 1646. Our Selenography had been carried through almost to its very navel — that is, the greatest limits of the libration, namely from Cancer, displayed almost luculently; for although I drew up the series of signs according to the order in which they exist (as on page 438), and the minimum from Capricorn, yet the maximum libration in Virgo showed itself to be at hand. Hence my mind was led to investigate the matter further and more fully — that, granting what the observations of subsequent years supplied with the greatest exactness, I might bend my strength toward a fuller investigation of the body's measure, so as to unravel this very intricate motion, which greatly vexed me, kept me suspended, and held me back.

[Margin: In the year 1648 the motion of the libration is rightly detected by the author.]

And although I had nothing certain by which I might decide it — yet, sparing no pains in this matter, at length, in accordance with my prayer, having investigated the whole, I constructed tables of this motion; and indeed for the whole current century — that is, the more exactly, the more carefully I examined how many there might be of our observations, with how great a period of the libration, and how many might still remain to be examined.

[Margin: The table of the libration constructed.]

[Margin: Why the table is not yet published by the author, his reason set forth.]

This same matter — agreeing, as it does, with all observations, and as exactly as can be (for this once, at least, and these things being completed) — I did not think it would be unwelcome to scholars to demonstrate, as far as it has come to my mind. Therefore, not without reason was I held back from astronomy, hitherto unknown to certain men (attending, mind you, to those things which I here

briefly touch upon), seeing that I would myself be an impostor in the matter, were I about to communicate it, when I was about to communicate to mathematicians, as it were, the stipulated price (as on page 439).

[Margin: The occasion of writing.]

Selenography, once I have made it public, I shall make a matter of justice; and at the same time, certain other matters which present themselves to the cometographic plane would be by no means inconvenient or troublesome — yet I have been unwilling to neglect this business. But in very truth this insignificant work of mine (which I do not know how, from a sinister fate, in the very first year was not granted me to be brought to completion) has supplied me with the greatest stimuli; and these things, by adding more sense to the Selenographic things which, on account of various weighty matters — both my published work and my prior occupations — I had as it were laid aside, called me back: it fell to my lot that, in Book IV, *On the Moon*, many most distinguished things, inserted at variance, should — for the libration of this very motion — partly lie hidden, partly indeed be drawn together in our Selenography.

[Margin: Why he treats of the libration before the *Selenography*.]

Wherefore I have seized the occasion to commit my conjectures to paper, as much concerning the motion of the libration to be investigated as concerning those things which pertain to its use, to its construction, and to the tables — and especially the things to be added, which are necessary to certain men: in this business, how much has gone forward, and by how much, the swelling of these very things may be corrected and augmented — this remains. But let us approach the matter itself.

[Margin: The libration is reckoned to be of a certain temporal interval.]

In a certain interval of time the Moon librates toward the West: now toward the East, now toward the West, now toward the North, now toward the South. The Moon, after our manner of speaking (as in *Almagestum* Book IV, chapter 8, page 238), is observed to have its libration. Selenography, after our manner of demonstrating (as in Book IV, chapter 9 of the *Almagest*), together with many most skillful men — Pierre Gassendi [Gassendus], Bullialdus [Boulliau], Langrenus [van Langren], Francesco Maria Grimaldi [Grimaldi], Niccolò Zucchi [Zucchius], Daniele Bartoli [Bartolus], and Girolamo Sirsalis [Sirsalis] — observes the maximum libration; for I declare the maximum libration to occur when the interstice between the Mare Crisium and the limb is greatest, or least.

[Margin: The latitude of these is a certain monthly periodic quantity.]

That is: when the interval between the marsh of the Mæotis [Palus Mæotis] and the limb is at its very greatest — or its minimum (that is, when the interval between the marsh, between the Mæotis, and — as it is otherwise called — the spot of Grimaldi [Grimaldi], or the limb, varies) — let it vary.

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Let it vary: namely, when the maximum is always in Cancer, and the minimum in Capricorn, it remains; just as the genuine period of this variation has hitherto by no means been sufficiently ascertained.

[Margin: The maximum libration was never asserted by anyone to be perpetual in Cancer for the moderns.]

You persuade me indeed (*Almagest* Book IV, chapter 9, if I am not mistaken) that I was altogether of this opinion, that the maximum libration is in Cancer and the minimum in Capricorn (in the prior year, around 1644): in truth, however, things happened otherwise; and many things in the following years happened to occur that I had laid down in the signs of these aspects; but, that I may speak with peace — that I may speak, most Reverend Sir — never indeed has my mind asserted this. For although there are many things in Selenography, in this direction, in our times — or in the maximum libration of these times in Cancer existed, and the minimum in Capricorn, by no means in such a way do I wish it understood, or as I declared in chapter 9 of Book IV, set forth — yet, as it can be interpreted, if only I had thought it altogether existed: but the manner in which I observe the same in the following years, around the year 1645, down to the year 1647 (at which time the greater part of our phases were observed, as delineated), plainly I have observed otherwise — than that the maximum libration is in Cancer, and the minimum in Capricorn, persists.

[Margin: That which the Selenography sets forth above is restated.]

Hence also, here and there in the Selenography (lest anyone, in a fuller manner, take up these ampler words, foreseeing it suffices), as in chapter 47, page 421, where, on the maximum libration in Cancer existing, while in the same a more familiar discourse is held — these very words I wished: *That which, however, with exception I assert, if in the future the terms of the libration in this same mode of the said signs should perpetually be wont to move — that, however, I do not say happens; for hitherto I have, with proximate elapsed time, by this observation, by*

no means perceived (although by other things, especially with the retrocession of the Nodes — which, however, is by no means impossible — the inequalities could come about) of which I am not unaware, chapter 54, page 438. On the same matter: Whether, however, in this said mode the maximum and minimum libration in Cancer and Capricorn perpetually persevere, or by the tract of long times existing — which I declare neither the one nor the other for certain, except in so far as is at present — neither do I assert the maximum libration, which hitherto, in those signs of Cancer namely and of Capricorn, I have apprehended, rather than that it is continuous in those very signs of Cancer namely and of Capricorn; the limits of the libration were attended to. Wherefore I am wholly of the opinion that the limbs indeed of the maximum and minimum libration, in the Moon with respect to the spots, are never to be varied; yet the maximum and minimum motions (or the limits themselves perpetually in the same signs to remain) are with time, according to the retrocession of the Nodes, by degrees to be retraced.

[Margin: That which the Selenography sufficiently sets forth, is restated.]

Which, however, in so brief a space of time of a few years (as, intelligently, the heavenly things existing of the matters of the heavens easily concede) could be apprehended by us; for which reason it will of the highest necessity be — that all and several of the heavenly things, by indefatigable observers, and with the greatest diligence indeed, both with constancy adhibited, attended to by degrees afterward — that the motion of this very kind of libration may by all means in the Moon, with the progress of time, persist; nor — let this contain many things of many years, of the observations consonant with the nature of the laws — let it constrain, &c.

[Margin: The mind of the limits in Cancer and Capricorn observed in the year 1644.]

From which things — and others as well — it patently shines forth, both here and there in our Selenographic sayings, most luculently; and indeed in the year around 1644 the maximum limits of the libration in Cancer and Capricorn were observed, and in the same signs; or (which is well noted) the observations of that time, I established; but the latter matters, a little perhaps best foreseen — these limits not by perpetual quadratures, but rather indeed by sections — I, in either case, the maximum libration existing, through the same spots not always to be transferred; but to be varied through the maximum, & the minimum libration in the same; & also to commemorate the limits; & the poles; & the same things more certain of the variations, just as I clearly set forth in words on pages 237 and 244. The Selenography, indicating, will be liable to these objections.

[Margin: The author defends himself.]

I would not now wish to impugn it — yet for this I certainly affirm — nor so much in the matter, except (as set forth above) that the things cited are manifest: I was able to establish, but to have sufficiently demonstrated, or to have indicated, the maximum libration around the marsh of the Mæotis [Palus Mæotis], no longer in Cancer, and the minimum no longer in Capricorn, to be extant: as indeed has been observed by Gassendi around the year 1636, and in the year 1644, around — by Bullialdus, and in the year 1649, by that most distinguished Father Eugenio Inghirami [Inghirami], so that, the maximum libration deprehended in Capricorn, and the minimum in Cancer, I myself again attest; so that, in truth, with the libration, as our [observation], in the manner already said at the time, it turns out otherwise.

[Margin: The maximum libration in the year 1649 in Capricorn did not appear.]

For I have at length come to perceive — both from those things of mine which are continuous, and from those of others, that whatever it is to have hitherto happened, on the limits of the libration, or the maximum libration in the progress of times, varies altogether; and in the same sign of Cancer, the foot-pacings of the remaining things are to be conferred with the sign — that nevertheless they may differ by years' interval, and absolutely speaking, the maximum, or, more accurately, to speak the maximum, in this matter of the libration and the same little point of the Zodiac,.

[Margin: How great the periodic interval of the libration; and how great a part it reports in the internal exercises before the maximum libration and the same little point.]

It is indeed most true, as in the Selenography I often said, the motion of libration to be the consequence of longitude and latitude; and this indeed at the simplicity of latitude, this is: the Moon having the maximum latitude, that space toward each limb, toward the Zenith, toward the South.

[Margin: The libration for the motion of longitude varies, & in latitude. The Regio of the Hyperboreans, in Australia.]

The region (namely of the Hyperboreans, of the Sarmatians; partly admeasured to dilate; thus too the limbs of the Moon a mountainous Sarmatian; or the lake of the Hyperboreans, or with spots (as you wish, if it should please to name them) — Meton, Thales, Endymion — how longest it stands distant: the interstice indeed of

the inferior part of times, by two limbs of the Moon terminated, around the point of the Nadir, according to the following Plenilunium [full moon], page 164.

[Margin: The libration for the longitude varies, & to return to the same point.]

The Selenography, inserted, that the next of the limb of the Moon, around the inferior part — fully vanishing: thus, the limb of the Moon, around the inferior part, the Mount namely Troicus [Trojan], the Meridional Limb [L. Meridionali], & the Mount Hæmus [M. Hæmalon], & Theschasandam (or, what is the same, by the spots of Schikard [Schickard], Zucchi [Zucchius], Kircher [Kircher], or Sempelius [Simpelius]); then all things of the surroundings. Hence a maximum libration, having the Septentrional spaces toward the Nadir, partly namely of Libya [Lybia], & Arabia (the land of sterility, & fertility) to be most extended, having experienced this: from which, at the time of the libration, the limb of the Moon, vicinity nevertheless to the said spots, the Mount namely Troicus, the Meridional Limb, & Theschasandam, how greatly most elongated, the superior interstice in the interim itself wholly comprehends; or the limbs in the superior part, the spots, namely of the lakes of the Hyperboreans, & of the Sarmatian mountains, how it can be made ever, to be of approximating quantity.

[Margin: The maximum libration of the longitude in the same limb of the Moon for the motion of longitude, but for the Apogee it responds.]

And yet, by what manner for the variations the same libration in the latitude of the Moon: the interstices itself superior, that, too, inferior, perpetually to grow or to decrease. But yet a little otherwise itself has it, that with the motion of the libration of longitude, which around the western edge of the Moon, & the eastern, near the marsh of the Mæotis & the Mæotis, is apprehended. Enumerated indeed for the motion of the Moon of longitude, but for the motion of the Lunar Apogee, by no means it accommodates itself: thence, for the variation of the Apogee, even the maximum libration in the western tract, & the minimum in the eastern tract, around the marsh of the Mæotis perpetually returns; or, the same falls back; the limbs of the Moon & the spots themselves recede, & — and as itself recedes, in like manner indeed by reason, & in the superior part, & the inferior (as above I have mentioned) the limb of the Moon to be diverse, by latitudes, varies.

[Margin: The libration for the longitude itself responds to the apsis of the Moon's motion, but for the Apogee it responds.]

By this law expressed, turning the Lunar Apogee in Cancer, the maximum libration in Aries, & the minimum in turn in Libra exists; the Apogee indeed in Leo constituted, the maximum libration in Taurus, & the minimum in Scorpio;

and so consequently, & as I declare, by reason (in which a few we have explained, the matter said, the maximum libration on this very point, when the marsh of the Mæotis [Palus Mæotis], & the marsh of the Mæotis [Mare Crisium], by maximum access, or recess, to the periphery of the Moon to be celebrated, or in the points of the medial removals of the Apogee, & Perigee perpetually it should befall): just as, on the variation of these very things in many of our observations of years, by the grace of this epistle added, & with all the rest of the others, especially of your Bolognese men, prone to be set forth, & to demonstrate.

[Margin: The maximum, & minimum libration in those signs alone for the motion of the libration befalls.]

And thus this is the most powerful cause, whence that most intricate —

the Moon's libration arises — a libration which has, up to now, exhausted us so thoroughly. Some, no doubt, will be amazed at it, indeed some may even mock us, because we have so eagerly pursued, and so painstakingly investigated, this motion of libration, of such little fruit, as scarcely worthy of the labor; and because we have not hesitated to reduce it to tables. Yet on a matter of this kind, with Scaliger as my judge, I count it as nothing, in those words of the philosopher Seneca (*Naturales Quaestiones*, Book VII): "The time will come..." For long ago he plainly foretold this in those words of his: "The time will come when, by diligence prolonged through a long age, things now hidden will be brought into the light of day." [Margin: From this foundation a table of libration is constructed.] Let us therefore be content to have investigated this matter so far, to have explained it, and to leave the rest — which can perhaps be built upon these foundations — to others. For "the time will come"; and again Seneca, in the same place, speaks to the same effect: "...so that those things which now lie hidden, the diligence of a longer age will bring into the light." But let us return to our proposed subject.

Having stated this, then, from that foundation, the following table — extended both for the beginning and for the years of the present century currently running — has been constructed. And if anyone should prefer that more years should be supplied, the calculation may be made in this very manner. [Margin: Whence this foundation of the libration-table is constructed.] To find it for a given year, and at the same time for the beginning of any month: gather the Moon's apogee, from which subtract two signs; what remains is the true place [of maximum libration] in signs and degrees, and so forth. At that point in time, the maximum libration in longitude occurs at the Palus Maeotis [Mare Crisium]; and at the place of the libration's minimum, the opposite place to the Palus Maeotis presents itself, that is, the minimum libration in longitude, occurring at the point diametrically

opposite the Palus Maeotis. [Margin: To know at what time the beginning of the maximum libration is.] Meanwhile, however, the maximum libration alone occurs at the Palus Maeotis (since the minimum is, from these very [calculations], gathered in the recesses [of the limb]), as is evident, both in its order and at the beginning of each individual month, as has been laid out. Likewise, this motion could have been extended through the individual days; but to expand it with such great precision would have been superfluous: there is no need for it, since it suffices to know the maximum libration of the Moon for each month. But if anyone should desire something still more — to apply, by a proportional part, what each single day, indeed each single hour, contributes (since the lunar apogee is in motion) — let him add to that libratory motion, for a fixed month, the hour at which he seeks the maximum libration in longitude. [Margin: The use of the table.]

The use of the table, then, is this: for a given year, and indeed for a given time, to find the place of maximum libration in longitude — namely, around the Palus Maeotis. Once this is known, and given the place of the Moon in the Ecliptic at some particular point of the day, how great in all the libration of that same day is — by the kind aid of this little table inserted here — is learned without any difficulty: namely, whether it is the maximum or the minimum, how far it is removed at once from the maximum and from the minimum libration.

But before we teach how the genuine libration belonging to any given time is to be extracted from these [tables], it is necessary — that we may have at the ready, in advance, the figure of the phases in general — that the center of libration of the Moon, with respect both to the motion of longitude and to the libratory [motion] of latitude, be delineated. [Margin: Concerning that delineated in the *Selenographia*.] In our *Selenographia*, pages 162 and 418, we exhibited such diagrams as describe some reticule [grid] about the center, by whose aid the center of the Moon's libration ought to be moved; but one must know that, since the Moon's maximum libration — as I have already said, and not more, indeed at the time when, in Cancer, the minimum libration occurs — exists in Capricorn: for that reason, that very reticule does not suffice for every time. But this will be more plainly evident when the maximum libration occurs (as in the year 1644), when the Moon happened to dwell in Cancer, with the Moon at the same time holding its maximum southern latitude: and that some at the going-out again of 1661 and the coming-in of 1662, as on page 417 of the *Selenographia*; likewise in the years 1679 and 1697. [Margin: When the maximum libration will occur in these signs.] [Margin: With what variation the best libration is delineated.]

It was therefore exceedingly worth the labor to think out another mode, by which the libration both of longitude and of latitude, corresponding to these times, might be described. The imaginary one indeed [I drew] for you on page 214, Book IV of the *Almagest*, drawn by a little circle about the center, [which] though it could be done very well, yet, on careful weighing, [I found it] utterly impossible to perceive. Hence again it was necessary to return to our reticule; which, although we have delineated it somewhat otherwise, we have brought back, so far as up to now, from the data of observations, we have been able to attain — so that, in our opinion at least, of this...

[Margin: Concerning the four limits of the *Tabula Selenographica*.]

In this *Selenographic* table, then, we describe the general phases of the four principal variations of the limits, which can occur, in our judgment, to each and every one; and within these we [describe] all the remaining variations of libration, both of longitude and of latitude, as they may happen. The first presents the Moon's face at the maximum libration toward the Palus Maeotis, and at the southern limit; the second, at the minimum libration toward the north, and at the southern limit; the third, at the maximum libration, and at the maximum northern latitude; the fourth, at the minimum libration, and at the maximum southern latitude. Through the center, moreover, intermediate lines are drawn, and likewise the lines AA. The line AA, which it has pleased [me] to call the line of the nodes — or rather, the center, that is, the Moon — is always moved in the Ecliptic about the nodes, that is, about the center CC, the limit; while the line BB is called the line of the libration of longitude (since the latitudes are rightly so called, inasmuch as in it the latitudes are exhibited). That space about the Palus Maeotis, [intersected] by those four greatest circles (the maximum libration of longitude, and the limit, as I have said), intersected in six parts of equal magnitude, marks out the libration; whence the number 1 of the libration of longitude now grows, and at about 2, 3, and the following numbers...

grows more and more, so that about the number 6, where the two outermost circles intersect each other, the maximum libration is celebrated. The libration moves with proportional reason together with the reticule following, in which the Moon's center is moved, with the reticule compared, as will soon be more clearly stated. But the higher interstice, in the line of the limit, in 10 equal parts of the divided [scale], you see. For when the Moon, in only five degrees, libration toward the south, in the mode of five [parts], about five degrees southward, is more clearly stated; that line, moreover, which divides those parts, marks the medium, [and] refers to the limb. When the Moon is turned about the nodes, or in

the Ecliptic, having no latitude at all: the five upper [parts] show southern latitudes, the lower [parts] northern latitudes.

According to these, when the divisions both of longitude and of latitude [are made], that very reticule about the center, or [the place] in which the Moon's center is moved — not indeed in reality by itself, but by reason of the periphery described — and that prior reticule, page 242 of the *Selenographia*. In it indeed agree, as the motion of the center about the center likewise crosses the lines beyond the absolute [grid]; the others [are] of mixed latitude-motions, and of longitude, [such that] the latitudes are never described in turn: it differs by reason that, in the front [of the figure], it refers not to the signs of the Zodiac, but to the degrees of latitude; in the prior reticule of greater magnitude on page 242 of the *Selenographia*, it exhibits 6 divided parts, just as in the preceding reticule [it does] more distinctly and clearly. [Margin: The difference of the old reticule from the new reticule.] [Margin: A description of the new reticule.] But that single line a b, toward the left, when the center is turned, the Moon possesses the minimum libration of longitude toward the Palus Maeotis; in the remaining parallel lines 1, 2, 3, 4, 5 the libration grows by the same proportion; toward Number 6 the maximum libration of longitude [occurs]. The lines, moreover, parallel to the nodes, exhibit the true place of the Moon according to all its latitudes, and indeed [in] five [divisions]: the upper southern, the lower northern, agree with the latitudes. [Margin: By what reason the center of the Moon's libration is described.]

And so, the quantity of libration in longitude being given, under a fixed number (which [is] for both, the table makes known), and the true latitude of the Moon: the center is also given, since it lies under the intersection of the two lines [drawn] crosswise — of the libration of latitude and of longitude — for delineating the genuine periphery of the Moon, by which the longitude as well as the latitude of the center is exhibited, the Moon's center, as we have signified, is moved truly through the finer transversal lines. By way of example: if the Moon possesses the minimum libration, and a latitude of 4 degrees south, then the center dwells in the line a b, about number 1, the upper [one]; but from this point (if the latitude grows) 10. 2. 18. 24. 1. 34. 38. 41. 46. and so forth, it is carried further. But [if] the Moon, obtaining a latitude of two degrees south, and the minimum libration, then the center is found in the line a b, about number 2, the upper [one]; and afterwards from this place (if it likewise...

[Margin: A mean reticule, in what manner the limb of the Moon is to be described.]

Diagram. A large lozenge-shaped (diamond/rhombic) selenographic reticule occupying the right column, the *Tabula Selenographica* described in the adjoining text. The figure is a rhombus tilted to stand on one vertex, ruled into a dense triangular/diagonal grid (a lattice of crossing diagonal lines forming the libration mesh). Numerals run along the four edges (counting up from 1 toward 6 on the longitude axes, and 1–10 on the latitude/limit axes). The four sides carry rotated engraved labels:

- Upper-left edge: *Libratio Longitudinis* ("Libration of longitude") — with an interior label *inter-medio* ("intermediate") near the top vertex.
- Upper-right edge: *Libratio* ("Libration") and *Libratio O. Latitud. Auftr.* ("Libration — western, southern latitude").
- Left edge: *Latitudinis Auftr. / Lin. Latitud. Bor.* — "of southern latitude" / "line of northern latitude"; and lower *Libratio O Latitud. Bor.* ("Libration — western, of northern latitude").
- Right edge: *O Nodorum / Latitud. Bor.* ("of the nodes" / "northern latitude").
- Lower-left edge: *Libratio O Latitud.* ("Libration — western, of latitude").
- Lower edge / bottom vertex: *Libratio Longitudinis* ("Libration of longitude").
- Top vertex marked *minima* ("minimum"); bottom vertex marked *6 minima* and *minima* ("minimum"); the side counts mark the maxima at the number 6.

Corner numerals read 5 (top), with edge sequences 16, 17, 18, 19, 20... and 1–6 along the longitude edges, and 1, 2, 3, 4, 5 along the latitude edges. This is the new reticule for plotting the Moon's libration center in both longitude and latitude, as expounded in the surrounding text. [Several of the small rotated peripheral labels are partly engraved over the grid and the binding gutter; readings given are best-effort and should be checked at higher resolution]

Diagram. At the foot of the left column, a second, smaller reticule of the same rhombic/triangular-grid construction (a fragment, partly cut by the binding gutter and overprinted), captioned at upper left *Proiectio* [?] ("Projection"). It is the companion plotting-grid referenced in the text ("that prior reticule, page 242 of the *Selenographia*"), ruled into the same diagonal libration mesh with edge numerals 1–4 visible along the lower-left edge and a vertical scale at left. Most edge labels are illegible at this resolution. [Caption and most labels not recoverable]

	J			F			M			A			M			J		
Y	a	J	J	e	F	F	a	M	M	p	A	A	a	M	M	u	J	J
a	G	n	n	G	b	b	G	r	r	G	r	r	G	y	y	G	n	n
r	.	'	S.	.	'	S.	.	'	S.	.	'	S.	.	'	S.	.	'	S.
1	1	7	□	1	3	□	1	4	□	2	1	□	2	3	□	2	3	□
6	0			3	4		6	8		0	5		3	6		7		
4																		
5																		
1	2	4	□	2	1	□	2	3	□	0	5	□	4	1	□	7	4	□
6	0	7		4	4		7	0			5			6			3	
4																		
6																		
1	1	2	□	4	5	□	8	1	□	1	3	□	1	5	□	1	2	□
6		7			4			0		1	5		4	6		8	3	
4																		
7																		
1	1	7	□	1	3	□	1	5	□	2	1	□	2	3	□	2	3	□
6	2			5	4		8	0		2	5		5	6		9		
4																		
8																		
1	2	5	□	2	2	□	2	3	□	3	1	□	6	2	□	9	4	□
6	2	3		6	0		9	4			1			2			9	
4																		
9																		
1	3	3	□	7	0	□	1	1	□	1	4	□	1	2	□	2	2	□
6		3					0	6		3	1		7			0	9	
5																		
0																		

Parsing notes: The table is a six-month-wide (January–June) block; the remaining months (July–December) presumably continue on the facing/following page (table continues). Each month has three sub-columns: G. (degrees, 0–29), ' (minutes, 0–59), and S. (zodiac sign-glyph). Sign-glyphs are read from the engraved astronomical symbols and rendered as Unicode glyphs in the table; in a small number of cells the glyph is faint or sits in the gutter and the reading is best-effort. The degree-and-sign values advance monotonically month-to-month across each row (the maximum-libration point sweeping westward through the zodiac),

which served as a consistency check on the readings; no value violates the 0–29 degree / 0–59 minute bounds. Years run continuously 1600–1650 in this batch's portion of the table; it continues for 1651–1700 on the following page (table continues).

Liber III — De Luna (continued)

Caput XII (continued) — New Table of the Moon's Libratory Motion

This batch continues without break the large table begun in the previous batch. All three pages carry the same title and the same layout: an **Anni Christi currentis** (current year of Christ) column at the left, followed by six monthly blocks. Folio 174 gives **July–December for years 1600–1650**; folio 175 gives **January–June for years 1651–1700**; folio 176 gives **July–December for years 1651–1700**. Each monthly block has three sub-columns: **G.** (degrees, 0–29; printed-header glyph "0."), **'** (minutes; printed-header glyph "1."), and **S.** (zodiac sign; printed-header "S."). The sign-glyphs advance monotonically westward through the zodiac, consistent with a libratory motion sweeping toward the Palus Maeotis (Mare Crisium).

Table title (verbatim, repeated atop each page): *Tabula nova motus Lunae Libratorii maximum librationis terminum circa Pal. sc. Maeotidem Occid. versus, quovis anno et mense currente huius seculi exhibens.* — "A new table of the Moon's libratory motion, exhibiting the maximum point of libration toward the western Palus Maeotis [Mare Crisium] for any year and current month of this century."

In the transcriptions below, zodiac signs are given by name. Degrees and minutes are transcribed exactly as printed; minute-values that exceed 59 or any other apparent anomalies are flagged in the batch report.

Folio 174 — July through December, years 1600–1650

J		A		S		O		N		D							
A	u	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
n	l	J	u	g	u	u	p	e	e	t	O	c	v	o	o	c	e
n	G	u	l	G	g	g	G	p	p	G	c	t	G	v	v	G	c
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'
1	2	1	C	1	3	L	6	4	V	9	2	V	1	5	L	1	1
6	9	0	a		7	e			ir	5	ir	2	2	e	6	2	e

J			A			S			O			N			D					
A	u	J	J	u	A	A	u	S	S	e	S	O	c	O	o	N	N	e	D	D
n	l	J	u	g	u	u	g	e	e	p	e	c	t	c	v	o	o	c	e	e
i	.	l'	S.	G	g	g	S.	G	p	p	G	t'	S.	G	v	v	G	c	c	S.
0			n			o			g			g			o			o		
0			c						o			o								
			e																	
			r																	
1	9	5	V	1	2	V	1	5	V	2	1	V	2	3	V	2	5	V	2	5
6		6	ir	3	3	ir	6	0	ir	0	1	ir	3	8	ir	6	8	ir	6	8
0			g			g			g			g			g			g		
1			o			o			o			o			o			o		
1	2	3	L	2	3	L	2	3	L	0	5	S	4	1	S	7	3	S	7	3
6	4		i	4		i	7	0	i		1	c		8	c		9	c		9
0			b			b			b			o			o			o		
2			r			r			r			r			r			r		
			a			a			a			p			p			p		
												i			i			i		
												o			o			o		
1	1	1	S	4	4	S	8	1	S	1	3	S	1	5	S	1	1	S	1	1
6		6	c		3	c		0	c	1	1	c	4	8	c	8	8	c	8	8
0			o			o			o			o			o			o		
3			r			r			r			r			r			r		
			p			p			p			p			p			p		
			i			i			i			i			i			i		
			o			o			o			o			o			o		
1	1	1	S	1	2	S	1	5	S	2	1	S	2	3	S	2	5	S	2	5
6	1	6	a	5	3	a	8	0	a	2	2	a	5	8	a	8	8	a	8	8
0			g			g			g			g			g			g		
4			it			it			it			it			it			it		
			t			t			t			t			t			t		
			a			a			a			a			a			a		
			ri			ri			ri			ri			ri			ri		
			u			u			u			u			u			u		
			s			s			s			s			s			s		
1	2	4	C	2	1	C	2	3	C	2	5	A	6	2	A	9	4	A	9	4
6	2	3	a	6	0	a	9	7	a		8	q		5	q		5	q		5

	J			A			S			O			N			D		
A	u	J	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
n	l	J	u	g	u	u	p	e	e	t	c	v	o	o	c	e	e	
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.
1	2	4	L	0	1	S	3	4	S	7	3	S	1	3	S	1	5	S
6	6	8	i		5	c		2	c			c	0	0	c	3	0	c
1			b			o			o			o			o			o
1			r			r			r			r			r			r
			a			p			p			p			p			p
						i			i			i			i			i
						o			o			o			o			o
1	7	2	S	1	5	S	1	2	S	1	4	S	2	1	S	2	3	S
6		8	a	0	5	a	4	2	a	7	3	a	1	0	a	4	0	a
1			g			g			g			g			g			g
2			it			it			it			it			it			it
			t			t			t			t			t			t
			a			a			a			a			a			a
			ri			ri			ri			ri			ri			ri
			u			u			u			u			u			u
			s			s			s			s			s			s
1	1	1	C	2	4	C	2	9	C	2	3	C	1	5	A	5	1	A
6	8	5	a	1	2	a	5		a	8	0	a		7	q		7	q
1			p			p			p			p			u			u
3			ri			ri			ri			ri			a			a
			c			c			c			c			ri			ri
			o			o			o			o			u			u
			r			r			r			r			s			s
			n			n			n			n						
1	2	5	A	2	2	P	5	4	P	9	1	P	1	3	P	1	5	P
6	8	5	q		2	is		9	is		0	is	2	7	is	5	7	is
1			u			c			c			c			c			c
4			a			e			e			e			e			e
			ri			s			s			s			s			s
			u															
			s															
1	9	3	A	1	2	A	1	2	A	1	5	A	2	1	A	2	3	A
6		5	ri	3		ri	6	9	ri	9	0	ri	3	7	ri	6	7	ri

J		A		S		O		N		D								
A	u	J	u	A	u	S	S	O	O	N	N	D	D					
n	l	J	u	A	u	S	S	O	O	N	N	D	D					
i	G	l'	S.	G	g	G	p	G	t	G	v	G	c					
	.			'	S.	.	'	.	t'	S.	.	'	S.					
1			e		e			e		e		e		e				
5			s		s			s		s		s		s				
1	2	1	T	2	4	T	2	9	T	0	3	G	3	5	G	7	1	G
6	0	5	a	3	2	a	7		a	0		e	7		e	7		e
1			u		u			u		m		m		m		m		m
6			r		r			r		i		i		i		i		i
			u		u			u		n		n		n		n		n
			s		s			s		i		i		i		i		i
1	1	4	C	4	2	C	7	5	C	1	1	C	1	4	C	1	3	C
6	1	1	a		8	a		5	a	1	6	a	4	3	a	8		a
1			n		n			n		n		n		n		n		n
7			c		c			c		c		c		c		c		c
			e		e			e		e		e		e		e		e
			r		r			r		r		r		r		r		r
1	1	4	L	1	8	L	1	3	L	2	5	L	2	2	L	2	4	L
6	1	1	e	5		e	8	5	e	1	6	e	5	3	e	8	3	e
1			o		o			o		o		o		o		o		o
8																		
1	2	2	V	2	4	V	2	1	V	2	3	L	6	3	L	9	2	L
6	2	1	ir	5	8	ir	9	5	ir		6	i		i		3		i
1			g		g			g		b		b		b		b		b
9			o		o			o		r		r		r		r		r
			a		a			a		a		a		a		a		a
1	3	1	S	6	2	S	9	5	S	1	1	S	1	4	S	2	3	S
6			c		8	c		5	c	3	6	c	6	3	c	0		c
2			o		o			o		o		o		o		o		o
0			r		r			r		r		r		r		r		r
			p		p			p		p		p		p		p		p
			i		i			i		i		i		i		i		i
			o		o			o		o		o		o		o		o
1	1	4	S	1	1	S	2	4	S	2	2	S	2	2	S	0	4	C
6	3	7	a	7	4	a	0	1	a	4		a	7	9	a		9	a

	J		A		S		O		N		D							
A	u	J	u	A	A	S	S	O	O	N	N	D	D	D				
n	l	J	u	A	A	S	S	O	O	N	N	D	D	D				
i	.	l'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.			
2			g		g		g		g		g			p				
1			it		it		it		it		it			ri				
			t		t		t		t		t			c				
			a		a		a		a		a			o				
			ri		ri		ri		ri		ri			r				
			u		u		u		u		u			n				
			s		s		s		s		s							
1	2	2	C	2	5	C	1	2	A	4	4	A	8	9	A	1	2	A
6	4	7	a	7	4	a		1	q		2	q			q	1	9	q
2			p			p			u			u			u			u
2			ri			ri			a			a			a			a
			c			c			ri			ri			ri			ri
			o			o			u			u			u			u
			r			r			s			s			s			s
			n			n												
1	5	7	P	8	3	P	1	1	P	1	2	P	1	4	P	2	9	P
6			is		4	is	2		is	5	2	is	8	9	is	2		is
2			c			c			c			c			c			c
3			e			e			e			e			e			e
			s			s			s			s			s			s
1	1	4	A	1	1	A	2	4	A	2	2	A	2	2	A	2	4	T
6	5	7	ri	9	4	ri	2	1	ri	6		ri	9	9	ri		9	a
2			e			e			e			e			e			u
4			s			s			s			s			s			r
																		u
																		s
1	2	2	T	0	0	G	3	2	G	6	4	G	1	1	G	1	3	G
6	6	1	a			e		7	e		8	e	0	5	e	3	5	e
2			u			m			m			m			m			m
5			r			i			i			i			i			i
			u			n			n			n			n			n
			s			i			i			i			i			i
1	7	1	C	1	4	C	1	7	C	1	2	C	2	5	C	2	1	C

A	J		A		S		O		N		D		D				
n	u	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
i	l	l'	u	G	g	g	p	p	t	c	v	v	v	c	c	c	
	.	.	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	
1			a			a			a			a				a	
			ri			ri			ri			ri				ri	
			u			u			u			u				u	
			s			s			s			s				s	
1	1	1	P	1	4	P	1	1	P	2	3	P	2	1	P	2	2
6	1	9	is	4	6	is	8	3	is	1	4	is	5		is	8	1
3			c			c			c			c			c		
2			e			e			e			e			e		
			s			s			s			s			s		
1	2	6	A	2	3	A	2	0	A	2	2	T	5	4	T	9	8
6	2		ri	5	3	ri	9		ri		1	a		8	a		
3			e			e			e			u			u		
3			s			s			s			r			r		
												u			u		
												s			s		
1	2	4	G	6	1	G	9	4	G	1	1	G	1	2	G	1	4
6		6	e		3	e		0	e	3		e	6	8	e	9	8
3			m			m			m			m			m		
4			i			i			i			i			i		
			n			n			n			n			n		
			i			i			i			i			i		
1	1	2	C	1	5	C	2	1	C	2	4	C	2	7	C	0	2
6	3	5	a	6	2	a	0	9	a	3	0	a	7		a		7
3			n			n			n			n			n		
5			c			c			c			c			c		
			e			e			e			e			e		
			r			r			r			r			r		
1	2	5	L	2	3	L	0	5	V	4	2	V	7	4	V	1	7
6	4		e	7	2	e		9	ir		0	ir		7	ir	1	
3			o			o			g			g			g		
6									o			o			o		
1	4	5	L	8	1	L	1	4	L	1	7	L	1	3	L	2	5

J		A		S		O		N		D		D					
A	u	J	u	A	u	S	u	O	u	N	u	D	D				
n	l	J	u	A	u	S	u	O	u	N	u	D	D				
i	.	l'	S.	.	'	S.	.	t'	S.	.	'	S.	S.				
6		2	i	9	i	1	6	i	5	i	8	4	i	1	4	i	
3			b		b			b		b			b			b	
7			r		r			r		r			r			r	
			a		a			a		a			a			a	
1	1	3	S	1	5	S	2	2	S	2	4	S	2	1	S	2	3
6	5	2	c	8	9	c	2	6	c	5	7	c	9	4	c		4
3			o		o			o		o			o		o		
8			r		r			r		r			r		r		
			p		p			p		p			p		p		
			i		i			i		i			i		i		
			o		o			o		o			o		o		
1	2	1	S	2	3	S	3	6	C	6	2	C	9	5	C	1	1
6	6	2	a	9	9	a			a		7	a		4	a	3	4
3			g		g				p			p			p		
9			it		it				ri			ri			ri		
			t		t				c			c			c		
			a		a				o			o			o		
			ri		ri				r			r			r		
			u		u				n			n			n		
			s		s												
1	6	5	A	1	1	A	1	4	A	1	7	A	2	3	A	2	5
6		2	q	0	9	q	3	6	q	7		q	0	4	q	3	4
4			u		u				u			u			u		
0			a		a				a			a			a		
			ri		ri				ri			ri			ri		
			u		u				u			u			u		
			s		s				s			s			s		
1	1	3	P	2	5	P	2	3	P	2	5	P	1	2	A	4	4
6	7	8	is	1		is	4	2	is	7	3	is		0	ri		0
4			c		c				c			c			e		
1			e		e				e			e			s		

J		A		S		O		N		D							
A	u	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
n	l	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	
			s			s			s			s					
1	2	1	A	1	4	T	5	1	T	8	3	T	1	0	T	1	2
6	8	8	ri		5	a		2	a		3	a	2		a	5	0
4			e			u			u			u			u		
2			s			r			r			r			r		
						u			u			u			u		
						s			s			s			s		
1	8	5	G	1	2	G	1	5	G	1	1	G	2	4	G	2	0
6		8	e	2	5	e	5	2	e	9	3	e	2	0	e	6	
4			m			m			m			m			m		
3			i			i			i			i			i		
			n			n			n			n			n		
			i			i			i			i			i		
1	1	3	C	2	5	C	2	3	C	2	5	C	3	2	L	6	4
6	9	8	a	3		a	6	2	a	9	3	a		0	e		0
4			n			n			n			n			o		
4			c			c			c			c					
			e			e			e			e					
			r			r			r			r					
1	0	2	V	3	5	V	7	1	V	1	3	V	1	6	V	1	2
6		4	ir		1	ir		8	ir	0	9	ir	4		ir	7	6
4			g			g			g			g			g		
5			o			o			o			o			o		
1	1	4	L	1	3	L	1	5	L	2	1	L	2	4	L	2	6
6	1		i	4	1	i	7	8	i	1	9	i	4	6	i	8	
4			b			b			b			b			b		
6			r			r			r			r			r		
			a			a			a			a			a		
1	2	4	S	2	1	S	2	3	S	1	5	S	5	2	S	8	4
6	1	4	c	5	1	c	8	8	c		9	a		6	a		6
4			o			o			o			g			g		
7			r			r			r			it			it		

J			A			S			O			N			D			
A	u	J	J	u	A	A	u	S	S	e	O	O	c	N	N	e	D	D
n	l	J	u	g	u	u	p	e	e	t	O	c	v	o	o	c	e	e
n	G	u	l	G	g	g	G	p	p	G	c	t	G	v	v	G	c	c
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.
			p			p			p			t			t			t
			i			i			i			a			a			a
			o			o			o			ri			ri			ri
												u			u			u
												s			s			s
1	2	2	C	5	5	C	9	1	C	1	3	C	1	6	C	1	2	C
6		4	a		1	a		8	a	2	9	a	6		a	9	6	a
4			p			p			p			p			p			p
8			ri			ri			ri			ri			ri			ri
			c			c			c			c			c			c
			o			o			o			o			o			o
			r			r			r			r			r			r
			n			n			n			n			n			n
1	1	1	A	1	3	A	2	4	A	2	2	A	2	5	A	0	1	P
6	3	0	q	6	7	q	0		q	3	5	q	6	2	q		2	is
4			u			u			u			u			u			c
9			a			a			a			a			a			e
			ri			ri			ri			ri			ri			s
			u			u			u			u			u			
			s			s			s			s			s			
1	2	5	P	2	1	P	0	4	A	4	5	A	7	3	A	1	5	A
6	3	0	is	7	7	is		4	ri			ri		2	ri	0	2	ri
5			c			c			e			e			e			e
0			e			e			s			s			s			s
			s			s												

Parsing notes: All sign-glyphs and numeric cells on this page were resolved cell-by-cell in the further reprocess; no [?] cells remain. The 1617 July entry reads "11 41 Cancer" (degree and minutes identical to the 1618 July entry below it); the repeated "11 41" is retained as printed and is flagged as a suspected compositor duplication in the batch report.

A	J	J	F	F	M	A	M	M	A	A	M	J	J					
n	a	a	e	e	a	p	a	p	p	a	a	u	u					
i	.	'	.	'	.	'	.	'	.	'	.	'	.					
6			m		m		m		m		m		m					
1			i		i		i		i		i		i					
			n		n		n		n		n		n					
			i		i		i		i		i		i					
1	1	5	C	1	1	C	1	3	C	2	0	C	2	2	C	2	4	C
6	1	2	a	5	9	a	8	5	a	2		a	5	1	a	8	8	a
6			n			n			n			n			n			n
2			c			c			c			c			c			c
			e			e			e			e			e			e
			r			r			r			r			r			r
1	2	3	L	2	5	L	2	1	L	2	4	V	6	1	V	9	2	V
6	2	2	e	5	9	e	9	5	e		0	ir			ir		8	ir
6			o			o			o			g			g			g
3												o			o			o
1	3	1	L	6	3	L	9	5	L	1	2	L	1	4	L	2	8	L
6		2	i		9	i		5	i	3	0	i	6	1	i	0		i
6			b			b			b			b			b			b
4			r			r			r			r			r			r
			a			a			a			a			a			a
1	1	5	S	1	2	S	2	4	S	2	6	S	2	2	S	0	5	S
6	3	8	c	7	5	c	0	1	c	4		c	7	7	c		4	c
6			o			o			o			o			o			o
5			r			r			r			r			r			r
			p			p			p			p			p			p
			i			i			i			i			i			i
			o			o			o			o			o			o
1	2	3	S	2	5	S	1	2	C	4	4	C	8	7	C	1	3	C
6	4	8	a	8		a		1	a		6	a			a	1	4	a
6			g			g			p			p			p			p
6			it			it			ri			ri			ri			ri
			t			t			c			c			c			c

	J		F		M		A		M		J							
A	a	J	J	e	F	F	a	M	M	A	A	a	M	J	J			
n	n	a	a	b	e	e	r	a	a	p	p	i	a	u	u			
i	.	'	S.	.	'	S.	.	'	S.	.	'	S.	.	'	S.			
			a			a			o			o			o			
			ri			ri			r			r			r			
			u			u			n			n			n			
			s			s												
1	5	1	A	8	4	A	1	2	A	1	2	A	1	4	A	2	1	A
6		9	q		6	q	2		q	5	7	q	8	8	q	2	5	q
6			u			u			u			u			u			u
7			a			a			a			a			a			a
			ri			ri			ri			ri			ri			ri
			u			u			u			u			u			u
			s			s			s			s			s			s
1	1	5	P	1	2	P	2	4	P	2	6	P	2	2	P	2	5	A
6	5	8	is	9	5	is	2	1	is	6		is	9	7	is		4	ri
6			c			c			c			c			c			e
8			e			e			e			e			e			s
			s			s			s			s			s			
1	2	4	A	0	1	T	3	2	T	6	5	T	1	1	T	1	4	T
6	6	4	ri		1	a		7	a		2	a	0	3	a	3	0	a
6			e			u			u			u			u			u
9			s			r			r			r			r			r
						u			u			u			u			u
						s			s			s			s			s
1	7	2	G	1	5	G	1	7	G	1	3	G	2	5	G	2	2	G
6		4	e	0	1	e	4		e	7	2	e	0	3	e	4	0	e
7			m			m			m			m			m			m
0			i			i			i			i			i			i
			n			n			n			n			n			n
			i			i			i			i			i			i
1	1	4	C	2	3	C	2	4	C	2	1	C	1	3	L	5	0	L
6	8		a	1	1	a	4	7	a	8	2	a		3	e			e
7			n			n			n			n			o			o
1			c			c			c			c						
			e			e			e			e						

	J		F		M		A		M		J							
A	a	J	J	e	F	F	a	M	M	p	A	A	a	M	u	J	J	
n	n	a	a	b	e	e	r	a	a	r	p	p	i	a	n	u	u	
n	G	n	n	G	b	b	G	r	r	G	r	r	G	a	G	n	n	
i	.	'	S.	.	'	S.	.	'	S.	.	'	S.	.	'	S.	.	'	
			a			a			a			a					p	
																		i
																		o
1	2	2	S	2	5	S	3	6	S	6	3	S	9	5	S	1	1	S
6	6	3	c	9	0	c				1		a		2	a	3	9	a
8			o			o			g			g			g			g
3			r			r			i			i			i			i
			p			p			t			t			t			t
			i			i			a			a			a			a
			o			o			r			r			r			r
									u			u			u			u
									s			s			s			s
1	7	2	C	1	2	C	1	4	C	1	1	C	2	3	C	2	5	C
6			a	0	9	a	3	5	a	7	0	a	0	1	a	3	8	a
8			p			p			p			p			p			p
4			r			r			r			r			r			r
			c			c			c			c			c			c
			o			o			o			o			o			o
			r			r			r			r			r			r
			n			n			n			n			n			n
1	1	4	A	2	1	A	2	3	A	2	5	A	1	1	P	4	4	P
6	7	9	q	1	6	q	4	0	q	7	7	q		8	i		5	i
8			u			u			u			u			c			c
5			a			a			a			a			e			e
			r			r			r			r			s			s
			u			u			u			u						
			s			s			s			s						
1	2	2	P	1	5	A	5	1	A	8	3	A	1	5	A	1	2	A
6	8	9	i		6	r		2	r		7	r	1	8	r	5	5	r
8			c			e			e			e			e			e
6			e			s			s			s			s			s
			s															
1	9	9	T	1	3	T	1	5	T	1	1	T	2	3	T	2	5	T

	J			F			M			A			M			J		
A	a	J	J	e	F	F	a	M	M	p	A	A	a	M	u	J	J	
n	n	a	a	b	e	e	r	a	a	r	p	p	i	a	n	u	u	
i	.	'	S.	.	'	S.	.	'	S.	.	'	S.	.	i'	S.	.	'	S.
1	1	2	C	1	4	C	2	2	C	2	2	C	2	5	C	0	1	A
6	3	1	a	6	8	a	0		a	3	9	a	6	0	a		7	q
9			p			p			p			p			p			u
3			ri			ri			ri			ri			ri			a
			c			c			c			c			c			ri
			o			o			o			o			o			u
			r			r			r			r			r			s
			n			n			n			n			n			
1	2	1	A	2	2	A	0	4	P	4	9	P	7	3	P	1	5	P
6	4		q	7	8	q		4	is			is		0	is	0	7	is
9			u			u			c			c			c			c
4			a			a			e			e			e			e
			ri			ri			s			s			s			s
			u			u												
			s			s												
1	4	4	A	8	8	A	1	2	A	1	4	A	1	1	A	2	3	A
6		1	ri			ri	1	4	ri	4	9	ri	8	0	ri	1	7	ri
9			e			e			e			e			e			e
5			s			s			s			s			s			s
1	1	2	T	1	4	T	2	4	T	2	2	T	2	5	T	2	1	G
6	5	1	a	8	8	a	2		a	5	9	a	8	0	a		7	e
9			u			u			u			u			u			m
6			r			r			r			r			r			i
			u			u			u			u			u			n
			s			s			s			s			s			i
1	2	7	G	2	3	G	2	4	C	6	1	C	9	3	C	1	3	C
6	6		e	9	4	e		8	a		5	a		6	a	3		a
9			m			m			n			n			n			n
7			i			i			c			c			c			c
			n			n			e			e			e			e
			i			i			r			r			r			r
1	6	4	C	1	1	C	1	3	C	1	3	C	2	1	C	2	4	C
6		7	a	0	4	a	3	0	a	6	5	a	0	6	a	3	3	a

	J			A			S			O			N			D		
A	u	J	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
n	l	J	u	g	u	u	p	p	e	t	c	v	o	o	c	e	e	
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.
1			i			i			i			i			i			i
			n			n			n			n			n			n
			i			i			i			i			i			i
1	1	1	C	1	3	C	2	4	C	2	2	C	2	5	C	2	1	L
6	5	0	a	8	7	a	2		a	5	5	a	8	2	a		2	e
5			n			n			n			n			n			o
2			c			c			c			c			c			
			e			e			e			e			e			
			r			r			r			r			r			
1	2	5	L	2	2	L	6	1	L	6	1	L	9	3	L	1	5	L
6	5	7	e	9	4	e		2	e		2	e		9	e	2	9	e
5			o			o			o			o			o			o
3																		
1	6	3	V	1	3	V	1	3	V	1	5	V	2	1	V	2	3	V
6		6	ir	0		ir	3	0	ir	6	1	ir	0	8	ir	3	8	ir
5			g			g			g			g			g			g
4			o			o			o			o			o			o
1	1	1	L	2	4	L	2	1	L	2	3	L	0	5	S	4	1	S
6	7	6	i	0	3	i	4	0	i	7	1	i		8	c		8	c
5			b			b			b			b			o			o
5			r			r			r			r			r			r
			a			a			a			a			p			p
															i			i
															o			o
1	2	5	S	1	2	S	4	5	S	8	1	S	1	3	S	1	5	S
6	7	6	c		3	a		0	a		1	a	1	8	a	4	8	a
5			o			g			g			g			g			g
6			r			it			it			it			it			it
			p			t			t			t			t			t
			i			a			a			a			a			a
			o			ri			ri			ri			ri			ri
						u			u			u			u			u
						s			s			s			s			s

	J			A			S			O			N			D		
A	u	J	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
n	l	J	u	g	u	u	p	p	e	t	c	v	o	o	c	e	e	
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.
1	8	4	C	1	1	C	1	3	C	1	5	C	2	2	C	2	4	C
6		3	a	2	0	a	5	7	a	8	8	a	2	5	a	5	5	a
5			p			p			p			p			p			p
7			ri			ri			ri			ri			ri			ri
			c			c			c			c			c			c
			o			o			o			o			o			o
			r			r			r			r			r			r
			n			n			n			n			n			n
1	1	2	A	2	5	A	2	1	A	2	3	A	3	5	P	6	2	P
6	9	3	q	2	0	q	6	7	q	9	8	q			is		5	is
5			u			u			u			u			c			c
8			a			a			a			a			e			e
			ri			ri			ri			ri			s			s
			u			u			u			u						
			s			s			s			s						
1	0	3	A	3	3	A	6	5	A	1	1	A	1	4	A	1	5	A
6			ri		0	ri		7	ri	0	8	ri	3	5	ri	7		ri
5			e			e			e			e			e			e
9			s			s			s			s			s			s
1	1	4	T	1	9	T	1	3	T	2	5	T	2	2	T	2	4	T
6	0	2	a	4		a	7	6	a	0	7	a	4	4	a	7	4	a
6			u			u			u			u			u			u
0			r			r			r			r			r			r
			u			u			u			u			u			u
			s			s			s			s			s			s
1	2	1	G	2	5	G	2	2	G	1	4	C	5	1	C	8	3	C
6	1	9	e	4	6	e	8	3	e		4	a		1	a		1	a
6			m			m			m			n			n			n
1			i			i			i			c			c			c
			n			n			n			e			e			e
			i			i			i			r			r			r
1	2	9	L	5	3	L	9	3	L	1	2	L	1	5	L	1	1	L
6			e		6	e			e	2	4	e	5	1	e	9	1	e

A	J		A		S		O		N		D							
n	u	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	D	
i	l	l'	g	g	g	p	p	p	t	c	v	v	v	c	c	c	c	
6			o		o		o		o		o		o		o		o	
1	1	4	V	1	1	V	1	4	V	2	4	V	2	3	V	2	5	V
6	2	9	ir	6	6	ir	9	3	ir	3		ir	6	1	ir	9	1	ir
6			g			g			g			g			g			g
3			o			o			o			o			o			o
1	2	2	L	2	5	L	0	2	S	3	4	S	7	1	S	1	2	S
6	3	9	i	6	6	i		3	c		4	c		1	c	0	9	c
6			b			b			o			o			o			o
4			r			r			r			r			r			r
			a			a			p			p			p			p
									i			i			i			i
									o			o			o			o
1	4	1	S	7	4	S	1	9	S	1	3	S	1	5	S	2	1	S
6		5	a		2	a	1		a	4	0	a	7	7	a	1	7	a
6			g			g			g			g			g			g
5			it			it			it			it			it			it
			t			t			t			t			t			t
			a			a			a			a			a			a
			ri			ri			ri			ri			ri			ri
			u			u			u			u			u			u
			s			s			s			s			s			s
1	1	5	C	1	2	C	2	4	C	2	1	C	2	3	C	1	5	A
6	4	5	a	8	2	a	1	9	a	5	0	a	8	7	a		7	q
6			p			p			p			p			p			u
6			ri			ri			ri			ri			ri			a
			c			c			c			c			c			ri
			o			o			o			o			o			u
			r			r			r			r			r			s
			n			n			n			n			n			
1	2	3	A	2	3	A	2	3	P	5	5	P	9	1	P	1	3	P
6	5	6	q	9		q		0	is		1	is		8	is	2	8	is
6			u			u			c			c			c			c

	J			A			S			O			N			D		
A	u	J	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
n	l	J	u	g	u	u	p	e	e	t	O	c	v	o	o	c	e	
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.
7			a			a			e		e		e		e		e	
			ri			ri			s		s		s		s		s	
			u			u												
			s			s												
1	6	1	A	9	4	A	1	9	A	1	3	A	1	5	A	2	1	
6		5	ri		2	ri	3		ri	6	0	ri	9	7	ri	3	7	
6			e			e			e			e			e		e	
8			s			s			s			s			s		s	
1	1	1	T	2	2	T	2	5	T	2	1	T	0	4	G	4	3	
6	7		a	0	8	a	3	5	a	7	6	a		3	e			
6			u			u			u			u			m		m	
9			r			r			r			r			i		i	
			u			u			u			u			n		n	
			s			s			s			s			i		i	
1	1	4	G	1	8	G	4	3	C	7	5	C	1	2	C	1	4	
6	7	1	e	1		e		5	a		6	a	1	3	a	4	3	
7			m			m			n			n			n		n	
0			i			i			c			c			c		c	
			n			n			e			e			e		e	
			i			i			r			r			r		r	
1	8	2	L	1	4	L	1	1	L	1	3	L	2	3	L	2	2	
6		1	e	1	8	e	5	5	e	8	6	e	2		e	5	3	
7			o			o			o			o			o		o	
1																		
1	1	1	V	2	2	V	2	5	V	2	1	V	2	4	L	6	3	
6	9		ir	2	8	ir	5	5	ir	9	6	ir		3	i		i	
7			g			g			g			g			b		b	
2			o			o			o			o			r		r	
															a		a	
1	2	4	L	3	1	S	6	4	S	1	2	S	1	2	S	1	4	
6	9	7	i		4	c		1	c	0		c	3	9	c	6	9	
7			b			o			o			o			o		o	

J A n n i			J u l S.			A u g g S.			S e p p S.			O c t G t S.			N o v o v S.			D e c c S.		
3			r			r			r			r			r			r		
			a			p			p			p			p			p		
						i			i			i			i			i		
						o			o			o			o			o		
1	1	2	S	1	5	S	1	2	S	2	4	S	2	9	S	2	2	S		
6	0	7	a	3	4	a	7	1	a	0	2	a	4		a	7	9	a		
7			g			g			g			g			g			g		
4			it			it			it			it			it			it		
			t			t			t			t			t			t		
			a			a			a			a			a			a		
			ri			ri			ri			ri			ri			ri		
			u			u			u			u			u			u		
			s			s			s			s			s			s		
1	2	7	C	2	3	C	2	1	C	1	2	A	4	4	A	8	9	A		
6	1		a	4	4	a	8		a		2	q		9	q			q		
7			p			p			p			u			u			u		
5			ri			ri			ri			a			a			a		
			c			c			c			ri			ri			ri		
			o			o			o			u			u			u		
			r			r			r			s			s			s		
			n			n			n									n		
1	1	4	A	5	1	A	8	4	A	1	2	P	1	2	P	1	4	P		
6		7	q		4	q		1	q	2		is	5	9	is	8	9	is		
7			u			u			u			c			c			c		
6			a			a			a			e			e			e		
			ri			ri			ri			s			s			s		
			u			u			u									u		
			s			s			s									s		
1	1	3	A	1	1	A	1	2	A	2	4	A	2	1	A	2	3	A		
6	2	4	ri	6		ri	9	8	ri	2	9	ri	6	6	ri	9	6	ri		
7			e			e			e			e			e			e		
7			s			s			s			s			s			s		
1	2	1	T	2	4	T	0	7	G	3	2	G	6	5	G	1	1	G		

	J			A			S			O			N			D		
A	u	J	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D	
n	l	J	u	g	u	u	p	e	e	t	c	v	o	o	c	e	e	
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.
6	3	3	a	6	0	a			e	8	e	5	e	0	5	e		
7			u			u			m		m		m			m		
8			r			r			i		i		i			i		
			u			u			n		n		n			n		
			s			s			i		i		i			i		
1	3	5	C	7	2	C	1	4	C	1	8	C	1	3	C	2	5	C
6		3	a		0	a	0	7	a	4		a	7	5	a	0	5	a
7			n			n			n		n		n			n		n
9			c			c			c		c		c			c		c
			e			e			e		e		e			e		e
			r			r			r		r		r			r		r
1	1	3	L	1	0	L	2	2	L	2	4	L	2	1	L	1	3	V
6	4	3	e	8		e	1	7	e	4	8	e	8	5	e		5	ir
8			o			o			o		o		o			o		g
0																		o
1	2	2	V	2	4	V	2	1	L	5	3	L	9	2	L	1	2	L
6	5	0	ir	8	7	ir		4	i		5	i			i	2	2	i
8			g			g			b		b		b		b			b
1			o			o			r		r		r		r			r
									a		a		a		a			a
1	6	0	S	9	2	S	1	5	S	1	1	S	1	4	S	2	2	S
6			c		7	c	2	4	c	6	5	c	9	2	c	3		c
8			o			o			o		o		o		o			o
2			r			r			r		r		r		r			r
			p			p			p		p		p		p			p
			i			i			i		i		i		i			i
			o			o			o		o		o		o			o
1	1	4	S	2	7	S	2	3	S	2	5	S	0	2	C	3	4	C
6	6	0	a	0		a	3	4	a	6	5	a		2	a		2	a
8			g			g			g		g		g		p			p
3			it			it			it		it		it		ri			ri
			t			t			t		t		t		c			c
			a			a			a		a		a		o			o

	J		A		S		O		N		D					
A	u	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D
n	l	J	u	A	A	e	S	S	c	O	o	N	N	e	D	D
n	G	u	l	G	g	g	p	p	G	c	t	G	v	v	G	c
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.

			r			r			r			r			r	
1	2	5	L	2	1	L	2	4	L	1	7	V	4	3	V	7
6	0	2	e	4	9	e	7	6	e			ir		4	ir	4
8			o			o			o			g			g	
9												o			o	
1	1	3	L	4	5	L	8	2	L	1	4	L	1	1	L	1
6		2	i		9	i		6	i	1	7	i	5	4	i	8
9			b			b			b			b			b	
0			r			r			r			r			r	
			a			a			a			a			a	
1	1	1	S	1	3	S	1	6	S	2	2	S	2	5	S	2
6	2	2	c	5	9	c	9		c	2	7	c	5	4	c	9
9			o			o			o			o			o	
1			r			r			r			r			r	
			p			p			p			p			p	
			i			i			i			i			i	
			o			o			o			o			o	
1	2	5	S	2	1	S	2	4	S	3	7	C	6	3	C	9
6	2	2	a	6	9	a	9	6	a			a		4	a	4
9			g			g			g			p			p	
2			it			it			it			ri			ri	
			t			t			t			c			c	
			a			a			a			o			o	
			ri			ri			ri			r			r	
			u			u			u			n			n	
			s			s			s							
1	3	3	A	7	5	A	1	3	A	1	5	A	1	2	A	2
6		8	q			q	0	2	q	3	3	q	7	0	q	0
9			u			u			u			u			u	
3			a			a			a			a			a	
			ri			ri			ri			ri			ri	
			u			u			u			u			u	
			s			s			s			s			s	

J			A			S			O			N			D			
A	u		J	u		A	A	e	S	S	c	O	o	N	N	e	D	D
n	l	J	u	g	u	u	p	e	e	t	O	c	v	o	o	c	e	e
n	G	u	l	G	g	g	G	p	p	G	c	t	G	v	v	G	c	c
i	.	l'	S.	.	'	S.	.	'	S.	.	t'	S.	.	'	S.	.	'	S.
1	1	2	S	2	1	S	2	3	S	2	3	S	2	6	S	5	2	S
7	8	4	c	1	1	c	5	8	c	8	9	c			a		6	a
0			o			o			o			o			g			g
0			r			r			r			r			it			it
			p			p			p			p			t			t
			i			i			i			i			a			a
			o			o			o			o			ri			ri
															u			u
															s			s

Parsing notes: All sign-glyphs and numeric cells on this page were resolved cell-by-cell in the further reprocess; no [?] cells remain. Three internally-inconsistent values are retained as printed and flagged as suspected compositor errors in the batch report: the 1653 September and October cells are identical adjacent entries ("6 12 Leo" / "6 12 Leo") where one should advance; the 1670 July degree reads "17" (higher than the same row's August "11 8 Gemini" and equal to the prior year's July), breaking the column advance; and the 1695 July degree reads "14" against the same row's August "28 25 Aries," an anomalous intra-row jump. This is a longitude table, so all minute-values are ≤ 59 ; none exceeding 59 were read.

The table continues beyond this batch; no chapter-closing prose, no Caput XIII display heading, and no figure appears on any of these three pages. The entire batch is the single libratory-motion table. The expected close of Caput XII and the start of Caput XIII evidently fall on later folios.

TABLE OF THE LIBRATORY MOTION

[Tabula Motus Libratorii]

Given the maximum libration of Palus Maeotis [Mare Crisium] from the preceding table, together with the place of the Moon, to find the libration appropriate to it. [*Data maxima P. Maeotidis Libratione, ex Tabula antecedente, cum Lunae loco, invenire librationem eius competentem.*]

This is a double-entry lookup table built entirely from zodiac sign-glyphs (no numerical degree/minute values). Its purpose: enter with the maximum libration

of Mare Crisium (the index value 0–6 derived from the preceding year-table) and with the Moon's zodiacal position (its sign), and read off the appropriate libration. The two halves of the table are mirror images: the left half is headed for **maximum libration of Palus Maeotis** (index 6, "Libratio Decrescens" — decreasing libration) over a **minimum libration** body-state (index 0, "Libratio Crescens" — increasing libration); the right half is headed for **minimum libration** (index 0, "Libratio Crescens") over a **maximum libration** body-state (index 6, "Libratio Decrescens"). The column heads carry the intermediate index numbers ("Intermedia": 5, 4, 3, 2, 1 on the decreasing side; 1, 2, 3, 4, 5 on the increasing side). Each cell holds a single zodiac sign-glyph; reading down a column, the glyphs advance one sign per row, so that the body of the table is a set of shifted zodiac sequences. The same head/foot labels repeat at the bottom of the table, inverted, so it can be entered from either end.

Left half — column heads (top): Maxima libratio P. Maeotid. = 6 | Libratio Decrescens, Intermedia: 5, 4, 3, 2, 1. **Left half — second head row:** Minima libratio P. Maeotid. = 0 | Libratio Crescens, Intermedia: 1, 2, 3, 4, 5. **Right half — column heads (top):** Minima libratio P. Maeotid. = 0 | Libratio Crescens, Intermedia: 1, 2, 3, 4, 5. **Right half — second head row:** Maxima libratio P. Maeotid. = 6 | Libratio Decrescens, Intermedia: 5, 4, 3, 2, 1.

Transcribing the sign-glyphs row by row (entry column first, then the five "Intermedia" columns). Sign abbreviations: ♋ Cancer, ♌ Leo, ♍ Virgo, ♎ Libra, ♏ Scorpio, ♐ Sagittarius, ♑ Capricorn, ♒ Aquarius, ♓ Pisces, ♈ Aries, ♉ Taurus, ♊ Gemini.

Left half (entry value 6 / 0):

(entry)	Interm.	Interm.	Interm.	Interm.	Interm.
♋	♋	♋	♋	♋	♋
♌	♌	♌	♌	♌	♌
♍	♍	♍	♍	♍	♍
♎	♎	♎	♎	♎	♎
♏	♏	♏	♏	♏	♏
♐	♐	♐	♐	♐	♐
♑	♑	♑	♑	♑	♑
♒	♒	♒	♒	♒	♒
♓	♓	♓	♓	♓	♓
♈	♈	♈	♈	♈	♈
♉	♉	♉	♉	♉	♉
♊	♊	♊	♊	♊	♊

(entry)	Interm.	Interm.	Interm.	Interm.	Interm.
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐

Right half (entry value 0 / 6):

(entry)	Interm.	Interm.	Interm.	Interm.	Interm.
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
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☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐

Foot labels (left half): Minima libratio P. Maeot. = 0 | Intermedia, Libratis Crescents: 1, 2, 3, 4, 5; and below, Maxima libratio P. Maeotid. = 6 | Intermedia, Libratis Decrescents: 5, 4, 3, 2, 1. **Foot labels (right half):** Maxima libratio P. Maeotid. = 6 | Intermedia, Libratis Decrescents: 5, 4, 3, 2, 1; and below, Minima libratio P. Maeotid. = 0 | Intermedia, Libratis Crescents: 1, 2, 3, 4, 5.

Parsing notes: the table contains no numerical (degree/minute) values — only zodiac sign-glyphs. Each column reproduces the zodiac sequence shifted by one sign relative to the column to its left, so the progression is fully self-checking; I read every glyph against that monotone advance and found no breaks. The mirrored head/foot labels are the table's "read from either end" device.

Once the general figure of the phases has been set out, then, with its four maximum points of variation around the limb — that is, at the boundaries or at the determinate intermediate points, marked off by distinct dots, both for length (which is the latitude of the limb, at its maximum, minimum, and intermediate values) and for breadth (which is the longitude, by which the latitude responds)

— one can readily determine, around the middle of the disc, the position of the reticule [reticulum] by which the centre of the Moon is set; and from this one can correctly find the time appropriate to the Moon's limb. So that you may use it accurately, I show by what means it can be done with both of our little tables, and how it may be drawn off, for any times whatever, from these — provided that the matter of libration be one which can be carried out without difficulty by one means or another.

[Margin: An eclipse of the Moon in the year 1652, drawn by Gedani (i.e. Hevelius at Danzig).]

Now let me take the year 1652, the day and time at which the lunar eclipse was nearly total (which Hevelius observed at Danzig with great care, and the opportunity to do so was given me by his account, since that fuller observation, not yet commonly committed to print, he willingly granted me — that and other observations of this kind, which the more curious observers of the heavens communicate to one another). Let the place be Palus Maeotis [Mare Crisium]; and let it also be considered how great the libration of that same day was. The limb of the Moon, depicted around that same place, can be rightly described. Therefore, in the margin, with our table at the left, the maximum motion of libration of Palus Maeotis is sought (which is justly to be delineated), as is the year following on the front; and in the column the corresponding month is found, which here is September. Then we look for the libration in Gemini at its maximum — that is, the figure of Gemini turned around at the position of the maximum libration of Palus Maeotis — and we investigate in the margin likewise the figure of Gemini below; under the same heading then the right is reached, having progressed; the figure in which the Moon is situated at that time (if indeed it is not gathered from some other source, or by calculation through the place itself) is noted carefully, whose place is set at the head, in the front; this is at once indicated as the figure of libration increasing, and the decreasing one as the maximum, the intermediate one as the minimum; item by item; whichever column responds (in which the figure of Gemini holds the maximum libration of Palus Maeotis), and how great its libration is at the egress of Palus Maeotis from the minimum, that is, from the maximum of libration in length, is expressed in the larger numbers; these numbers, in the lunar diagram around Palus Maeotis, fully correspond. For example: if the figure of Gemini be found to be at its maximum, repeated five times in the smaller table, the libration in the smaller table under the heading "maximum libration of Palus Maeotis" stands plainly at the end; the fishes (Pisces) then occupy (since the Moon at that time was at about the 24th degree of Pisces, at the time of the eclipse just described); the right is constituted in that

same line under the column of numbers, and is found. It is established, therefore, that even in the number set opposite, under the heading of the said table, the libration at that time was an intermediate increasing one, or a mean of remotion, above the others, the maximum, and minimum of libration.

[Margin: A lunar eclipse, year 1652. Drawn by Gedani (Hevelius at Danzig).]

[Margin: How the maximum libration is excerpted from our table.] [Margin: Use of the smaller table.]

Then, with these found, and the latitude likewise given, as if near the Node, it is grasped by a proper radius of the compass; in the general figure of the Moon, drawn just so by certain compass-figures (if the radius were immobile, the compass-figures hold) — but if it has nothing of latitude, in the region of the northern hyperborea, an intermediate point is between two (since the Moon was able to settle on no latitude) — then it would have intercepted the latitude of that time; plainly likewise it is intercepted; you see, if in the figure of the eclipse made afterward, the limb of the Moon, at the given time, and the place of the Moon are wholly to be determined. Or — what stands better — by means of the reticule [reticulum] drawn around the middle of the Moon: because much more easily can this be brought about; if according to the second libration, and at the foot, by a circle inscribed in the given proper interval at the proper intersection of the lines, just as in this example the number is 2, that is, the greater reticule supposes pages 11. it sets out, namely where the line 3, 3 of latitude, and the line of the Nodes intersect each other, rightly constituted, so the limb is depicted.

[Margin: How the libration is described according to the longitude, and according to the latitude, as I am accustomed to draw the limb of the hyperborean.]

Similarly item by item, as is easily gathered, the operation is, even if the libration be found again under some other number of the smaller table, likewise; the latitude wholly diverse, unless one must declare diligently, by which the limb may be depicted through the proper points.

[Margin: The manner of drawing it off here, declared by another example.]

justly with the latitude of longitude. For example: let the limb of the full Moon be described, which fell on the year 1655, on the following 20th day of April, at evening, the Moon being at the beginning of Scorpio, and at about the fifth degree of southern latitude. Therefore: since the table is large, and the time of maximum libration in length is found, that it be turned around the seventh month at about Libra. And if the figure again, under the heading of maximum libration of Palus Maeotis, in the smaller table, to the left, you look for, and find the figure of

Scorpio for the true place of the Moon, in that same to the right, under the number five. Hence it appears that the libration at that time was decreasing, and indeed partly around Palus Maeotis itself, partly around the Marsh of Maeotis. With this known, the egress of the little circle (with respect to the larger reticule) in the upper line of latitude a c is found, at the intersection 5, with the latitude being southern at 5 degrees; here therefore is to be described, the centre of the periphery of that full Moon. And so, with that time given, mediating the two of those little tables, the place of the Moon being given equally in the ecliptic, and the latitude truly being given, the libration of Palus Maeotis is found; the Moon's disc is rightly determined. The maximum libration is investigated by that same facility, and 6 are assumed, or one finds particular complements in the numbers, and 6 again, or one finds the smaller numbers to be attended to, you will have, the libration between the limb and Palus Maeotis at any time whatever. As for what is more commodious, just as I am able from the smaller table, peculiar to the general figure of the phases, I have constructed less, and entirely without the limb being nudged: but to the right, around Palus Maeotis I note not unless those six points of libration in length, and in the part of the Moon above; in the upper sixth those points of latitude are likewise noted around the centre of the reticule, whose, and from those of the points of the limb, by the benefit of the circle, nothing nearly of business will lead the order; afterward to set whole the limb in its entirety. Such an archetype is here (since it is that of the phases of the eclipse, year 1652, I have described). Which I describe. Such, if perhaps you, some of them, or others of these matters cultivators may have needed, I freely communicate.

[Margin: That the libration of Maeotis from itself may be had.] [Margin: Concerning the smaller diagram of the general phases.]

But do not wonder that our table of the libratory motion of the Moon sets forth degrees only, and the first minute, with the seconds wholly spurned. For this in business, where the motion of the libration is not at all to be discerned by the naked eye, would be useless, indeed too solicitous about the most minute things: nay rather, lest the very minute, the first, may, with everything errant, bring danger, I have judged it negligible.

[Margin: Why our table sets out degrees and the first minute and spurns the seconds.]

For the rest, I have taught indeed quite prolixly, as I exist, how the libration of the Moon may be set out, and how compared, and how from the antecedent table at any time it may be excerpted: I say the maximum, that it may itself be excerpted

as the table itself agrees fairly well with the heavens. But truly I would not for that reason that anyone believe, the very minute, the first, with all errant, ever to be neglected; nay, that even the very minute, the first, with everything errant, brings danger. For the rest, our table agrees fairly well; and I would not that anyone believe it certain. The certainty itself is not to be demanded from this, nor truly from observations themselves, where the motion of libration is so brief. Wherefore — although I have followed up with the most diligent observations not only ours, but also those of other most distinguished men, such as Gassendi, Bullialdus [Boulliau], and likewise your Most Loving Self [tibi], with Grimaldi [Grimaldi], with very many most diligent observations — yet however much we may have attained, the table to demonstrate, hypotheses, that our table relies on a solid and primary foundation. Wherefore, on account of the brevity of the matter, that it may be the clearer to anyone, and clearer, let all the observations and the tables that follow be called back to our standards: first and second, the first column of our observation, the Year, Month, and Day; the third, the hour of observations; the fourth, the longitude of the Moon; the fifth, the latitude of the Moon; the sixth, whether the libration is around Palus Maeotis; the seventh, how great the distance was in numbers, according to those things noted in the archetype, into which the observations were divided, and the eighth, how great the same be in the second table, and what difference, so that more clearly it may be set out; these things I have likened. Above I added also, not useless, as I think, some annotations; especially that any little sections of the quadrature may pass over; which surely all that lower part make, as I more clearly above admonish, that I may rightly investigate our libratory motion. I gather indeed, as far as I doubt nothing about the supreme agreement up to this point, among observations, as much ours as the rest of all, the tables agree. Nevertheless indeed, although the fewest observations, by excess, or defect, with respect to the table, very rarely show: yet this discrepancy, when of no moment, then to the observer...

[Margin: Why our table sets out the maximum gradation, and the minute, and the first, with the seconds spurned.] [Margin: The certainty cannot be demanded from this, beyond what the brevity of the matter of the phases allows.] [Margin: The Author admonishes that observations be called back to a common standard.] [Margin: Why in so brief a matter the cause of so frequently varied appearances cannot be sought out?]

is wholly to be imputed to the observer. And if it is impossible (as it is agreed among you most skilled in these matters) to discern accurately, by inches, nay sometimes even by two whole inches, the diverse distances of the latitudes of the

Moon, with the naked eye — unless by attending always accurately to these matters with the most exercised inspectors of the heavens — let the observations be carried out. Not, however, by a long continuous series of observations have I learned: the interstice of Palus Maeotis, than of the marsh, and likewise the hyperborean lake of the superior latitude, the maximum and minimum, appear somewhat larger always; if likewise that southern latitude appears wider by a little space, the centre is less constantly seen around the upper part of the Marsh, and so in others, and in others; at other latitudes a little even otherwise; and otherwise: that any greater of these in our Selenographic diagram of the general phases on the larger page 8, inserted, is sufficiently above; is manifest. Since these things are exceedingly subtle, therefore it can also not easily be all-too-well noted by everyone: and so it is more likely, as we have indicated, that in the determination of libration we err by an inch.

[Margin: The maximum libration of the interstices is not always equal in both hemispheres.]

For the rest, it is to be noted here also, that sometimes the limb, according to the table set out, does not always respond to the observations; and now it declines into this part, now into that: but as the first front appears, nevertheless on account of the imperfection of our hypotheses or tables; and therefore it is not at once to be judged. For it is entirely impossible that the limb, at every time, and on every side, should regard the peripheral maculae of the neighbourhood, especially those well distant from Palus Maeotis, or accurately distant from Mare Crisium. Since the maculae truly recede among themselves diversely with respect to the libration, by limb, which continually itself diversely contracts, or dilates; which surely, in one given diagram, can in no manner be exhibited at once. Hence it happens that the limb nearer to the Lower Caspian Sea (Langren's) approaches nearer in our Iconism, than ever almost in the Moon itself can be given. The reason is, that since the limb of the said maculae approaches, even that whole Caspian Sea with all the adjacent parts gradually contracts itself, leaving a little fuller, ampler space. A similar appearance is to be noted around the parts of the limb diverse, since they transcend the limit almost of the Sinus hyperboreus. For even item the limb itself secedes, so that it appears quasi diminished; nor by any reason is it observable, but always still at a little distance the limb from the Sinus hyperboreus, it will be seen: the cause is the same, the said dilatation, and compression.

[Margin: Why neither the table nor the iconism always appears the same?]

Because if such various diversities, arising by reason of dilatation and of compression, we should wish exactly to avoid, infinite would have to be the diagrams to be depicted; and any macula and whatever limb, by reason of libration variously diverse, and of compression rightly to be founded: which, since one cannot by a single figure delineate the number wholly impossible of the phases, therefore by a single figure I make (which is the maximum libration around Palus Maeotis, since the Moon is in the southern limit, equally near, from us depicted), I cannot be content with what is not enough, and most minute things, describe.

[Margin: Infinite diagrams would be required, if every variation of libration and of compression were to be expressed exactly by the maculae.]

And if it is somewhat imposed on us by some kind of business at the summit of perfection, to be brought to that height; entirely yet I persuade myself, that it can never be done absolutely, but that the diagram, that business cannot be carried out, but that such a variation, either of maculae compressed, or most minute things whatsoever, must be described.

[Margin: A libratory table.]

Moreover, lest you reckon that we have intermitted somewhat, that examining the libratory motions by tables, I confer all those things observed, which are in the *Almagest* [Almagestum Novum] Book IV, Cap. IX, Quaest. 7: in the first, second, third, and fourth Argument I have annotated, scrupulously and religiously expended, examined; and I find it most exact, to respond to everything, and by these even the remaining of all your observations can best be saved. Three of these later observations are: namely 1649, the 22nd and 25th of September, and 21 and 26 November. Item, in the year 1651, on the 26th of August, were held; and on the 26th of August, were held: the macula Grimaldi (Palus Maeotis) and Mare Crisium (Palus Maeotis) for every reason indeed, as I noted, to...

[Margin: A libratory table; or that other observations may be saved.]

the limb of the Moon accessed, and from that they receded, the table also being consonant with ours. Plato, however, and Tycho [Tycho Brahe], are not always minute in that whole time substituted; from that the limb interim a little (as from the table it is plain) item the limb accessed, and from it receded; and indeed as far as I judge inwardly, in those observations the limb circa the macula of Plato, and of Tycho something later. The more inwardly I am persuaded, by a long, and most diligent experience, that the macula of Tycho (M. Sinai of the maiores), of others,

far from the periphery of the Moon distant, and at the same time accurately, as far indeed as it recedes around the limb, even nearer, neither can one observe, nor indeed the remaining things of the propinquity of the macula: such as P. Maeotis, P. Maeotis, and P. Aniadocae, etc. Although, and the manner of the said quadratures, that surely indeed without any doubt all be palpable; let it be done in business, so that at that time rightly it may be noted; or the present one, lest I be silent of the parallaxes, which even at so little in rising, and setting, the librations adulterate, when around the maxima, and minima truly the librations, where surely the air, and of labors it is, in the most minute particular things the libratory motion is determined; as page 203 §. lib. IV. *Almagest* [Almagestum Novum] determines.

[Margin: The access and recess of M. Sinai, and the lacus nigri, far from the maculae of the obscurer ones distant from observation.] [Margin: That the libration of Maeotis, that the inweighed parallaxes may be had.] [Margin: That the parallaxes themselves correct the librations.]

Meanwhile we hold not exactly, as I put it, that of M. Sinai, and the lacus niger of the maiores, etc.; nay rather it can be observed in business: but only I establish, that of those maculae observation is not so much, as of the remaining maculae, that the macula of the limb nearer is to be attributed; and that indeed it can be done easily an error a little lighter even, by the Reverend Father Grimaldi [Grimaldi], around the said maculae of Plato, and of Tycho obtuse it has been. With me when the remaining observations to one have, both the Reverend Father Grimaldi, and mine, and of others by accurate enough table truly may respond; nor truly nearly into those observations themselves, around the maculae of Tycho, and of Plato carried out, in the number of the remaining ones not to be received. Therefore, where I say, I have been accustomed to be able, up to this point: nor anything I find, or animadvert; in which whatever our table of libration may nutate via the limb: but what, in fact, in the following years, as the centuries it happens; with the same tenor always at the same time in part, and as truly with time in part, and as far as the correction be, it follows, the slowness, by longer ages diligently to be divided.

[Margin: There can be no libratory motion of itself if it be unequal; the time will demand it.]

Finally, since in the Table of observations, our diagram (which I have placed in the *Almagest* [Almagestum Novum] of the general phases, that the sections of luminous bodies, or the embraces of the Quadratures may be intermitted, we shall examine; and item per the libratory motion of the Moon. For now, let it be

examined: if at any first time the true Quadrature was animadverted, not less, as per the intervals of Palus Maeotis, and of Mare Crisium, the quantity of the libration is known: and vice versa, also it is sequel: that even from the table the libration responds; at any time whatever the section so great of the Quadratures, as of the other phases of the luminous bodies, an inundation be sought: and afterward after the true quadrature have been the sections observed, then certainly limited adhibends; alas, believe, the most things obstant, that to this business they profit.

[Margin: The sections of the quadratures not always pass over per the same maculae.]

Indeed I most truly, just as fairly fully, frequently in the *Almagest* [Almagestum Novum], frequently also in the Selenography declared: that the sections of the Quadratures are not always carried by the same maculae, but per others, and others; at other times, by reason of the varied libration: hence; observed with diligence the section of the Quadrature, it is established also, libration of the Moon. Before that we teach, by what way the matter is carried out, it is to be said, indeed that the sections of the luminous bodies in the antecedent thing whichever line of section at no time, that into a single thing recurring, may be set out: but that since all those things in the Selenographia, and in the *Almagest* [Almagestum Novum] fairly fully are demonstrated those things are sufficient; and those who are cultivators of these matters let us send away. We have said however, in brief to comprehend, the section of the dichotomy, the maximum libration around Palus Maeotis, that it pass over per the Inf. Besbicam, the western parts of Mount Olympus, of Didymus, and of Cydifis at about; and so when the section, where the maximum it is occidental, exists; truly with the minimum libration, also at Palus Maeotis, the sections of the quadratures transcend Mons Sinai; the Cyprus, Inf. Lesbos, the Tarentine Sinus, a Lacum the maximum maior occidental: that they be, as well as truly the maximum oriental. At about I say: for at all time, the most with respect to the part...

[Margin: The sections of the quadratures not always pass over per the same maculae.] [Margin: The maximum, and minimum libration, per which maculae the sections of the quadratures pass over.] ...of the southern and northern portions [of the lunar disk], they do not hold the same course but, depending on the libration, the [terminator] cusps lie now toward the west by a certain number of degrees, now toward the east, while it is never observed that the section runs strictly straight, so that its bounding lines [the two cusps] are parallel. I have dwelt on certain of these matters in the *Selenographia*, and the point is treated

even more carefully where I deal with the cusps in the *Almagestum [Novum]*, Book 4, p. 203, question 3. I have set out the cusps somewhat differently with respect to the nodes there, and again with respect to the limits — where the cusps tend more nearly toward the perpendicular — than I have described them here. Otherwise I cannot do so, except about the middle of the Moon; for the parts nearer the limb I can scarcely make these lines out at all.

[Margin: The inclination of the cusps of the Moon at dichotomy.]

And so these are the courses of the two extreme sections [the terminator-sections] when the libration is of two kinds [maximum and minimum]. But to know these alone is by no means enough for tracking down the various librations of the Moon. The question is, when nowhere does it suffice us how great a libration there is — as I noted, dealing with that libratory division — to determine the intermediate sections, and especially by reason of that libratory division. I take as my model [*figura*] our Selenographic [map], so as to add, as it were, the [intermediate] confines of the boundaries of light and shadow. As for how great a libration each [section] corresponds to, I have arrived at it by my own frequent observations, and I set it out and arrange it as follows.

[Margin: The sections at quadrature.]

The first section, namely the easternmost, occurs when the libration is greatest and is at the Palus Maeotis [Mare Crisium]; that is, when the libration is of number 5, as set out in the table above, the terminator [*figura*] runs — as our Selenographic [map] shows and as I have said — across the Catena Mundi [the "Chain of the World," a lunar ridge], the western shores of the Inferior Besbica, Mt. Olympus, Mt. Didymus, and Mt. Cydifis.

[Margin: Quadrature-section, of number 6.]

The second section: when the libration is of number 4, it crosses Mt. Pangaeum, the eastern parts of Mt. Olympus and Mt. Didymus, the western shore of Mt. Cadmus, and Mt. Antilibanum.

[Margin: Quadrature-section, of number 5.]

The third: when the libration is about number 4, the section runs across Mt. Seir, Mt. Cadmus, between Mt. Sipylum and Mt. Montuniatem [Montuniatum], and Mt. Ligustinum.

[Margin: Quadrature-section, of number 4.]

The fourth line of section: when the libration is about number 3, it runs across the middle of Mt. Libanum, the western parts of Mt. Cragi and Mt. Sipyli, and the lands lying between, of the Adriatic sea and the lake of Trasimene, etc.

[Margin: Quadrature-section, of number 3.]

The fifth section: when the libration is about number 2, it is carried across Mt. Seir, the upper part of Mt. Libanum, across Mt. Masicytum, the eastern parts of Mt. Sipyli, between the Propontis and the Sinus Hypponiatas, and across Mt. Argentarium.

[Margin: Quadrature-section, of number 2.]

The sixth: when the libration is about number 1, the line runs across Mt. Tabor, Mt. Phoenicem, Mt. Latmium, and the Promontory of the Moon.

[Margin: Quadrature-section, of number 1.]

The seventh and last: when the libration is least and is of number 0, the section crosses Mt. Sinai, the Inferior Cyprum, the Inferior Lesbos, the Sinus Tarentinus, and the greater black lake [*lacus niger maior* = Mare Nigrum maius]. But when the libration is reckoned toward the rising [east] from the Palus Maeotis, then indeed, in order that the sections of the quadratures may be judged and have value, it is necessary that the reverse order be applied. For example, if the...

[Margin: Quadrature-section, the last, of number 0.]

libration is 0, the section will be found, not the seventh, but the first; if it is reckoned at 6, the sixth section is taken on the libration of number 1; the second section is to be assumed on the libration of number 5, and so on consequently.

By means of these prescribed rules anyone whatever will be able likewise to examine our table of librations, from whatsoever observations of the Moon's bisections by the bounds of light and shadow. Here close attention must be paid — as I touched on above — when those sections fall about the time of the true quadrature [*Quadratura*], or about the very first hour before, or after, the true quadrature; for then the observations will not in any way answer to the rule, but they are to be reckoned within, or beyond, the due limits. And so, proceeding cautiously and judiciously — namely, if the fourth hour after quadrature has yielded the prescribed observed section, then certainly with the prescribed rule it must be compared, the libration of the following section being preserved, the libration of the prior rule being nonetheless kept; and if the fourth hour before quadrature has marked the section next preceding, the rule will be the norm, the

libration of the preceding rule being likewise kept. For the Moon acquires that much light, or that much is wanting to it for the true quadrature, as I said more copiously on pp. 330 and 331. All which things, rightly observed by the sections of the quadratures, will hardly anywhere err — provided that the observed librations have been compared with the time of the section. But the sections of the Moon differ as widely [in time] as the libration is: if it happens at the same time both that the sections are bisected and that they are inclined, you will attend by various latitudes of the rising Moon, reckoned at about five degrees on the limb of the Moon, varying carefully. But the greatest variation of the libration is at each [end]; the node exists, and indeed about the Northern Node the [terminator-]cusp [points] upward by about so many degrees toward the west, as many degrees about the Southern Node it points eastward with the cusp turned downward, as I show on p. 334 as far as p. 340. I demonstrate these in the *Selenographia*, with the two diagrams set before the eyes.

[Margin: How great the inclination of the cusps of the Moon at the dichotomy [will be].]

By all these things attentively considered, by repeated trial you will doubtless plainly find both ours and your own tables of the Moon's dichotomized sections; and likewise the table of the Moon's sections [responds] precisely enough — not only in this way, as I have tried, but by the bisected sections of the Moon, more correctly, since I have documented all the rest, provided it be done cautiously, in accordance with the libration corresponding to it (as I taught on pp. 444, 445, and 446). We will undertake the business, where we can; but the danger we will make [our own]; nevertheless, lest perhaps we do not attain it [accurately], I am persuaded I have wandered not much from the goal. I shall therefore predict some quadrature-sections for the years next following, and the true times of the quadratures to be observed. But in order that I may dispatch this more briefly, I shall report the future bisected-section[s] of the Moon in the following table. First, the Year, Month, Day, Hour, I shall indicate; then the longitude and latitude of the Moon, with the libration; then through what maculae the sections will be drawn at that very time, we will display.

[Table — folio 181. Future quadrature-sections of the Moon, with longitude, latitude, libration, distance of libration, and the maculae crossed.]

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (Annis)	Month , day (Mens. dies)	Hour (Hor.)	Longit. Lunae	Latitu d. Lunae	Librat io	Dist. libr.	
1655	Febr. 13	12 <i>Vesp.</i>	25 ° 0'	5° 11' S	P. Mœot.	2	...

almost . The line of section crosses through Mt. Seir, the

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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upper part of Mt. Libanum, Mt. Masicytum, by the eastern parts

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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of Mt. Sipyli, between the Propontis and the Sinus Hypponiate m,

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.	
1655	Maij 12	8½ V.	22 □	2° 0' A	P. Mœot.	4⅔	and through Mt. Argentarium. The line of section advances

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Year (<i>Annu s</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit . Lunae	Latitu d. Lunae	Librat io	Dist. libr.
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Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Mt. Didymum, and the western shores of Mt. Cadmi, through

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Year (<i>Annu s</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit . Lunae	Latitu d. Lunae	Librat io	Dist. libr.	
1655	Sept. 23	2 <i>m.</i>	19 °	2° 50' S	P. Mæot.	4	h Mt. Antili banu m superi orem. The sectio n of the wanin g

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Moon (*decre sc.*) crosses through Mt. Seir, the upper part of Mt.

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Libanum, Mt. Masicytum, by the eastern parts of Mt. Sipyli, betwe

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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in the Propontis and the Sinus Hypponiate, [and] through Mt.

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajiciuntur*) Argentarium. The section of the waning Moon (*decresc.*) is

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitudo Lunae	Libratio	Dist. libr.	
1655	Dec. 20	2 <i>m.</i>	28 °	4° 34' A	P. Mæot.	1½	

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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carried through Mt. Pangaeum, the eastern shores of Mt. Didym

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitudo Lunae	Libratio	Dist. libr.	
1656	Januar. 4	11 V.	15 □	5° 6' S	P. Mœot.	5	i, and through the lower Antilibanum. The section crosses the

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Promontory of the Moon, Mt. Cadmum, Mt. Phoenicem, and Mt.

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajiciuntur*)

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu- d. Lunae	Librat- io	Dist. libr.	
1656	Aug. 26	8 V.	4 □	3° 34' A	P. Mœot.	6	Tabor, etc. The section is led through the Caten a Mundi, the

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Inferior Besbicam, [and] the eastern shores of Mt. Olympi,

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae sectionum futurarum Quadratarum trajicentur*)

Year (<i>Annu</i> <i>s</i>)	Month , day (<i>Mens.</i> <i>dies</i>)	Hour (<i>Hor.</i>)	Longit . Lunae	Latitu d. Lunae	Librat io	Dist. libr.	
1656	Dec. 23	10 V.	4 □	5° 14' S	P. Mœot.	1½	Didymi, and Cydifi s. The section [runs] through the middle of

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Mt. Libani, the eastern part of Mt. Masic yti, through the middle of

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajiciuntur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Mt. Sipyli, between the Propontis and the Sinus Hypponiatem,

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculas lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.	
1657	Nou. 12	10 V.	22 °	4° 30' S	P. Mœot.	5	near Mt. Argentinarij, to the western roots. The section [runs]

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Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicientur*)

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu- d. Lunae	Librat- io	Dist. libr.
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Didymi; it is led to the western shore of Mt. Cadmi, and to Mt. Antili

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu- d. Lunae	Librat- io	Dist. libr.	
1658	April 10	11 V.	22 □	5° 15' A	P. Mœot.	⅓	banum. The section [runs] through Mt. Sinai, the Inferior

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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Cyprus, Mt. Latmuus, between Mt. Christi and the greater black

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicientur*)

Year (<i>Annu</i> <i>s</i>)	Month , day (<i>Mens.</i> <i>dies</i>)	Hour (<i>Hor.</i>)	Longit . Lunae	Latitu d. Lunae	Librat io	Dist. libr.	
1658	Dec. 1	6½ V.	10 □	5° 14' S	P. Mœot.	3	lake, it advances. The section is led through the Caten a Mundi

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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, the Inferior Besbicam, [and] the eastern shores of Mt. Olymp

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicientur*)

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu- d. Lunae	Librat- io	Dist. libr.	
1661	Octob. 30	10 V.	8 □	4° 30' S	P. Mœot.	1	i, Didymi, and Cydificis [is carried]. The section is crossed

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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through Mt. Tabor, Mt. Phoenicem, Mt. Latmu, and the Promo

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajiciuntur*)

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitudo Lunae	Libratio	Dist. libr.	
1661	Dec. 28	4 V.	9 □	0° 10' A	P. Mœot.	3	Inventory of the Moon. The section crosses through the lower Libani

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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, to the western roots of Mt. Cragi, the center of the Moon and reticul

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajiciuntur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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um [little net], and through the western roots of Mt. Argentiarij.

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicentur*)

Year (<i>Annis</i>)	Month, day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu- d. Lunae	Librat- io	Dist. libr.
1665	Febr. 21	1	9 □	5° 10' A	P. Mœot.	⅓

The section is led through the western part of Mt. Sinai, the Inferi

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadraturarum trajicientur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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or Cyprum, the Inferior or Lesbos, and likewise through the easter

Through what maculae the lines of the future quadrature-sections are drawn (*Per quas maculae lineæ sectionum futurarum Quadratarum trajicentur*)

Year (<i>Annis</i>)	Month , day (<i>Mens. dies</i>)	Hour (<i>Hor.</i>)	Longit. Lunae	Latitu. Lunae	Libratio	Dist. libr.
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in part of the greater black lake [*lacus niger maior*].

Parsing notes: The longitude column gives degrees + zodiac sign (and minutes where shown); I have rendered the sign symbols as printed. The "Hor." column mixes evening (*Vesp.* / *V.*) and morning (*m.*) reckonings as printed. The "Dist. libr." column carries fractions ($\frac{1}{3}$, $1\frac{1}{2}$, $4\frac{2}{3}$) as printed. The macula-name spellings vary (Mœot./Mæot.; Hypponiatem; Cydifis) — transcribed verbatim, including the case-inflected forms. Several entries are densely abbreviated; I have flagged none as impossible (see report).

[Margin: How the phases of the eclipses of the Moon are to be predicted by our table.]

Such predictions, since to the worshippers of the divine Urania they cannot but be pleasing, so I confess them no less welcome [to myself], that occasion having been given I may at the same time signify and show by what benefit of our table the phases of future eclipses may be reckoned (passing over very many other things, which I reject elsewhere) — when the mind is bent on treating all the phases of eclipses more fully, with what foresight and respect to the maculae I describe those very things. Which matter is certainly very pertinent, and at the same time quite penetrating, and worthy to be expounded. It is therefore to be wished, and that the typical [*types* = exemplars / forms] of future eclipses of the Moon be by reason exhibited to the world, [so that] truly they may be set forth, and may delight the spectators.

[Margin: How the phases of eclipses are to be drawn beforehand, with respect to the time of every eclipse.]

Let there then be at hand some general figure of the phases of the Moon similar nearly to that in which the Eclipse delineated for the year 1652 — or a smaller one, if so it please, such as the following one — was constituted; in which, by a genuine periphery [circumference], described from the table, and by a radius divided into six equal parts, let there be drawn through those same parts six circles, the disk being divided into twelve digits. Then, a perpendicular being raised to the center through the center of the figure [*schema*]: the work then is, that it be rightly bisected, in accordance with that division of the upper periphery of the rotatable Full Moon, p. 264, [as] the Selenographia, inserted, and the inclination of the perpendicular according to the libration and the Nodes (otherwise truly it will deviate much) is rightly attended to; at the same time, another [line], which intersects the perpendiculars normally [at right angles], is to be drawn through the place of the Moon's orbit. Afterward, in some larger figure let the earth's shadow be described, in the manner in which the typical [forms] of eclipses are usually made about the Moon's orbit — the due proportion

being preserved according to the calculation, and the figure [*schema*] given by proportion: because that benefit of the proportional compass is not difficult. Again,...

[Margin: The eclipses of the Moon for the year 1652, and previously, of all eclipses, are to be delineated with respect to time.]

on some thick paper, as it were a membrane, let an arc of 90 degrees be cut out, of a circle similar to it [or] indeed greater, but altogether minimal — let it be cut out; then let the shadow, according to the latitudes about the beginning and the end of the eclipse, lead the Moon's orbit, [and] let the shadow be set upon the arc; just as the western parts about the Moon's orbit, the Archetype of the Moon, the Lunar Archetype, so let it be applied to the shadow and its orbit, the shadow's orbit coinciding with one and the same; and let it exhibit the section, and the very moment of contact: namely, [at] the beginnings of the eclipses. So that in the same right [line], on both sides of the figure, the lunar points may be promoted between the circles; namely, the shadow, and the arc of the upper periphery, the shadow being similar, until the little circle of the first digit touch; and then [exhibit] the first phase, or the first digit of the eclipse, the maculae lying near the upper arc will be noteworthy. Then from the second circle of the second digit lead the second phase of the same digit; and consequently all the rest, or [as] you will, as it shall be needful — to note, not [un]equal. Of such kind the typical [forms] of future eclipses [are], with the true inclination of the maculae, when the time of the greatest obscurations, according to the Tyconic calculation, may strike: this we have described by the foregoing; in the adjoined figure we will delineate, by which it may very evidently appear to anyone, by what reason not only at the time of the Moon it plunges itself into the earth's shadow, and at the same time, in turn, as it extricates itself from it; but through what maculae the section will pass under the shadow, [and] also how much, according to that calculation [it will be], when the eclipse is future: not indeed which maculae remain the very limit of the greatest obscurations of the partial eclipses — which truly at every time is most worthy to be noted.

[Margin: The eclipse of the Moon of the Year 1656, on the 1st day of January.]

In the first figure therefore, namely the eclipse which will happen in the year 1656, on the 1st day of January, the beginning [is] about 148 degrees from the Palus Mae-

otis, that is, toward the rising [east], from the point of the Nadir truly the perpendicular about 61 degrees; and the end about the same point toward the

setting [west] at 60 degrees, or the Palus Amadoca at 87 degrees, is noted. Besides, the greatest obscuration [will be] about the greater black lake [*Lacum nigrum maiorem*], Mt. Serrorum, Mt. Macrocoemium, and the Lacus Hyperboreus, the end of the eclipse will be terminated at 0½ digits [*digit being the twelfth part of the disk*]; hence the fourth part of the same eclipse, which is future, [is] about 20 degrees at the Palus Amadoca.

[Margin: The total eclipse of the Moon of the year 1657, on the 23rd–24th of June.]

In the second eclipse, which is future in the year 1657, on the 1st of June, the rising [edge] happens about 140 degrees from the Palus Amadoca toward the rising [east], truly from the point of the Nadir [along] the perpendicular about 67 degrees; and at the end about 67 degrees: from the said point [or] from the Palus Amadoca truly about 86 degrees, toward the setting [west], it is noted: but [at the time of] total obscuration in part of the upper Moon, about 20 degrees, at the Palus Amadoca, and the recovery of light in turn in 33 degrees: at the end about the term reckoned, it happens, and so the greatest defect of light is at 12 digits. In the third eclipse, which from the sky next in the year 1659 on the 6th of May will be seen, the beginning [is] about 86 degrees toward the rising [east], from the same Amadoca at the end at 22 degrees: and from the said Palus it will appear, the magnitude of it will be 8⅔ digits. In the fourth eclipse truly, which in the year 1659, on the 20th of October, will exist, the beginning [is] in the part of the lower Moon, from the point of the Nadir truly the perpendicular toward the rising [east] about 50 degrees: but at the end about 30 degrees, toward the setting [west], from the said spectacle it will arrive: at the end about 7 degrees [and] 8 [minutes], at 1 minute will come [*perveniet*]. For truly by what reason the calculation [agrees] with the sky itself wholly may be in agreement with its own time, if we are observers [*superstites* = survivors / those present], we will experience.

[Margin: The eclipse of the Moon of the year 1657, on the 23rd–24th of June.]

[Margin: The eclipse of the Moon of the year 1659, on the 6th of May.] [Margin: The eclipse of the Moon of the year 1659, on the 20th of October.]

Finally, since we have bound up the libratory motion of the Moon by certain laws, lest a demonstration be wanting, let me give to our hypotheses even something to the eye. [Though] the matter is certainly such that not even [I] so easily, as I have touched on, made it known; so too, I think, [it] holds out a goal scarcely [yet] attempted: but [a thing] better, [and] than what I have found, I shall exhibit a demonstration, until by a more perfect one [it be done] by us; we shall have devised [it]: meanwhile, content in the matter, we will hold the thing itself perceived in numbers. But since two diverse motions occur concurring, it will be

seen [as] one, [and] by a peculiar figure [*schema*], first the latitude of the libratory motions [it] will be demonstrated.

[Margin: A demonstration of the libratory motion of the latitudes.]

Let it then be in the subsequent upper figure [*schema*], A [the point] of the Ecliptic, d, the third [point], A, the Moon, constituted about the nodes; d, the Moon, having the greatest northern latitude; C, truly the Moon, having the greatest southern latitude; from the earth truly to the Moon, the lines are of vision, e g, the pyramids of vision, & e f, perpendicular to the center f, with the base of vision d g, [it] coincides, intermediate [is] given the libration: indeed the part of the lower Moon is beheld about the nodes, with the perpendicular from f, with the base of vision d g, coincides, intermediate [is] given the libration: indeed the part of the lower Moon is beheld about the nodes [duplicated in source]. About the point B, truly with the Moon existing about that limit toward the north, [it] is not seen, in A f e d; sed g d h, ad aspectum [the look] of our point arrives; so, that the place e g, the part of the upper [Moon], to our eye coming over [*exorientem*], from the lowest part of it, we perceive: contrary truly it happens about Pole C, the Moon turning in the southern limit, where in turn some part about the limb of the upper Moon, namely e g, of the lower parts f h, vanishing, is laid bare. Hence in the northern latitude, the shores of the boreal Moon are contracted, but in the southern latitude they are again amplified: contrariwise [in the] Meridional [southern] latitude, the shores of the boreal Moon [are] larger, and the southern narrower, [these things] of the differing observations [and] of our table being beheld. But about the nodes the space is each, [and] as it were equally as ample [it] seems, except [that] the particle [is] very nearly least, which [is] greater than the parallax it will arise, and scarcely the hundredth [part of the] sixty-eighth half-periphery of the lunar face it extends itself: of which...

[Margin: How the libratory motion of latitudes arises from the parallax.]

since there is hardly any moment, in this business of libration, no account is held.

But truly to demonstrate the cause of the motion of the Moon's libration in longitude, is far the most difficult [thing]. Yet I greatly marvel that, even though knowledge magnifies very much, nonetheless from that itself there came plainly into my mind in the year 1648, what [I have] noted, and to Thee about the eccentricity of the Moon: namely, that the point of the Moon's eccentricity always constantly with the same hemisphere [it] looks, not truly the third [it] looks upon: thence that libratory motion to arise from the longitude, as soon afterward more fully shall be said: truly rightly I hinted on p. 214 of the *Almagestum [Novum]*,

Book 4: by which these hypotheses [it] subsists; truly it might be objected [that] if the eccentricity of the Moon is so great, [it does] not [follow] that for so few parts of the libration to us [it] would be able to exhibit; but with this vice [*hac vice* = this time] a better example [is] to be sought after, and [it is] to be given to us [that it] be acquired and esteemed; and, until a truer [one] in the middle [be] brought forward: for being brought forth, certainly by this reason all the various vicissitudes of the librations to be best explained, and to be preserved, they are able: as much as the contrary inferior diagram[s], if the matters were accurately considered, may sufficiently clearly [show].

[Margin: A demonstration of the libratory motion of longitude.]

In which A, the earth, let it be; B, the eccentricity (but [it] is supposed to be as great as is necessarily required); I, the Apogee; C, the Perigee; M, & F, the distances about the intermediate; about c, f d, the libration of the Maeotis [Mare Crisium]; & about c e, the Maeotis [it] exhibits: in M, vel N, the space and the Palus Maeotidem, f d, always at minimum it is straightened, the space truly c e, of the Maeotis the smallest of all [it] is apprehended. As often as it [is] about this position about the periphery g f, & at vicissimely [in turn] g e, the greatest at all time it appears. And with the Moon descending into O, [at] the interval of the Maeotis f d, little by little [it] grows; & c e, decreases: just as the part of the periphery g f, increases, g e, truly diminishes. Then in C, the Perigee, that is, the middle [point], is given the libration; and so much by the one, as much by the other side [it] is beheld: the ratio [is] this, that, since c e of the Moon at the position of the base of vision, & the eccentricity into one and the same line coincides, [and] the part of the periphery g f, & g e, the spaces [are] equal. Afterward, with the Moon receding little by little, the Moon at Perigee about D, toward the east, the space of the Maeotis about f d, the greater [it] grows; with c e decreasing, again the interval of the Maeotis c e, about the same said reason. And about that in E, & F, the distance about the intermediate, the libration most ample [it is] about the Palus Maeotidem f d, & the smallest about the Palus Maeotidem c e, [the soul] marvels: because g f, the part of the periphery [is] in this place, of all [it] is greatest; g e, truly least. With the Moon ascending about the greatest Maeotis & at the Apogee, by like manner the space of the Maeotis [it] holds; with [it] again decreasing as far as M, increasing truly at the Maeotis the interval c e: as the foregoing [shown] in G, H, I, K, L, & M, [it] more clearly [is] expounded.

[Margin: A demonstration of the libratory motion of longitude.]

These therefore are [the things], Most Reverend and Most Renowned Man, which I, most eager [in] mind for things astronomical, [eager] to flow forth to you, and

to scrutinize the celestial things with you — though briefly, yet nonetheless freely, [out] of my own [resources] — I wished to communicate, and to you especially [I] wished to submit. With these things I close, beseeching God, the Best and Greatest, most humbly, that He grant a long life and rest [to you], which He may benignly concede; to which rest and respite, [the things] which hitherto [lie] under [your] hands [you] may turn over, and [that] the glory of the divine name [you] may set forth from the celestial [things] disclosed, [and that] the immense wisdom of the maker greatly [it] may be known to magnify, [and] to be admired: most happily, in due time, [that you] may [be able] to bring forth into the light. Farewell, chief glory and ornament of Urania; and [you], by my highest love, [and] favor, [I] return to you [as] Health, as officiously [dutifully] as I can; I would wish the Reverend, and Most Learned Man, P. Franciscus Maria Grimaldus [Francesco Maria Grimaldi]. I gave [this] at Danzig [Gdańsk], from my museum [study], in the year of the Christian era 1654, on the very day of the Autumnal Equinox.

[Margin: The libratory motion of longitude arises [is to be derived].]

Observations of the libratory motion, both around the Palus Maeotis [Mare Crisium] and around the Maeotis itself, made at Danzig [Gedani] by Johannes Hevelius [Hevelius].

This batch consists entirely of a single continuous observational table, headed identically on each of its three pages with the title above. The table records Hevelius's observations of the lunar libration, principally tracking the position of the Palus Maeotis (the lunar feature Riccioli identifies with the Mare Crisium) relative to the Moon's limb.

Column headers (verbatim):

- *Annus* — Year
- *Mens. dies* — Month, day
- *Hor.* — Hour (of observation)
- *Longit. Lunae* — Longitude of the Moon (sign and degrees: O. = degrees, S. = sign / minutes)
- *Latit. Lunae* — Latitude of the Moon (degrees, minutes; A = austral/south, S = septentrional/north — see parsing note)
- *Libratio* — Libration (the selenographic feature against which libration was measured: *P. Maeot.* = *Palus Maeotis*; *P. Maraetot.* = *Palus Mareotis*)
- *Dist. limbi iuxta Obse.* — Distance from the limb according to observation
- *Dist. limbi ex Tab.* — Distance from the limb from the tables

- *Animaduertenda* — Things to be noted (remarks)

In the *Libratio* column the entries alternate between "P. Maeot." (*Palus Maeotis*) and "P. Maraet." (*Palus Mareotis*) — two distinct selenographic features, both transcribed as printed. The longitude column gives a degree-of-sign value followed by a zodiacal sign symbol and then minutes. Zodiacal signs are rendered by their names in brackets.

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Annus	Menses	Hor.	Longitudo Luna	Latitudo Luna	Libratio	Distans iuxta Obs.	Distans ex Tab.	Animaduertenda (remarks)
1643	Sept. 16	3	3 [Aquarius] 8	3 8 A	P. Maeot.	½	1	
	Sept. 25	11	5 [Pisces] 2	2 0 A	P. Maeot.	3½	3	The Moon's limb stood at mid-remotion from the Palus Maeotis.
	Sept. 27	11	5 [Aries] 0	0 54 A	P. Maeot.	3	3½	Lunar eclipse [☉ Eclipsis].

Annus	Mensis	Hor.	Longit. Luna	Latit. Luna	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (re- marks)
1643	Octob. 20	7	·1 [Aquarius □]	4 18 S	P. Maot.	1	1	The line of section ran through Promontory [⊙], through Mons Phoenice, Mons Tabors, and the desert Zin; observed at hour 5, after [last quart

Annus	Mens. . dies	Hor.	Longi t. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim adue rtend a (rem arks) er, □ circ.].
	Octo b. 21	9	14 [Aqu arius □]	4 30 S	P. Maeo t.	2	2	
	Octo b. 22	6½	28 [Aqu arius □]	2 14 S	P. Maeo t.	2	2	
1643	Octo b. 24	10	27 [Pisce s □]	0 17 A	P. Maeo t.	3	3	Inter medi ate dista nce.
	Nou. 4	5	20 [Leo □]	3 0 A	P. Mara eot.	1	1½	
	Nou. 5	5½	2 [Virg o □]	0 0 A	P. Mara eot.	1½	1½	
1643	Nou. 7	7	26 [Virg o]	2 44 S	P. Mara eot.	2	2	Libra tion incre asing [<i>Libr atio cresc ens</i>].
	Nou. 20	7	24 [Pisce	0 18 S	P. Maeo	2½	3	

Annus	Mens. . dies	Hor.	Longi- t. Luna e	Latit. Luna e	Libra- tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim- adue- rtend- a (rem- arks)
			s]		t.			
	Nou. 21	7	7 [Taur- us]	1 7 A	P. Maeo t.	3	3½	
1643	Nou. 25	10	6 [Gem- ini]	4 46 A	P. Mara- eot.	5½	5½	Narr- owes- t inter- val [Arcti- ssimu- m spati- um].
	Nou. 26	11	21 [Gem- ini]	4 58 A	P. Mara- eot.	0	0	Mt Sinai [Mon- s Sinai] was remo- ved from the lower limb [of ☾] by 31 parts, the radiu

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								s of [C] being 100.
	Nou. 27	11	4 [Cancer]	4 51 A	P. Mareot.	0	0	
1643	Nou. 29		20 [Cancer □]	4 28 A	P. Mareot.	1	1	
	Dec. 2	4	27 [Leo]	2 0 A	P. Mareot.	2	2	
	Dec. 3	5	10 [Virgo]	0 0	P. Mareot.	2	2	The line of section passed across the eastern foothills [radices orient.] of M[ons]

Annus	Mensis . dies	Hor.	Longi- t. Luna e	Latit. Luna e	Libra- tio	Dist. iuxta Obs.	Dist. ex Tab.	Animad- vertenda (rem- arks)
								Aurei , throu- gh M[on- s] Pang- aeum , Olym- p[us], Didy- m[us] , the Anti- Liban- us, and Mt Fortis [Mon- tem Forte- m]; at hour 3, befor- e [last quart- er, □].

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
1643	Dec. 5	6½	4 [Libra]	1 0 S	P. Maraeot.	2	2½	
	Dec. 14	Vesp.	7 [Pisces]	3 30 S	P. Maeot.	½	2	
	Dec. 19	Vesp.	19 [Aries]	1 42 A	P. Maeot.	3½	3½	
1643	Dec. 31	3	17 [Virgo □]	0 9 A	P. Maraeot.	2½	2½	Mt Sinai stood 36 parts distant from the periphery.
1644	Ianuar. 1	3	17 [Gemini]	0 45 S	P. Maraeot.	2½	3	The section [ran] from Mt Argentarius [M. Argentari

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								um], across the strait [Sinu- m] to the Helle- spont [Helle- spont- um]; M[on- s] Masic- iam, M[on- s] Tabo- r betw- een [M[on- s]] Phoe- nice- m, and M[on- s] Crag- um noted

Annus	Mensis . dies	Hor.	Longi- tudo Luna e	Latitudo Luna e	Libra- tio	Distans iuxta Obs.	Distans ex Tab.	Animad- vertenda (remar- ks) at the true time [tem- pore vera], before [last quar- ter, □].
	Ian. 2	6	12 [Cancer]	1 55 S	P. Mareot.	3	3	
1644	Ian. 12		1 [Virgo]	1 33 S	P. Maeot.	1	2	
	Ian. 13		16 [Virgo]	0 8 S	P. Maeot.	2	2	
	Ian. 21		8 [Cancer □]	4 41 A	P. Maeot.	6	6	The inter- val, of all the most con- spic- uous, was at its

Annus	Menses . dies	Hor.	Longi- tudo Luna e	Latitudo Luna e	Libra- tio	Distans iuxta Obs.	Distans ex Tab.	Animad- vertenda (re- marks)
								wide st [dilatatum]. Mt Sinai stood 30 parts remote from the limb, the radius of [C] being 100.
1644	Ian. 22		21 [Cancer]	4 15 A	P. Maeot.	5	5¼	Wide st inter- val [Interstitium amplissimum].
	Febr. 17		8 [Taurus]	5 0 A	P. Maeot.	6	6	

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
	Febr. 19		us] 1 [Gem ini]	3 40 A	t. P. Maeo t.	5	6	It bega n to decre ase [<i>Decr escer e incipi ebat</i>].
1644	Mart. 15	7	19 [Pisce s]	5 12 A	P. Maeo t.	6	6	The line of sectio n adva nced near M[on s] Lygu slinu m and M[on s] Ment uniat em; throu gh

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								the eastern foothills of Mons Olympi & Didymi, and through the lower Anti-Libanus [M. inferi- orem Antili- bani], at hour 2 after the true [last quarter,

Annus	Menses . dies	Hor.	Longi- tudo Luna	Latitudo Luna	Libra- tio	Distans iuxta Obs.	Distans ex Tab.	Animadu- erenda (re- marks)
								□].
	Mart. 16		14 [Cancer □]	4 51 A	P. Maeot.	6	6	
	April. 9	8	27 [Taurus]	4 50 A	P. Maeot.	4½	14½	
1644	April. 10		12 [Gemini]	4 41 A	P. Maeot.	4	2½	
	April. 11		26 [Gemini]	5 5 A	P. Maeot.	5	5	
	April. 12		10 [Cancer]	4 44 A	P. Maeot.	6	6	The upper Lacus Hyperboreus [Lacus hyperboreus superior], and likewise the island

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								ds near the Caspi- an Sea, were 11 parts dista- nt from the limb, the radiu- s of [C] being 100.
1644	April. 13		23 [Canc- er]	45 A	P. Maeo t.	6	6	The line of sectio- n graze- d the easte- rn shore [littu- s orien-

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								tale] of the Pontus Euxinus [Pontus Euxinus]; Mons Catenaria Mundi, the eastern margin of the Insula Baetica [Insulae Baeticae], crossing throu

Annus	Menses . dies	Hor.	Longitudo Lunae	Latitudo Lunae	Libratio	Distans iuxta Obs.	Distans ex Tab.	Animadvertenda (remarks)
								through the western part of Mons Didymi, and through Mons Cydisium, at hour 2 before the true [last quarter, □].
April.	10	12	0 40 S	P.	3½	3½		
18		[Virgo]		Maeot.				
April.	10	18	0 44 S	P.	3	3		
20		[Libra]		Maeot.				

Annus	Menses . dies	Hor.	Longitudo Lunae	Latitudo Lunae	Libra tio	Distans iuxta Obs.	Distans ex Tab.	Animadvertenda (remarks)
			a]		t.			

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Annus	Menses . dies	Hor.	Longitudo Lunae	Latitudo Lunae	Libra tio	Distans iuxta Obs.	Distans ex Tab.	Animadvertenda (remarks)
1644	April. 21	11	1 [Aquarius]	3 33 S	P. Maeot.	1½	2	At full Moon [☾] the Moon was not yet quite complete in light at its eastern limb, but on the lower part,

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								name- ly the south- ern [Aust- r.], it was still notic- eably rough h [aspe- ra]; at hour 4 befor- e oppo- sition [♁].
	April. 23		14 [Aqui- arius]	4 15 S	P. Mara- eot.	4	4	Inter- val quite ampl- e [<i>Spati- um satis ampl- um</i>].

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
	April. 26		23 [Pisces]	5 0 S	P. Mareot.	5½	5½	
1644	April. 27	4	7 [Capricorn]	4 45 A	P. Mareot.	6	6	It proved altogether the widest [<i>Omnino amplissimum extitit</i>].
	Maij 10	9	18 [Cancer]	4 8 A	P. Maeot.	6	6	
	Maij 11	10	1 [Leo]	3 20 A	P. Maeot.	6	5½	Decreasing [<i>Decrescens</i>].
1644	Maij 12	9	14 [Leo]	2 30 A	P. Maeot.	5	5	The line of section [ran]

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								about the reefs [scop- ulos], rising up [hype- rb.] throu- gh M[on- s] Pang- aeum ; led to the easte- rn footh- ills of M[on- s] Olym- pi, throu- gh part of M[on- s] Didy- mi,

Annus	Mensis . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								and to Mt Fortis [M. Forte m]; at hour 5¼ after [last quart- er, □].
	Maij 13		16 [Leo]	1 43 A	P. Maeo t.	3½	4½	A simil- ar sectio- n to that whic- h was noted on 13 Marc- h, at hour 6 befor- e [last quart- er,

Annus	Mens. dies	Hor.	Longi- t. Luna e	Latit. Luna e	Libra- tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim- adue- rtend- a (rem- arks)
								□].
	Maij 14		8 [Virg o]	0 30 A	P. Maeo t.	4	4	
1644	Maij 15		20 [Virg o]	0 30 S	P. Maeo t.	4	4	
	Maij 18		26 [Libr a]	2 35 S	P. Maeo t.	3	3	Inter- medi- ate dista- nce [<i>Dist- antia inter- medi- a</i>].
	Maij 21		1 [Sagit- tariu- s]	4 51 S	P. Maeo t.	½	1	
1644	Iunij 17	10	28 [Aqu- arius]	4 50 S	P. Maeo t.	1	1½	
	Iunij 19		25 [Pisce- s]	4 50 S	P. Maeo t.	5	5	
	Iulij 7		1 [Virg o]	0 49 A	P. Maeo t.	5	5	It was decre

Annus	Mensis . dies	Hor.	Longit. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
1644	Iulij 11		19 [Aqu- arius]	3 17 S	P. Maeo- t.	2	3	asing [<i>Decre- scebat</i>]. The sectio- n passe- d throu- gh M[on- s] Ligus- tianu- m and M[on- s] Mont- uniat- em, and cross- ed throu- gh M[on- s] Crag- um [Crag- um

Annus	Mens. dies	Hor.	Longit. Luna	Latit. Luna	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks) trans- iuit].
	Iulij 14	9	25 [Aquarius]	5 0 S	P. Maeot.	2	2	
	Iulij 16	9	20 [Pisces □]	4 0 S	P. Maeot.	1	1	
1644	Iulij 19		28 [Pisces □]	3 20 S	P. Maeot.	0	0	Least libration [<i>Minima libratio</i>].
	Iulij 23	2	13 [Pisces □]	0 30 A	P. Maeot.	4	4	
	Iulij 24	3	29 [Pisces □]	1 50 A	P. Maeot.	4	4	
1644	Iulij 26	2	26 [Aries □]	3 53 A	P. Maeot.	3	3	A section nearly similar to that whic

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								h was noted on 8 Octo- ber of the year 1643, at hour 1 after [last quart- er, □]. It adva- nced more over throu- gh M[on- s] Arge- ntar[i- um], Meso- gis [Mes- ogis], the

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
	Aug. 10	7	20 [Aquarius □]	5 0 S	P. Maot.	2	2	western shore [or m occid.] of Sipyli , Tabo- r, etc.
	Sept. 7		28 [Aquarius □]	5 12 S	P. Maot.	2	2	
1644	Sept. 9		23 [Capricorn]	5 3 S	P. Maot.	½	1	The line of sectio- n [ran] throu- gh the weste- rn part of the

Annus	Menses	Horae	Longitudo	Latitudo	Libra	Distans	Distans	Animadvertenda
s	. dies		Luna	Luna	tio	iuxta	ex	(remarks)
			e	e		Obs.	Tab.	
								large dark lake [lacus nigri maioris]; the Insula Lesbos [Insulae Lesboid], the Insula Cyprus [Insulae Cypriam], M[ons] Albarim, and at the same

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								time [vna mq.] throu- gh a third part of M[on- s] Sinai, desce- nding on the weste- rn side [occi- dente vergi- s]; at hour 1 befor- e [last quart- er, □]. And never thele

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								ss it appe- ared some what conn- ected [aliq- uant o conn- exa].
	Sept. 12		1 [Aqu- arius □]	3 7 S	P. Maeo- t.	1	0	
	Sept. 18	11	19 [Arie- s □]	5 13 A	P. Mara- eot.	4	3	At full Moon [☉]: throu- gh M[on- s] Aur. to the easte- rn shore [ad- orā- or.]

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								of the Insula Besb., through Olympus], through 1/3 to the western [side] of Mons Didymus] ; so much so that at this interval it appeared as remote from

Annus	Mensis . dies	Hor.	Longi t. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim adue rtend a (rem arks)
								M[on s] Sinai as from the large r dark lake [lacu nigro maio r.]. True time [Tem p. vera, □].
1644	Sept. 23	3	29 [Gem ini □]	4 45 A	P. Mara eot.	3	3	At full Moon [☾]: throu gh the Pyra mide s [Pyra m.], M[on

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								s] Meso- g[is], acros- s the weste- rn shore [ora- m occ.] of M[on- s] Sipyli- , and Masic- iam; betw- een Mare Pamp- h[yli- um] and M[on- s] Liban- i; throu- gh M[on- s]

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								Tabid ” M[on- s] Sin[ai-], one diam- eter of the said mou- ntain ; at hour 7 befor- e [last quart- er, □].
	Octo- b. 8		13 [Capr- icorn]	4 10 S	P. Maeo t.	½	0	
	Nou. 5		22 [Capr- icorn]	3 26 S	P. Maeo t.	0	0	The Lacus Hype- rbore- us was obser-

Annus	Mensis	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								ved almo- st bene- ath the limb itself.
1644	Nou. 6	6	6 [Aqui- arius □]	2 30 S	P. Maeo- t.	0	0	On both sides [Vter q.] the Lacus Hype- rbore- us stood very close to the limb.
	Dec. 4		14 [Aqui- arius □]	2 38 S	P. Maeo- t.	0	0	
	Dec. 19	1½	6 [Virgo]	0 30 S	P. Mareot.	1	1	
1644	Dec. 21	7	5 [Capr]	2 0 S	P. Mara	2	2	Incre- asing

Annus	Mens. dies	Hor.	Longi t. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim adue rtend a (rem arks)
			icorn ?]		eot.			[<i>Cres cens</i>].
	Dec. 22		17 [Aqu arius]	3 15 S	P. Maeo t.	2	2½	
1645	Febr. 18		14 [Arie s]	3 38 A	P. Maeo t.	2	2	
1645	Mart. 4		10 [Gem ini]	5 6 A	P. Maeo t.	4	4	
	Mart. 7		22 [Canc er]	3 5 A	P. Maeo t.	5	5	Incre asing [<i>Cres cens</i>].
	Mart. 12		10 [Virg o]	1 0 S	P. Maeo t.	5	5	Decre asing [<i>Decr escen s</i>].

Page 3 of table (folio 185, PDF p. 219)

Annus	Mens. dies	Hor.	Longi t. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim adue rtend a (rem arks)
1645	Mart. 31		7 [Gem	5 10 A	P. Maeo	3	3½	Inter medi

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (remarks)
			ini]		t.			ate dista- nce [<i>Dist- antia inter- medi- a</i>].
	April. 3		20 [Cancer]	4 3 A	P. Maeot.	5	5	
	April. 7		12 [Virgo]	1 8 S	P. Maeot.	4½		
1645	April. 19	4	28 [Capricorn]	2 28 S	P. Maeot.	4	5	The boundary [Confinium] [ran] through the larger dark lake [lacum nigrum]

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (re- marks)
								mai.] — S. Tara- nt. — Phoe- nic. and Tabo- r, and cross- ed throu- gh the shore on the weste- rn side of the deser- t Zin [ora- m occ. deser- ti Zin]; at hour 4

Annus	Mensis	Hor.	Longit. Luna	Latit. Luna	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								before [last quart- er, □].
	Maij 8	8	12 [Leo]	110 A	P. Maeo t.	5	5	The line of sectio- n [ran] throu- gh M[on- s] Aurei , Mysi- um, Olym- p[us], Didy- m[us] , and at the same time appe- ared betw- een the

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								Anti- Libanus and Cydisium at hour 2 before [last quarter, □].
	Iun. 8	12	12 [Capricorn ?]	4 45 S	P. Maest.	3	3	That part toward the Eurus [Eurus] and the south [Australis], from the Lacus [as

Annus	Mensis . dies	Hor.	Longi t. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim adue rtend a (rem arks)
								far as M. arxot ide] to M[on s] Dala ng., was stron gly roug h and unev en [aspe ra, & inaeq ualis] .
1645	Sept. 5	10	10 [Pisce s]	20 A	P. Maeo t.	0	0	At full Moon [♌], the easte rn limb being scabr ous [scab

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduenda (remarks)
								ro], the upper and lower part were seen round enough and smooth [satis rotundas ac leues]; at hour 4 before [☉].
Sept. 13	2		22 [Gemini]	4 17 A	P. Mareot.	2	2½	The boundary of light and shad

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								ow [ran] throu- gh the large r dark lake [lac. nig. mai.], L. Trasi- m[en- us], M[on- s] Cadm- [us], betw- een Lib[a- nus] & Antil- iban- us]; and onwa- rd [perg- .]

Annus	Mensis	Hor.	Longit. Luna	Latit. Luna	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (re- marks)
								M[on- s] Seir cross- ed [tran- si], at hour 4½ after [last quart- er, □].
Octo- b. 5	8		4 [Gem- ini □]	4 55 A	P. Maeo- t.	3	3	At full Moon [☾]: the north- ern parts of the perip- hery appe- ared rathe- r roug- h [sat- anfra- ctuos

Annus	Mensis . dies	Hor.	Longi t. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim adue rtend a (rem arks)
1645	Octo b. 27	9	5 [Aqu arius]	0 53 S	P. Maeo t.	1	1	ae]. The sectio n [ran] at the weste rn footh ills [radi ces occ.] of the large r dark lake [lacu s nig. mai.], on throu gh to the easte rn footh ills [radi ces orien t.] of

Annus	Mens. . dies	Hor.	Longi t. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Anim adue rtend a (rem arks)
								M[on s] Sipyli , & Liban i; betw een Tabo r & Liban [us] it stood out, at the true time [tem pore vera, □].
	Nou. 27	7	21 [Pisce s]	3 1 A	P. Maeo t.	0	0	
	Dec. 21		9 [Canc er]	0 45 S	P. Maeo t.	0	1	
1645	Dec. 25		1 [Arie s]	3 52 A	P. Maeo t.	2	1	
	Dec. 31		27 [Gem	3 31 A	P. Maeo	3	3	Inter medi

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
			ini ☐]		t.			ate dista- nce [<i>Dist- antia inter- medi- a</i>].
1646	April. 29	9	1 [Canc- er]	4 1 A	P. Maeo t.	3½	4	At full Moon [☾] the limb [of ☾] was on all sides nearl- y roun- d, excep- t that on the south- ern part it was some

Annus	Mensis . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (re- marks)
								what more notic- eably scabr- ous [scab- rosus] and bent [flex- uosus]; wher- e the roug- hness exten- ded itself to about 90 degre- es of the perip- hery.
1646	Iunij 27	6	4 [Capr- icorn]	2 15 S	P. Maeo t.	2½	2½	At full Moon [♁] the

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (re- marks)
								limb of [☾] reached almost to the smaller western Palus [Palus d. occident. minor].
	Iulij	2	26 [Aquarius]	2 0 A	P. Mareot.	4	4½	
	Iulij	3 1	10 [Pisces]	3 0 A	P. Mareot.	5	5	
1646	Iulij	4 1	21 [Pisces]	3 50 A	P. Mareot.	5	5½	Interval quite ample [Satis]

Annus	Mensis . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								<i>amplum spatium</i>].
	Iulij 5	2½	1 [Aries]	4 30 A	P. Mareot.	5½	5½	The limb had with drawn yet farther from the Palus [Limbus à Palude adhuc magis recesserat]
	Iulij 6		14 [Aries]	5 0 A	P. Mareot.	5½	6	. The section crossed throu

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								gh the weste- rn footh- ills of the large r dark lake [occi- d. lacus nigri maio- ris] per Prom- . Luna e, to the easte- rn footh- ills [radi- ces orien- tal.] of Sipyli

Annus	Mensis . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
1646	Aug. 25		27 [Cancer]	15 A	P. Maeotic.	1	1½	e [last quarter, ☐]. The Maeotic limb [Lim- bus Maeo- tidis] was very close; but from the Lacus Hyper- boreus [the featu- re] was some- what far elong- ated [satis-

Annus	Menses . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								elong- abatur], just as the Palus Ama- doca [Pal. Ama- doca] was clearly con- spic- uous.
	Sept. 24	11	2 [Arie- s]	2 30 A	P. Maeo- tis.	½	½	At full Moon [☾] it was quite near the limb of the P[alu- s] Maeo- tis.

Annus	Mens. dies	Hor.	Longit. Luna	Latit. Luna	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
	Octo- b. 22		4 [Arie- s]	4 45 A	P. Maeo- t.	½	½	
1646	Nou- 19		16 [Arie- s]	0 A	P. Maeo- t.	0	0	
1647	Ian- 19	9	14 [Canc- er]	0 45 A	P. Maeo- t.	3	2½	
	Mart. 20		1 [Libra]	4 45 S	P. Maeo- t.	5	5	At full Moon [☾] the lower part of the limb was seen rough and unev- en [anfr- actuosa aspera].
1647	April. 12		28 [Canc- er]	1 5 S	P. Maeo- t.	1	2½	

Annus	Mensis . dies	Hor.	Longit. Luna e	Latit. Luna e	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
	Sept. 4		1 [Capricorn ?]	3 30 S	P. Maeot.	6	6	Interval quite ampl e [Inter uallu m admo dum ampl um extitit].
	Sept. 6		25 [Capricorn ?]	1 35 S	P. Maeot.	5½	5½	
1647	Sept. 11		24 [Aquarius]	3 20 A	P. Maeot.	3	3	Inter- medi- ate remo- tion [Rem- otio inter- medi- a].
	Sept. 21		28 [Gemini □]	0 48 A	P. Maeot.	5½	5½	
	Octo		3	0 20 S	P.	5	+5	Decre

Annus	Mensis . dies	Hor.	Longit. Luna e	Latit. Luna e	Libra tio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
	b. 4		[Capricorn □]		Maeot.			asing [<i>Decres-</i> <i>cen-</i> <i>s</i>].
1647	Octob. 5		15 [Capricorn]	0 35 A	P. Maeot.	5	4½	
	Octob. 6		27 [Capricorn]	1 40 A	P. Maeot.	4	4	
	Octob. 17	10	1 [Gemini]	2 55 A	P. Maeot.	6	6	Great- est remo- tion from the limb [<i>Maxi-</i> <i>ma-</i> <i>limbi-</i> <i>remo-</i> <i>tio</i>].
1647	Nov. 3		5 [Aquarius □]	2 40 A	P. Maeot.	4	4	The Palus Ama- doca [Palus Ama- doca]

Annus	Mens. . dies	Hor.	Longit. Lunae	Latit. Lunae	Libratio	Dist. iuxta Obs.	Dist. ex Tab.	Animaduer- tenda (rem- arks)
								was clearly seen.
	Nou. 6		11 [Pisces □]	4 40 A	P. Maest.	3	3	
	Nou. 12		25 [Taurus □]	3 18 A	P. Maest.	3	3	A very narrow w inter- stice appe- ared [<i>Inter- stitium valde artum appa- ruit</i>].

Parsing notes:

- The *Latit. Lunae* column carries a one-letter direction flag after the minutes: **A** = *Australis* (south) and **S** = *Septentrionalis* (north). These are transcribed verbatim as printed.
- The *Longit. Lunae* sub-headers read **O.** (= *gradus*, degrees) and **S.** (= *signa*, sign) with the zodiacal sign symbol; in each cell the degree-of-sign value precedes the sign symbol, and the minutes follow it. Zodiacal sign identifications are given in brackets; after the focused re-read, nearly all

sign glyphs are resolved with confidence — only the few genuinely ambiguous or gutter-lost glyphs retain a [?].

- The *Hor.* (hour-of-observation) column is frequently blank in the source on pp. 218–219; genuinely blank hour cells are left empty rather than flagged. Hour values are reckoned from noon; values >12 (none here) would not be impossibilities.
- The remarks (*Animaduertenda*) column is set in small italic with heavily abbreviated selenographic place-names (Hevelius's *Selenographia* nomenclature: M. = Mons/Mare, Ins. = Insula, lac. = lacus, etc.) and astronomical symbols (☾ = Moon, ☽ = opposition/full Moon, ◻ = quadrature/last quarter). Abbreviations are expanded in brackets where confident and left as printed (with the abbreviation point) where the expansion is uncertain.
- Two "Dist." columns (*iuxta Obse.* = by observation; *ex Tab.* = from the tables) hold small whole numbers and fractions (½, ⅔, ⅘, 3½, etc.); these are the limb-distances Hevelius is comparing observation against computation. Several anomalous magnitude spikes (13, 13½, 14½, 15, 15½, 25) are flagged as numerical impossibles below and transcribed as printed.

Observations of the libratory motion, both around Palus Maeotis and around Maraotis [Mare Maraoticum], made at Danzig [Gedani] by Johannes Hevelius [Hevelius].

(Table continued from the previous batch. The column headings are: Year [Annus] | Month, day [Mens. dies] | Hour [Hor.] | Moon's longitude [Longit. Lunæ: O. = degrees, S. = sign + minutes] | Moon's latitude [Latit. Lunæ, with A = Australis/south, S = Septentrionalis/north] | Libration [Libratio] | Distance of the limb according to observation [Dist. limbi iuxta Obs.] | Distance of the limb from the table [Dist. limbi ex Tab.] | Remarks [Animadvertenda]. The Libration column reads "P. Mæot." = Palus Maeotis or "P. Maraot." = Palus Maraotis. The italic remarks describe selenographic place-names and the appearance of the libration interstice.)

Year	Month, day	Hour	Lon g. O.	Lon g. S.	Lat.	A/S	Libratio	Dist. obs.	Dist. tab.	Remarks
1648	Jan. 3		20	☐ 0	5 0	A	P. Mæot.	2	2	Wa nin g [De

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Jan. 4		3	□ 4	4 40	A	P. Mæot.	1½	1½	cre cen s].
	Jan. 5		15	□ 8	3 56	A	P. Mæot.	1	1	
1648	Jan. 6		28	□ 8	3 7	A	P. Mæot.	0	½	Wa nin g [De cres cen s].
	Jan. 8		25	□ 11	0 55	A	P. Mæot.	0	0	Wa xing [Cre sce ns].
	Feb. 11		13	□ 8	4 0	A	P. Mæot.	1	1	□ A line of sect ion ran nea r Lac us Nig er maj or,

Year	Month, day	Hr.	Longitude O.	Longitude S.	Latitude	A/S	Library	Distance obs.	Distance tab.	Remarks
										through Sinus Promontorii Lunae, like the shore of S. Tarentus]; [the coast of Mons Tarentus]; it nearly touched M. Phoeniceis

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Library	Dist. obs.	Dist. tab.	Remarks
										[Mons Phoenicis], grazing Mons Tab or, embracing the western part ; M. Sina i, and with the cup of the upper figure on the circle of

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										the upper [figure] divided at no. 35 [num. 35], and below the cusp at 207 grad. [degrees].
	Feb. 2		7	□ 11	2 10	A	P. Mæot.	0	0	
	Feb. 4		20	□ 11	1 0	A	P. Mæot.	0	0	
	Feb. 5		3	□ 0	0 0		P. Mæot.	0	0	The interstice

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										[Interstitium] as much constricted as possible.
1648	Feb. 6		17	00	115	S	P. Mæot.	1	1	□ A section of 29 degrees in the northern part, and in Aust. [Australia] 117 (but

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										in the circumference. [super. num.] it touched; thus as also through M. Fortem, Diasmym. [Diasyrtos] Olymp. near Ligust. it passed in true

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Dec. 11 10		5	□ 0	5 10	A	P. Mæot.	4	4	time □).
164 2	Feb. 19 6		3	□ 0	0 52	A	P. Mæot.	2	2	
164 9	Mar. 24 9		15	□ 4	4 34	S	P. Mæot.	10	8	The interest was very much attenuated, so that it could scarcely be constricted further.
	Mar		13	□ 13	4 12	S	P.	1½	1½	

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	t. 26 6						Mæ ot.			
	April. 18		15	□ 8	3 6	S	P. Mæ ot.	0	0	Quite close to the limb [Ad mo du m vici na lim bo].
164 9	April. 19		26	□ 0	4 0	S	P. Mæ ot.	3	3	☾ At least full from the lower part , it was obs erv ed.
	April.		7	□ 0	2 26	S	P. Mæ	3	3	

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	26						ot.			
	Mai j 17		7	□ 0	4 33	A	P. Mæ ot.	0	0	The inte rstic e [Int erst itiu m] was so con stric ted as it coul d eve r be.
164 9	Nou . 15		16	□ 0	5 28	A	P. Mæ ot.	4	4½	
	Nou . 17		11	□ 0	1 34	A	P. Mæ ot.	13½	4	
	Nou . 18		23	□ 0	0 38	A	P. Mæ ot.	3	3	nea rly [fer è].
164 9	Nou . 27		6	□ 0	5 13	S	P. Mar aot.	6	6	□ A con fine of ligh

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Libration	Distance Dist. obs.	Distance Dist. tab.	Remarks
										t and shadow ran through Lacus Niger major, near r the extreme coast t of Sin. Tarrant. [Sinus Tarrantius], through M. Tabor; the radices

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Libration n	Dist. obs.	Dist. tab.	Remarks
										[roots] of Hermonthis to the west; M. Sinai was carried [ducebatur] on the circle in true [time]: 38, and 208 it showed in true time \square .

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Dec. 9		6	□ 0	5 10	A	P. Mar aot.	6	6	
	Dec. 24 6		27	□ 0	4 30	A	P. Mar aot.	4	4½	
164 2	Dec. 25 7		9	□ 0	5 0	S	P. Mar aot.	5	5	Waxing [Crescens].
	Dec. 26 7		21	□ 0	5 14	S	P. Mar aot.	5	5	
165 0	Januar. 10		4	□ 0	1 0	A	P. Mæ ot.	3½	4	
165 0	Feb. r. 11 10		1	□ 0	3 6	S	P. Mæ ot.	2½	2½	Waning [Decrescens].
	Feb. r. 12		12	□ 0	3 45	S	P. Mæ ot.	5	5	
	Feb. r. 14		6	□ 0	4 46	S	P. Mæ ot.	1	1	
165 0	Feb. r. 15		19	□ 0	4 56	S	P. Mæ ot.	0	0	Lacus Hyperb

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										orei [the Hyperborean lakes] almost deceived the sight.
	Feb r. 16		3	10	454	S	P. Mæ ot.	0	0	The interstice was almost the narrowest [strictissimum].
	Mar t. 6 6		7	10	410	A	P. Mæ ot.	4	4	
165	Mar		13	10	00		P.	3½	3½	Mid

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
0	t. 7						Mæot.			ding distance, about [Media circiter distantiā].
	Mar t. 9		13	□ 0	13	S	P. Mæot.	1	1	
	Mar t. 13		1	□ 0	4 47	S	P. Mæot.	1	1	nearly [ferè].
1650	Mar t. 16		10	□ 0	4 43	S	P. Mæot.	0	0	The limb [Limb us] was very near, yet a part

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										of the southern [Australis] limb was seen to be rough [aspera] and uneven [inaequalis], nearly [ferè].
	Mar t. 17		24	□ 0	4 10	S	P. Mæot.	0	0	
	Mar t. 18		9	□ 0	3 16	S	P. Maot.			

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
1650	April. 10		10	□ 0	5 8	S	P. Mæot.	1	1	
	April. 13 9		18	□ 0	4 12	S	P. Mæot.	0	0	We have scarcely ever seen the interstic e [Interstitium] so constricted.
	April. 15		16	□ 0	2 55	S	P. Mæot.	1	1	
1650	May j 12		10	□ 0	3 16	S	P. Mæot.	1	1	
	Iulij 7 10		28	□ 0	1 36	S	P. Mæot.	1	1	

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Aug . 39		25	□ 0	1 35	S	P. Mæ ot.	1	1	
165 0	Aug . 4		8	□ 0	0 25	S	P. Mæ ot.	1½	1½	
	Aug . 10		5	□ 0	4 54	A	P. Mæ ot.	4	4½	
	Aug . 11		10	□ 0	4 56	A	P. Mæ ot.	5	5	
165 0	Sept . 89		28	□ 0	4 47	A	P. Mæ ot.	5	5	∞ The nort her n peri phe ry [Per iph ery Bor eal.] fro m M. Ala bast rino as far as the

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										Hyperborean lakes [lacum hyperb. inf.] was observed to be notably rough [anfractuosa] and rough [aspera].
	Sept. 9		12	00	416	A	P. Mæot.	5½	5½	
	Sept		16	00	16	S	P.	0	½	Mar

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	. 13						Mar aot.			e Mar is [Sta gnu m Miri s] as if adh ere d to the lim b itsel f.
165 0	Nou . 4 8		1	□ 0	3 14	A	P. Mæ ot.	6	6	The inte rstic e was alm ost the gre ates t of all, and inde ed suffi cien tly am

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										ple above.
	Nov. 57		15	00	214	A	P. Mæot.	6	6	Never, that I know of, have I seen a wider interval [interillum].
	Dec. 36		24	00	120	A	P. Mæot.	6	5½	It appeared almost maximally dilated [dilatat

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
1651	April 29 10		1	□ 0	4 31	S	P. Mæot.	1	2	a].
	Mai j 1 10		26	□ 0	3 0	S	P. Mæot.	1	1	
	Mai j 4 9½		6	□ 0	0 30	A	P. Mæot.	0	0	
1651	Mai j 5 9½		20	□ 0	1 43	A	P. Mæot.	1	1	Palus Amadocawas seen almost beneath the very limb itself [sub ipso fere limbo

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Mai j 27		10	□ 0	4 0	S	P. Mæ ot.	1	1½	con spec ta].
	Mai j 29		4	□ 0	2 24	S	P. Mæ ot.	1	1	
165 1	Iun. 1 10		14	□ 0	1 5	A	P. Mæ ot.	0	0	The lim b ver y nea r to Pal us [Li mb us per qua m vici nus Pal udi]
	Dec. 19		4	□ 0	1 20	A	P. Mæ ot.	4	3½	.
	Dec. 20		16	□ 0	0 0		P. Mæ ot.	4	5	

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
165 1	Dec. 25		23	0	4 30	S	P. Mæ ot.	0	0	The limb very close [Limb us pro pin quis sim us].
165 2	Ian. 15		28	0	1 24	A	P. Mæ ot.	4	4	Waxing [Cre scens].
	Ian. 21		19	0	4 30	S	P. Mæ ot.	5	5	
165 2	Ian. 22 8		1	0	4 10	S	P. Mæ ot.	5	5	The limb had reached as far as the western

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Library Libratio n	Distance Dist. obs.	Distance Dist. tab.	Remarks Re mar ks
										side of Lacus major [Limbus adlatu s mai. occi d. per uen erat]. The space, indeed, between Insula Maris Caspia [Ins. Maris

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										Caspii] and the limb was very ample.
	Feb r. 21		5	□ 0	4 46	S	P. Mæ ot.	4	4	
	Feb r. 22		17	□ 0	4 15	S	P. Mæ ot.	5	4½	
165 2	Feb r. 24		10	□ 0	2 44	S	P. Mæ ot.	3	3	The limb had withdrawn very far from Palus [Limb us à Pal

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										ude quà m long issi mè desc esse rat].
	Mar t. 15 7		12	□ 0	4 20	A	P. Mæ ot.	6	6	
	Mar t. 16 11		25	□ 0	5 0	S	P. Mæ ot.	5½	5½	□ A line of sect ion thro ugh M. Aur eu m, nea r Ins. Bes b. on the righ t side M. Did

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										ym. passes through M. Armenia; an hour 1 before ☐.
1652	Mar. 17 10		8	□ 0	5 14	S	P. Mæot.	5	5	
	Sept. 17 8		25	□ 0	0 30	A	P. Mæot.	2½	3	Eclipse full Moon [Plenilunium Eclipticum]
	Oct. 12 7		19	□ 0	4 23	A	P. Mæot.	2½	2	.
165	Oct		8	□ 0	2 42	S	P.	4	4½	Pal

Year	Month, day	Hr.	Lon g. O.	Lon g. S.	Lat.	A/S	Libr atio n	Dist. obs.	Dist. tab.	Re mar ks
2	ob. 17						Mæ ot.			us Am ado ca ben eath the ver y lim b [Pal us Am ado ca sub ipso lim bo]. Mar e Mar is [Sta gnu m Miri s] as if adh ere d to the mar gin:

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Libration n	Distance Dist. obs.	Distance Dist. tab.	Remarks
										as yet the limb, Sinus Apollinis [Sinus Apollini], pressed in very much.
	Oct ob. 199		5	10	4 10	S	P. Mar aot.	4	4½	The limb was the very nearest [vicinities]: Mar

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Libration n	Dist. obs.	Dist. tab.	Remarks
										e Mar is [Sta gnu m Miri s] besi des had reac hed alm ost to the ver y mar gin.
	Oct ob. 20		17	□ 0	4 44	S	P. Mar aot.	0	0	
165 2	Oct ob. 21 10		1	□ 0	5 12	S	P. Mar aot.	0	0	The inte rstic e scar cely eve r offe red itsel

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Library	Dist. obs.	Dist. tab.	Remarks
										f to us nar row er [stri ctiu s]; Mar e Mar is [Sta gnu m], so ver y nea r the lim b, and so exte nde d it stoo d fort h, that it nea rly

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										cluded the practiced sight of the observer.
	Oct ob. 22 11		14	□ 0	5 0	S	P. Mar aot.	0	½	
	Nou . 13		27	□ 0	2 15	S	P. Mar aot.	4	4	The space appeared a little above the middle; so that the western lake

Year	Month, day	Hr.	Lon g. O.	Lon g. S.	Lat.	A/S	Libr atio n	Dist. obs.	Dist. tab.	Re mar ks
										of the maj or [sea] [lac us occi d. mai.] mig ht be see n ben eath the ver y lim b itsel f.

Year	Month, day	Hr.	Lon g. O.	Lon g. S.	Lat.	A/S	Libr atio n	Dist. obs.	Dist. tab.	Re mar ks
165 2	Nou . 14 8		12	□ 0	3 25	S	P. Mæ ot.	4½	4½	A littl e gre ater

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Libration n	Distance Dist. obs.	Distance Dist. tab.	Remarks
										it stood forth, so that both lakes [vertebr; lacus] could be seen; yet the greater lake as if adhered to the limb.
	Nov. 15 8		27	10	4 13	S	P. Mæot.	5	5	More and more it

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Libration n	Distance Dist. obs.	Distance Dist. tab.	Remarks Re mar ks
										waxes, waning by turns with the uppermost interstice [Magis magisq; crescent e, decreasing vicissim superiori interstitio].

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Dec. 169		16	□ 0	4 51	S	P. Mar aot.	0	0	Mar e Mar is ver y nea r to the lim b [Sta gnu m Miri s lim bo vici niss imu m].
165 2	Dec. 17		1	□ 0	4 12	S	P. Mar aot.	1	1	It wax ed [Cre uit].
165 3	Ian. uar. 9 6		1	□ 0	4 20	S	P. Mæ ot.	1	1	
	Ian. 13 6½		25	□ 0	4 20	S	P. Mæ ot.	5½	5½	The dist anc e ver

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										y gre at [Dis tant ia vald e mag na].
1653	Ian. 14 7		8	□ 0	3 33	S	P. Mar aot.	1	1	
	Feb r. 6		12	□ 0	5 2	S	P. Mæ ot.	5	5	
	Feb r. 7		21	□ 0	4 40	S	P. Mæ ot.	6	6	
1653	Feb r. 11		18	□ 0	3 0	S	P. Mæ ot.	5	5	♂ A not able rou ghn ess [As peri tas insi gnis] fro m Ins. Cer

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										cinna as far as the Montes Caucasos [Montes Caucasos] was detected.
	Mar t. 4 9½		24	10	4 46	S	P. Mæ ot.	6	4½	□ The section appeared exactly such as it had stood

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										d forth on 27 November in the year 164 9 in true time □.
	April	4	15	□ 0	4 31	S	P. Mæ ot.	6	6	
165	Mai	j 3	8	□ 0	3 40	S	P. Mæ ot.	5½	5½	
	Mai	j 6	14	□ 0	0 53	S	P. Mæ ot.	5	5	∞ The peri phe ry fro m the low est part was

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										observed quite uneven [admodum inaequalis] and rough [aspera].
	Dec. 4		15	□ 0	4 56	S	P. Mæot.	4	4	
1654	Feb. 11		18	□ 0	5 6	A	P. Mar aot.	4	4	
	Feb. 19		8	□ 0	1 0	S	P. Mæot.	6	6	
	April. 13 9		24	□ 0	2 37	S	P. Mæot.	5	5	□ The line of section

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										to the naked eye appears in part concave; but to the armed [eye = telescope] it had already gone beyond a straight line, and as if

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Libration n	Distance Dist. obs.	Distance Dist. tab.	Remarks ks
										convex it was seen on the part. The section, however, passed through M. Audum, M. Ysiu m, Olimp. Didym. and Antilib. [M. Antiliba

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										ni]: thus as in the lower limb at 24 and 219 grad. it touched. Hour 1 after □.
1654	April. 26		13	□ 0	0 50	A	P. Mæ ot.	4½	4½	
	Mai j 25		5	□ 0	2 34	A	P. Mæ ot.	5	5	
	Mai j 29		24	□ 0	4 55	A	P. Mæ ot.	3	3½	
1654	Juni j 8 3		2	□ 0	2 42	S	P. Mar aot.	5	5	□ The section to the

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										naked eye appeared concave, but to the armed [eye] convex. Mars is by so much the greater interval from the limb,

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Library ation	Distance Dist. obs.	Distance Dist. tab.	Remarks marks
										by how much it was removed from Mar e Eoo [Ma re Eou m]. The section at the very roots of the black lakes [lac us nigr i maj

Year	Month, day	Hr.	Longitude O.	Longitude S.	Latitude	A/S	Library	Distance obs.	Distance tab.	Remarks
										orum], through Prom. Lunae, Sint. Tarentinum through Montes Latronum, T. Tablor, was carried to the roots of M. Sinaia.

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	June 189		22	00	030	S	P. Mæot.	5½	5½	
	June 1910		6	00	045	A	P. Mæot.	5½	6	
1654	June 2511		5	00	52	A	P. Mæot.	3½	3½	Libration wanting [Libration decreases]
	June 279		15	00	459	A	P. Mæot.	2½	2½	.
	July 111		3	00	150	A	P. Maraot.	5	5	
1654	July 3110		7	00	116	S	P. Maraot.	6	6	The amplitude interesting [Amplissimum]

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Aug. 10		22	□ 0	2 15	S	P. Mæ ot.	6	6	interstitium]. It had decreased very little [Parum admodum decesserat].
	Aug. 3 10		19	□ 0	4 10	S	P. Mæ ot.	5	4½	
1654	Aug. 23 10		14	□ 0	3 30	A	P. Mæ ot.	2	2	
	Aug. 26 9		12	□ 0	1 0	A	P. Mæ ot.	1	1	
	Aug. 27 10		4	□ 0	0 55	S	P. Mæ ot.	0	0	Eclipse full

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										Moon [Plenilunium Eclipticum]. The space appeared quite tenuous [Spatium admodum tenuerunt].
1654	Aug. .28 10		17	10	147	S	P. Maot.	6	6	The maximu

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
	Aug. .29 11		3	□ 0	3 0	S	P. Mar aot.	5	5	m east ern libr atio n [Ma xim a libr atio orie ntal is]. It was wan ing [De cres ceb at].
	Aug. .31 11		28	□ 0	4 42	S	P. Mar aot.	4½	4½	Mor e and mor e [Ma gis mag isq;] .
165 4	Sept .1 10		12	□ 0	5 6	S	P. Mar aot.	4	4	□ The sect

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										ion to the naked eye seemed almost concave, though to the eye armed [with the telescope] it would indeed be bisected [bisect

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										a]. It passes, however, r, [through h] the minor or lake [Lacum nigr .min ore m], near M. Argent. [Mons Argenta rius , to the right side of

Year	Month, day	Hr.	Longitude O.	Longitude S.	Latitude	A/S	Library	Distance obs.	Distance tab.	Remarks
										Lacus Adriaticus [Lacus Adriaticus]; it cuts off the third part to the west of M. Sipli, and reaches to the roots of M. Crazi [M. Crazi],

Year	Month, day	Hr.	Longitude g. O.	Longitude g. S.	Latitude Lat.	A/S	Library ation	Distance Dist. obs.	Distance Dist. tab.	Remarks ks
										through Lib an. [M. Lib ani] M. Scir. [M. Scir onis , and Tec hisa nda m [Tec bisa nda m]: thus as in the upp er cus p on the lim b and hori zon,

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										[it] above number 34 graduated, and below the cusps at 211 1/2 graduated, it would cut. A section truly not able, since the libration

Year	Month, day	Hr.	Long. O.	Long. S.	Lat.	A/S	Libration	Dist. obs.	Dist. tab.	Remarks
										stood forth quite intermediate, at the maximum latitude of September in true time <input type="checkbox"/> to be observed.
	Sept. 3		11	10	50	S	P. Mar aot.	3	3	
	Sept. 6		11	10	344	S	P. Mar aot.	2	2	

Parsing notes: This table is dense and the figures partly faint at the gutter and along the inner edge. The Hour column (Hor.) is frequently blank where Hevelius did not record an hour; where a value follows the day in the "Mens. dies" column it is the recorded hour (e.g. "Feb. 1 11" = February 1 at hour 11). The Longitude is split: O. = whole degrees, S. = zodiac sign + minutes; many entries show 0 in one sub-column. Several year-cells in the leftmost column are blank where the year carries down from the row-group above; I have repeated the governing year at each visible group-marker. The 1642 and 1648 year-values that interrupt the otherwise 1648→1654 progression appear as printed (see anomalies). The marginalia symbols ☉ (opposition), ☾ (Moon), □ (a section/quadrant observation marker used by Hevelius), and ♂ are transcribed as printed. Latin selenonyms (Hevelius's *Selenographia* place-names: M. Sinai, Prom. Lunae, Sin. Tarantius, Mons Tabor, Lacus Niger, Mare Maris/Stagnum Miris, Palus Amadoca, Ins. Maris Caspii, etc.) are kept in their abbreviated Latin forms as printed, since they are proper names on Hevelius's lunar map.

Liber III — De Luna (continued)

Pierre Gassendi's Observations of the Librational Motion, both around Palus Maeotis and around Palus Maraotis

[Petri Gassendi Observationes motus Libratorij, tam circa Paludem Maeotidem, quam Maraotidem]

The table records, for each observation: the year; month and day; hour; the Moon's longitude (O. = degrees, S. = zodiacal sign); the Moon's latitude (in degrees and minutes, A = south, S = north); the libration point (P. Maeot. = Palus Maeotis [Mare Crisium]; P. Maraot. = Palus Maraotis); the limb-distance taken from the table [Dist. limbi ex Tab.]; and Gassendi's selenographic remarks on the libration according to his observations [Libratio secundum Observationes].

Year	Month -day	Hour	Long. ☾ (O°. S.)	Lat. ☽ (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
1636	Sept.		15 ☐	2 0 S	P.	1½	Easter

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
		23			Marao t.		n macul a seen close to the rising limb.
	Sept. 24		1 □	1 0 S	P. Marao t.	1	Still seen close by.
	Sept. 25		13 □	0 0	P. Marao t.	$\frac{3}{4}$	More constr icted [contr actor]
1636	Octob. 8		1 □	0 50 A	P. Maeot.	1	. The interst ice betwe en Macul a Caspia and the wester n limb of the Moon

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
	Octob. 9		15 □	0 45 A	P. Maeot.	¾	was so thinne d out that I have never seen it narro wer.
	Octob. 20	m.	14 □	2 0 S	P. Marao t.	1½	The same interst ice persist ed.
1636	Nou. 9	V.	3 □	4 0 S	P. Maeot.	1	The neigh boring easter n macul a very well obser ved at the limb. Most slende r: if ever

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							at any other time there was an interstice between Caspia and the limb, here it was scarcely $\frac{1}{3}$ — and even that more constricted than usual.
	Nou. 11		2 □	4 56 S	P. Maeot.	2	The interstice between the limb

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							and Caspia was seen to have increa sed perce ptibly.
	Nou. 19	m.	23 □	1 0 A	P. Marao t.	½	The easter n macul a very close to the limb.
1636	Nou. 20		5 □	2 0 A	P. Marao t.	0	The same, very close.
	Nou. 21		18 □	3 10 A	P. Marao t.	¼	A trifle more distan t.
	Dec. 5		16 □	3 15 S	P. Maeot.	0	Caspia right at the edge.

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
1636	Dec. 10		26 □	4 50 S	P. Maeot.	2	Caspia perce ptibly more distan t.
1637	Febr. 27	V.	17 □	4 50 S	P. Maeot.	1	Caspia very close to the limb.
	Febr. 28		1 □	5 8 S	P. Maeot.	1½	Closer to the limb.
1637	Mart. 1		13 □	5 0 S	P. Maeot.	1½	It had recede d little from the limb.
	Mart. 9		6 □	2 40 A	P. Maeot.	5½	Caspia still more distan t from the limb, and the interst ice

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							was seen to be more than half a degree of longit ude, etc.
	Mart. 10		20 □	3 40 A	P. Maeot.	6	The distan ce of Caspia the same.
1637	Iunij 29		14 □	5 10 A	P. Maeot.	6	Caspia stood off from the limb by as great an interv al as it is itself wide;

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							from this the two oblon g macul ae were seen more distinc tly.
	Iulij 27		24 □	5 15 A	P. Maeot.	5½	Caspia stood off from the limb by almost as much as it is itself wide.
	Octob. 3		7 □	4 46 S	P. Maeot.	0	Caspia fairly close to the wester

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							n edge: the smalle r oval- shape d macul a opposi te, set towar d the east, fairly immer sed.
1638	Ian. 24		25 □	4 15 S	P. Maeot.	1	Caspia was close to the limb, and thus very thin.
	Dec. 30		24 □	0 30 S	P. Maeot.	0	Caspia very close to the limb.

Year	Month -day	Hour	Long. ☉ (O°. S.)	Lat. ☉ (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
1639	Febr. 13	.	27 ☐	0 10 S	P. Maeot.	¾	Caspia very tight, and very close to the limb.
1642	April. 14		20 ☐	5 0 S	P. Maeot.	0	Caspia fairly far advan ced into the wester n limb.

Ismaël Bullialdus's Observations

[Ismaelis Bullialdi Observationes]

(Same column scheme as above.)

Year	Month -day	Hour	Long. ☉ (O°. S.)	Lat. ☉ (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
1643	April.	11	16 ☐	2 0 A	P.	2½	Caspia

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
	1				Maeot.		stood off from the limb by half the latitud e of the macul a itself.
	April. 24	8½	22 □	5 0 A	P. Maeot.	4½	Caspia stood off from the limb of the Moon by three- quarte rs of the latitud e of the macul

Year	Month -day	Hour	Long. ☉ (O°. S.)	Lat. ☽ (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
	April. 29	9	21 ☐	1 20 A	P. Maeot.	2½	a. Caspia stood off by less than half the macul a's width.
1643	Maij 3	8¼	12 ☐	3 0 S	P. Maeot.	¾	♂ Caspia was distan t from the limb by scarce ly a quarte r of its own latitud e. The adjace nt oblon g macul

Year	Month -day	Hour	Long. › (O°. S.)	Lat. › (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
	Maij 30		6 †	2 50 S	P. Maeot.	1	a had disapp eared. Caspia had drawn nearly up to the limb.
	Maij 31		20 †	3 35 S	P. Maeot.	¾	Still closer.
1643	Iunij 2		17 †	4 50 S	P. Maeot.	¾	♂ Caspia was off the limb by an interv al of less than a fifth part of its own latitud e, etc.
	Iunij 3	11	1 †	4 58 S	P. Maeot.	5	The macul a was

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
	Sept. 18	7½	28 □	4 35 S	P. Maeot.	¾	distan t by its whole length from the rising point, and even that small an interst ice was off. Caspia almost graze d the limb, but I did not see it any closer.
1643	Sept. 27		4 □	0 25 A	P. Maeot.	3½	♂ Caspia obser

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							ved at half its own latitud e, or a little more distan t, from the limb.
	Sept. 30		18 □	3 50 A	P. Marao t.	½	The easter n macul a had drawn up to the limb, so that the interst ice could fill its latitud e to the utmos

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
	Octob. 1		23 □	4 10 A	P. Marao t.	5%	t. The easter n macul a came nearer and was more contra cted; and I had not before seen it so close to the limb.
1643	Octob. 24		27 □	0 0	P. Maeot.	3	Caspia had recede d from the limb by seven-

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							twelft hs of the macul a's latitud e; the oblon g macul a appea red in the interst ice.
	Octob. 26	7	27 □	2 40 A	P. Maeot.	4	♂ Caspia stood off from the limb by three- quarte rs of the macul a's latitud e; in

Year	Month -day	Hour	Long.)(O°. S.)	Lat.)(O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
	Octob. 27	10	15 □	4 0 A	P. Marao t.	1	the interst ice two longis h macul ae were seen. The easter n macul a stood off by a little more than its own latitud e.
1643	Nou. 16	V.	27 □	4 16 S	P. Maeot.	1	Caspia stood off from the limb by a

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							quarte r of its own latitud e.
	Nou. 20		22 □	0 15 S	P. Maeot.	½	Caspia was off the limb by an interv al a little less than half its own latitud e.
	Nou. 21		7 □	1 0 A	P. Maeot.	3½	Caspia was off the limb by two- thirds of its own latitud e, and

Year	Month -day	Hour	Long.)(O°. S.)	Lat.)(O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							the oblon g macul a appea red in the interst ice.
1643	Nou. 22	12	20 □	2 15 A	P. Maeot.	½	Caspia stood off from the limb by three- quarte rs of its own latitud e.
	Nou. 30	12	5 □	3 45 A	P. Marao t.	1½	The easter n macul a stood off

Year	Month -day	Hour	Long. ☽ (O°. S.)	Lat. ☽ (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							from the limb by half of its own length .
1648	Mart. 30	8	25 ☽	0 20 A	P. Maeot.	0	Palus Maeot is was very close to the limb of the Moon.
1648	Iulij 22	9	2 ☽	4 47 S	P. Maeot.	2½	Palus Maeot is was still very close to the wester n limb. <i>[Margi n: From</i>

Year	Month -day	Hour	Long. » (O°. S.)	Lat. » (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s
							<i>a letter of Bullialdus to the author — Ex literis Bullialdi ad auctorem]</i>
	Iulij 24		1 □	5 6 S	P. Maeot.	3	The said macula had perceptibly receded from the edge.
	Aug. 26	8	21 □	0 6 S	P. Maeot.	5½	Palus Maeotis was at its greatest distance

Year	Month -day	Hour	Long. ⋈ (O°. S.)	Lat. ⋈ (O'. — A/S)	Librat ion	Dist. limbi ex Tab.	Librat ion accord ing to obser vation s ce from the limb.
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The Observations of P. Francesco Maria Grimaldi

[P. Francisci Mariae Grimaldi Observationes]

This page is laid out in two columns, each containing several short titled sub-tables. The column scheme for each sub-table is: year; month-day; Moon's longitude (O°. S = sign); Moon's latitude (O'. — A/S); the distance [Distantia]; whether the distance is at maximum or minimum [Maxim. / Minim.]; the value from observation [Ex Obse.]; and the value from the table [Ex Tab.].

Left column

Distance of Mare Crisium, or Palus Maeotis, from the western limb — both according to observation and according to our table, in parts of which the Moon's semidiameter is 100

[Distantia Maris Crisij, sive Palud. Maeotidis à limbo occidentali, tam secundum Observat. quàm nostram tabulam, in partibus qualium Semidiameter Lunae est 100]

Year	Month -day	Long. ⋈ (O°. S.)	Lat. ⋈ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1649	Aug. 12	13 □	4 0 B	Minim		6	5
	Aug. 21	20 □	5 0 A	Maxi m.		12	11
	Sept. 18	29 □	5 0 A	Maxi m.		11	11

Year	Month -day	Long.)(O°. S.)	Lat.)(O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1649	Octob. 14	13 □	5 0 A	Maxi m.		13	11
	Nou. 12	3 □	5 0 A	Maxi m.		14	11
	Dec. 11	1 □	5 0 A	Maxi m.		13	10
1650	Ian. 9	16 □	5 0 A	Maxi m.		11	10
	Mart. 7	14 □	0 0 A	Maxi m.		8	8
	Mart. 10	6 □	5 0 B	Minim .		3½	3
1650	April. 11	18 □	5 0 B	Minim .		4	4
	Maij 8	23 □	5 0 B	Minim .		4	4
	Iunij 6	6 □	5 0 B	Minim .		7	3½
1650	Iulij 2	18 □	5 0 B	Minim .		3	4
	Aug. 1	23 □	4 0 A	Minim .		4	3½
	Aug. 29	4 □	4 0 A	Minim .		5	5½
1650	Sept. 10	21 □	4 0 A	Maxi m.		11	11
	Octob. 7	1 □	5 0 A	Maxi m.		11	11
	Nou. 4	27 □	5 0 A	Maxi m.		11	11
1650	Dec. 2	17 □	2 0 A	Maxi m.		10½	11

Year	Month -day	Long. ☉ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
	Dec. 30	17 ☐	2 0 A	Maxi m.		11	11
1651	Febr. 25	3 ☐	5 0 A	Maxi m.		8	9
1651	Mart. 26	18 ☐	4 0 B	Minim .		7½	8
	April. 4	26 ☐	2 0 B	Minim .		3½	4
	Maij 4	4 ☐	1 0 A	Minim .		3½	4
1651	Maij 31	26 ☐	1 0 B	Minim .		3½	3½
	Iunij 1	4 ☐	0 0 A	Minim .		3	3½
	Iulij 25	3 ☐	1 0 A	Minim .		5	3½
1651	Aug. 21	25 ☐	1 0 A	Maxi m.		11½	11¾
	Octob. 27	28 ☐	½ 0 A	Maxi m.		11½	11½

Parsing notes: in this sub-table the Max/Min designation (Maxim./Minim.) appears as a single word per row in the "Distantia" column group; I have placed it in its own "Max/Min" column with the "Distance" cell left blank, since the printed table gives only the qualifier plus the two numeric columns (Ex Obse., Ex Tab.). Several latitude minute-values read "0" with the degree being the listed figure; faint cells flagged where uncertain.

Distance of the eastern limb of Macula Grimaldaea, or Palus Maraotidis, from the eastern limb of the Moon — both according to observation and according to our table, in parts of which the Moon's semidiameter is 100

[Distantia limbi orientalis Maculae Grimaldae, sive Pal. Maraotidis à limbo Lunae Orientali, tam secundum Observat. quàm nostram tabulam, in partibus qualium semidiam. Lunae est 100]

Year	Month -day	Long. ☉ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1649	Iulij 18	1 ☐	4½ A	Minim .		4½	4½
	Sept. 2	17 ☐	4 B	Maxi m.		14	11
	Sept. 30	24 ☐	4 B	Maxi m.		11	11
1649	Nou. 27	7 ☐	5 B	Minim .		11½	11
1650	Febr. 16	28 ☐	1 B	Maxi m.		12½	11
	Mart. 19	17 ☐	2 B	Maxi m.		9	9

[Margin note at foot of left column: *Margin: P. M... had preceded the limb... but it accedes; thus, by Pierre Gassendi's observation — Petrus... praecedebat à limbo... Frans autem accedebat, ideoque Petro (?)... Observationis* — partly illegible] [?]

Right column

Year	Month -day	Long. ☉ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1650	April. 26	18 ☐	4 A	Minim .		4	4
	Maij 25	17 ☐	3 A	Minim .		4	4
	Iunij 21	27 ☐	5 A	Minim .		4	4
1650	Iulij 19	7 ☐	2½ A	Minim .		3½	3½
	Aug. 16	19 ☐	4½ A	Minim .		4½	4
	Sept. 8	8 ☐	4½ A	Minim .		4	4

Year	Month -day	Long. ☾ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1650	Octob. 20	4 ☐	5 B	Maxi m.		10	11
	Dec. 17	11 ☐	4 B	Maxi m.		12	11

Distance of the northern limb of Endymion, or the hyperborean lake, from the northern limb of the Moon

[Distantia limbi Borealis Endymionis, sive lacus hyperborei à limbo Lunae boreali]

Year	Month -day	Long. ☾ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1650	April. 21	21 ☐	5 B	Minim .		3	0
	Iunij 7	21 ☐	4 A	Minim .		0	0
	Octob. 8	9 ☐	1½ B	Maxi m.		9	6
1650	Nou. 5	14 ☐	2 A	Maxi m.		10	10
	Dec. 1	1 ☐	2 A	Maxi m.		10	10
1651	Maij 26	26 ☐	4½ B	Minim .		2	2
1651	Iunij 22	22 ☐	4 A	Minim .		3	0
	Iulij 20	23 ☐	4 B	Minim .		4	0

Distance of the northern limb of Plato, or the greater black lake, from the northern limb of the Moon

[Distantia limbi borealis Platonis, sive lacus nigri maioris à limbo Lunae boreali]

Year	Month -day	Long. ☽ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1651	Iulij 4	28 ☐	5 A	Maxi m.		28	27
	Augl. 1	11 ☐	4 A	Maxi m.		26	27
	Aug. 29	21 ☐	4 A	Maxi m.		24	26

Distance of the Center of Tycho, or of Mount Sinai, from the southern limb of the Moon — both according to observation and according to our table

[Distantia Centri Tychonis, sive Montis Sinai à limbo Lunae Australi, tam secundum Observationes, quàm nostram Tabulam]

Year	Month -day	Long. ☽ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1649	Sept. 23	3 ☐	4 A	Minim .		28	30
	Nou. 14	11 ☐	4½ B	Maxi m.		40	39
1650	Febr. 16	11 ☐	4½ B	Maxi m.		40	39
1650	Mart. 18	6 ☐	3 B	Maxi m.		36	37
	April. 14	3 ☐	4½ A	Minim .		29	27
	Sept. 8	9 ☐	4½ A	Minim .		25	28
1651	Febr. 7	21 ☐	3 B	Minim .		17	37 [?]
	Iulij 3	13 ☐	5 A	Minim .		22	31
	Aug. 3	21 ☐	3 A	Minim .		24	30

Year	Month -day	Long. ☽ (O°. S.)	Lat. ☽ (O'. A/S)	Distan ce	Max/ Min	Ex Obse.	Ex Tab.
1651	Aug. 29	21 ☐	4½ A	Maxi m.		26	27
	Nou. 29	7 ☐	4½ A	Maxi m.		18	27

Parsing notes: the right column's sub-tables are heavily faded with show-through from the verso; longitude signs and several Ex Obse./Ex Tab. integers are faint. Values transcribed as best read; uncertain cells flagged. The "Febr. 7, 1651" row of the Tycho sub-table shows Ex Tab. "37" against Ex Obse. "17", a large discrepancy that may be a compositor error or a faded misread — flagged.

[Margin / foot of right column, partly illegible analytical note]: *Margin:... Bullialdus, when he reported these observations... in which the macula... is contained: but in our observations and in those communicated to us, the distance is not yet brought into agreement with the Almagestum Novum... [?]*

Liber III — De Luna (continued)

CAPVT XIII.

Brief Reply to Hevelius's Remonstrance. [*Breuis Responsio ad Heuelij expositulata.*]

[Margin: 1] There are two points in all that Hevelius, in the preceding Letter, supposes I have falsely ascribed to him. The first is the permanent residence, throughout this present age, of the maximum libration in Cancer and the minimum in Capricorn — not that he expressly stated this in so many words, but because no one could interpret his remarks otherwise. See Book IV, Chapter 5 of the *Almagestum Novum* [Almagestum Novum]. The second is the perpetual immobility of the libration's limits, which I asserted he held when in fact he taught the opposite.

[Margin: 2] As to the seat of the maximum libration in Cancer and the minimum in Capricorn: I could, on the basis of my own statements, have prudently interpreted this Hevelian view, throughout this present age of ours, as tying that maximum to Cancer and the minimum to Capricorn. For on page 211, number 6, in discussing this Hevelian view, he adds, speaking of it: "If, with the nodes

gradually changing in other respects, the libration may sometimes attain its maximum even in signs other than the ones we are accustomed to celebrate." By contrast, Hevelius, in Chapter 54, page 438, said: "Whether indeed it remains constantly so, the maximum and minimum libration in Cancer and Capricorn, will only be settled by the more prolonged passage of time, since the Moon still undergoes certain irregularities, etc." Therefore, when he uses the observations of Boulliau [Boulliau] and Gassendi [Gassendi], he himself gives no small occasion for supposing that more years are required before the maximum libration migrates from Cancer into another sign — since nonetheless, after a few years, it did migrate. But in truth Hevelius restricts that stationary state in Cancer to the years 1643, 1644, and 1645, and neither asserts anything about the future nor refers it to himself, unless he has something further to set against me. And so I am glad of the opportunity to explain this matter more clearly.

[Margin: 3] But as to what concerns the immobility of the limits: I did not attribute this to him absolutely, nor in that rigorous sense. For in Book IV, page 211, number 17, I retain "the limits of libration" as the very thing Hevelius does — "or as nearly as he taught it." And indeed, by the words of that same Question 7, I said: "It must be conceded by Hevelius, and from many of our own observations it stands certain — frequently confirmed, that the limits are nearly as he himself assigns." For although Hevelius once held those limits to be movable, he nonetheless takes care that the little net of the prior position not be disturbed: "I do not remove the limits in the present sense which he expressly stated"; namely: "Inasmuch as I take my whole position to rest on this opinion — that, with respect to the spots, the limits of maximum and minimum libration in the Moon will never vary, though the libration itself, namely the limits, will, in the same signs, persist permanently — though sometimes, according to the retrograde motion of the nodes from Cancer and Capricorn, advancing step by step." By which words he plainly teaches that the limits of libration do indeed vary, insofar as the lunar limits in the Zodiac, or with respect to the signs of the Zodiac, change; but that with respect to the lunar spots they always remain about the same. Yet afterwards, in the preceding Letter, he introduced a far larger net, and recognized that the line of the limit, distant by 90 degrees from the line of the nodes, ranged through about 35 degrees from the position laid down in Book IV of the *Almagestum Novum*, Chapter 9, Question 7. And from what is to be said below, it will appear far more plainly that those limits err by many more than 35 degrees — to such a degree that they are somewhat notably below the line drawn through the middle of Mare Crisium [Mare Crisium], the Caspian, and the spots of Grimaldi [Grimaldi]; somewhat notably above; namely, to a degree, the line of the limit. Yet truly he questions that the spots laid down in Question 9 have it in their

title: "Whether the limits of the maximum lunar libration lie in a determinate part of the Moon, and the limits of the nodes themselves, or the poles." But let them not perpetually adhere to the same signs. Again, since I give him thanks, because he most learnedly composed the Letter, and lest I should seem to be in doubt by the occasion, I should support it; now we must come down to other observations not commonly published in our *Almagestum*.

CAPVT XIV.

Observations Concerning the Mobility of the Poles, or of the Nodes of the Lunar Libration, from the Year 1649 to 1656. [*Observationes circa Mobilitatem Polorum, seu Nodorum Librationis Lunaris ab Anno 1649. ad 1656.*] For these, the Figure in the *Almagestum Novum*, Book 4, Chapter 7, is to be consulted, or Chapter 11 above.

It pleases me to bring forward here only those Observations from which something is established in some way about the place on the lunar limb of the conjoined Nodes, or of the Poles of the Lunar Libration; and others too, that pertain to libration of this kind. For although those observations exhibit, from one or another spot, only a particular detail of the libration on that particular day, nonetheless they may be compared with other observations which other men perhaps had in those same years; and, made public, they may serve toward the understanding of this period — which is indeed under investigation in the matter of lunar libration, but which we cannot yet perfectly determine — from those things which have hitherto been observed. So that the matter may become clearer, and that under one view the mobility of these Poles may appear, I deduce it from the observations themselves; for they are one and the same — namely, the line of one or the other of the Poles. And because the Lunar Libration itself is divided by us into eight parts, or octants, expressing the Limb itself in the image of the Lunar libration, we set down separately in the lateral column the number of the Octant in which the other Pole appears to be contained in this matter — so that from the twofold position contained here for any one spot, the very Observations may, in conjunction, determine something more accurately as to the said limb. For from the one Pole, the place of the other is at once known, being diametrically opposite.

Anno 1649.

July, day 28. The spot Grimaldi [Grimaldi] was distant from the lunar Limb by exactly as much as had been observed on the immediately preceding days.

Day 30 and 31. Grimaldi stood farther from the lunar limb than on the preceding day.

August 1 and 3. Grimaldi did not vary its distance from the lunar Limb.

Days 13 and 14. Mare Crisium did not vary its distance from the lunar limb, being nearest.

Days 15, 18, 19, and 21. Mare Crisium was increasing its distance from the limb.

Days 23, 24, and 26. Grimaldi was receding from the nearest limb.

Day 29. Grimaldi was receding from the lunar limb, while Plato [Plato] was approaching. From this it is gathered that the Pole of the libration of the other Pole lay between these two spots — that is, in the Octant. [Margin: I.]

Day 30 and 31. Grimaldi was receding from the limb.

September 1 and 2. Grimaldi was receding from the limb.

Days 3 and 4. Grimaldi was approaching the limb.

Days 12, 13, and 14. Mare Crisium was increasing its distance from the lunar limb.

Days 16, 17, 18, and 20. Mare Crisium did not vary its distance from the limb.

Days 23 and 24. Plato was receding from the limb.

Days 26 and 27. Grimaldi and Tycho [Tycho] were receding from the lunar limb; therefore the other Pole was perhaps in the first Octant. [Margin: I.]

Day 28. Grimaldi and Tycho were receding from the limb; but Plato was approaching; therefore the Pole was in the first Octant. [Margin: I.]

[Anno 1649, continued]

Day 29 and 30. Grimaldi was receding from the lunar limb.

October 11, 13, and 14. Mare Crisium was receding from the lunar limb.

November 9. Mare Crisium was approaching the limb.

Days 10, 12, and 13. Mare Crisium and Endymion [Endymion] did not vary their distance from the lunar limb.

Day 14. Mare Crisium was approaching the limb.

Day 21. Grimaldi and Sinus Roris were receding from the lunar limb, and the spots in Terra Siccitatis [the Land of Dryness] did not vary their distance from the lunar limb. Therefore the other of the Poles was perhaps in the second Octant. [Margin: II.]

Days 22, 24, and 25. Grimaldi was receding from the lunar limb, while Sinus Iridum, Plato, and Tycho did not vary. And therefore one of the Poles was perhaps in the second Octant. [Margin: III.]

Day 27. Grimaldi was receding from the limb.

December 9. Mare Crisium and Endymion were receding from the lunar limb, and on that account the Pole was in the first or second Octant. [Margin: I.]

Days 10, 11, and 12. Mare Crisium and Endymion did not vary their distance from the limb. [Margin: II.]

Days 12 and 13. Pitiscus was receding from the limb.

Day 22. Grimaldi was increasing its distance from the lunar limb; Tycho and the spots above Plato did not change theirs. Therefore one Pole was perhaps in the second Octant. [Margin: II.]

Anno 1650.

January 8. Mare Crisium, Endymion, and Pitiscus did not vary their distance from the limb.

Days 9 and 10. Mare Crisium and Endymion did not vary.

Days 11 and 12. Mare Crisium and Endymion were approaching the limb.

Day 14. Mare Crisium and Endymion were approaching the limb; but Tycho was receding; and on that account one of the Poles was in the first Octant. [Margin: I.]

February 9. Mare Crisium and Endymion were approaching the limb; Pitiscus was receding; therefore one of the Poles was in the first Octant. [Margin: I.]

Days 10, 11, and 12. Mare Crisium was approaching the limb; Pitiscus on day 10 was receding.

Days 15 and 16. Mare Crisium did not vary.

Days 17 and 18. Grimaldi was approaching the limb a little; Tycho did not vary.

Day 19. Grimaldi and Tycho were scarcely approaching the limb; Plato was scarcely receding. From this it is gathered that the other Pole was in the first Octant. [Margin: I.]

Days 21 and 22. Grimaldi and Tycho were strongly approaching the limb; but Plato was greatly receding; and so it is confirmed that the Pole was in the first Octant. [Margin: I.]

Days 25 and 26. Grimaldi was approaching the limb.

March 6, 7, and 8. Mare Crisium and Endymion were not approaching the limb.

Days 10, 11, and 12. Mare Crisium was approaching the lunar limb.

Day 13. Mare Crisium was approaching the lunar limb, and Plato and Aristoteles [Aristoteles] were receding from their own nearest limb; on that account the other of the Poles was in the third Octant. [Margin: III.]

Days 15 and 16. Mare Crisium did not vary.

Day 17. Mare Crisium was receding from the limb.

Day 20 and 24. Grimaldi was approaching the lunar limb; therefore one of the Poles was perhaps in the first Octant. [Margin: I.]

April 6. Mare Crisium and Endymion were approaching the lunar limb, and consequently one of the Poles was in the first Octant. [Margin: I.]

Day 7. Mare Crisium and Endymion were approaching the lunar limb; but Pitiscus was receding: whence it is confirmed that the other of the Poles was in the first Octant. [Margin: I.]

Days 9 and 10. Mare Crisium was approaching. Endymion did not vary.

Day 11. Mare Crisium and Endymion did not vary. Tycho was scarcely increasing its distance from the limb.

Day 12. Mare Crisium did not vary. Tycho was approaching the limb.

[Anno 1650, continued]

Days 13, 14, and 15. Tycho was approaching. Mare Crisium, Endymion, Aristoteles, and Plato were receding from the limb; on that account the Pole was in the first Octant. [Margin: I.]

Day 16. Tycho was approaching. Plato was receding.

Days 20, 21, and 23. Grimaldi was approaching.

Day 24. Grimaldi was approaching a little.

Day 25. Grimaldi was approaching, but on days 26 and 27 it did not vary.

May, day 7. Endymion did not vary. Mare Crisium was approaching the limb a little.

Days 11, 12, and 13. Endymion was receding from the limb.

Day 14. Mare Crisium, Endymion, and Aristoteles were receding from the limb.

Days 19 and 20. Tycho was approaching the limb. Plato was receding. Grimaldi was approaching a little. From these gather that the Pole was at the beginning of the Octant.

Day 24. Grimaldi was approaching the limb.

June 4, 5, and 6. Mare Crisium did not vary. Endymion was approaching the limb.

Days 10, 11, and 12. Mare Crisium and Endymion were receding from the limb. Tycho was approaching. The Pole therefore was in the Octant.

Day 18. Grimaldi was approaching the limb, and on days 23 and 24 it was already receding from the same.

July 4. Mare Crisium and Endymion were receding from the lunar limb.

Day 5. Mare Crisium and Endymion were receding from the lunar limb. Pitiscus was approaching. Therefore the Pole was in the Octant. [Margin: I.]

Day 7. Mare Crisium was receding from the limb.

Day 12. Mare Crisium was receding. Tycho was approaching the lunar limb; therefore the Pole was at the very beginning of the Octant. [Margin: I.]

Days 17, 18, 19, and 21. Grimaldi did not vary.

Days 22 and 23. Grimaldi was receding from the limb.

August 2, 3, 4, and 5. Mare Crisium and Endymion were approaching the limb. Pitiscus did not vary; from which the other of the Poles is detected to be in the Octant.

Days 6, 7, 8, and 9. Mare Crisium and Endymion were receding from the lunar limb.

Days 11 and 13. Tycho and Grimaldi were approaching the limb. Therefore the other of the Poles was in the Octant. [Margin: I.]

Days 15 and 16. Tycho and Grimaldi did not vary.

Day 17 to 22. Grimaldi was receding from the limb.

Days 30 and 31. Mare Crisium was receding from the limb.

September 1 and 4. Mare Crisium was receding from the lunar limb.

Days 5 and 7. Mare Crisium and Endymion were receding from the limb. But Tycho was approaching. Gather that one Pole was in the first Octant. [Margin: I.]

Day 8. Mare Crisium was receding from the limb. Tycho and Endymion did not vary.

Day 9. Mare Crisium, Endymion, and Tycho did not vary.

Day 12 to 18. Grimaldi and Tycho were receding from the limb. But Plato was approaching. The Pole was in the first Octant. [Margin: I.]

Days 19 and 20. Grimaldi was receding from the limb.

Days 29 and 30. Mare Crisium was receding from the limb. Endymion, however, and Pitiscus did not vary. The Pole therefore was perhaps at the beginning of the Octant. [Margin: I.]

October 2 and 3. Mare Crisium and Endymion were receding from the limb. Pitiscus was approaching: and on that account the Pole was in the first Octant. [Margin: I.]

Days 7 and 8. Mare Crisium, Endymion, Aristoteles, and Tycho did not vary.

Day 9. Mare Crisium, Endymion, and Aristoteles were approaching the limb. Tycho, however, was receding: on that account it must be said that the Pole was in the Octant. [Margin: I.]

Day 11 and 12. Grimaldi was receding from the limb. Tycho and Plato did not vary.

Day 15. Grimaldi and Tycho were receding from the limb, but Plato was approaching. It is shown that the Pole was in the Octant. [Margin: I.]

Day 16. Grimaldi and Tycho were receding from the limb.

Day 20. Grimaldi was receding from the lunar limb.

Days 21, 22, and 23. Grimaldi was approaching the limb.

[Anno 1650, continued]

Days 29 and 30. Mare Crisium and Endymion were receding from the lunar limb. Pitiscus was approaching: on that account it could be believed that the Pole was in the first Octant. [Margin: I.]

Day 31. Mare Crisium and Endymion were increasing their distance from the lunar limb.

November 2. Mare Crisium, Endymion, and the spots in Terra Siccitatis were receding from the lunar limb.

Day 3. Mare Crisium, Endymion, and Tycho were receding; and consequently the other of the Poles was perhaps in the first Octant. [Margin: I.]

Day 6. Mare Crisium and Endymion did not vary. Tycho was receding from the limb.

Days 9 and 10. Grimaldi and Tycho were receding from the limb. Sinus Roris did not vary; therefore the Pole was confirmed to be in the first Octant. [Margin: I.]

Days 11 and 12. Tycho did not vary. Grimaldi was receding from the lunar limb.

Day 28. Mare Crisium was increasing its distance from the lunar limb.

Day 29. Mare Crisium, Endymion, and Pitiscus were receding from the limb; on that account one of the Poles was in the second Octant. [Margin: II.]

December 9. Mare Crisium, Endymion, and Pitiscus did not vary.

Days 5, 6, and 7. Mare Crisium and Endymion were approaching the lunar limb. Tycho was receding. And the Pole was in the Octant.

Day 8. Tycho was receding from the lunar limb.

Days 12, 13, and 14. Harpalus in Sinus Roris was approaching the lunar limb; on that account the Pole was in the Octant. [Margin: I.]

Day 18. Grimaldi was beginning to approach the lunar limb.

Days 28 and 29. Mare Crisium was receding from the limb.

Day 30. Mare Crisium did not vary.

Day 31. Mare Crisium and Endymion were approaching the lunar limb. Pitiscus was receding; therefore the Pole must be said to have been in the libration's Octant. [Margin: I.]

Anno 1651.

January 1. Mare Crisium, Endymion, and Aristoteles were approaching the lunar limb. Pitiscus was receding; therefore the Pole was then in the Octant. [Margin: I.]

Days 8 and 9. Grimaldi was receding from the lunar limb. Tycho and Harpalus did not vary.

Day 14. Grimaldi was receding from the limb.

Day 31. Mare Crisium was approaching the limb.

February 3. Mare Crisium and Plato were approaching the lunar limb. Tycho was receding; on that account the other of the Poles was in the Octant. [Margin: I.]

Days 5, 6, and 7. Tycho and Grimaldi were receding from the limb. Plato, however, was approaching: from which gather that the Pole was in the Octant. [Margin: I.]

Day 9. Grimaldi did not vary. Plato and Harpalus in Sinus Roris were receding from the lunar limb; from which it is argued that the Pole was in the Octant. [Margin: III.]

Days 11 and 12. Grimaldi, Harpalus, and Plato were receding from the lunar limb. Tycho was approaching; and on that account the Pole must be said to have been in the Octant. [Margin: IV.]

Days 13 and 14. Grimaldi did not vary. Tycho was approaching the limb. Harpalus and Plato were receding from the lunar limb; whence it is gathered that the Pole was in the Octant. [Margin: III.]

Days 15 and 16. Grimaldi was already approaching the lunar limb. [Margin: IV.]

Day 27. Mare Crisium was approaching the lunar limb.

Day 28. Mare Crisium and Endymion were approaching the lunar limb.

March 1, 2, 4, and 6. Mare Crisium was approaching the lunar limb. Tycho did not vary.

Day 7. Grimaldi, Harpalus, Plato, and Endymion were receding from the limb; on that account the Pole was in the Octant. [Margin: III.]

Days 8 and 9. Grimaldi was receding from the limb.

Day 25. Mare Crisium was approaching the lunar limb.

Day 27. Mare Crisium and Endymion were approaching the lunar limb a little.

Days 28, 29, and 30. Mare Crisium, Endymion, and the spots in Terra Siccitatis were approaching the lunar limb, and on that account the Pole was in the Octant. [Margin: I.]

Day 31. Mare Crisium was approaching the lunar limb.

April 1 and 2. Mare Crisium and the spots in Terra Siccitatis were approaching the lunar limb.

Day 4. Mare Crisium and Plato did not vary.

Day 5. Mare Crisium, Plato, and Endymion were receding from the limb, and consequently the other of the Poles was in the Octant. [Margin: I.]

Day 6. Plato was receding from the lunar limb. Tycho did not vary.

Days 11 and 13. Grimaldi was approaching the limb.

Day 25. Mare Crisium was approaching the limb.

Day 26. Mare Crisium and Endymion were approaching the lunar limb.

Day 28. Pitiscus and Mare Crisium were approaching the lunar limb. Endymion and Aristoteles were receding from the lunar limb: with these positions laid down, one of the Poles was in the Octant. [Margin: III.]

Day 30. Mare Crisium was approaching the lunar limb. Endymion and Aristoteles were receding from the limb; and from these it is confirmed that the Pole was in the Octant. [Margin: III.]

May 1, 2, and 3. Mare Crisium and Tycho were approaching the lunar limb. Endymion and Aristoteles also were receding. Therefore the Pole was in the Octant. [Margin: III.]

Day 13. Grimaldi did not vary: the spots in Sinus Roris were receding a little from the limb. Tycho was approaching.

Day 14. Grimaldi was approaching the limb.

Days 27, 28, and 29. Mare Crisium was approaching the lunar limb. Endymion, however, and the spots in Terra Siccitatis were receding from the limb: and so the Pole must be said to have been in the Octant. [Margin: III.]

Days 30 and 31. Mare Crisium did not vary. Endymion and the spots in Terra Siccitatis were receding from the limb. Tycho, however, was approaching. The Pole therefore was in the Octant. [Margin: III.]

June 1, 2, and 3. Mare Crisium, Endymion, and the spots in Terra Siccitatis were receding from the lunar limb; Tycho on that account was approaching: on that account the Pole must be said to have been in the Octant. [Margin: IV.]

Days 13 and 14. Grimaldi did not vary. [Margin: IV.]

Day 23. Mare Crisium and Endymion did not vary. [Margin: I.]

Day 24. Mare Crisium did not vary. Endymion was increasing its distance from the lunar limb a little.

Day 26. Mare Crisium did not vary. Endymion was receding from the lunar limb. Pitiscus was approaching. Therefore one Pole was in the Octant. [Margin: IV.]

Days 27. Endymion and Aristoteles were receding from the limb. Langrenus and Pitiscus were approaching: therefore the Pole was in the Octant. [Margin: IV.]

July 1. Langrenus, Mare Crisium, Endymion, Aristoteles, Plato, and Sinus Roris were receding from the lunar limb. Tycho was approaching: from which it is fitting that the Pole was in the Octant. [Margin: IV.]

Day 2. Mare Crisium and Endymion were receding from the lunar limb. Tycho was approaching.

Days 3, 6, and 7. Grimaldi and Tycho were approaching the lunar limb.

Day 8. Grimaldi was approaching the lunar limb.

Day 9. Grimaldi was scarcely approaching. Tycho did not vary.

Day 11. Grimaldi and Tycho were receding from the limb. Harpalus and Plato were approaching: on that account the Pole was in the Octant. [Margin: III.]

Day 22 to 25. Mare Crisium did not vary. Endymion was receding from the lunar limb. Pitiscus was approaching. Therefore the Pole was in the Octant. [Margin: IV.]

Day 27 to August 1. Mare Crisium, Endymion, and Plato were receding from the lunar limb; that which indicate the Pole to have been in the Octant. [Margin: I.] [Margin: IV.]

August 3, 4, and 5. Tycho did not vary. Grimaldi and Harpalus in Sinus Roris were approaching the limb. Wherefore the Pole of the libration must be said to have been in the Octant. [Margin: II.]

Days 6 and 8. Grimaldi was scarcely approaching. Harpalus and Plato — [Margin: III.]

Liber III — De Luna (continued)

Caput XIV (continued): Observations on the Mobility of the Poles, or Nodes, of the Lunar Libration, from 1649 to 1656

[This batch continues the day-by-day catalogue. Each entry records which named lunar spots approached (accedebat) or receded from (recedebat) the Moon's limb on a given day, whether others remained unchanged (non variabat), and the libration-pole octant inferred from this, given in the source as a marginal Roman numeral I–IV. I have preserved the inferred octant at the end of each entry as a marginal note, e.g. [Margin: Octant III].]

Plato was approaching the Moon's limb; Tycho was receding. Therefore the Pole was in the octant. [Margin: Octant III]

Day 9. Harpalus was approaching the Moon's limb; Tycho was receding.

Day 10. Grimaldi and Harpalus were receding from the Moon's limb [Grimaldi marked with the spot-symbol ☉].

Days 11 & 12. Grimaldi was receding from the limb [☉].

Day 20, 21 & 22. Mare Crisium did not change; Endymion was receding from the limb [☉].

Days 23, 25 & 27. Mare Crisium, Langrenus, and Endymion were receding from the limb [☉]; Pitiscus was scarcely approaching. Therefore the Pole was in the octant. [Margin: Octant I]

Days 28, 29 & 30. Mare Crisium, Langrenus, Endymion, and Aristoteles were receding from the Moon's limb; Tycho and Plato did not change. Therefore the Pole was in the octant. [Margin: Octant II]

Day 31. Tycho did not change; Grimaldi, Harpalus, Plato, and Aristoteles were approaching the Moon's limb. The Pole was therefore in the octant. [Margin: Octant III]

September 1, 2 & 3. Grimaldi, Harpalus, and Plato were approaching the Moon's limb; Tycho, however, was receding. The Pole may therefore be said to have been in the octant. [Margin: Octant III]

Day 4. Grimaldi did not change; Tycho was receding from the limb [☉]; Harpalus and Plato were approaching the limb [☉]. Therefore the Pole was in the octant. [Margin: Octant III]

Day 6. Tycho and Grimaldi were receding from the limb [☉]; Harpalus and Plato were approaching. Thus the Pole was in the octant. [Margin: Octant III, alternatively IV]

Day 8. Tycho and Grimaldi were receding from the Moon's limb; Harpalus was approaching slightly. Therefore the Pole was in the octant. [Margin: Octant IV]

Days 18 & 19. Mare Crisium did not change; Endymion was receding from the Moon's limb.

Day 20. Mare Crisium was receding slightly from the limb [☉]; Endymion was strongly receding; Langrenus did not change; Pitiscus was approaching. Therefore the other of the Poles was in the octant. [Margin: Octant I]

Days 22, 23 & 24. Mare Crisium and Endymion were receding; Langrenus did not change. And so the Pole was in the octant. [Margin: Octant I]

Days 25 & 26. Mare Crisium and Langrenus were receding from the limb [☉]; Endymion and Tycho did not change. Accordingly the Pole was one in the octant. [Margin: Octant II]

Day 27. Mare Crisium, Langrenus, and Tycho were receding from the limb [☉]; Harpalus and Plato were approaching the limb. Therefore one of the Poles was in the octant. [Margin: Octant III]

October 3 & 4. Tycho, Grimaldi, Harpalus, and Plato did not change.

Day 20. Mare Crisium and Endymion were receding from the Moon's limb.

Day 27. Mare Crisium was receding from the Moon's limb.

November 20 & 21. Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb; Endymion and Aristoteles did not change. Therefore the Pole was in the octant. [Margin: Octant I]

Days 22, 23 & 25. Mare Crisium, Langrenus, and Tycho were receding from the Moon's limb; Endymion, Aristoteles, and Plato were approaching the limb. The Pole was therefore in the octant. [Margin: Octant III]

Day 26. Mare Crisium did not change; Langrenus and Tycho were receding; Endymion and Plato were approaching. And so the Pole was in the octant. [Margin: Octant IV]

Day 27. Tycho was receding; Harpalus was approaching the Moon's limb.

Day 28. Grimaldi and Harpalus were approaching the Moon's limb; Tycho and Plato did not change.

Day 30. Harpalus and Tycho did not change; Grimaldi was receding.

December 1. Grimaldi was receding from the limb [☉]; Tycho, Harpalus, and Plato did not change.

Day 5. Grimaldi, Harpalus, and Plato were receding from the Moon's limb [☉]; Tycho did not change. Accordingly the Pole was therefore in the octant. [Margin: Octant III]

Day 6. Grimaldi and Harpalus were receding from the limb [☉].

Day 20. Mare Crisium did not change.

Day 30. Grimaldi, Harpalus, and Plato were receding. ...from the Moon's limb; Tycho was approaching. From this the Pole is gathered to be in the octant. [Margin: Octant III]

Anno 1652.

January 17, 20 & 21. Mare Crisium did not change; Endymion was approaching; Langrenus and Pitiscus were receding from the limb; and on that account the Pole was in the octant. [Margin: Octant III]

February 1. Grimaldi was receding from the Moon's limb. [Margin: Octant IV]

Day 2. Grimaldi and Sinus Roris were receding from the Moon's limb. [Margin: Octant IV]

Day 3. Grimaldi did not change; Sinus Roris was receding from the Moon's limb.

Days 14 & 16. Mare Crisium did not change; Endymion was approaching; Langrenus and Pitiscus were receding from the Moon's limb; whence it is argued that the Pole was in the octant. [Margin: Octant III]

Days 18, 21 & 22. Langrenus, Mare Crisium, Endymion, Plato were approaching the limb [☉]. Therefore the Pole was in the octant. [Margin: Octant IV]

Day 26. Tycho was approaching the Moon's limb. [Margin: Octant I]

March 26. Grimaldi and the Ecliptic Shore [Littus Eclipticum] were receding from the limb.

May 15 & 16. Mare Crisium and Langrenus did not change; Endymion was receding; Langrenus was approaching the Moon's limb. Therefore the Pole was perhaps in the octant. [Margin: Octant IV]

Days 19 & 20. Endymion was receding; Mare Crisium and Langrenus were approaching the Moon's limb; Tycho did not change. The Pole was therefore in the octant. [Margin: Octant III]

Day 21. Endymion was receding; Mare Crisium, Langrenus, and Tycho were approaching the Moon's limb, on which account the Pole is confirmed to be in the octant. [Margin: Octant III]

Day 22. Mare Crisium and Endymion did not change; Langrenus and Tycho were approaching the Moon's limb slightly.

Day 28. Grimaldi did not change; Tycho was approaching the Moon's limb.

Days 30 & 31. Tycho, Grimaldi, the Ecliptic Shore, and Sinus Roris were approaching the limb [☉]. Therefore it is said that the Pole was at the beginning of the octant. [Margin: Octant II]

June 1. Grimaldi, the Ecliptic Shore, and Sinus Roris were approaching the Moon's limb; Kircher and Bettinus were receding from the limb. And so the Pole was in the octant. [Margin: Octant III]

Day 3. Grimaldi was approaching the Moon's limb.

Day 12. Endymion was receding from the Moon's limb.

Day 16. Mare Crisium was scarcely approaching the limb [☉]; Langrenus and Pitiscus were approaching the Moon's limb; Endymion, however, was receding. The Pole was therefore in the octant. [Margin: Octant III]

Day 18. Endymion was receding; Mare Crisium and Langrenus were approaching the Moon's limb; from which the Pole is confirmed to be in the octant. [Margin: Octant III]

Day 19. Endymion was receding; Mare Crisium, Langrenus, and Tycho were approaching the Moon's limb; and so the Pole is again confirmed to be in the octant. [Margin: Octant III]

Day 21. Mare Crisium and Langrenus did not change; Tycho was approaching the Moon's limb slightly.

Day 27. Tycho was receding from the Moon's limb; Plato and Sinus Roris were approaching the Moon's limb.

Day 28. Tycho was receding; Grimaldi, Sinus Roris, and Plato were approaching the Moon's limb. From this the Poles are deduced to have been in the octant. [Margin: Octant III]

Day 30. Grimaldi and the Ecliptic Shore were approaching the Moon's limb; Zucchius, Bettinus, and Kircher were receding from the limb. From which the Pole is confirmed in the octant. [Margin: Octant III]

July 1. Grimaldi did not change; Harpalus was approaching the Moon's limb; Zucchius, Bettinus, and Kircher were receding from the Moon's limb. The Pole was therefore in the octant. [Margin: Octant III, alternatively IV]

Day 2. Grimaldi did not change.

Days 10 & 11. Mare Crisium did not change; Endymion was receding; Langrenus was approaching the Moon's limb. On that account the Pole is to be said to have been in the octant. [Margin: Octant III]

Day 13. Mare Crisium, Langrenus, and Pitiscus were approaching the Moon's limb slightly; Endymion was receding. Therefore the Pole was in the octant. [Margin: Octant III, alternatively IV]

Day 14. Mare Crisium did not change notably; Endymion was receding; Langrenus and Pitiscus were approaching the limb [☉]; and on that account the Pole was in the octant. [Margin: Octant III]

Day 15. Mare Crisium, Langrenus, and Pitiscus were approaching... [Margin: Octant III, alternatively IV]

the limb [☉]; Endymion and Plato were receding from the limb. From which the Pole is held to have been in the octant. [Margin: Octant...]

Days 16 & 17. Mare Crisium, Langrenus, and Endymion did not change; Tycho was approaching the Moon's limb; Aristoteles was receding.

Day 19. Endymion, Mare Crisium, Langrenus, and Furnerius were approaching slightly the Moon's limb; Tycho was approaching. The Pole was therefore in the octant. [Margin: Octant I]

Day 20. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Tycho did not change.

Day 21. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Tycho and Sinus Roris did not change. Hence gather the Pole to have been in the octant. [Margin: Octant...]

Day 22. Grimaldi was approaching the Moon's limb; Tycho and Sinus Roris did not change. [Margin: Octant IV]

August 9, 11, 12 & 13. Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb; Endymion was receding — at which time the Pole is to be said to have been in the octant. [Margin: Octant...]

Day 14. Mare Crisium did not change.

Day 15. Mare Crisium was now receding from the Moon's limb; Endymion did not change.

Day 16. Mare Crisium, Langrenus, Furnerius, and Tycho were receding from the Moon's limb; Endymion did not change, and accordingly the Pole was in the octant. [Margin: Octant...]

Day 17. Mare Crisium, Langrenus were receding from the Moon's limb; Endymion did not change.

Day 18. Mare Crisium, Langrenus, and Tycho were receding from the Moon's limb; Plato was approaching. Therefore the Pole was in the octant. [Margin: Octant...]

Day 19. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Tycho did not change.

Day 20. Grimaldi, the Ecliptic Shore, and Plato were approaching the Moon's limb; Tycho did not change. Therefore the Pole was in the octant. [Margin: Octant...]

Days 22, 23 & 24. Grimaldi, the Ecliptic Shore, Harpalus, and Plato were approaching the Moon's limb; Tycho and Schillerus [Schillerus] were receding from the Moon's limb. And so the Pole was in the octant. [Margin: Octant III, alternatively IV]

Day 26. Grimaldi, Harpalus, and Plato were approaching the Moon's limb; Tycho was receding. Therefore the Pole is confirmed in the octant. [Margin: Octant...]

September 9. Mare Crisium and Langrenus were approaching the Moon's limb; Endymion was receding. Therefore the Libration Pole was in the octant. [Margin: Octant...]

Day 12. Mare Crisium and Langrenus were receding from the limb.

Days 13, 14 & 15. Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb; Endymion did not change.

Day 16. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Endymion, however, was approaching. Therefore the Pole was in the octant. [Margin: Octant...]

Day 17. Mare Crisium, Langrenus, Pitiscus, and Tycho were receding from the Moon's limb; Endymion and Plato were approaching the Moon's limb. And so the Pole was one in the octant. [Margin: Octant...]

Day 18. Tycho was receding from the limb; Grimaldi and Plato were approaching the Moon's limb. And so the other Pole was in the octant. [Margin: Octant...]

Day 19. Grimaldi, Harpalus, and Plato were approaching the Moon's limb; Tycho and Schikardus [Schikardus] were receding from the limb. Whence the Pole is to be said to have been in the octant. [Margin: Octant...]

Day 20. Grimaldi was approaching the Moon's limb; Schikardus, however, was receding. Therefore the Pole was in the octant. [Margin: Octant...]

Day 22. Grimaldi, Harpalus, and Plato were approaching the Moon's limb; Schikardus indeed was receding; from which it is further confirmed the Pole was still in the octant. [Margin: Octant...]

Day 26. Grimaldi did not change; Harpalus and Plato were approaching the Moon's limb.

October 13 & 14. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Endymion did not change.

Day 15. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Endymion was approaching. Therefore the Pole was in the octant. [Margin: Octant III]

Day 16. Mare Crisium did not change; Langrenus and Furnerius were strongly receding from the Moon's limb; Endymion was approaching the limb. The Pole was therefore still in the octant. [Margin: Octant III]

Day 17. Langrenus, Furnerius, and Tycho were receding from the Moon's limb; Grimaldi, the Ecliptic Shore, and Plato were approaching the Moon's limb. On that account the Pole is to be said to have been in the octant. [Margin: Octant III]

Day 18. Tycho was receding from the Moon's limb; Grimaldi, Harpalus, and Plato were approaching the Moon's limb. From which the Pole is confirmed in the octant. [Margin: Octant III]

November 11 & 12. Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb; Endymion was approaching. And so the Pole was detected in the octant. [Margin: Octant...]

Day 13. Mare Crisium did not change notably; Langrenus and Pitiscus were receding; Endymion and Plato were approaching the limb.

Day 14. Mare Crisium, Langrenus, and Pitiscus were receding from the limb; Endymion and Plato were approaching the limb. From which again follows the Pole to have been in the octant. [Margin: Octant...]

Day 18. Grimaldi, Harpalus, and Plato did not change; Tycho was approaching the Moon's limb slightly.

Day 27. Grimaldi and the Ecliptic Shore were receding from the Moon's limb.

December 6 & 7. Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb; Endymion did not change.

Days 8 & 9. Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb; Endymion was approaching. Accordingly the Pole was in the octant. [Margin: Octant...]

Day 11. Mare Crisium, Langrenus were receding from the Moon's limb; Endymion was approaching. And this is confirmed: the Pole was in the octant. [Margin: Octant III]

Day 12. Mare Crisium and Endymion did not change notably; Langrenus, Furnerius, and Claramontius [Claramontius] were receding from the Moon's limb.

Day 13. Mare Crisium, Langrenus, Furnerius, and Claramontius were receding from the Moon's limb; Endymion did not change; Plato was approaching the Moon's limb. With these granted, the Pole was in the octant. [Margin: Octant...]

Days 17 & 18. Grimaldi did not change; Tycho was approaching; Harpalus and Plato were approaching the limb [☉]. [Margin: Octant IV]

Day 20. Tycho was approaching the Moon's limb; Grimaldi, Harpalus, and Plato were approaching the Moon's limb; consequently the Pole was in the octant. [Margin: Octant III]

Days 21 & 22. Plato and Tycho did not change; Grimaldi, Harpalus, and the Ecliptic Shore were receding from the Moon's limb.

Day 23. Grimaldi, Harpalus, and the Ecliptic Shore were receding from the Moon's limb.

Anno 1653.

January 6. Mare Crisium, Langrenus, and Petavius [Petavius] were receding from the Moon's limb; Endymion was approaching. The Libration Pole was in the octant. [Margin: Octant...]

Day 7. Mare Crisium was receding slightly from the limb; Langrenus and Petavius were strongly receding from the Moon's limb; Endymion did not change.

Day 8. Mare Crisium, Langrenus, Petavius, and Claramontius were receding from the Moon's limb; Endymion did not change.

Day 9. Mare Crisium was receding slightly; Petavius and Claramontius were receding from the limb [☉]; Endymion was scarcely approaching, and so the Pole was in the octant. [Margin: Octant III]

Days 10 & 12. Mare Crisium was approaching slightly; Langrenus and Petavius were receding from the Moon's limb; Endymion did not change appreciably.

Day 14. Tycho, Grimaldi, and Harpalus did not change.

Day 15. Tycho and Grimaldi did not change; the Ecliptic Shore, Harpalus, and Plato were receding from the Moon's limb.

Day 16. Grimaldi did not change; the Ecliptic Shore, Harpalus, and Plato were receding from the Moon's limb. On that account the Pole is said to have been in the octant. [Margin: Octant III]

February 2. Mare Crisium, Langrenus, and Petavius were receding from the Moon's limb; Endymion did not change.

Day 7. Mare Crisium was receding slightly from the limb [☉].

Day 9. Endymion was receding from the Moon's limb.

Day 10. Mare Crisium and Endymion were receding from the Moon's limb; Pitiscus was approaching. Therefore the Pole is to be said to have been in the octant. [Margin: Octant I]

March 2. Messhala [Messhala] did not change; Furnerius was receding from the Moon's limb.

Day 3. Messhala and Furnerius were receding from the limb [☉].

Day 7. Mare Crisium and Langrenus were receding from the Moon's limb.

Day 10. Mare Crisium was scarcely approaching the Moon's limb; Plato was receding from the Moon's limb; Furnerius was approaching; and so the Pole is to be said to have been in the octant. [Margin: Octant IV]

Day 11. Mare Crisium did not change; Langrenus and Furnerius were approaching the Moon's limb; Endymion and Aristoteles were receding from the limb. For that reason the Pole was in the octant. [Margin: Octant III]

Day 12. Mare Crisium, Langrenus, and Furnerius were approaching the Moon's limb; Endymion and Aristoteles were receding from the limb. Therefore the Libration Pole was in the octant. [Margin: Octant III, alternatively IV]

Day 13. Mare Crisium, Langrenus, Furnerius, and Tycho were approaching the Moon's limb; Endymion and Aristoteles were receding from the limb. From which the Pole is confirmed in the octant. [Margin: Octant III]

Day 14. Harpalus and Plato were receding from the Moon's limb.

Day 15. Harpalus and Plato were receding from the Moon's limb; Tycho was approaching; Grimaldi did not change.

April 1 & 2. Mare Crisium and Seneca [Seneca] were near it, and likewise Langrenus was approaching the Moon's limb.

Day 3. Mare Crisium and Langrenus were receding from the Moon's limb; Endymion did not change.

Day 4. Mare Crisium and Langrenus were receding from the Moon's limb.

Day 7. Mare Crisium was scarcely receding; Endymion too was receding from the Moon's limb.

Day 8. Mare Crisium and Langrenus did not change; Endymion was receding from the Moon's limb.

Day 10. Endymion was receding from the Moon's limb; Langrenus and Pitiscus were approaching the Moon's limb. Therefore the Pole was in the octant. [Margin: Octant III]

Days 19 & 20. Grimaldi and the Ecliptic Shore were approaching the Moon's limb; Tycho did not change; Plato and Sinus Roris were scarcely approaching the Moon's limb. [Margin: Octant III, alternatively IV]

Day 22. Grimaldi was approaching the limb slightly from the Moon's limb; the Ecliptic Shore and Harpalus were approaching the Moon's limb, and consequently the Pole was argued to be in the octant. [Margin: Octant IV]

Day 23. Grimaldi was receding from the Moon's limb; the Ecliptic Shore was approaching the Moon's limb, and so the Pole is confirmed in the octant. [Margin: Octant IV]

May 2 & 3. Mare Crisium, Endymion, and Langrenus were receding from the Moon's limb.

Day 4. Endymion and Mare Crisium were receding from the Moon's limb; Langrenus did not change.

Days 6 & 7. Mare Crisium did not change; Endymion was receding; Langrenus and Pitiscus were approaching the Moon's limb. The Pole was therefore in the octant. [Margin: Octant III]

Day 8. Endymion was receding; Mare Crisium, Langrenus, and Pitiscus were approaching the Moon's limb. Therefore the Pole was in the octant. [Margin: Octant III, alternatively IV]

Day 9. Mare Crisium, Langrenus, and Pitiscus were approaching the Moon's limb; Endymion and Aristoteles were receding from the limb. And the Pole was hence confirmed in the octant. [Margin: Octant III]

Day 10 & 11. Mare Crisium and Langrenus were approaching the Moon's limb; Endymion did not change.

Day 14. Tycho, Riccioli, and the Ecliptic Shore were receding from the Moon's limb; Sinus Roris did not change.

Day 17. Grimaldi and the Ecliptic Shore were receding from the Moon's limb; Tycho and Sinus Roris did not change.

Day 19. Tycho and Sinus Roris did not change; the Ecliptic Shore was approaching the Moon's limb; Grimaldi did not change.

Day 20. Grimaldi did not change; the Ecliptic Shore and Sinus Roris were approaching the limb.

Days 21 & 22. Grimaldi did not change; Schikerus [Schikerus] was receding; the Ecliptic Shore and Sinus Roris were approaching...

the Moon's limb. From which the Pole is gathered to have been in the octant. [Margin: Octant III]

Day 30. Mare Crisium and Endymion did not change. [Margin: Octant IV, alternatively...]

Day 31. Mare Crisium did not change; Endymion was receding from the Moon's limb. [Margin: Octant IV]

June 1. Mare Crisium and Endymion were receding from the Moon's limb; Langrenus was approaching. Therefore the Pole was in the octant. [Margin: Octant IV]

Day 3. Mare Crisium and Endymion did not change; Langrenus was approaching the Moon's limb.

Day 5. Endymion did not change; Mare Crisium and Langrenus were approaching the Moon's limb.

Days 6, 7, 8 & 9. Mare Crisium, Langrenus, and Pitiscus were approaching the Moon's limb; Endymion did not change. Therefore the Pole was in the octant. [Margin: Octant III]

Day 10. Endymion, Mare Crisium, Langrenus, and Pitiscus were approaching the Moon's limb. The Pole was therefore in the octant. [Margin: Octant II]

Day 11. Tycho did not change.

Day 16. Grimaldi did not change; the Ecliptic Shore was approaching.

Days 18 & 20. Grimaldi, the Ecliptic Shore, and Sinus Roris were approaching the Moon's limb; Tycho was receding from the limb. Therefore the Pole was in the octant. [Margin: Octant III]

July 1. Mare Crisium and Langrenus did not change; Endymion was receding from the Moon's limb.

Days 4 & 5. Mare Crisium and Langrenus were approaching the Moon's limb; Endymion did not change.

Day 7. Mare Crisium, Langrenus, and Pitiscus did not change.

Day 9. Mare Crisium, Langrenus, and Pitiscus did not change; Endymion was scarcely approaching the Moon's limb.

Day 13. Grimaldi was receding from the Moon's limb; the Ecliptic Shore was approaching. Therefore the Pole was at the libration in the octant. [Margin: Octant IV]

Day 14. Tycho and Grimaldi were receding from the limb [☉]; the Ecliptic Shore and Sinus Roris were approaching the limb; and so the Pole was in the octant. [Margin: Octant IV]

Day 15. Grimaldi did not change; Tycho was approaching; the Ecliptic Shore and Sinus Roris were approaching the Moon's limb. And consequently the Pole was in the octant. [Margin: Octant III]

Days 17 & 18. Tycho was receding; Grimaldi, the Ecliptic Shore, Sinus Roris, and Plato were approaching the limb [☉]. From which the Pole is deduced to have been in the octant. [Margin: Octant III, alternatively IV]

Day 21. Grimaldi was approaching the Moon's limb.

Day 30. Mare Crisium was scarcely approaching the Moon's limb; Endymion was receding. Therefore the Pole was in the octant. [Margin: Octant III]

August 1, 3 & 5. Mare Crisium and Langrenus were approaching the Moon's limb; Endymion did not change.

Day 6. Mare Crisium, Langrenus, and Pitiscus did not change; Endymion was scarcely approaching the limb [☉].

Days 7 & 8. Mare Crisium did not change; Endymion was approaching; Langrenus and Pitiscus were approaching the Moon's limb.

Day 11. Tycho was receding; Plato and Sinus Roris were approaching the limb.

Days 12, 13 & 15. Tycho was receding; Grimaldi, Sinus Roris, and Plato were approaching the Moon's limb. The Pole was therefore on that account in the octant. [Margin: Octant III]

Days 18 & 19. Grimaldi and Sinus Roris were approaching the limb.

October 6. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Endymion was approaching. On that account the Pole was in the octant. [Margin: Octant III]

Day 29. Mare Crisium did not change; Endymion was approaching; Langrenus and Pitiscus were receding from the Moon's limb.

November 1 & 3. Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb; Endymion was approaching. On that account the Pole in the octant. [Margin: Octant III]

Days 28 & 29. Mare Crisium did not change; Langrenus, Furnerius, and Pitiscus were receding from the Moon's limb.

December 1, 3 & 4. Mare Crisium, Langrenus, and Furnerius were receding from the Moon's limb; Endymion did not change.

Days 5 & 6. Grimaldi was approaching the Moon's limb.

Days 7 & 8. Tycho, Grimaldi, Sinus Roris, and Plato were approaching the limb [☉]. Therefore the Pole was in the octant. [Margin: Octant II]

Liber III — De Luna (continued)

Caput XIV (continued) — Day-by-day libration-pole catalogue

(Catalogue continued from the prior batch; entries record which named lunar spots approached or receded from the Moon's limb, with the inferred octant of the libration pole given as a marginal Roman numeral.)

[Year] 1654 (*continued from 1653; the 1654 heading appears mid-column on this page*)

- Dec. 9: Tycho was approaching the Moon's limb. Grimaldus did not vary.
- Dec. 29: Mare Crisium, Langrenus, and Pitiscus were receding from the Moon's limb.

Anno 1654.

- Jan. 1: Mare Crisium and Langrenus were receding from the Moon's limb.
- Jan. 3: Endymion was receding from the Moon's limb. Tycho was approaching.

- Jan. 4: Tycho was approaching. Grimaldus, Harpalus, and Plato did not vary.
- Jan. 6 and 7: Grimaldus did not vary. Tycho was approaching. Plato was receding from the Moon's limb.
- Jan. 25: Mare Crisium did not vary. Endymion scarcely approached. Langrenus and Pitiscus were approaching the Moon's limb.
- Jan. 26 and 27: Mare Crisium, Langrenus, Furnerius, and Pitiscus were receding from the Moon's limb. Endymion did not vary.
- Jan. 28: Mare Crisium, Endymion, Langrenus, and Furnerius were receding from the Moon's limb.
- Jan. 29, 30, and 31: Mare Crisium, Langrenus, and Furnerius did not vary. Endymion and Plato were receding from the Moon's limb.
- Feb. 1: Mare Crisium, Endymion, and Plato were receding from the Moon's limb.
- Feb. 23: Mare Crisium and Langrenus were receding from the Moon's limb. Endymion perhaps was approaching.
- Mar. 3: Tycho was approaching. Plato was receding from the Moon's limb.
- Mar. 5: Tycho was approaching. Plato and Harpalus were receding from the Moon's limb. Grimaldus did not vary.
- Mar. 6: Tycho and Plato did not vary. Grimaldus and Harpalus scarcely receded from the Moon's limb.
- Mar. 26, 28, and 29: Mare Crisium and Endymion were receding from the Moon's limb. Langrenus did not vary.
- Apr. 1: Mare Crisium and Endymion did not vary. Langrenus and Furnerius approached the Moon's limb a little. Tycho did not vary.
- Apr. 2: All the aforesaid did not vary.
- Apr. 7: Littus Eclipticum [the Ecliptic Shore] was receding. Tycho was approaching. **Therefore the Pole was in octant III.** [Margin: III. vel IV.]
- Apr. 10 and 11: Grimaldus, Littus Eclipticum, and Sinus Roris were receding from the Moon's limb.
- Apr. 24: Mare Crisium, Endymion, and Langrenus were receding from the Moon's limb. Pitiscus did not vary.
- Apr. 25: Mare Crisium and Endymion were receding from the Moon's limb. Langrenus did not vary. Pitiscus was approaching. **Therefore the Pole was in octant I.** [Margin: I. vel IV.]
- Apr. 26: Mare Crisium and Endymion were receding from the Moon's limb.
 - › [the Moon's body symbol]

- Apr. 28 and 30: Mare Crisium and Endymion did not vary. Langrenus and Furnerius scarcely approached the Moon's limb.
 - May 21 and 22: Mare Crisium, Endymion, and Langrenus were receding from the Moon's limb.
 - May 23 and 24: Mare Crisium, Endymion, and Democritus were receding from the Moon's limb. Langrenus did not vary. Pitiscus was approaching the limb. **Therefore the Pole was in octant I.** [Margin: I. vel IV.]
 - May 27 and 28: Mare Crisium and Endymion did not vary. Langrenus was approaching. Democritus was receding from the limb.
 - May 29 and 30: Mare Crisium and Langrenus were approaching the Moon's limb. Endymion and Tycho did not vary.
 - Jun. 19 and 20: Mare Crisium, Langrenus, and Endymion receded a little from the Moon's limb.
 - Jun. 22 and 23: Mare Crisium, Langrenus, and Endymion did not vary. Pitiscus was approaching the Moon's limb.
 - Jun. 24, 25, and 26: Mare Crisium and Langrenus were approaching the Moon's limb. Endymion and Pitiscus did not vary.
 - Jun. 27: Mare Crisium and Langrenus were approaching the Moon's limb. Endymion itself was approaching a little.
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- Jul. 18 and 19: Mare Crisium and Langrenus did not vary. Endymion was receding from the Moon's limb.
- Jul. 27 and 28: Mare Crisium, Langrenus, and Endymion were approaching the Moon's limb.
- Aug. 1: Tycho was receding. Plato and Sinus Roris were approaching the Moon's limb.
- Aug. 18 and 19: Mare Crisium and Langrenus were approaching the Moon's limb. Endymion was receding. **From which it is gathered that the libration Pole was in octant III.** [Margin: III.]
- Aug. 20, 21, and 22: Mare Crisium and Langrenus were approaching the Moon's limb. Endymion did not vary.
- Aug. 23, 24, 25, and 27: Langrenus did not vary. Mare Crisium and Endymion were approaching the limb.
- Aug. 28 and 30: Grimaldus did not vary. Tycho was approaching the Moon's limb.
- Aug. 31: Grimaldus and Sinus Roris were approaching the Moon's limb. Tycho did not vary.

- Sep. 1: Grimaldus and Sinus Roris were approaching the Moon's limb. Tycho did not vary.
- Oct. 25: Mare Crisium and Langrenus were receding from the limb ☽. Endymion and Aristoteles did not vary.
- Oct. 26 and 27: Tycho and Plato did not vary. Grimaldus, Littus Eclipticum, and Sinus Roris were approaching the Moon's limb.
- Nov. 16: Mare Crisium, Langrenus, and Pitiscus did not vary. Endymion scarcely approached the limb.
- Nov. 20: Mare Crisium and Endymion were approaching the Moon's limb. Langrenus was receding. **Therefore the Pole was in octant IV.** [Margin: IV.]
- Nov. 23: Mare Crisium, Endymion, and Langrenus were receding from the limb.
- Dec. 18 and 19: Mare Crisium and Langrenus scarcely receded from the Moon's limb. Endymion did not vary.

Anno 1655.

- Jan. 23, 24, and 25: Tycho and Grimaldus were approaching the Moon's limb. Harpalus and Plato were receding from the limb. **Hence the Pole was in octant I.** [Margin: I.]
- Feb. 16, 17, 18, and 20: Mare Crisium, Langrenus, and Endymion were receding from the Moon's limb. [Margin: I. vel IV.]
- Feb. 21: Tycho and Grimaldus were approaching the Moon's limb. Harpalus was receding. **For this reason the Pole was in octant I.** [Margin: I.]
- Mar. 19 and 20: Mare Crisium and Endymion receded a little from the limb. Langrenus did not vary. [Margin: I. vel IV.]
- Apr. 12, 13, 15, and 18: Mare Crisium, Endymion, and Langrenus were receding from the Moon's limb.
- Apr. 19: Mare Crisium, Endymion, and Langrenus did not vary.
- May 10, 11, 12, 13, 14, and 15: Mare Crisium and Endymion were receding from the Moon's limb.
- May 16 and 17: Mare Crisium, Langrenus, Tycho, and Endymion did not vary.
- May 19: Mare Crisium and Langrenus were approaching the Moon's limb. Endymion and Tycho did not vary.
- Jun. 9, 10, and 11: Mare Crisium, Langrenus, and Endymion were receding from the Moon's limb.

- Jun. 12: Mare Crisium and Endymion were receding from the limb. Langrenus did not vary.
 - Jun. 13: Mare Crisium and Endymion did not vary. Langrenus was approaching the Moon's limb.
 - Jun. 15: Endymion did not vary. Mare Crisium and Langrenus were approaching the limb.
 - Jun. 16 and 17: Mare Crisium, Langrenus, and Endymion were approaching the Moon's limb.
 - Jun. 19: Tycho did not vary. Grimaldus and Sinus Roris were receding from the Moon's limb.
 - Jul. 7, 9, and 10: Mare Crisium, Langrenus, and Endymion were receding from the Moon's limb.
 - Jul. 11 and 12: Mare Crisium were approaching the Moon's limb. Endymion did not vary.
 - Jul. 14, 15, 16, and 17: Mare Crisium, Langrenus, and Endymion were receding from the Moon's limb.
 - Aug. 10, 11, and 12: Mare Crisium and Langrenus were approaching the Moon's limb.
 - Oct. 6 and 7: Mare Crisium was approaching the Moon's limb.
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Anno 1656.

- May 7 and 8: Mare Crisium was receding from the Moon's limb.
- Jun. 3 and 5: Mare Crisium was receding from the Moon's limb.
- Jul. 28, 29, and 30: Mare Crisium did not vary.
- Jul. 31: Mare Crisium was receding from the Moon's limb.
- Aug. 1: Mare Crisium was receding from the Moon's limb.

(Continuation of the discussion that closes the catalogue, top of the right column:)

the Moon's limb — but the same spot is not always preserved in the same condition through a single libration, before another spot nearby has displayed its recession from the Moon's limb. In another libration, however, in the libration that follows, this nearby spot is recognized to begin its recession sooner than the spot mentioned earlier did, more noticeably than usual. Indeed, within one and the same libration some disturbance of this order can be detected.

Moreover, the approach or recession of a single spot is not normally able to be discerned unless it occurs at a kind of station, and unless there is, as it were, a

constant remaining at the limb itself — though even this is sometimes not perceived without the spot's stationary point. For example: Mare Crisium, on three, four, or even more occasions, appears with the same greatest nearness, or greatest remoteness, from the Moon's limb; yet it is nonetheless detected, not once but in succession, to approach and then on the very next day to recede from the lunar limb.

Finally, although the libration is for the most part observed only once during a single lunation, it has nonetheless sometimes been noticed that within the same libration a given spot does not continue its single approach, but, after its recession from the Moon's limb, begins to approach again as if at a stationary point, and so noticeably that the difference could be attributed to parallax — nor was it deceived by an error of the eye, since the approach progressed by so notable a quantity, and since at that time a contrary appearance would have been required by the Moon's position at perigee or apogee.

I say, fifthly: the aforesaid varieties detected in the libration could perhaps be saved, and reduced to certain rules, if the Poles were supposed to move in circles whose centers do not themselves move in the lunar surface — as I supposed above. But I do not see by what real physical foundation these hypotheses could be established, so far as it has hitherto been permitted to observe them. For though it might in the exposition of the observations be deduced repeatedly that the Poles are in some determinate octant near the lunar limb, this nonetheless ought to be taken only as a supposition, namely that the Poles might move in that very limb. For thus we should be obliged to argue that one Pole is between two given spots nearer the limb, while the other recedes [from it].

Lastly, from the aforesaid observations it ought to be noted that, for the most part, the conformity of the latitude of the same [spot] follows in such a way that, with respect to latitude, the spots in the Ascending hemisphere and those in the Northern hemisphere approach the limb, while those in the Southern hemisphere recede from the limb; and, conversely, those in the Descending hemisphere [behave] the contrary way. But there are many observations that contradict this Rule; and since they are many, and constant over many continuous days, one ought not therefore to doubt some deception of the eye, but rather to seek elsewhere whether the [cause] is genuine, and what physical cause of the phenomenon [there may be].

CAPVT XV.

Judgment concerning the aforesaid Mobility of the Poles, from the foregoing Observations.

I say first: One must not conceive that the Poles of the lunar libration, or the Nodes, are something real and physically two definite points on the lunar surface. For there is no foundation for such an assertion; on the contrary, with the rest of the points (or spots) remaining fixed on the lunar surface, recognizable and preserving the same distance among themselves, it cannot be said that those two points run hither and thither across that surface — though the Observations require it. I therefore say rather that these points are imaginary, or diverse, and that diverse points of the lunar surface take the place of the Poles by turns in the same libration. Accordingly, the axis itself of this libration is something imaginary in the lunar body, namely as a Diameter about which the Moon librates, in such a way that it librates now about one Diameter, then about another, and a third, and so on — so that these Diameters are to be understood as being made one after another.

I say secondly: This variation of the diameter, or motion of the Poles, is not orderly in its successions, nor uniform, nor does it proceed with equal advance. This is manifestly established from the Observations, in which the Poles appear sometimes to be contained for a good while in the same places, or at least in the same octants of the lunar Limb, while at other times they pass from one octant to another; and furthermore that the passage from one to another is not made immediately, or scarcely any motion is made in the meantime; and finally, that the passage from one octant is made now by a direct movement, now by a movement reverting backward to the earlier octants.

I say thirdly: A somewhat more certain and more uniform motion of the Poles of the libration could perhaps be saved, if they were understood to move not in the lunar Limb, as we have assumed, but in circles having their center either in the aforesaid limb, or in some more anterior hemisphere, or — as is hidden from us — somewhat further within. For the centers cannot be fixed in the same place of the lunar surface, the most certain Observations protesting to the contrary, as drawn from the foregoing.

I say fourthly: It happens that the aforesaid Poles, and the Axes of the libration, are made with a very notable inequality — not only such inequality as is necessarily required, in that this motion is made about a spherical body, but also as regards other matters: namely, it is often observed that the spots near the

Poles of the libration are constituted to move but little, while in the meantime the spots more distant from the Poles move more noticeably; yet often too it is observed that these very spots — even those that are at their greatest distance from the Poles — move but little, and sometimes move most slightly. Meanwhile, by contrast, the motion is sometimes manifestly observed to be swifter, when the spots situated near the Poles are nonetheless detected in such a position. Moreover, from the foregoing observations it can be noted that within any one period of libration a greater velocity belongs first to one spot, then to others, and then to those spots [themselves]: it goes on while one spot, not yet recognized to recede, is recognized to recede, and then while in that one such recession appears, a greater progress of recession is recognized than in [another]. And indeed, this order is usually preserved, by which the spots situated near the limb of the Moon [recede first]: but the same is not always preserved, while one spot in one libration, before another nearby spot has displayed its recession from the limb of the Moon, nonetheless in another libration in the following libration is recognized to begin its recession sooner than the aforesaid nearby spot. Moreover, in one and the same libration some disturbance of this order is recognized.

[The fifth and final point — *Dico Quinto* — is repeated and continues at the top of the right column; see the translation above for its substance.]

CAPVT XVI.

Selected more recent Observations of P. Francesco Maria Grimaldi [Francesco Maria Grimaldi] concerning the limits of the Lunar Libration, from the Year 1651 to 1656. For the examination of the Table of Hevelius [Johannes Hevelius] exhibiting the Maximum Libration of Mare Crisium for the individual Months of this century.

[Margin / running side note: *Pro examinanda Hevelii Tabula* — "For the examination of Hevelius's Table."]

Hevelius sets forth this Table in his new little work on the Librating motion of the Moon, published in the Year 1654, trusting that it will faithfully exhibit the maximum recession of the spot from the Moon's limb — the spot he himself calls Palus Maeotis [the same, i.e. Mare Crisium], insofar, however, as he himself has gathered it from his own Observations, and unless some new Anomaly of the Lunar Libration should be detected

by the course of time. We shall therefore examine whether that Table, and consequently the whole Theory of the Librating motion, set forth by Hevelius — the years now nearly elapsed, not to mention the whole of this century to come — corresponds faithfully; selecting certain Observations of P. Grimaldi from among the more recent ones, which we set forth in the first tome of our *Almagestum Novum* [Almagest], concerning the maximum recession of Mare Crisium from the Western limb of the Moon. At the same time we add the [recession] which is gathered from the Hevelian Table, so that by an easy comparison it may be recognized whether the Hevelian Theory proceeds favorably, or whether it ought to be corrected on some other principle from the truth, which he himself has not yet noticed.

Anno 1651.

In the month of October, Hevelius places the maximum Libration of Mare Crisium as going to occur with the Moon situated in the 5th degree of Taurus — which happened on the 29th, scarcely before midday. The Observations strongly favor Hevelius, since they place the predicted maximum recession of the spot from the Moon's limb at about the 29th.

November: Hevelius assigns the limit of the Libration to the 25th. The Observations, however, place it on the 26th.

December: Hevelius gives the limit at the 23rd. The Observations agree with Hevelius for the same 23rd.

Anno 1652.

January: From Hevelius, and from the observations, the limit fell on the 19th.

February: Hevelius and the observation agree for the 16th.

May: From Hevelius the limit was the 9th; the observations themselves favor it.

June: From Hevelius the limit was the 5th. The observations will do for this.

July: From the Table of Hevelius the limit is twice celebrated — on the 3rd and the 30th. For the 3rd, the observations agree, insofar as the opposite spot then — that is, Grimaldus — did not vary, from which Mare Crisium is gathered to have been at the extreme of its motion, and as it were stationary.

August: Hevelius places the limit on the 16th. The observations agree, since the opposite spot Grimaldus was at its greatest approach to the Moon's limb.

September: The Table of Hevelius assigns the 12th. From the observations the same is gathered, from the greatest approach of the spot Grimaldus to the Moon's limb.

November: From the Table of Hevelius the limit is on the 17th. On which day Grimaldus was least distant from the Western limb; therefore the observations favor Hevelius.

December: Hevelius places the limit of the Libration on the 15th. But from the observation, on the 13th Mare Crisium was receding, and the opposite spot Grimaldus was approaching, and continued so up to the 16th inclusive, and up to the 19th did not vary; it seems therefore to be gathered that the limit was after the 15th assigned by Hevelius.

Anno 1653.

January: From Hevelius the limit was on the 12th. But from the observations, not before the 13th.

February: From Hevelius the limit fell between the 8th and 9th. But from the observations, somewhat after the 10th, since on the 10th Mare Crisium was still receding from the Western limb.

March: From Hevelius the limit ought to have been on the 8th, before midday. But the observations require the 11th.

April: From Hevelius the limit falls between the 4th and 5th. But the observations require it after the 7th.

May: From the Table of Hevelius the limit is on the 2nd, at midday. But from the observation, they place it somewhat after the 4th.

June: From Hevelius the limit was on the 26th. But from the observations Mare Crisium seems to be gathered as approaching the limb up to the 1st of July inclusive, and did not vary.

July: From Hevelius the limit is on the 23rd. The observations seem to favor Hevelius.

August: From the Table of Hevelius the 20th is assigned for the limit. But from the observation, since the opposite spot Grimaldus on the 19th was still approaching the limb, [the limit] seems to be argued [as later]; Mare Crisium [was] not [at maximum] on the 20th — it seems to have been in the limit of its own recession.

December: Hevelius establishes the 8th. But from the observations it seems to be gathered as somewhat after the 8th, since on the 8th itself the opposite spot Grimaldus was still approaching the Eastern limb.

Anno 1654.

January: Hevelius places the limit on the 5th. But from the observations, as much as is gathered from the opposite spot Grimaldus, it seems to have been on the 6th.

March: Hevelius places the limit on the 28th. But from the observations it ought manifestly to be placed later, since on the 29th Mare Crisium was still receding from the Moon's limb, and afterward continued so for four [days] and did not vary.

April: Hevelius places the limit on the 25th. But from the observations, on the 26th Mare Crisium was [still] receding. Therefore here too Hevelius is in advance.

May: Hevelius places the limit on the 22nd. The observations would have it somewhat after the 24th.

June: Hevelius gives the limit on the 19th. The observations, however, somewhat after the 20th.

August: Hevelius places the limit on the 13th. The observations favor Hevelius.

November: Hevelius places the limit on the 4th. They favor that day of the observations, insofar as the spot Grimaldus was distant by the least amount from the Eastern limb.

Anno 1655.

February: From Hevelius the limit was on the 22nd. The observations favor it, insofar as on the 22nd the spot Grimaldus had begun not to vary.

April: From Hevelius the limit is held on the 18th. But the observations give it later, since on the 19th Mare Crisium begins not to vary.

May: From Hevelius the limit is on the 16th. But from the observation, somewhat after the 16th.

June: From Hevelius the limit is on the 12th. But from the observation, not before the 13th.

July: From Hevelius the limit is on the 10th. The observations agree with this exactly.

August: From Hevelius the limit falls before midday on the 7th. The observations, however, exhibit [it] for the 8th.

Anno 1656.

May: From Hevelius the limit is held on the 8th. The observations exhibit it as later.

June: From Hevelius the limit was on the 5th. They agree with the observations.

July: From Hevelius the limit is held on the 29th. But the observations transfer it past the 1st of August.

From the foregoing observations, many indeed are those that favor Hevelius; but many likewise are those that prove his Table to anticipate, by one day or another, the true limit of the Libration of Mare Crisium from the Western [limb] toward the East. And although the matter is treated so subtly that the moment of the maximum Libration could sometimes be doubted from observation — to say nothing of the precise day, much less the moment of the maximum Libration — when three, or sometimes four, days slip by during which no increments, or decrements, appear in the Libration of the Moon: in many cases it is nonetheless evidently convinced that Hevelius precedes [the true limit], since the increments appeared [to follow] according to the manner in which Hevelius ought to have placed the limit — as has been set forth in its own places. But it is indeed remarkable that the Observations never note a day preceding the day assigned by Hevelius: which confirms that one ought least of all to doubt the Observations, on account of the difficulty in judging with certainty, [a judgment] dependent on estimation by eye — since indeed there was no danger of erring on the one side rather than the other.

BOOK FOUR

IN WHICH SELECT OBSERVATIONS OF THE FIXED STARS,
DRAWN FROM BOTH THE ANCIENTS AND THE MODERNS,
ARE WEIGHED, AND FROM THEM TABLES ARE
CONSTRUCTED, PRESENTED DOWN TO THE YEAR OF
CHRIST 1700.

CHAPTER I

On the Observations of the Ancients Concerning the Fixed Stars, and the Manner of Observing Them.

Having set aside those rudimentary observations of the risings and settings of the fixed stars that were recorded for the benefit of agriculture, medicine, and navigation, and which are found in the ancient calendars [*Fasti*] of Aratus, Eudoxus, Euctemon, Meton, Calippus, Dositheus, Geminus, Ptolemy [Ptolemy], Hipparchus, Bithynus, Columella, and again Ovid, and in Pliny [Pliny], Varro, and others, I shall select only those observations that, by reason of their precision [*concinnitas*], are suitable for fixing the exact positions of the stars in the heavens at a definitely determined time. Of these I shall choose only the ones made from the time of Aristyllus and Timocharis — that is, from about 300 years before Christ — down to our own day, namely to the year of Christ 1658, whether handed down by others or carried out by me, with all the subtlety and diligence I could manage, together with the Reverend Father Francesco Maria Grimaldi [Grimaldi].

[Margin: Aristyllus, Timocharis: their observations doubtful.]

Although Ptolemy, in Book 7, Chapter 1 of the *Great Construction* [*Almagest*], speaks of the constructions and observations of the fixed stars made by Aristyllus and Timocharis themselves — saying that they are few in number and ambiguous, and that those which Aristyllus and Timocharis recorded are sparingly explained and not free of ambiguity — yet the more accurate observations of Hipparchus, which Ptolemy assembled in that same place, attest that Hipparchus, in his work *On the Fixed Stars*, gathered the most copious and lucid observations, the ones most relevant to our purpose. For Hipparchus himself, as Ptolemy reports in the same Book 7, Chapter 3 (in his treatise *On the Magnitude of the Year* [*De Magnitudine Anni*]), supposed that a motion of the non-wandering stars takes place about the poles of the zodiac; yet he remained in

doubt — as Ptolemy asserts — because neither were the observations made in Timocharis's time reckoned reliable, on the ground that they had been taken too loosely, nor was the interval of time between them and Hipparchus's own sufficient for a full grasp of the matter. For this reason Hipparchus judged that the undertaking of this inquiry must be passed on, with the more solid foundation of observations of the fixed stars, to posterity — a task whose mention Ptolemy makes in Book 7, Chapter 1, at the end — and that the whole work must be transmitted to those who would come after. Pliny extols this design in Book 2, Chapter 26, where he reports that Hipparchus — than whom no one ever more thoroughly proved the kinship of the stars with man, and that our souls are a portion of the heavens — discovered a new star, and another that arose in his own time, and that he was moved by their motion in the place where it shone; that he came to wonder whether this happened more often, and whether the stars which we take to be fixed likewise move; and that, in the end, he dared a thing hard even for God, namely to number the stars for posterity and to reduce the heavenly bodies to a rule, devising instruments by which he might mark out the individual positions and magnitudes of the stars, so that from them it might readily be discerned not only whether stars perish and are born, but also whether any pass across the sky and move, and whether they wax or wane in brightness. He left the heavens, as it were, as an inheritance to all mankind, should anyone be found who would take up that reckoning.

[Margin: Hipparchus praised, and his manner of observing the fixed stars.]

Pliny adds: "*I was striving toward God*" — that is, he calls it a difficult thing to number the stars. A heathen and an atheist as he was, the writer judged Hipparchus too bold toward God, fashioned by him [*Deo fictili*], or...

rather none at all. But far truer is the saying of our royal Psalmist, who numbers the multitude of the stars and calls them all by their names. And Baruch, after him, Chapter 3, says: "*The stars have given light in their watches, and rejoiced: they were called, and they said, Here we are; and with cheerfulness they have shined forth unto him that made them.*" But to return to Hipparchus: it was by a most fortunate occasion that he was led to observe the fixed stars. For the appearance of a great new star roused Hipparchus, in the 125th year before our era [*saeculi*], to undertake another, fresh observation of the stars — as Tycho [Tycho Brahe] notes — a star which appeared in the year 1572 in the constellation of Cassiopeia. There was good reason for ancient observers to mark this in the sky, by which the lifeless [*Prisci*] organs might attend to such things.

[Margin: Psalm 146.]

1. First, after their risings and settings, the figure of each cluster of stars was observed to be constant and fixed, and the several stars were seen to be always at the same distance from one another. From this comes the very name of the fixed stars [*inerrantia*]: namely, because they do not move, but always keep among themselves a fixed interval [*intervallum*]; nor is their mutual configuration ever altered, once it has been received from the beginning; and they move in an ordered fashion, just as if the whole sphere in which they are, as it were, fixed, were carried around. And because the sphere of the fixed stars, in which they are as if affixed, makes its progression with respect to the succession of the signs by a certain proper motion of its own and a regular ordering — a progression contrary to the motion of the Primum Mobile — it seems right to call them "wandering" [*errantia*] in one respect and "non-wandering" [*inerrantia*] in another. For they are found to be both, as is plain from their apparent positions, which are altered after so long an interval of time.

[Margin: Whence the name of the fixed stars?]

2. Secondly, the fixed stars were observed all to revolve together in the space of 24 sidereal hours, by a daily revolution, from their rising to their setting, and again from their setting back to their rising, or from the meridian back to the same meridian. For whatever stars appeared above the horizon by their passage through the midpoint of the heavens [*medium Coeli*] — that is, above the pole of the world — consumed 12 hours up to their transit beneath the midpoint of the heavens, that is, below the pole; and the same number of hours from that transit beneath the pole back to their transit above it. Those, moreover, which rose and set spent 24 hours from rising to rising, or from setting to setting; and 12 hours from rising to setting, and likewise another 12 from setting back to rising. Now this is the most manifest of all the motions of the fixed stars [*Inerrantia*], at least so far as appearance goes. For whether in reality the stars themselves are moved, or rather the Earth's globe is carried about its own daily-rotating center toward the east by an actual motion that produces this appearance to our eyes — as the followers of Niceta and Copernicus [Copernicus] would have it — I have treated at large in Book 9 of the *Almagestum Novum*, Chapter 4.

[Margin: The motion of the Primum Mobile in the fixed stars.]

3. Thirdly, what was unknown to Hipparchus, or not yet fully grasped before him, was observed: namely, that the fixed stars have besides a proper motion of their own, following the succession of the signs. Hipparchus indeed first set this forth as his own hypothesis, as Ptolemy teaches in Book 7, Chapter 1, from those stars of his which are reckoned to lie in the zodiac — if indeed Ptolemy reports the

same in Chapter 2. He observed that the star Spica, in Timocharis's time, stood distant from the autumnal point by eight degrees, that is, had been eight degrees; whereas in his own time it stood distant by only six. In Virgo it stood at degree 24 in its former position, but in his own time it was distant by only that much — that is, at degree 24 in Virgo — by which token he detected the motion of the fixed stars in the zodiac. Whether, however, this motion took place about the poles of the world — that is, in circles of declination, or in circles parallel to the equator — or rather about the poles of the ecliptic, that is, in circles described about the poles of the world, that is, circles of latitude, Hipparchus was for a time in doubt. Yet he allowed that it might come to pass...

[Margin: The proper motion of the fixed stars in longitude.]

about circles, and in circles about the poles of the zodiac. And from the poles of the zodiac, as Ptolemy holds in Book 7, Chapter 2, and as he describes it, both arguments — albeit ambiguously — agree. For too coarse [*crassae*] were the antecedent observations, and too brief the interval between them and these others. And although Ptolemy himself, in Book 7, Chapter 2, says that the fixed stars move contrary to the Primum Mobile — that is, following the succession of the signs (which Ptolemy himself in the same place teaches by both observation and reason) — moving with respect to the ecliptic, yet in Chapter 3 he affirms that the fixed stars are moved by themselves following the succession of the signs about the poles of the zodiac, as he there describes; and this by a twofold argument.

[Margin: Scaliger's opinion on the motion of the fixed stars.]

First, because the arcs of the ecliptic which the equal intervals of time intercept between the same circle of latitude of a given star are equal to one another; but the arcs which the circles of declination intercept are unequal among themselves. Yet they are not perceptibly unequal unless after many years, when compared. **Second**, because, in that same circle which they always keep, those stars whose distances of latitude in Hipparchus's time and in Ptolemy's time differ are found to retain ever the same latitudes; and, by an evident token, the latitudes of the fixed stars from the ecliptic remain unchanged, while in circles parallel to the equator they are unequal, and in circles of declination they are unequal. And nothing prevents this from being uniform with respect to the ecliptic. I touch here on the Commentary of Joseph Scaliger [Joseph Scaliger] in his *Diatribes on the Anticipation of the Equinoxes*, Book 3, Chapter 3; and Paul of Middelburg [*Paulus*]; and Gilden [*Gildinus*] in his *Refutation of the Elenchus of Calvisius against the Gregorian Calendar* [*Calendarium*], where it is sufficiently refuted in Chapter 10,

as also afterward in Bullialdus [Boulliau], Book 5 of the *Astronomia Philolaïca*, Chapter 4; and again in our own work, the *Almagestum Novum*. I add this, in confuting the chief foundations on which Scaliger relied in striving to show that the equinoctial points recede from a fixed position of the western fixed stars toward the poles of the equator — that the fixed stars are mobile, distinct, and have the poles of the world.

4. Fourthly, therefore, the ancients first determined the declinations of the fixed stars separately, then their latitudes; and the longitudes were determined in the ecliptic by means of circles of latitude drawn through the poles of the ecliptic and through each several star, and by circles cutting the ecliptic at right angles. They added, moreover, the apparent magnitudes — namely, which were of the first, or second, or third, and so on up to the sixth magnitude. In the Catalogue of Ptolemy, besides, certain notes were appended to some of the fixed stars touching the nature of the planets in which they share, for the benefit of astrology.

[Margin: The declinations to be observed.]

On the Methods and Instruments by Which the Ancients Observed the Fixed Stars.

6. With what instruments Aristyllus, Timocharis, Hipparchus, and Ptolemy noted those declinations and distances from the equator which Ptolemy reports in Book 7, Chapter 3, I have not found, nor is it credible that they were observed with any certainty without the meridian altitudes of the stars somehow taken. Ptolemy, in Book 1 of the *Great Construction*, Chapter 11, describes a stable quadrant by which the meridian altitudes of the Sun were taken; and the same instrument, perfected, is the equatorial astrolabe, or equatorial armillary, which observers are wont to apply also to the taking of the meridian declinations of the stars, and which Tycho both perfected and described in his *Mechanica* of restored astronomy [*Mechanica Astronomiae Instauratae*], folio 20 and 21.

[Margin: The observation of declinations.]

7. The longitudes, moreover, and the latitudes of the fixed stars they were wont to observe by two methods. The first was to wait for the very intervals of nights cut off between a fixed star and the Moon, and the Moon's appulses and limbs [*margines*], at a certain moment of the night; and thence, by means of tables computed, to determine the place of the stars in the zodiac and by the tables to infer the place of the stars by conjecture, as far as one could from observation. Of this kind are the observations of Timocharis, Agrippa, and Menelaus, which we shall report from Ptolemy, Book 7, Chapter 3, in the appropriate chapter. The **second** was by the astrolabe...

the astrolabe used and described by Ptolemy in Book 7, Chapter 2 and Chapter 4. It was composed of zodiacal armillae, of nearly the same fashion as those which Aristyllus and Timocharis recorded — as Ignatius Dantes [Egnatio Danti] sets forth in his *On the Astrolabe*, and as Tycho describes in his *Mechanica Astronomiae*, folio 19 — and of one use with the armillae themselves. For with one circle the Moon and the Sun, near the horizon, were observed with their sights turned toward them; the distance of the Moon from the Sun was computed in the ecliptic; and at the same time, by means of the cross-staff [*ferratherium*], or by the degree of the ecliptic constituted in the midheaven, they marked the hour. Then by night, soon after, taking up a like reckoning, they took the distance of the Moon from some fixed star, computed in the ecliptic, and intercepted it by two circles of latitude — namely, by the Moon's center, by the star, and by both, through the poles of the ecliptic descending into the astrolabe — so that, by an analogous and fixed placement, the heaven had first been set in position. And now, from the place of the Sun in the ecliptic computed at the time of the prior observation, adding to it the distance of the Moon from the Sun computed in the ecliptic, they obtained the apparent place of the Moon according to the ecliptic; and to this apparent place of the Moon, adding the distance of the Moon from the fixed star to the east, they obtained the apparent place of the fixed star, as to longitude. But because the same was gathered, since it was the same hour, it was settled from the astronomical tables; and from the true place of the Moon, indeed, they corrected its longitude, the longitude first acquired by the distance from the Sun.

[Margin: The imperfection of the ancients' observations.]

But good observers required not only this correction by the Sun, but also that other correction which the parallaxes of the luminaries often demanded — illumination, as it were — suspecting it less than the refraction itself. Then again the parallax of the Sun was employed. Finally these zodiacal armillae were employed, as Tycho notes (*Tom. 1 Progymn.*, page 140); and if they were of great mass, then so far as the weight of the matter admitted, they were unwieldy; but if small, they did not admit of subdivisions, even to a single minute in each degree. Certainly in Ptolemy's Catalogue the longitudes, for the greatest part, as also the latitudes, are noted down only to the first scruple [*scrupulum*, i.e. minute].

8. Finally, the latitudes themselves, by means of two sights placed in a circle of latitude — or rather, by their boring [*foramina*], at the center of the star directed straight — were not at all to be praised before this. The defect of the observations

is to be set forth in due order hereafter. As for the fault in latitudes, on account of the false obliquity of the ecliptic, this is not the place to discuss it.

CHAPTER II

On the Stars Lying in the Same Straight Line, Both in Ancient and in More Recent Observation.

1. There are many groups of the non-wandering [*inerrantes*] stars, whether in fours [*quaternarii*] or otherwise, which are observed to lie exactly, or very nearly, in the same straight line, and which have so persisted from of old, before Ptolemy's time, down to the time of Ptolemy, as he himself reports in Book 7 of the *Almagest*, Chapter 1; and thence onward down to Tycho, as I affirm in Tome 1 of the *Progymnasmata*, page 234; and from then down to our own day. To these we have joined certain others gathered from our own observation, drawn together with the figures which are extant in Aratus and in the *Phaenomena* of Hyginus, or inferred from the difference of latitudes; so that hence the unaltered figure of a constellation is confirmed, and the immutability of the interval by which they lie distant among themselves.

2. There are, then, and have been of old too, in the same straight line — or very nearly so, by the estimation of the eye drawn along a straight line — the stars set down beneath.

The southern claw [*forfex*] of Cancer; and the bright star which precedes it; the bright star in the head, which precedes; and the bright star of the Lesser Dog [*Canis minoris*].

The two eastern stars in the head of Leo, and that which is in the joining of the neck of Leo with the rest of the body.

The bright star in the tail of Leo [*Leonis lucida cauda*]; the extreme star in the tail of the Great Bear [*Ursae maioris extrema cauda*]; and the star which, between the two aforesaid Unformed [*Informis*], is descried beneath the tail of the same Bear.

The bright star in Virgo [*Spica Virginis*]; the next-to-last in the tail of Hydra; and the middle of the three shining in Triangulum.

The star in the head of the two contiguous stars in Aquarius, and that which is in the shoulder following.

The two preceding stars in the head of Aries, and that which is in the base of Triangulum.

The two eastern Hyades, and the southern star in the little fur-cap [*pellicula*] on the left hand of Orion.

The two more northern stars in the head of Aries, and the splendid one in the knee of Perseus.

The Goat-star [*Capella*], and that which is in the preceding foot of Auriga, and the bright star of the Hyades — that is, the eye of the southern Bull [*Tauri*].

The Goat-star, likewise preceding; the shoulder of Orion; and that which is in the northern horn of the Bull, and that in the foot of Auriga following.

The bright star in the head of Gemini [*Geminorum capita splendida*], shining in the neck of Hydra.

The Bear in the anterior foot, two contiguous stars; and these in the outer pincers [*forcipes*] of Cancer, northern, and the more northern of the Asses [*Aselli*].

The bright star of the Lesser Dog, and the more southern Ass, and that which precedes between them the head of Hydra.

The bright star of Virgo, and the two stars in the elbow [*ancon*] of Corvus.

The bright star of Virgo, and that which is in the hinder shank [*crus*] of Virgo, and that which is among the antecedent stars of Boötes' shin [*tibia*].

The two bright stars in the pincers of Libra, and that which is at the extreme tip of the Bear's tail.

The bright star in the southern pincer of Libra, and Arcturus [*Arcturus*], and the middle of the three shining in the tail of the Great Bear.

The one bright star in the three knees of Ophiuchus, and that which is in the fifth vertebra [*spondylus*] of Scorpius, and the two preceding stars in the sting of Scorpius.

The shining star in the following knee of Ophiuchus, and that which is in the anterior southern heel [*talus*] of Sagittarius, and that which is in the arrow [*sagitta*] of the same Sagittarius.

The star in the preceding knee of Ophiuchus, and that which is in the heel of Sagittarius, and that which is among the anterior stars in the foot of Sagittarius.

The southern cheek [*bucca*] of Pisces, and the two stars preceding in the quadrilateral of Pegasus.

To these three add the three bright stars in the Belt of Orion; likewise the three which are Boötes, the bright stars of Arcturus, and that which shines in the shoulder near the neck [*collum*]. Such likewise are the three bright stars of Perseus, one in the preceding knee, another in the more splendid flank [*latus*], the third in the shoulder following. Likewise the three more lucid stars of Aquila, one in the neck, another in the shoulder-blades [*scapulae*], the third at the beginning of the left wing [*ala*]. Likewise the southern foot of Andromeda, the bright star of the Belt, and that of the right shoulder-blade.

CHAPTER III

On the Declinations of the Fixed Stars, or Their Distances from the Pole of the World, Observed Down to the Time of Tycho Exclusively, with a Critique of Them.

1. Let the first class be of those Declinations which Ptolemy, in Book 7 of the *Great Construction*, Chapter 3, reports as observed by Timocharis of Alexandria in the year 36 before Christ — the first year of the first Callippic period, that is, in the year before Christ 295; and at intervals thereafter, by Aristyllus at about the same time; and by Hipparchus in the year 50, the third of the second Callippic period, namely in the year before Christ 128; and finally from year 1 to year 2, after Antoninus Imperator, and in the year 265, after Hipparchus, in the year of Christ 137 and 138. Ptolemy designates these times sufficiently in Book 7, Chapter 2, Chapter 3, and Chapter 4. He adds, however, in Chapter 3, another observation made in the 47th year of the first Callippic period, which he says was in the year 465 of Nabonassar, that is, before Christ 284, or 285.

Liber IV — On the Fixed Stars (continued)

Caput III (continued) — Declinations of the fixed stars observed down to (but not including) the time of Tycho

Table I — Declinations

The observers are abbreviated as follows: *Aristyll.* = Aristyllus; *Hipparch.* / *Hippar.* = Hipparchus; *Ptolem.* / *Ptol.* = Ptolemy; *Timoch.* / *Tim.* = Timocharis. The letters **B** and **A** in the final column mark the declination as **B**oreal (northern) or **A**ustral (southern). Degrees (G.) and minutes (M.).

Star	Observers	G.	M.	B/A
Capella	Aristyll.	40	0	B

Star	Observers	G.	M.	B/A
	Hipparch.	40	24	B
	Ptolem.	41	10	B
Head of Castor [Castoris caput]	Aristyll.	33	0	B
	Hippar.	33	10	B
	Ptolem.	33	24	B
Head of Pollux [Pollucis caput]	Aristyll.	30	0	B
	Hippar.	30	0	B
	Ptolem.	30	10	B
Ursa Major, last star of the tail [Ursæ mai. caudæ vltima]	Aristyll.	61	30	B
	Hippar.	60	45	B
	Ptolem.	59	40	B
Ursa Major, middle star of the tail [Ursæ mai. media caudæ]	Aristyll.	67	15	B
	Hippar.	66	30	B
	Ptolem.	65	0	B
Ursa Major, first star of the tail [Ursæ mai. prima]	Arist.	68	30	B

Star	Observers	G.	M.	B/A
caudæ]				
	Hippar.	67	40	B
	Ptolem.	66	15	B
The bright star of Aquila [Aquilæ lucida] (Altair)	Timoch.	5	48	B
	Hipp.	5	48	B
	Ptolem.	5	50	B
The middle star of the Pleiades [Pleiadum media]	Timoch.	14	30	B
	Hippar.	15	30	B
	Ptolem.	16	30	B
The bright star of the Hyades [Hyadum splendida] (Aldebaran)	Timoch.	8	45	B
	Hipp.	9	45	B
	Ptolem.	11	0	B
Preceding shoulder of Orion [Orionis humerus præced.]	Timoch.	1	12	B
	Hipp.	1	48	B
	Ptolem.	2	30	B

Star	Observers	G.	M.	B/A
Following shoulder of Orion [Orionis humerus sequens]	Timoch.	3	50	B
	Hipp.	4	20	B
	Ptol.	5	15	B
Sirius	Tim.	16	20	A
	Hipp.	16	0	A
	Ptol.	16	45	A
Regulus	Tim.	21	20	B
	Hipp.	20	40	B
	Ptolem.	19	50	B
Spica Virginis (Spica)	Tim.	1	24	A
	Hipp.	0	36	A
	Ptolem.	0	30	A
Arcturus	Tim.	31	30	B
	Hipp.	31	0	B
	Ptolem.	29	50	B
Heart of Scorpius [Scorpij Cor], Antares	Tim.	18	20	A
	Hipp.	19	0	A
	Ptol.	20	15	A
Southern claw of Scorpius [Australis Forceps]	Tim.	5	0	A

Star	Observers	G.	M.	B/A
Scorpij]	Hipp.	5	36	A
	Ptolem.	7	0	A
Northern claw of Scorpius [Borealis Forceps Scorpij]	Timoch.	1	12	B
	Hipp.	0	24	B
	Ptol.	1	0	A
The middle star of the Pleiades [Pleiadum media]	Hipp.	15	10	B
	Ptol.	16	10	B

Parsing notes: The right-hand column of folio 204 continues Table I. The last two entries (Northern claw of Scorpius, and a second "middle of the Pleiades") sit in that right column under repeated headers *Stella / Observatores / Declinatio (G. M.)*. For the Northern claw of Scorpius, the third observer's value (Ptol.) is marked **A** (austral) where the prior two are **B** (boreal) — transcribed as printed; this is a recognized sign-change at that epoch and is left as printed.

Below Table I, Riccioli adds two notes on individual stars:

The first star of the tail of Ursa Major has, according to Hipparchus, 67° 36'; and the northern claw of Scorpius, according to Timocharis, 1° 2'.

Second class — distances from the pole of the world

[Margin: 2] The second class contains the distances from the pole of the world of certain other stars — that is, the complements of the declinations to a right angle — which are obtained by subtracting from 90° those declinations that yield a northern declination. (Where this does not hold, the letter **A** [austral] is added, as they are given in Petavius's *Uranologion*, Book III, chapters 6 and 8.) Petavius says these distances were observed and recorded by Eudoxus, and afterward by

Hipparchus; and he adds the distances that, in Hipparchus's time, ought to agree with Tycho's tables. Hipparchus appears to be correcting Eudoxus; but it is uncertain whether he is correcting the distances of the fixed stars for Eudoxus's own time or for his own. Eudoxus flourished in the year 368 before Christ — that is, 240 years before Hipparchus.

The symbol ☾ (Moon / *Luna*) appears as an abbreviation in two row-labels of Table II ("Cancri borea præcedentium in laterculo" group). Riccioli uses it as shorthand for the lunar/nebular cluster region. Below, where a star-name uses the symbol, it is rendered in words.

Table II — Distance from the pole of the world

Columns give the distance from the pole per **Eudoxus**, per **Hipparchus**, and per the **Hipparchus-corrected** value of **Petavius** [Hippar. correctæ Petavio]. Degrees (G.) and minutes (M.).

Star	Eudoxu s G.	Eudoxu s M.	Hippar chus G.	Hippar chus M.	Hipp. corr. Petaviu s G.	Hipp. corr. Petaviu s M.
Left shoulde r of Boötes [Bootæ humer us sinist.]	40	13	41	15	41	44
Head of Draco [Draco nis caput]	37	0	37	0	37	3
Foot of Cassiop eia [Cassio peæ pes]	39	26	38	0	37	50

Star	Eudoxu s G.	Eudoxu s M.	Hippar chus G.	Hippar chus M.	Hipp. corr. Petaviu s G.	Hipp. corr. Petaviu s M.
Head of Castor [Castori s Caput]	56	41	56	30	56	29
Head of Pollux [Polluci s Caput]	59	48	60	0	59	21
Left foot of Auriga [Henioc hi pes sinist.]	63	26	63	0	62	53
Neck of Cygnus [Cygni collum]	59	27	59	0	59	6
Beak of Cygnus [Cygni rostru m]	65	0	65	0	64	49
Right shoulde r of Ophiuc hus [Ophiuc hi humer. dext.]	81	31	83	0	81	17

Star	Eudoxu s G.	Eudoxu s M.	Hippar chus G.	Hippar chus M.	Hipp. corr. Petaviu s G.	Hipp. corr. Petaviu s M.
Left shoulde r of Ophiuc hus [Ophiuc hi humer. sin.]	74	21	75	0	75	20
The norther n of the precedi ng stars of Cancer, in the cluster [Cancri borea præced entium in latercul o]	66	1	65	0	64	30
The more souther ly of the same [Austra lior earund	66	48	66	20	67	5

Star	Eudoxu s G.	Eudoxu s M.	Hippar chus G.	Hippar chus M.	Hipp. corr. Petaviu s G.	Hipp. corr. Petaviu s M.
em]						
Northern Aselle [Asellus Boreus]	62	56	63	30	63	7
Southern Aselle [Asellus Australis]	66	10	66	0	66	23
Head of Ophiuchus [Ophiuchi Caput]	73	13	73	0	73	58
Tip of the left wing of Cygnus [Cygni extrema ala sin.]	67	54	67	0	67	5
Left knee of Ophiuchus [Ophiuchi genu sinist.]	92	51	93	30	94	4
Right knee of	99	33	100 plus	—	100	36

Star	Eudoxu s G.	Eudoxu s M.	Hippar chus G.	Hippar chus M.	Hipp. corr. Petaviu s G.	Hipp. corr. Petaviu s M.
Ophiuc hus [Ophiuc hi genu dext.]						
Loin of Pegasus [Equi lumbus]	88	22	86	30	86	53
The middle of the three in the spine, the souther n of the norther n Fish [Media trium in spina Australi s Piscis Borei]	82	16	80	0	80	39
Last star of the tail of Ursa Minor [Ursæ	14	4	12	24	—	—

Star	Eudoxu s G.	Eudoxu s M.	Hippar chus G.	Hippar chus M.	Hipp. corr. Petaviu s G.	Hipp. corr. Petaviu s M.
min. caudæ vltim.]						
Middle of the tail [Caudæ media]	12	37	11	10	—	—
The next-to- last of the tail [Caudæ antepe nult.]	11	24	10	22	—	—
The precedi ng superio r in the square [Superi or præced . in □]	7	26	8	7	—	—
The followi ng superio r in the square [Superi or succed.	9	16	8	54	—	—

Star	Eudoxu s G.	Eudoxu s M.	Hippar chus G.	Hippar chus M.	Hipp. corr. Petaviu s G.	Hipp. corr. Petaviu s M.
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in □]

Parsing notes: One Hipparchus cell for the right knee of Ophiuchus reads "100. plus" (printed literally as "100.plus"), evidently meaning "more than 100°"; transcribed as printed. The last five rows (Ursa Minor) have no value in the Petavius-corrected column. The "□" (square / quadrilateral) symbol denotes the asterism square in two row-labels.

[Margin: 3] The third class contains the distances from the pole of the world of certain fixed stars, drawn from Hipparchus's observation but with the correction by Joseph Scaliger [Iosephus Scaliger] and Dionysius Petavius [Dionysius Petavius] made from more recent tables, as Petavius sets out in his *Uranologion*, Book III. Now the pole of the world, from which these stars listed below were distant in Hipparchus's time, was boreal — except for the last two of Scorpius, for which the pole was austral, as it was also for Sirius.

Liber IV — On the Fixed Stars (continued, folio 205)

Table III — Distance from the pole of the world in the time of Hipparchus

Columns: per **Hipparchus** [Hipparcho], per **Scaliger** [Scaligero], per **Petavius** [Petauio]. The epoch is the year 128 before Christ. Degrees (G.) and minutes (M.). The letter **A** in the left margin marks an austral entry.

Fixed star (Year 128 before Christ)	Hippar chus G.	Hippar chus M.	Scaliger G.	Scaliger M.	Petaviu s G.	Petaviu s M.
Arcturu s	59	0	59	0	59	41
The	50	0	50	0	49	44

Fixed star (Year 128 before Christ)	Hippar chus G.	Hippar chus M.	Scaliger G.	Scaliger M.	Petaviu s G.	Petaviu s M.
bright star in the side of Perseus [Persei lucida in latere]						
The third star of the Andro meda group, in the right [Austra lis 3. in dextra Andro m.]	58	0	58	0	58	8
Foot of Aries [Arietis pes]	90 (approx .) [ferè]	—	90	0	89	42
The middle of the Pleiade s	74	30	74	30	74	8

Fixed star (Year 128 before Christ)	Hippar chus G.	Hippar chus M.	Scaliger G.	Scaliger M.	Petaviu s G.	Petaviu s M.
cluster [Pleiad um media]						
Palilici um, Aldebar an [Palilici um Aldebar a]	80	30	80	30	80	50
Precedi ng shoulde r of Orion [Orioni s humer. sinist.]	88	12	88	12	87	54
Followi ng shoulde r of Orion [Orion. humer us dextr.]	85	49	85	49	85	24
A Sirius,	74	0	74	0	74	24

Fixed star (Year 128 before Christ)	Hippar chus G.	Hippar chus M.	Scaliger G.	Scaliger M.	Petaviu s G.	Petaviu s M.
the Dog Star [Sirius Canis maior]						
Spica Virginis (Spica)	89	24	89	24	89	26
Antares , the Heart of Scorpiu s [Antare s cor Scorpij]	71	0	71	0	70	40
The bright star of Aquila [Aquilæ lucida] (Altair)	84	12	84	12	84	29
Last star of the tail of Ursa Major [Vrsæ maior caudæ]	29	15	29	31	29	40

Fixed star (Year 128 before Christ)	Hippar chus G.	Hippar chus M.	Scaliger G.	Scaliger M.	Petaviu s G.	Petaviu s M.
vlt.]						
Middle of the tail [media caudæ]	23	30	23	26	23	19
Next-to- last of the tail [antepe nult. caudæ]	22	24	22	25	22	5
A Souther n claw of Scorpiu s [Scorpij Chela australi s]	84	24	84	24	84	34
The extrem e star of Pegasus [Pegasi alæ extrem a]	87	0	87	0	86	51
The	63	0	64	0	62	11

Fixed star (Year 128 before Christ)	Hippar chus G.	Hippar chus M.	Scaliger G.	Scaliger M.	Petaviu s G.	Petaviu s M.
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most
souther
ly of
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three in
the left
shoulde
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Boötes
[Austra
lissima
trium
in
sinist.
humero
Bootæ]

Parsing notes: For the foot of Aries the Hipparchus column reads "90 ferè" (approximately 90°); rendered as "90 (approx.)" with no minutes. Two rows are marked **A** (austral) in the source margin: Sirius and the southern claw of Scorpius.

[Margin: 4] The fourth class gives the distance from the pole of the world of the boreal star at the extremity of the tail of Ursa Minor — the star now called **Polaris** — but which in Eudoxus's and Hipparchus's time was not Polaris (i.e. not the pole star), the distance being observed by various authors at various times, as below.

Table IV — Distance from the pole of the star at the extremity of the tail of Ursa Minor

Columns give the year (Years before / after Christ) and the distance from the pole. Degrees (G.), minutes (M.), seconds (S.).

Authority	Year	Dist. G.	Dist. M.	Dist. S.
Eudoxus, in Petavius Book III, <i>Diss. Uranologii</i> cap. 3	368 before Christ	14	4	0
Hipparchus , in Petavius Book I, <i>Geogr.</i> cap. 7	128 before Christ	12	24	0
Johannes Regiomont anus [Regiomont anus], Book I, On Triangles, from his own observation or another's — it is not clear	1470	4	9	0
Petrus Nonius [Pedro Nunes], Book II, On Observatio ns, cap. 7, from Naukler [ex Naclero]	1500	3	30	0
Gemma	1547	3	7	0

Authority	Year	Dist. G.	Dist. M.	Dist. S.
Frisius, from his own observation at Louvain, as Petavius reports in <i>Astrolabiu m Catholicum</i> cap. 9 (for his star [Polaris] stands too high, having 3° 35')				
Paulus Hainzelius [Paul Hainzel], in Petavius, <i>Progymnas mata</i> tom. I, p. 361	1572	3	0	15
Tycho [Tycho Brahe], tom. I, <i>Progymn.</i> p. 361	1577	2	58	50
the same, in the same place	1581	2	57	30
the same, in the same place	1585	2	56	10

Authority	Year	Dist. G.	Dist. M.	Dist. S.
Christophorus Rothmannus [Christoph Rothmann], in the <i>Hassiac Observations</i> at Wilhelm of Brunswick's [apud Villebiordum Snellium]...	1586	2	55	40
Tycho Brahe, tom. I, <i>Progym.</i> p. 362	1589	2	54	50
Jacobus Krismannus [Jakob Christmann], Book I, <i>On the Solar Astrolabe</i> , observed	1596	2	51	50
Andreas Garzia Cespedius [Andrés García de Céspedes],	1598	2	59	30

Authority	Year	Dist. G.	Dist. M.	Dist. S.
in his <i>Directory of Navigation</i> , where he adds an observation by Roderico Zamorano [Rodrigo Zamorano] of the year 1584				

(Table IV continues into the right column of folio 205.)

Authority	Year	Dist. G.	Dist. M.	Dist. S.
...the same [continuati on of context], differing by 3° 8', and so consenting with neither Tycho — because the annual approach, in proportion to the seconds at that time, requires only 20" [continuati on of	—	—	—	—

Authority	Year	Dist. G.	Dist. M.	Dist. S.
preceding entry]				
Jacobus Krismannus [Jakob Christmann], in his <i>Commentary on al-Farghānī</i> [ad Alfraganum]	1618	2	44	30
Adriaan Metius [Adrianus Metius], in his book <i>On the Use of the Globe</i>	1625	2	42	0
Petrus Gassendus [Pierre Gassendi], in his <i>Judgment Concerning the 9 Stars Around Jupiter</i>	1633	2	40	15
Petrus Herigonius [Pierre Hérigone], tom. 4, <i>Cursus Mathematic</i>	1640	2	33	0

Authority	Year	Dist. G.	Dist. M.	Dist. S.
<i>i</i>				
Fr. Stephanus Ofalul Minimus [Father Stephanus Ofalul, of the Order of Minims], in letters to me — though astronomic ally it ought to be 2° 36' 50"	1643	3	6	20
The Lord Jo. Dominicus Cassinus [Giovanni Domenico Cassini], at the house of the Malvasias [Maluaticis] of Bologna, observed it most subtly	1656	2	32	28
We ourselves [Riccioli], the same year, together	1656	2	32	28

Authority	Year	Dist. G.	Dist. M.	Dist. S.
with Father Grimaldo [Francesco Maria Grimaldi], by the gnomon, in the new Temple of S. Lucia				

Parsing notes: Table IV spans the page-column boundary on folio 205. The first row of the right-column continuation is the tail of the prose entry that overflows from the left column (the "3° 8'" passage); its year/distance cells are blank because the value belongs to the prose, not the tabulated series. The Cassini entry and the Riccioli/Grimaldi entry both read 2° 32' 28" for 1656.

Riccioli adds (right column): In the new Temple of S. Lucia, where the vault is obscured above, the feet stand at 74 [palms?]; one must rather stand there, than make such an observation with smaller instruments, as related in *Almag. Nov.* cap. 4. Neither did Cassini reckon our number [of observers], nor did we, Cassini, reckon yours — since the observation itself by a gnomon of such magnitude (as Cassini's was, the gnomon's altitude being 80 palms) and conducted with such diligence, by the very agreement [of results], makes it the more credible.

Fifth class

[Margin: 5] The fifth class comprises the declination of **Spica, Regulus, Arcturus**, the **Scale (Lanx) of the austral Balance, Fomalhaut**, and **Rigel** [Rigel], observed by the authors written below, but standing in need of a particular discussion.

[Margin: Spica observed by Werner] Johannes Vernerus of Nuremberg [Johann Werner], as Daniel Santbech relates in *Phænomenorum Prop. 20*, in the year 1514, on the 16th of December, observed at Nuremberg the parallactic altitude of Regulus [Reguli Parallacticæ Altitudinem] to be the meridian altitude 32° 7'; and thence, supposing the altitude of the pole to be 49° 24' 30", he deduced the austral declination [Declinationem Australem] of Spica to be 8° 29' 30". Thence, supposing the obliquity of the ecliptic to be 23° 30', and the austral latitude of Spica [Latitudo Austr.] to be 2° as handed down by Ptolemy, he derived the longitude [Longitudinem] in ♎ (Libra) at 16° 53' 20". Observing Regulus likewise

on the same day, he found the meridian altitude, and thence the boreal declination [Declinationem] to be $14^{\circ} 7'$, its longitude [Longit.] in \square (Leo) at $22^{\circ} 42'$. Finally, observing the austral Scale of the Balance [Lancis Australis] there at the time, he found the austral declination [Declinationem Austr.] to be $13^{\circ} 30'$; and likewise its longitude [Longit.] in \square (Scorpio) at $8^{\circ} 14'$; on which Werner [Vuernerus] also relies, *Theorema 7, Progymn.* pag. 221, and before all others Werner himself in his *Opusculum on the Motion of the eighth sphere* cap. 4.

[Margin: Et Regulus] [Margin: Et Lanc. Austr.] A great disagreement [Magnum Dissidium] is noted between these observations of Werner's, and Copernicus's, and Cardano's — on which more below. But Tycho [Tycho Brahe] suspects, and presses, that he did not so much make these observations of his own as accommodate the declinations at his own discretion to Ptolemy's latitude, and to a difference of longitude — which is itself in question concerning Regulus and Spica at $54^{\circ} 10'$ between Spica and the Scale [Lancem] at $8^{\circ} 53' 19''$; while the Scale of the Balance [Lancx] itself was $11^{\circ} 14'$. Also, the altitude of the pole at Nuremberg [Altitudo Norimbergæ] was truer for Tycho than the $49^{\circ} 26'$ Werner used; and therefore, if the true meridian altitude was that of Werner, the **[Margin: Werner's fallacies — Vueneri fallaciæ]** boreal declination of Regulus [Declinatio Borealis Reguli] would be $14^{\circ} 16'$, and the austral [declination] of Spica $8^{\circ} 27'$; and that of the Scale [Lancis] austral $13^{\circ} 36'$; from which Tycho assumes his own latitudes, and the obliquity of the ecliptic at $23^{\circ} 30'$. He gathers a trigonometric longitude [Longitudinem Trigonometricè] very dissonant from that which is owed to these stars by Tychonic observations down to the year 1515, applied to those [stars], as is plain from the subjoined Tychonic Table.

Liber IV — On the Fixed Stars (continued, folio 206)

Table — Vernerian and Tychonic calculations compared (Year 1515 incomplete [incoëpto])

Columns: **Latitude per Ptolemy** [La. Ptol.]; **Vernerian longitude from his own declination** [Calculus Vuerner. ex sua Declinat. — Longitudo]; **Latitude per Tycho and corrected longitude** [Calculus Tychon. ex Vueneri Decl. corrected from his tables — Lat. Tych. / Longit.]. Degrees (G.), minutes (M.). The letters **B / A** mark boreal / austral.

Star [Nom ina Stella rum]	La. Ptol. G.	La. Ptol. M.	Longi tudo G.	Longi tudo M.	Lat. Tych. G.	Lat. Tych. M.	Longi t. G.	Longi t. M.
Regul us	0	10 B	☐ 22	42	23	27 [?]	0	26 || 2 [?]
Spica	2	0 A	☐ 16	53 [?]	16	47	1	59
Austr al Scale [Lan x Austr .]	0	40 B	☐ 8	14	7	19	0	25

Parsing notes: This small comparison table at the top-left of folio 206 is finely set and ink-degraded; a few cells in the right-hand "Lat. Tych." / "Longit." sub-columns remain uncertain and carry [?]. The zodiac signs ☐ (Leo) for Regulus, ☐ (Libra) for Spica, ☐ (Scorpio) for the Scale are legible in the longitude column. The "La. Ptol." cell for the Austral Scale reads **0° 40' B** (degrees 0, minutes 40, Borealis), following the same G. + M. + hemisphere-letter pattern as the Regulus (0 10 B) and Spica (2 0 A) rows above it; the Vuerner longitude for that row stands in its own column at ☐ 8° 14' (Scorpio). A further review resolved the earlier "40 8" reading of this cell as a column slip (the spurious "8" was the adjacent Scorpio-longitude degree value), not a compositor error.

Therefore, from such doubtful declinations, the Vernerian one [Vuerneriana] permits nothing certain to be gathered concerning the place of these fixed stars.

[Margin: 6] [Margin: Spica observed by Copernicus — Spica obseru. à Copernico] Nicolaus Copernicus [Copernicus], *Revolutions* Book III, chapter 2, says that at Frauenburg in Prussia [Fruenburgi Prussiae], in the year 1525, he observed the meridian altitude of Spica, very nearly 27° in parts; whence, supposing the latitude of Frauenburg [latitudine Fruenburgica] to be 54° 19' 30", he gathered the austral declination [Declinationem] of Spica to be 8° 40'. Whence, assuming Ptolemy's latitude of 2°, he deduced the longitude [Longitudinem] to be 17° 21', very nearly. Adding, moreover, that before a century — that is, in the year 1515 — he repeated this same observation of Spica, and found the declination [Declinationem] to be 8° 36', and the longitude [Longitudinem] in ☐ (Libra) at 17°

14'. Here truly Petrus Nonius [Pedro Nunes], Book II, On Observations, cap. 4, exposes a great disagreement [dissidium] between Werner and Copernicus, since in the same year 1525 the former places Spica in Libra at $16^{\circ} 54'$, the latter at $17^{\circ} 14'$; **[Margin: Cardano's fallacy — Cardani fallacia]** Cardano [Girolamo Cardano], in turn, after some years — i.e. in the year of Christ 1537 — drags the same observation to the eleventh degree at $16^{\circ} 18'$ in Libra. Tycho, however, in tom. I, *Progym.* pag. 220, having earlier explored the altitude of the pole at Frauenburg to be $54^{\circ} 22' 15''$, **[Margin: Copernicus's fallacy — Copernici fallacia]** corrects the declination of Spica for the year 1515 to be $8^{\circ} 23' 15''$. And then, having assumed the latitude of Frauenburg to be $54^{\circ} 19' 30''$, he gathers the longitude of Spica in Libra to be $17^{\circ} 2' 30''$; and likewise so for the year 1525. The corrected declination of Spica being used at $8^{\circ} 37' 15''$, he obtains the longitude in Libra at $17^{\circ} 14'$; and likewise, limiting it for the year 1520, the latitude [latitude] in Libra at $17^{\circ} 8' 30''$. But Philippus Lansbergius [Philip Lansberge], **[Margin: Lansberg's fallacy — Lansbergi fallacia]** in his *Thesaurus of Observations of the Fixed Stars*, where he places Spica according to his own tables computed for the year 1525 in Libra at $17^{\circ} 35'$, confirms the Copernican observation, [pointing out] two faults of Astronomy admitted — one of omission, the other of commission — in pursuing the refraction at his own pleasure. For it would arise from a refraction of $2^{\circ} 30'$, the true altitude being $26^{\circ} 57'$; whence, having supposed the altitude of the equator to be $8^{\circ} 44'$, by which he observed Copernicus's declination of $8^{\circ} 44'$, and the latitude to be $1^{\circ} 58'$; but the obliquity of the ecliptic at $23^{\circ} 30'$, he extends the longitude in Libra to $17^{\circ} 35'$.

[Margin: 7] [Margin: Stadius observed Spica — Stadij obseru. Spica] Johannes Stadius [Johannes Stadius], in his *Commentaries on the Fixed Stars* cap. 1, relates an observation he himself made at Brussels of the altitude of the equator to be $38^{\circ} 40'$, and in the year 1559, on the Nones of July [Nonis Iulij], the altitude of Spica at the meridian to be $29^{\circ} 52'$; and thence he gathered the austral declination of Spica to be $8^{\circ} 48'$, whence its longitude [longitude] in Libra at $17^{\circ} 40'$; and he reduced the Alphonsine Calculation, which he derives for the same year, to require Spica in Libra at $16^{\circ} 50'$; **[Margin: Et Arcturi, Sirij]** and Cardano, on whom see above. He narrates, moreover, cap. 1, in the same year 1559, having observed on the eve of the Ides of April [pridie Idus Aprilis] the meridian altitude, and thence the declination of Arcturus to be $69^{\circ} 30'$; and in the year 1598, on the Nones of March [Nonis Martij], the meridian altitude of Sirius to be $22^{\circ} 45'$, hence the austral declination to be $15^{\circ} 55'$; **[Margin: Fomahât]** and of Fomalhaut [Fomahant] the meridian altitude to be $5^{\circ} 6'$, hence the declination austral to be $33^{\circ} 55'$; finally, **[Margin: Rigel]** the meridian altitude of the left foot of Orion, Rigel [sinistri pedis Orionis Rigel], to be $19^{\circ} 18'$, hence the austral declination to

be 9° 12'; and from his longitude of Fomalhaut in Pisces at 28° [**Margin: Stadij errores**] and Rigel in Gemini at 10° 10'. But in our *Reformed Geography* I have shown from Langren [Langrenus] and the observations made at Brussels that the altitude of the pole there is 50° 48', and the altitude of the equator 39° 12'; therefore, supposing the meridian altitude of Stadius, the declinations are to be corrected, and below, which nonetheless do not cohere with the required Tychonic Table.

(Right column of folio 206:)

Tychonic Table — declination and observation by Stadius (Year 1559)

Columns: **Year** [Anno]; **False [declination] of Stadius** [Falsa Stadij]; **Corrected [declination] of Stadius** [Correcta Stadij]; **Tychonic** [Tyconica]. Degrees (G.), minutes (M.), seconds (S.). The letters **B / A** mark boreal / austral.

Year	Star	Falsa Stadij		Corre cta Stadij		Tych onica		
		G.	M.	G.	M.	G.	M.	S.
1559	Arcturus [Arcturi]	22	0	22	32 B	21	32	30
1559	Sirius [Sirij]	15	55	16	27 A	16	9	22
1559	Fomalhaut [Fomahant]	33	33	34	6 A	30	56	36
1559	Rigel	9	12	9	44 A	9	21	6
1559	Spica [Spicae]	8	48	9	20 A	8	47	40

Parsing notes: The "Decl. & Observ. Jo. Stadij — Anno" header spans the year column. The middle "Correcta Stadij" column carries the B/A sign letter on its minutes value (e.g. "32 B", "27 A"). The Tychonic column gives degrees, minutes, and seconds.

It is therefore plain that, just as the declinations stated by Stadius are false, so the places of the said stars introduced by Stadius are false; and so too the place of Regulus, which (Chapter 2, *Commentary on the Fixed Stars*) he affirms to have been found by himself in the year 1555 in Leo [♌] at $23^{\circ} 30'$.

Caput IV — Longitudes and Latitudes of the Fixed Stars, selected from observations down to (but not including) the time of Claudius Ptolemy, with a critique of them

Besides the twofold mode of Observing the Longitudes of the Fixed Stars — namely the ecliptic distance among themselves, captured together with the Moon by naked eye or by astrolabe, and likewise the distance of the same Fixed Stars from the Sun (which I indicated in chapter 1 of this Book) — later astronomers, down to Ptolemy and even to Tycho, used a third mode: namely, assuming their latitude (as found by Ptolemy, since it is as it were unchangeable) together with the obliquity of the ecliptic, and the declination at the time of observation, they investigated the longitudes of the same by triangular analysis. I therefore set out beforehand the longitudes acquired by the earlier authors down to Ptolemy, and then those selected by Ptolemy himself down to those successors down to the time of Wilhelm Landgrave of Hesse [Vilhelm Lantgravii Hassiæ] and of Tycho Brahe — noting for each what seems worthy of estimation. Yet by way of foundation must be premised, from our *Reformed Chronology*, the best Chronographs: that in the year of the vulgar Epoch of Christ, on the 23rd of August by the Julian Calendar, began the year 749 of Nabonassar; whence, from the years of Nabonassar handed down by Ptolemy, the years before or after Christ are easily gathered, as set out above.

[Margin: 1] [Margin: Spica observed by Timocharis — Spica obseru.

Timocharidis] Timocharis of Alexandria [Timocharis], as Ptolemy relates (*Almagest* cap. 7), observed Spica to be distant from the point of the Autumnal Equinox 8° — that is, in Virgo [♍] at 22° , very nearly — but he does not express the Year, as he does in others; quote 2, when he narrates Timocharis's observed boreal declination of Spica to be 24° below, in the same year, in the first month, which he notes to have been Nabonassar 454 — that is, the year of Christ 295. Therefore, this Year is in question; not improbably it is accepted from *Almag.* Book 5, *Astronomiæ Philolaicæ* cap. 3 — to which it refers from Nabonassar 454, with the declination foretold and the latitude of Spica, he gathers its place in Virgo [♍] at $22^{\circ} 19'$.

[Margin: 2] [Margin: Spica observed by Timocharis — Spica obseru. Timoch.] Timocharis likewise of Alexandria, as Ptolemy has it (*Almagest* cap. 3), in the year 36 of the first Callippic Period [primæ Callippi Periodi] consisting of 76 years, on the 15th of Elaphebolion [Elaphebolionis], that is, in Nabonassar 454, before Christ 294, in the month Tybi [Tybi Mensis] on the 5th, beginning the night on the sixth at the third hour — that is, a quarter past midnight, in temporal as well as equinoctial hours — saw the Moon reach with its eastern limb to Spica, and Spica was carried away so exactly along with the Moon, that he gathers Spica to be at the same point as the Moon's centre. From the Moon's diameter, distant northward, Ptolemy gathers from his Lunar tables the longitude of Spica in Virgo [□] at $22^{\circ} 20'$, and the austral latitude very nearly 2° . Copernicus uses this observation (*Revolutions* Book 3).

(*De Revolutionibus* III, *Revolutions* chapter 2), and [Tycho Brahe], in *Progymnasmata* pages 253 and 254, rightly adds that, from this observation down to his own observation of Spica made in the year of Christ 1585, complete years numbering 1879 had elapsed. And yet, though Tycho gives the years correctly, Timocharis does not rightly state that, in his time, Spica stood in $\square 22^{\circ} 20'$. For [Ptolemy], from his own calculation, deduces from Timocharis's observation that Spica stood very nearly at $\square 22^{\circ} 20'$. Lansbergius [Philip van Lansberge], however, in his *Thesaurus* of observations, on page 146, assigns the position of the fixed stars (as on his *Tables*) at $\square 22^{\circ} 4' 38''$, and a true latitude of 2° austral. He misreads the size of this observation enormously, since in the history of his observation [Ptolemy] expressly relates the *triangle* of the diameter of the Moon, falling short by $4^{\circ} 45'$ to the south of Spica; and in the final calculation it came to $4^{\circ} 45'$ — that is, one-third of a semidiameter, not the diameter.

[Margin: Error of Lansbergius.]

§3. Likewise [Timocharis] of Alexandria, as [Ptolemy] relates (*Almagest* VII.3, Year 48 of the first Callippic period, expiring on day 6 of Pyanepsion, and 7 Thoth elapsed, at hour 10 and $1/2$ of the night, saw Spica exactly touching the northern part of the Moon, then above the eastern horizon, in the Year of Nabonassar 466 — that is, before Christ 283 — and at hour 3 and $1/2$ temporal, after midnight he concludes the position of Spica in $\square 22^{\circ} 30'$, with austral latitude 2° . Concluding very nearly, between the earlier observation and this one, Spica advanced 12 minutes. And as to part of this observation, Spica is set forth, in Greek codices, where one codex reads \square — that is, the figure 5 with an acute accent over it — which signifies not the place 10 but the sixth part of unity, just as the Latin interpreter renders it. Longomontanus [Christen Sørensen Longomontanus],

however, in *Astronomia Danica* (Book 2 of the *Theorica*, chapter 1, in his Commentary *On the Fixed Stars*), from his own lunar hypotheses places Spica in $\square 22^{\circ}30'$, at hour 15 $\frac{1}{4}$ [?] equal [from] after the meridian at Alexandria in the Year of Nabonassar 466 — but 1884 before Christ, the Year 1600 current [?]. From which observation he found Spica to have stood, 284 years before Christ. But Lansbergius, in his *Thesaurus* of observations, page 146, places the hour at the equal hour at Alexandria as $2^{\circ}30'$, after midnight, and Spica, by his tables, in $\square 22^{\circ}12'21''$ [?].

[Margin: Spica & austral. Timochar.]

§4. [Timocharis], from [Ptolemy] (*Almagest* VII.3, at Alexandria, Year 47 of the first Callippic period, at Nabonassar 465, that is, before Christ 284, on day 29 of the month Athyr, at hour 3 and $\frac{1}{2}$ temporal nocturnal — that is, hour $3^{\circ}30'$ equal before midnight — diligently noted the middle of the austral Pleiad applied to the middle of the Moon, or the third following it, where [Timocharis] would have placed the fixed star here in Aries [\square] $29^{\circ}30'$, with northern latitude $3^{\circ}40'$, very nearly. Longomontanus already, from the place stated above, deduces the position of the Pleiad in $\square 29^{\circ}30'$; and Lunar at the meridian $8^{\circ}40'$ [?]; and the Moon with the Pleiad in $\square 29^{\circ}32'$.

[Margin: Lucid Pleiad observed by Timocharis.]

§5. [Timocharis], finally, in [Ptolemy] (*Almagest* I.7, chapter 3, at Alexandria, Year 36 of the first Callippic period, and Nabonassar 454, at Alexandria, day 25 of Phaophi exactly Possidonios, and day 16 of Phaophi truly, at hour 16 incipient — that is, hour 10 after midnight, hours 3 temporal, equal hours however $3^{\circ}10'$ — observed the Moon with its northern extremity touching the northern part of the three [stars] in the front of Scorpius, where [Ptolemy] deduces it to have been in Scorpius [\square] 2° , with boreal latitude $1^{\circ}10'$. But Longomontanus, where he places above, sets the hour $15^{\circ}30'$ after the meridian, the place; the Star with the Moon in Scorpius $\square 1^{\circ}58'$. Lansbergius, in his *Thesaurus*, page 148, asserts that [Ptolemy] is not to be doubted to have here deceived himself, since it is a faulty longitude of the Star, the true one being in Scorpius $\square 1^{\circ}26'29''$, with latitude $1^{\circ}15'$ boreal; and therefore the conjunction of the Moon and the fixed star was seen in the horizon, hour $2^{\circ}30'$ equal after midnight, and the place of the Moon true in Scorpius $\square 0^{\circ}50'32''$, and the boreal latitude $1^{\circ}16'49''$.

[Margin: Front of Scorpius.]

§6. [Hipparchus], as [Ptolemy] relates (*Almagest* I.7, chapter 2, from his own time — that is, that, by a subsequent observation collecting the Year 50 of the third

Callippic period, this being before Christ 128, sees Spica to stand in the preceding part of the autumnal section by 6°, but, this being on day 24, in 14°. Yet he collects (as above) Spica's place of declination as boreal 0°36'. Boulliau [Ismaël Bullialdus] (*Astron. Phil.* chapter 3, the latitude of Spica) collects its place in 23°59'. Longomontanus, however, with respect to the true equinox, where above, places it in 24°25'.

[Margin: Spica observed by Hipparchus.]

§7. [Hipparchus] likewise, as [Ptolemy] relates (*Almagest* I.7, chapter 2 —

would have observed, in the Year 50 of the third Callippic period, Spica to be in the Heart of Leo [Regulus] in Cancer 29°50'. [Tycho Brahe] places it, from his own time, in Tome 1 of the *Progymnasmata*, page 253; he received it, as he had himself observed it, in the Year of Christ 1585, completed, [reckoning] fluxible years 1713; and at the Year of Nabonassar 621. By comparison with [Copernicus] (Book 3, chapter 2, he has it at the Year of Nabonassar 196 from the death of Alexander the Great. Boulliau, however, from the place stated above, has the Year of Nabonassar 621, since [Ptolemy] himself, in the Year of Nabonassar 265, places the observations among the fixed stars, which he himself dictates to have made; nevertheless, comparing this same year with Antonine the Emperor, here he counts the Year of Nabonassar 886. But Lansbergius, in his *Thesaurus* page 153, asserts, from his own tables, the position of Regulus in Cancer 29°[?]'4'[?] from that year up to which he counts the years of Nabonassar 618 complete: the Egyptians [counted] 618 days, 365, the same with 36 [?]; the first year of the Callippic period was the Year of Nabonassar 454 incipient, and [Ptolemy] asserts the Callippic period to consist of years 76; and [Ptolemy] (*Almagest* I.7, chapter 3, that the year, the 50th of the third Callippic period, ran with the Year of Nabonassar 620, [Spica] increasing soon 621.

[Margin: Regulus observed by Hipparchus.]

[Margin: The Chronology differs from both Bullialdus and Lansberge.]

§8. [Agrippa], as [Ptolemy] writes (*Almagest* I.7, chapter 2, in Bithynia, in the Year 12 of the rule of the Emperor Domitian, and 840 of Nabonassar, on day 7, Metroi, and day 2 of Tybi, at the beginning of the night, hour 3 temporal, observed the austral part of the Moon applied, and the middle Pleiad. [Ptolemy] adds that, at Alexandria, the hour was equinoctial 5°[?], the middle of the night. From this, from his own Lunar tables, he deduces the place of the Pleiad in Taurus 3°5', with northern latitude 3°40'. The Year of Christ was 92.

[Margin: Pleiad observed by Agrippa.]

§9. [Menelaus] at Rome, in the first year of the Emperor Trajan, as [Ptolemy] has it (*Almagest* I.7, chapter 3, in the Year of Nabonassar 845, day 15, Mechir, sequent 16, at hour 10 temporal of the night, observed the austral part of the Moon adhering to Spica, the Moon then in operation, truly austral, after midnight, Spica appeared distant from the center of the Moon nearly less than [?], by one diameter of the Moon, and equally removed from the lunar horns. [Ptolemy] subjoins that the Moon had then earlier, at the same time, [stood] at Alexandria at hour 6°15' after the middle of the night, [and] that Spica stood in $\square 25^{\circ}43'$. Lansbergius, in his *Thesaurus*, page 147, says it stood at Rome equal 4°57', the middle of the night, and the years of Christ 97 complete, of the year fluxible. Spica then stood in $\square 26^{\circ}1'36''$. But the latitude (as [Copernicus] Book 3, *De Revolutionibus*, has it) was the Year of Christ 99 from the days of Nabonassar.

[Margin: Spica observed by Menelaus.]

§10. [Menelaus] again, in the same Year 1 of Trajan, from [Ptolemy] above, day 18, Mechir, sequent 19, hour 11, observed at Rome the austral horn of the Moon in a straight line with the middle of Scorpius, and so much that the austral horn deflected from the straight line, by as much; distinct from the middle of these, as much also the austral, & equally the northern front of Scorpius. [Ptolemy] asserts it to have been at Alexandria at equal hour 7°10', after the middle of the night, where, from his own Lunar tables, he collects the boreal front of Scorpius in Scorpius $\square 5^{\circ}10'$, with latitude 1°10' boreal. Lansbergius, in his *Thesaurus* page 149, asserts that the hour was the middle of the night 6°12', equal to Rome, and the Star to have stood in Scorpius $\square 5^{\circ}24'36''$, with latitude boreal 1°15'.

[Margin: Scorpius front observed by Menelaus.]

§11. [Ptolemy] himself (*Almagest* VII.3, the declination of Spica 0°[?], the austral observation [?] [?], at the fixed [date], and which [Ptolemy] had dictated, in the Year 2 of Antoninus the Emperor, day 9 of Pharmuthi, hour after midnight 5°30', observed by the Astrolabe the distance of Spica from the dividing Ecliptic of the Moon, austral by 3 degrees [?]; and a north-austral position from the Sun in the Ecliptic place of Leo, secondly succeeding, 57°10'; whence he collects the place of Regulus in Leo $\square 2^{\circ}30'$. [Copernicus] Book 3 *De Revolutionibus*, chapter 2, affirms the same year, 462 from the death of Alexander the Great. Longomontanus, in the said Commentary *On the Fixed Stars*, from his own tables, collects Regulus to have stood in Leo $\square 3^{\circ}53'$; computed, by refraction, since the Sun being westerly moves, diminishes the longitude of the Moon. And that Year was the Year of Christ 138,

and 265. [Ptolemy] in his observation here noted, when smaller longitude [is] noted, the minor longitude [of] Ptolemy in his observation, when the latitude itself in $\square 25^{\circ}43'$ [?]; truly [Ptolemy] numbers the Year of Christ 1464, since [the year] is in only 1462 complete. Lansbergius, in his *Thesaurus* page 153, places the Year of Christ 138; Regulus, in Leo $\square 2^{\circ}30'4''$; nothing curious of the Refraction of the Sun, which doubtless minor [factor] represents [?]; and [Ptolemy] had represented to himself the longitude of the Moon, saying the Sun to have been

[Margin: Spica & Regulus observed by Ptolemy.]

[Margin: Inconstancy of Lansbergius.]

very nearly close to setting, & yet otherwise (as we have seen) he did not neglect Refraction. Let us now compare into one conspectus the places of the aforesaid fixed stars.

Table I. This is a citation-grade comparison table collating the deduced longitudes of the fixed stars from the ancient observations discussed above, giving for each observation: the order, the star observed with its observer and year, the calculators from the observations, and the deduced places of the fixed stars (in degrees, in two longitude columns headed G. I and II). Transcribed below as a pipe-table.

I. TABULA

Order of observation	Star observed, & Observers, & Years	Calculators from the observations	Places of Fixed Stars deduced (Sig. G. — M.)
1	Spica of Timocharis, before Christ 296	Timochar. / Bullialdus	$\square 22$ [nearly] / 22 59
2	Spica of Timocharis, before Christ 296	Ptolemæus / Latit. / Lübergius [Lansbergius] / Latit.	$\square 22 20 0$ / $\square 2$ [nearly] / $\square 22 4 28$
3	Spica of Timocharis, before Christ 283	Ptolemæus / Latit. / Longomöt. / Latit. /	$\square 22 30 0$ / $\square 2$ [nearly] / $\square 22 30 0$ / 2 0 0 / $\square 22 12 21$

Order of obser- vation	Star observed, & Observers, & Years	Calculators from the observations	Places of Fixed Stars deduced (Sig. G. — M.)
		Läbergius [Lansbergius]	
4	Lucid Pleiad of Timocharis, before Christ 284	Ptolemæus / Latit. / Longomöt.	□ 29 30 0 / □ 3 40 0 / □ 29 32 0
5	Boreal front of Scorpius, of Timocharis, before Christ 295	Ptolemæus / Latit. / Longomöt. / Lansberg. / Latit.	□ 2 10 0 / □ 1 20 0 / □ 1 16 30 / □ 1 15 0
6	Spica of Hipparchus, before Christ 129	Hipparch. / Longomöt. / Bullialdus	□ 24 0 0 / 24 25 0 / 23 59 0
7	Regulus of Hipparchus, before Christ 129	Ptolemæus / Lansberg.	□ 29 50 0 / 29 49 4
8	Lucid Pleiad of Agrippa, [after] Christ 92	Ptolemæus / Latit.	□ 3 5 0 / □ 3 40 0
9	Spica of Menelaus, [after] Christ 98	Ptolemæus / Latit. / Lansberg.	□ 25 45 0 / □ 2 0 0 / □ 26 1 36
10	Boreal front of Scorpius, of Menelaus, Christ 98	Ptolemæus / Latit. / Lansberg. / Latit.	□ 5 20 0 / □ 1 20 0 / □ 5 24 0 / □ 1 15 0
11	Regulus of Ptolemy, Christ 138	Ptolemæus / Longomöt. / Lansberg.	□ 2 30 0 / 3 53 0 / 2 30 4

Parsing notes: The position block lists, per observer/calculator row, either a sign G M triple or a bare G M pair (when a latitude-derived variant repeats the same sign); each numbered observation occupies several physical rows, one per calculator, in the same top-to-bottom order as the calculator names. Latitude sub-rows (marked "Latit.") shift into the next sign (♎ Libra / ♏ Scorpius) and carry their own degrees/minutes; transcribed as printed. Readings marked [nearly] correspond to the source's "proximè"/"proxim." (= "very nearly"). Row 11's middle value 3 53 is Longomontanus's Regulus longitude (Leo implied, no sign reprinted) and diverges from Ptolemy's 2 30 and Lansberge's 2 30 4 — a genuine authority disagreement discussed in the prose (§11), transcribed as printed. The values follow the prose discussion in §§2–11 above.

§12. Since we have arrived at [Ptolemy], it would seem appropriate here to subjoin the Ptolemaic Catalogue of the Fixed Stars, which we have collated with the Greek text of the Basel edition, with the Translation of Georgius Trapezuntius [George of Trebizond], revised by Andreas his son, & by Luca Gauricus; likewise with the abacus [computational tables] of the Alphonsine, Prutenic, Copernican, Clavian, and Pisan [astronomers]. But, lest we burden the Typographers and the Readers with so great a mass of false longitudes and latitudes, [we proceed thus]. For excepting some few of the fixed stars, of which the places can be conferred [with those] of the more recent erudite Astronomers, by Study, the rest are useless, since either they manifestly labor under a fault — suspect, or vitiated — whether by the rudeness of the observations, or by Refractions omitted in the catching of the distances of the Sun from the Moon, through which the places of the fixed stars [are] sought; or [as] it [is] attested by [Ptolemy] (*Almagest* VII, chapter 4, both by the fallacy of the place of the Sun itself and of the Moon, from too great Parallax, and by the false and false obliquity of the Ecliptic. It is sufficient, therefore, to select the fixed stars of the first and second magnitude, and a very few more notable of the third magnitude. The places of the rest, [those] of [Ptolemy] down to our own time, are better collected from our Universal Catalogue, the Annual motion of the Fixed Stars, or the difference of Longitude among them; and these we here give.

[Margin: The Ptolemaic Catalogue [is] imperfect.]

II. TABULA

Of the selected fixed stars from the Ptolemaic Catalogue, with the Variant Reading of Longitude, or of Latitude where there is need. To the beginning [of the reign] of Antoninus the Emperor, that is, the Year of Christ 137 & 138.

Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among them	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
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**URS
A
MIN
OR**

1	Cauda extrema, <i>tunc non Polaris</i> (Tail-end, <i>then not the Pole star</i>)	□	0	10	66	0	B	3	♃ ♀
4	Aust	□	29	40	75	40	B	4	

Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among them	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
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ralis in præcedenti later e □ (Austral in the preceding side □) — Copernico

29 40 75 20 B

Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among them	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	—		29	40	75	50	B		
	Prutenicus								
6	Australis in sequenti latere □ (Australis in the following side □)	□	17	10	72	50	B	2	
	—		17	20	72	10	B		

Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among them	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
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Græcus code x

7	Borealis sequentis lateris (Boreal of the following side)	□	16	10	74	50	B	2	
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URS
A
MAI

Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among them	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
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OR

16	Quæ in dors o, & in quadrilater o (Which is on the back, & in the quadrilateral	□	17	40	49	0	B	2	□
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Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among the m	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
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17	Quæ in later e in quadri later o (Which is on the side in the quadrilateral)	□	22	10	44	30	B	2	
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Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among the m	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
18	Quæ in radice Caudæ (Which is at the root of the Tail)	□	5	10	51	0	B	2	
19	Quæ in posteriori sinistra	□	4	0	46	30	B	2	♃ ♃

Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	among them	Longitude Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	coxa (Which is on the posterior left haunch)								
25	Prima Caudæ (First of the Tail)	□	12	10	53	30	B	2	
	— Græ		12	10	57	30	B		

Constellations

, that is, Stars, & the Fixed stars selected

Ptolemaic Order	name	Longitud. Sig.	Long. . G.	Long. . M.	Latit. . G.	Latit. . M.	B/A	Magnitude	Nature
	cuscode x								
26	Media Caudæ (Middle of the Tail)	□	18	0	55	40	B	2	
27	Extréma Caudæ (End of the Tail)	□	20	50	54	0	B	2	

Parsing notes: Columns are Ptolemaic catalogue order; the constellation/star description; longitude as zodiac sign (Sig.) + degrees (G.) + minutes (M.); latitude as degrees (G.) + minutes (M.) with B (borealis = north) or A (australis = south); magnitude; and "Nature" (planetary-temperament glyphs, e.g. ♄ Saturn, ♀ Venus, ♂ Mars, ☿ Mercury). Variant readings (Copernican, Prutenic, Greek codex) are entered as indented sub-rows beneath their base star with their alternative coordinates. The □ glyph in some descriptions denotes "in the quadrilateral/square." Table continues on the next page (DRACO).

II. TABULA (continued)

Ptolemaic Order	Constellations & Star	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Mag nitude	Nature
DRACO									
2	Quæ in ore (Which is in the mouth)	□	11	50	78	30	B	4	♄ ♀
3	Quæ supra oculum est (Which is above the eye)	□	13	10	75	40	B	3	
5	Quæ	□	29	40	75	30	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	supra caput (Which is above the head)								
	— Copenico (by Copernicus)		29	10	75	30	B	3	
16	Sequens in sequenti flexu Δ (Following in the following bend Δ)	\square	26	10	80	15	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
20	Sequens in parte Occident. Δ (Following in the western part Δ)	\square	28	40	87	30	B	6	
	— Prutenicus	\square	26	40	87	30	B	6	
30	Proxima extremae caudae (Nearest to the end of	\square	19	10	67	35	B	3	\sphericalangle

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	TOP HYL AX								
5	Quæ in humeris sinistro (Which is on the left shoulder)	□	19	40	49	0	B	3	
16	Quæ in crure dextro ad cingulum (Which is on the right leg at	□	0	0	44	0	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	the girdle)								
	—	□	0	0	45	15	B		
19	Alphonso, & Copernico Quæ in dextro calcaneo (Which is on the right heel)	□	5	20	28	0	B	3	
20	Borealis trium in tibia sinistra (Boreal of the	□	21	10	28	0	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	three in the left shin)								
	Informis intercrura, seu Arcturus (Shapeless [star] between the legs, that is, Arcturus)	□	27	0	31	30	B	1	♂
	— Græcus Codex	□	27	0	31	10	B	1	
	COR	□	14	40	44	30	B	2	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	ON Æ Borealis lucida (Bright [star] of the Northern Crown)	□	14	40	44	36	B	2	
	— Prutenicus								
	ENG ONA SI, seu HERCULES								
1	Quæ est in capitale (Which is	□	17	40	37	30	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	in the head)								
3	Quæ in brachio dextro (Which is in the right arm)	□	1	40	40	10	B	3	
5	Quæ in humero sinistro (Which is in the left shoulder)	□	16	40	48	0	B	2½	
11	Quæ in dextro	□	6	50	36	40	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	later e (Which is in the right side)								
	— □ Græcus Code x	□	6	50	40	0	B		
25	Quæ in genu dextro (Which is in the right knee) LYR A, seu VUL TUR CAD ENS (Lyr	□	15	40	65	30	B	3½	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	a, or the Falling Vulture)								
1	Lyræ lucidissima (Brightest of the Lyre)	□	17	20	62	0	B	1	♃ ♀
	[Vega]								
3	Australium lucidissimum (Austral of the two	□	19	0	61	0	B	3½	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
9	near the brightest one) Borealiorsudarium sequentium in iugo (More boreal of the two following in the yoke) CYGNUS, seu GALLINA (Cyg	□	24	10	55	20	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	nus, or the Hen)								
1	Quæ in ore, seu rostr o (Whi ch is in the mou th, or beak)	□	4	30	49	20	B	3	☿
4	Quæ in pect ore (Whi ch is in the brea st)	□	28	30	57	10	B	3	
5	Luci da caud æ	□	9	10	60	0	B	2	□

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	(Bright [star] of the tail) [Deneb]								
6	Quæ in ancone alæ dextæ ræ (Which is in the elbow of the right wing)	□	19	40	64	0	B	3	
	— Prutenicus	□	19	20	64	40	B	3	
10	Quæ in ancone	□	0	50	49	30	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	alæsinistræ (Which is in the elbow of the left wing)								
12	In extremopectoris alæsinistræ (At the end of the breast of the left wing)	□	6	40	44	0	B	3	
	—	□	6	40	74	0	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	Prutenicus								
	CAS SIEP EA								
1	Quæ in capite (Which is in the head)	□	7	50	45	20	B	3½	♃ ♃
2	Quæ in pectore Schedir (Which is in the breast, Schedir)	□	10	50	46	45	B	3	
4	Quæ in cruri	□	16	40	49	0	B	2½	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
5	Quæ in genibus (Which is in the legs)	□	20	40	45	0	B	3	
	— Prutenicus	□	20	20	45	30	B	3	
13	Quæ in medio Cathedræ (Which is in the middle)	□	7	50	51	40	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
7	Lucida in dextro latera (Bright [star] in the right side) [Mirfak]	□	4	50	30	0	B	2	
10	Sequentium post lucidam lateris (Following of the three behind the	□	7	40	27	20	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	bright one of the side)								
	—	□	7	40	27	30	B	3	
12	Alphonsinis Fulgida in Gorgonis capite (Bright [star] in the head of the Gorgon)	□	29	40	23	0	B	2	ஃ ௩
26	Quæ in genu sinis	□	19	15	19	15	B	3	

Ptolemaic Order	Constellations, & Stars	Long . Sig.	Long . G.	Long . M.	Latit . G.	Latit . M.	B/A	Magnitude	Nature
	tro (Which is in the left knee)								
	— □	8	40	19	50	B			
28	Alphonsinis, ac Prutenicis Quæ in sinistro calcaneo (Which is in the left heel)	□	0	10	12	0	B	3½	
29	Extramediasinis	□	6	20	11	0	B	2½	

Ptolemaic Order	Constellations, & Star	Long. Sig.	Long. G.	Long. M.	Latit. G.	Latit. M.	B/A	Magnitude	Nature
	tri (End of the left foot)								

Parsing notes: Same column structure as the previous page. Constellation names are display sub-headers in the description column. Variant-reading sub-rows (Copernicus, Prutenic, Alphonsine, Greek codex) are entered indented beneath their base star. \triangle and \square are positional glyphs printed in the source descriptions (denoting the "triangle"/"quadrilateral" figures of the constellation). The "Nature" column carries planetary-temperament glyphs (♄ Saturn, ♃ Jupiter, ♂ Mars, ♀ Venus, ☿ Mercury) that are faint in places; the few that could not be fixed are flagged [?]. Suspected source/compositor slips transcribed as printed: Cygnus ord. 12 Prutenic latitude 74 (against the main row's 44); Perseus ord. 26 main-row repeated 19 15 in both longitude- and latitude-degree. Table continues on the next page.

Liber IV — De Fixis Stellis (Book IV — On the Fixed Stars), Caput IV (continued)

II. Table — Selected Fixed Stars from the Ptolemaic Catalogue (continued)

The catalogue (Table II) continues from the previous batch. Columns: Ptolemaic order-number | Constellation & star description (constellation names as bold sub-headers; variant readings — Greek codex, Alphonsine, Prutenic, Copernicus, Clavius — appear as indented sub-rows) | Sign (Sig.) | Longitude in degrees (G.) and minutes (M.) | Latitude in degrees (G.) and minutes (M.) | B/A = Borealis (north) / Australis (south) | Magnitude (Magnitudo) | Nature (Natura — planetary-temperament glyph). Zodiac-sign glyphs are rendered by their names. Longitudes

are reckoned within each zodiac sign (0–30°). Variant-reading rows give an alternative longitude/latitude for the star named in the line immediately above.

Page 244 (folio 210) — Auriga through Pegasus

AURIGA, seu HENIOCHUS [Auriga, "the Charioteer"]

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
3	Capella, shining, on the left shoulder [Capella]	Taurus	25	0	22	30	B	1	♂ ♀
	— <i>Greek code x</i>	Taurus	25	0	22	10	B	1	
4	The one that shines on the right shoulder	Gemini	2	50	10	0	B	2	
8	The following	Taurus	22	10	18	0	B	3½	

No	Desc ription	Sign	Long .°	Long .′	Lat. °	Lat. ′	B/A	Mag.	Natu re
	of the Kids [Hae di]								
9	The prec edin g of the Kids	Taur us	22	0	18	0	B	4	
	— <i>Prut enic</i>	Taur us	22	40	18	0	B	4	
10	The one on the left ankl e	Taur us	19	50	10	10	B	3½	
11	The one on the right ankl e, or the nort h horn of Taur us	Taur us	25	40	5	0	B	3	

OPHIUCHUS, seu SERPENTARIUS [Ophiuchus, "the Serpent-bearer"]

No	Description	Sign	Long .°	Long .′	Lat. °	Lat. ′	B/A	Mag.	Nature
1	The one on the head	Scorpius	24	50	36	0	B	2½	♃ ♀
2	The preceding of the two on the right shoulder	Scorpius	28	0	27	15	B	3	
7	The preceding of the two on the left hand	Scorpius	5	0	17	30	B	3	
8	The following of the two on	Scorpius	6	0	17	30	B	3	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	the left hand								
	— <i>Alph onsi ne</i>	Scor pius	6	0	17	30	B	3	
	— <i>Prut enic</i>	Scor pius	6	0	12	30	B	3	
12	The one on the right knee	Scor pius	21	10	7	40	B	3	
13	The one on the right shin	Scor pius	26	40	2	15	B	3½	

SERPENS [Serpens, "the Serpent"]

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
3	The one shini ng on the	Libr a	24	20	36	0	B	3	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	tem ples								
	—	Libr	24	20	35	0	B	3	
	<i>Alph onsi ne & Prut enic</i>	a							
4	The one at the root of the neck	Libr a	22	0	11	15	B	3	
	—		22	0	34	15	B	3	
	<i>Gree k code x</i>								
	—		22	0	34	15	B	3	
	<i>Alph onsi ne & Prut enic</i>								
7	The one after the first ben d of the	Libr a	21	41	29	15	B	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
17	neck The next-to-last in the tail	Sagittarius	8	40	10	0	B	3½	

SAGITTA [Sagitta, "the Arrow"]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
1	The solitary one on the iron (arrowhead)	Capricorn	10	10	39	40	B	4	☐☐
—	<i>Alphonsine & Prutenic</i>	Capricorn	10	10	39	30	B	4	

AQUILA, seu VULTUR VOLANS [Aquila, "the Eagle," or "the Flying Vulture"]

No	Description	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Nature
1	The one shining on the neck	Capricorn	4	50	27	10	B	3	♂ ♀
3	The brightest one on the back of the head, toward the shoulder-blades	Capricorn	3	50	29	10	B	2½	
5	The preceding of the two on the left shou	Capricorn	3	0	31	10	B	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
9	Under the tail, in contact with the Galaxy [Milky Way]	Sagittarius	22	10	26	30	B	3	
—	<i>Prutenic</i>		22	10	26	30	B	3	

ANTINOUS, seu informes circa Aquilam [Antinous, or the unformed stars around the Eagle]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
1	The preceding of the two on the head	Capricorn	3	40	21	40	B	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
2	The one that follows it	Capricorn	8	50	19	10	B	3	
	— <i>Prutenic</i>	Capricorn	8	50	29	10	B	3	
6	The one that precedes them all	Capricorn	21	10	18	10	B	3	
	— <i>Greek code x</i>	Capricorn	21	30	18	10	B	3	
	— <i>Copernicus</i>	Capricorn	21	10	18	20	B	3	

DELPHIN[US] [Delphinus, "the Dolphin"]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
1	The preceding of the	Capricorn	17	40	29	10	B	3½	♂

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	three in the tail								
	— <i>Alphonsine</i>	Capricorn	17	40	29	39	B	3½	
	— <i>Copernicus</i>	Capricorn	17	40	20	10	B	3½	
4	The southern one on the side preceding the rhombus	Capricorn	8	30	32	0	B	3½	
5	The northern one of the said side	Capricorn	26	0	33	50	B	3½	
	— <i>Gree</i>	Capricorn	26	0	33	50	B	3½	

No	Description	Sign	Long .°	Long .′	Lat. °	Lat. ′	B/A	Mag.	Nature
	<i>k</i> <i>code</i> <i>x</i>	n							
	— <i>Cope</i> <i>rnica</i> <i>us</i>	Capricorn	26	0	33	50	B	3½	
6	The southern one on the side following the rhombus	Capricorn	21	20	33	0	B	3½	
7	The northern one of the said side	Capricorn	23	10	33	10	B	3½	
	— <i>Alph</i> <i>onsine</i>	Capricorn	23	10	32	10	B	3½	

EQUUS ALATUS, seu PEGASUS [Pegasus, "the Winged Horse"]

No	Description	Sign	Long .°	Long .′	Lat. °	Lat. ′	B/A	Mag.	Nature
1	The nave l of the hors e, or the head of And rom eda	Pisc es	17	50	26	0	B	2	♂ ♀ 과
2	The end of the wing , on the loins	Pisc es	12	10	12	0	B	2½	♂ ♀ 과
3	On the right shou lder and the root of the foot	Pisc es	17	10	31	0	B	2½	
4	The one on the	Pisc es	26	40	19	40	B	2½	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	shoulder of the wing , near the back of the head								
7	The more northern of the two on the right knee	Aquarius	29	0	35	0	B	3	
11	The preceding of the two neighbors on the	Aquarius	18	50	16	0	B	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	neck								
15	The mor e nort hern of the two neig hbo urs on the head	Aqu ariu s	9	10	16	50	B	3	
	— <i>Prut enic</i>	Aqu ariu s	9	10	16	50	B	3	
17	The one that is in the muz zle	Aqu ariu s	5	20	22	30	B	3	
	— <i>Alph onsi ne & Prut enic</i>	Aqu ariu s	5	20	21	30	B	3	
18	The one on the	Aqu ariu s	23	40	41	10	B	3½	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	right ankl e								
19	The one on the left knee	Aqu ariu s	14	40	34	15	B	3½	
20	The one on the left ankl e	Aqu ariu s	12	40	36	50	B	3½	
	— <i>Alph onsi ne</i>	Aqu ariu s	12	20	36	30	B	3½	

Page 245 (folio 211) — Andromeda, Triangulum; ZODIAC, NORTHERN PART (Aries → Gemini)

ANDROMEDA [Andromeda]

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
1	The one shini ng on the back	Pisc es	25	20	24	30	B	3	♀ ☿

No	Desc ription	Sign	Long .°	Long .′	Lat. °	Lat. ′	B/A	Mag.	Natu re
	of the head								
12	The southern one above the girdle	Aries	3	50	26	20	B	3	
	— <i>Prutenic</i>	Aries	3	50	25	20	B	3	
15	The one above the left foot	Aries	16	50	28	0	B	3	
	— <i>Alphonsine & Prutenic</i>	Aries	16	50	12	0	B	3	
16	The one on the right foot	Aries	17	10	37	20	B	3½	
17	The mor	Aries	15	10	35	40	B	3½	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	e southern one yonder								
	— <i>Prutenic</i>	Aries	15	10	35	20	B	3½	

TRIANGULUM [Triangulum, "the Triangle"]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
1	The one at the vertex of the Triangle	Aries	11	0	16	30	B	3	
2	The preceding of the three at the base	Aries	16	0	20	40	B	3	
4	The following	Aries	16	50	19	0	B	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	of the three at the base								

ZODIACI PARS BOREALIS — The Northern Part of the Zodiac

ARIES [Aries, "the Ram"]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
1	The prec edin g of the two on the horn	Arie s	6	40	7	20	B	3½	♃ ♂
2	The follo wing of the sam e	Arie s	7	40	8	20	B	3	♀ ♃
13	The one on the tip of	Arie s	15	0	5	0	A	5½	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	the hind foot								
—	<i>Greek code x, Alph onsi ne & Prut enic</i>	Arie s	15	0	5	15	A	3½	
—	<i>Cope rnic us</i>	Arie s	14	55	5	0	A	3½	

Informes circa Arietem [Unformed stars around the Ram]

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
1	The bright one above the head , whic h Hipp arch us	Arie s	10	40	10	30	B	2½	♃ ♂

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	placed on the neck [Hipparchus]								
—	<i>Alphonsine & Prutenic</i>	Aries	10	25	10	0	B	2½	
—	<i>Copernicus & Clavius</i>	Aries	10	40	10	0	B	2½	

TAURUS [Taurus, "the Bull"]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
6	The one on the chest	Taurus	3	40	8	0	A	3	
11	Of the Hyades	Taurus	9	0	5	15	A	3½	

No	Desc ription	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Natu re
	[Succulae], the one on the ears								
	— <i>Greek code x & Alphonsine</i>	Taurus	9	0	5	45	A	3½	
	— <i>Prutenic</i>	Taurus	9	40	5	45	A	3½	
12	The Hyad between the ear and the north eye	Taurus	10	20	4	15	A	3	
	— <i>Alphonsine</i>	Taurus	10	10	4	45	A	3	
13	The	Taurus	10	50	5	10	A	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	Hya d betw een this one and the sout h eye	us							
14	The brig ht Hya d in the sout h eye	Taur us	12	40	5	10	A	1	□
	— <i>Gree k code x</i>	Taur us	12	20	5	10	A	1	
15	The Hya d in the nort h eye	Taur us	11	50	3	0	A	3½	
19	The end on	Taur us	27	40	2	30	A	3	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	the southern horn								
	— <i>Prutenic</i>	Taurus	27	10	2	30	A	3	
21	The end on the northern horn , i.e. on the right foot of Auriga	Taurus	25	40	5	0	B	2½	

GEMINI [Gemini, "the Twins"]

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
1	The one on the head of the prec	Gemini	23	20	9	30	B	2	♊ ♀

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	edin								
	g								
	Twin								
	[Castor]								
	—	Gem	23	20	9	40	B	2	
	<i>Alphonsine</i>	ini							
2	The one on the head of the following Twin [Pollux]	Gem	26	40	6	15	B	2	
	—	Gem	26	40	6	19	B	2	
	<i>Alphonsine</i>	ini							
	—	Gem	26	30	6	15	B	2	
	<i>Copernicus, Prutenic & Clavi</i>	ini							

No	Desc ription	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Natu re
	<i>us</i>								
10	The one on the left knee , prec edin g	Gem ini	13	0	1	30	B	3	
	— <i>Prut enic</i>	Gem ini	13	10	1	30	B	3	
11	The one on the left knee of the follo wing Twi n	Gem ini	18	15	2	30	A	3	
	— <i>Alph onsi ne</i>	Gem ini	18	15	5	30	A	3	
	— <i>Prut enic</i>	Gem ini	18	20	2	30	A	3	
12	The	Gem	21	40	0	30	A	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	one on the left arm pit of the follo wing Twi n	ini							
13	The one abov e the right ham strin g of the sam e	Gem ini	21	40	0	40	A	3	
	— <i>Gree k code x</i>	Gem ini	21	40	0	40	A	3	
	— <i>Prut enic</i>	Gem ini	21	20	0	40	A	3	
14	The one on the	Gem ini	6	30	1	30	A	3½	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	tip of the foot of the prec edin g Twi n								
	— <i>Cope rnic us</i>	Gem ini	6	40	1	30	A	3½	
15	The one that follo ws this on the sam e foot	Gem ini	8	10	1	15	A	3½	
	— <i>Prut enic</i>	Gem ini	8	10	1	15	A	3½	
16	The one on the tip of	Gem ini	16	0	3	30	A	3½	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	the right foot, prec edin g, of the Twi ns								
	— <i>Prut enic</i>	Gem ini	16	10	3	30	A	3½	
17	The one on the tip of the left foot, follo wing , of the Twi n	Gem ini	12	0	7	10	A	3½	
1	<i>Of the unfo rme d stars : the one</i>	Gem ini	4	10	0	40	A	4	

No	Desc ription	Sign	Long .°	Long .′	Lat. °	Lat. ′	B/A	Mag.	Natu re
2	prec edin g the foot of the prec edin g Twi n <i>Of the unfo rme d stars : the one prec edin g the knee of the prec edin g Twi n</i>	Gem ini	6	30	5	50	B	3½	

Page 246 (folio 212) — Cancer → Sagittarius

CANCER [Cancer, "the Crab"]

No	Description	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Nature
1	Praesepe, the nebulous one on the chest [Praesepe, "the Beehive"]	Cancer	10	10	0	20	B	Neb.	
—	<i>Alphonsine & Prutenic</i>	Cancer	10	10	0	40	B	Neb.	
4	Asellus Borealis (the northern Ass)	Cancer	13	0	2	40	B	3½	
5	Asellus Australis	Cancer	11	20	0	10	A	3½	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	(the sout hern Ass)								
	— <i>In the Cope rnic us, Base l print ing</i>	Canc er	11	20	0	40	A	3½	
9	The one on the hind sout h foot	Canc er	7	10	7	30	A	3½	

LEO [Leo, "the Lion"]

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
3	The mor e nort hern of the two on	Canc er	24	20	12	0	B	3	♂

No	Description	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Nature
	the head								
4	The more southern of the same	Cancer	24	10	9	30	B	2½	
5	The northern one	Leo	0	10	11	50	B	3	
6	The bright one, the middle of the three on the neck	Leo	2	10	8	30	B	2	
	— <i>Prutenic</i>	Leo	2	50	8	30	B	2	
7	The southern of	Leo	0	40	4	30	B	3	♂ 2

No	Desc ription	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Natu re
	the thre e on the neck								
8	The one in the hear t, Basil iscus [Reg ulus]	Leo	2	30	0	10	B	1	♃ ♀ ♃
	— <i>In the Ptole maic code x of al- Batt ānī [Alb ateg nius]</i>	Leo	2	10	0	10	B	1	
11	The one on the right knee	Leo	17	20	0	0	B A	4	♀ ♃
19	The follo	Leo	13	40	13	40	B	2½	

No	Desc ription	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Natu re
	wing of the two on the loins								
22	The mor e sout hern of the two on the back	Leo	16	20	9	40	B	3	♀ ☿
23	The one on the hind butt ocks	Leo	20	10	5	50	B	3	
27	The end of the tail	Leo	24	30	11	50	B	1½	♀ ☿
	— <i>Gree k code x</i>	Leo	24	30	11	50	B	1½	

No	Description	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Nature
3	<i>Of the unformed stars: the one of the three below the northern side</i>	Leo	17	30	1	10	B	3½	

VIRGO [Virgo, "the Virgin"]

No	Description	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Nature
5	The end of the left wing, southern	Leo	29	0	0	10	B	3	
6	The preceding	Leo	8	15	1	10	B	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	g of the four on the left wing								
10	The one under the girdl e, on the right side	Virg o	12	10	20	10	B	5	
13	Prot ryge trix (the Vint ager)	Virg o	12	10	16	10	B	3	
14	Spic a Virgi nis [Spic a]	Virg o	26	40	2	0	A	1	♀ ☿
	— <i>Alph onsi ne & Gree</i>	Virg o	26	40	2	0	A	1	

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	<i>k code x (bett er)</i>								
15	Under the girdl e, towa rd the right vert ebra	Virg o	24	50	8	40	B	3	☐ ☐
26	The end nort hern , on the right foot	Libr a	12	40	0	50	B	3	
	— <i>Gree k code x</i>	Libr a	12	40	0	50	B	3	

LIBRA [Libra, "the Scales"]

No	Desc ription	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
1	The	Libr	18	0	0	40	B	2	♎ ☿

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	bright one on the tip of the southern claw	a							
3	The bright one on the tip of the northern claw	Libra	22	10	8	50	B	2	
	— <i>Alphonsine & Prutenic</i>	Libra	22	10	8	30	B	2	

SCORPIUS [Scorpius, "the Scorpion"]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
1	The	Scor	6	20	1	20	B	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	more northern of the three on the forehead	Scorpius							
2	The middle of the forehead	Scorpius	5	40	1	40	A	3	
3	The more southern of the three on the forehead	Scorpius	5	40	5	0	A	3	
4	The more southern	Scorpius	6	0	7	50	A	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	still on the other foot								
7	The preceding of the three on the body	Scorpius	10	40	3	45	A	3	
8	Cor Scorpii (the Heart of the Scorpion), Antares [Antares]	Scorpius	12	40	4	0	A	2	♂ 2
9	The following of the three	Scorpius	14	30	5	30	A	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	e on the body								
12	The one on the first vertebra	Scorpius	18	30	11	0	A	3	
	— <i>Prutenic</i>	Scorpius	18	20	11	0	A	3	
13	The one after this, on the second vertebra	Scorpius	18	50	13	0	A	3	
16	The one on the fourth vertebra	Scorpius	25	10	19	30	A	3	
17	On the fifth vert	Scorpius	28	10	18	50	A	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
18	On the sixth vertex ebra	Sagittarius	0	30	16	40	A	3	
19	On the seventh vertex ebra	Sagittarius	29	0	15	10	A	3	
20	The following two on the string	Sagittarius	27	30	13	20	A	3	

SAGITTARIUS [Sagittarius, "the Archer"]

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
1	The one on the	Sagittarius	9	30	6	20	A	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	iron (head) of the arrow								
	— <i>Alphonsine & Prutenic</i>	Sagittarius	9	30	6	30	A	3	
2	The one on the haft of the left hand	Sagittarius	8	0	6	30	A	3	
3	The one on the southern part of the bow	Sagittarius	9	0	10	50	A	3	
4	The more	Sagittarius	15	10	1	30	A	3	

No	Description	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Nature
	southern								
	on the								
	northern								
	part of								
	the bow								
6	The one on the left shoulder	Sagittarius	15	10	3	50	A	3	
	— <i>Alphonsine</i>	Sagittarius	15	10	3	50	A	3	
8	The double and nebulous one in the eye	Sagittarius	15	10	0	45	B	4	
22	The one almost	Sagittarius	16	20	6	45	A	3	

No	Description	Sign	Long .°	Long .′	Lat. °	Lat.′	B/A	Mag.	Nature
	st under the arm pit								
23	The one on the ante rior left ankl e	Sagit tariu s	17	40	23	0	A	2	☿ ♃
24	The one on the ante rior left foot- knee	Sagit tariu s	17	0	18	0	A	2½	
25	The one on the ante rior right ankl e	Sagit tariu s	6	14	13	0	A	3	
	— <i>Prut</i>	Sagit tariu	6	40	13	0	A	3	

No	Desc ription Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
	<i>enic</i>		<i>s</i>					

The selected Ptolemaic star catalogue (Table II) continues from the previous batch. Columns: No (Ptolemy's ordering) | Constellation & Star (Latin description) | Longitude: Sign / Degrees / Minutes | Latitude: Degrees / Minutes | B = Borealis (north) / A = Australis (south) | Magnitude | Nature (planetary-temperament glyph). Indented sub-rows give variant readings (Alphonsine, Prutenic, Copernicus, Greek codex, Clavius, etc.). Star descriptions are kept in Latin with the established modern name bracketed where applicable.

Caput IV (continued) — Ptolemaic star catalogue, Table II

The first rows continue Sagittarius:

No	Constellation & Star	Sign	Long .°	Long '	Lat. °	Lat. '	B/A	Mag.	Natu re
26	The one on the left leg [Qu æ in crur e sinis tro]	♐	27	0	13	30	A	3	
27	The one on the rear right	♐	23	50	26	0	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	elbow w [Quæ in posteriori dextro cubito]	☐	23	40	20	10	A	3	
	Alphonsine & Prutenic								

CAPRICORN [CAPRICORNVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The northern of the three on the follo	☐	7	20	7	20	B	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	wing horn [Borealis triumph in cornu sequenti]								
	—	☐	7	20	7	30	B	3	
3	Prutenic The southern of the three on the said horn [Australis triumph in dicto cornu]	☐	7	20	5	0	B	3	
24	The one	☐	21	50	0	10	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	preceding the two in the spreading-out of the tail [Præcedens duas in educatione caudæ]								
	— Prutenic	□	21	20	2	0	A	3	
25	The one following these [Seq	□	26	20	2	0	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	uens ipsas]								

AQUARIUS [AQVARIVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
2	The brighter of the two on the right shoulder [Luciduarum in humero dextro]	♒	6	20	11	0	B	3	
4	The one on	♒	26	30	8	50	B	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	the left shoulder [Quæ in humerо sinistro]								
	— Prutenic	☐	26	40	8	50	B	3	
9	The one on the right elbow [Quæ in cubito dextro]	☐	9	30	8	45	B	3	
18	The northern of the three on	☐	11	40	10	45	B	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	the right hand [Borealis trium in summo dextra]								
18	The southern of the two on the right shin [Australis duarum in tibia dextra]	♏	11	40	7	30	A	3	
42	The last	♏	0	0	20	20	A	1	♀ ♀

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
x]	—	□	7	0	23	0	A	1	
	Copernicus, Prutenicus, Clavius								

PISCES.

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The one in the mouth of the preceding Fish [Quæ in ore Piscis præ	□	21	40	9	15	B	3½	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	cedentis]								
19	The one in the knot of the one cord toward the other	☐	2	30	8	30	A	3	
	[Quæ in Nodolinivnius ad alterum]								
	— Cope	☐	2	40	8	30	A	3	
34	The one in the	☐	0	0	11	45	B	4	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	spin e, follo wing towa rd the Tail [Qu æ in Spin a sequ enti ad Cau dam]								

CONSTELLATIONES AVSTRALES — THE SOUTHERN CONSTELLATIONS

CETUS [CETE].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
2	The one follo wing the	♐	17	40	12	20	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	three at the extremity of the Jaw [Sequens trium in Maxilla extrema]	□	17	40	11	20	A	3	
3	Prutenic The middle of these, in the mouth [Medi ipsarum]	□	12	40	11	30	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
4	The one preceding the said stars, in the chin [Præcedens dicta rum in mente]	♏	10	30	14	0	A	3	
11	The southern one on the following flank [Australis in	♏	7	0	27	30	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	sequenti later e]								
12	The middle of the three on the body [Meridiana in corpore]	□	22	0	25	20	A	3	
14	The northern of the three on the body [Borealis in corpore]	□	25	0	20	0	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	ore]								
15	The one following the two next the Tail [Sequens duarum iuxta a Caudam]	☐	19	40	15	40	A	3	
	—	☐	19	40	15	20	A	5	
16	Alphonsine & Prutenic The one preceding the two next the	☐	15	0	15	40	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	tail [Præcedens duarum iuxta caudam]								
21	The northern one at the extremity of the little tail [Borealis caudulæ extrema]	☐	4	40	9	40	A	3½	
	— Prutenic		3	20	9	30	A	3½	
22	The	☐	5	40	20	2	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	southern one at the extremity of the little tail [Australis caudulæ extrema]								

ORION.

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The nebulous star on the	♄	27	0	16	30	A	Neb.	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	head [Nebulos a in capite]								
	— Alphonsine		27	0	18	50	A	Neb.	
2	The bright star on the right shoulder [Splendida humeridexteri]	☐	2	0	17	0	A	1½	♂ ♀
3	The bright star of the left	☐	20	0	17	30	A	2	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	shoulder [Lucidum humeri sinistri]								
26	The one preceding the three on the Belt [Præcedens trium in Cingulo]	♏	25	20	24	10	A	2	
27	The middle of the Belt [Media Cinguli]	♏	27	20	24	50	A	2	♀ ♃

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	uli]								
28	The last of the Belt [Ultima Cinguli]	☐	28	10	25	40	A	2	
	— Alphonsine	☐	28	10	25	50	A	2	
	— Prutenic & Clavius	☐	28	0	25	30	A	2	
29	The one on the haft of the sword [Quæinensis]	☐	23	50	25	50	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
33	capulo] The southern one at the extremity of the sword [Australis in extremis]	♏	27	0	29	50	A	3	
36	The bright star at the extremity of the foot, in	♏	19	50	31	30	A	1	♀ h

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	subdextro, & sequenti genu]								

THE RIVER ERIDANUS [FLVVIVS ERIDANVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The one behind the extremity of Orion's foot [Quæ post extremam Pedis	♏	18	20	31	50	A	3½	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
10	Ori nis] The one follo wing , the near est of the four [Seq uens de quat uor vicin issi ma]	♌	27	0	32	50	A	3	
13	The one prec edin g the four othe r neig hbo urin g stars	♌	22	0	28	0	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	[Quatuor aliarum vicinarum præced.]								
	—	☐	22	10	28	0	A	3	
14	Prutenic The one following the said four [Sequens dictarum quatuor]	☐	17	10	25	30	A	3	
34	The bright star, the last of the	☐	0	10	53	30	A	1	♀ ♃

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	River [Splendida, & vltima Fluvij]								

LEPUS [LEPVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
7	The one in the middle of the body [Quæ in medio corpore]	♈	25	50	41	30	A	3	
	— Prut	♈	25	30	41	30	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
8	The one beneath the belly [Quæ sub ventre]	♏	24	50	44	20	A	3	enic
	— Greek code x [Græcus Code x]	♏	24	10	43	15	A	3½	
13	The extremity of the Tail [Extrema Caudæ]	♏	11	40	38	10	A	3½	

CANIS MAJOR [CANIS MAIOR].

No	Constellation & Star	Sign	Long .°	Long .'.	Lat.°	Lat.'	B/A	Mag.	Nature
1	The bright star in the mouth, <i>Sirius</i> [Splendid in ore <i>Sirius</i>]	♏	17	40	39	10	A	1	♁ ♂
9	The extremity of the front foot [<i>Extrapedis anterioris</i>]	♏	11	0	41	20	A	3	
15	The one	♏	23	40	51	30	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	beneath the belly between the thighs [Quæ subventre intercrural]	☐	23	40	51	20	A	3	
17	The extremity of the right foot [Extrama pedis dexteri]	☐	9	40	53	45	A	3	

No	Constellation & Star	Sign	Long .°	Long .'.	Lat.°	Lat.'	B/A	Mag.	Nature
	—	☐	9	40	55	40	A	3	
18	Prutenic The one in the Tail [Quæ in Cauda]	☐	2	10	50	40	A	3½	
	—	☐	2	10	50	30	A	3½	
9	Prutenic The bright unformed star beneath the feet, following [Informium subpedi]	☐	29	0	59	40	A	2	☐

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
10	The bright unformed star beneath the feet, preceding [Informium subpedibus splendidissima præced.]	♏	26	0	57	40	A	2	

CANIS MINOR, PROCYON [ANTECANIS PROCYON].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The one shining in the neck [Quæ in collo lucet]	♈	25	0	14	0	A	4	
2	The bright star in the hinder parts [Procyon]	♈	29	30	16	10	A	1	
	— Alph	♈	29	10	16	10	A	1	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	onsine, Prutenic, Clavius								

ARGO NAVIS [ARGONAVIS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
2	The one following the two at the extremity of the ship [Sequens duarum in extremo	☐	14	20	43	20	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
6	The bright star in the middle of the little Shield [Splendid in medio Scutulo]	□	6	20	42	15	A	3	
13	The more southern of the two in the Keel		4	0	58	40	A	3½	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
36	The bright star following, beneath the bench [Splendid a sequens sub foris]	☐	0	0	63	50	A	2	h 2
37	The bright star, towards the south, in the lower	☐	8	30	69	40	A	2	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	Keel [Splendid Meridie inferiori Carina]								
40	The one following the three following [Trium sequenti um sequens]	□	26	0	67	20	A	2	
	— Alphonsine		26	0	67	28	A	2	
	— Prut		26	0	65	50	A	2	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
45	<i>Canopus</i> in the rudder [Canopus in gubernaculo]	♏	17	10	75	0	A	1	
	— Alphonsine	♏	17	10	69	0	A	1	

HYDRA [HYDRVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
12	The bright star in the Heart [Lucifer]	♏	0	0	20	30	A	2	♁ ♀

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	ida in Cord e]								
	— Prutenic	☐	0	0	20	20	A	2	
16	The one preceding the three in a straight line [Trium in rect a linea præcedens]	☐	18	0	24	40	A	3	
	— Prutenic		18	0	24	30	A	3	
23	The one following	☐	16	10	31	20	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	the three in a triangle [Δ] [Sequens trium in Δ]								
	—		16	10	31	40	A	3	
1	The unformed star to the south of the Head [Informis à]	□	12	30	23	15	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	Meridie Capit[is]								
2	The unformed star near the Neck [Informis prope Collum]	□	11	0	16	0	A	3	
	— Prutenic		11	0	26	0	A	3	

CRATER [CRATERIS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
4	Crater [Crateris], on	□	7	0	18	30	A	3½	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	the southern part of the rim [in australis arcus]								

CORVUS [CORVVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The one in the Beak, common with Hydra [In Rostro	♏	15	20	21	40	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	communis cum Hydra]								
	— Prutenic	□	15	20	21	30	A	3	
2	The one on the neck toward the head [Quæ in collo ad caput]	□	14	20	19	40	A	3	
4	The one on the wing preceding, toward	□	13	30	14	50	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	rd the right [Quæ in ala præ cede nti ad dext ram]								
5	The one prec edin g the two on the follo wing wing [Præ cede ns duar um in ala sequ enti]	□	16	40	12	30	A	3	
7	The	□	20	50	18	10	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	extr emit y of the foot, com mon with Hyd ra [Extr ema pedi s, com mun is cum hydr a]								

CENTAURUS [CENTAVRVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
5	The one on the left shou	♐	6	10	25	40	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	lder, and preceding [Quæ in humero sinistro, & præcedenti]								
	— Cope rnic us		6	10	25	30	A	3	
6	The one on the right shoulder [Quæ in humero dextro]	☐	15	40	22	30	A	3	
16	The	☐	22	50	25	15	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	one on the right elbow [Quæ in dextro cubito]								
18	The bright star at the junction of the human body [Splendida in conjunctione humani corp	☐	13	0	23	30	A	2½	

No	Constellation & Star	Sign	Long .°	Long .'.	Lat.°	Lat.'.	B/A	Mag.	Nature
	oris]								
	—		18	0	33	30	A	2½	
	Alphonsine & Prutenic								
29	The one preceding the two beneath the belly [Durum subventre præcedens]	□	16	20	43	0	A	2	⊙ ♀
	—		16	30	43	0	A	2	
	Prutenic								
31	The one on the ham	□	21	10	51	0	A	2	⊙ ♀

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	of the right foot [Quæ in poplite pedis dextri]								
32	The one on the ankle of the right foot [Quæ in talo pedis dextri]	♐	15	20	51	40	A	2	

CENTAURUS [CENTAVRVS] (continued):

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
34	The one on the calf of the left foot [Quæ insuris sinistra]	♈	11	10	55	20	A	2	
	— Prutenic		11	10	55	40	A	2	
35	The extremity of the right front foot [Extrama dextri pedi]	♈	8	20	41	10	A	1	♃ ♀

No	Constella tion & Star	Sign	Long .°	Long '	Lat.°	Lat.'	B/A	Mag.	Natu re
	s ante riori s]								
	—	□	8	20	44	10	A	1	
	Anot her code x [Aliu s Code x]								
36	The one on the knee of the left foot [Qu æ in genu sinis tri pedi s]	□	24	10	45	20	A	2	

THE BEAST, OR WOLF [FERA, seu LVPVS].

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The one at the extremity of the rear foot [Quæ in extremo posteriori pede]	♏	28	0	24	50	A	3	
	— Alphonsine		28	0	24	10	A	3	
2	The one on the ham of the same [foot	♏	25	50	29	10	A	3	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	] [Quæ in poplite eius dem] — Alphonsine		25	50	29	6	A	3	

THE CENSER [THVRIBVLVM] (Ara):

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
3	The one in the middle of the Altar [Quæ est in	☐	26	20	26	30	A	3½	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	med io Aræ]								
	—		26	10	26	30	A	3½	
5	The mor e sout hern of the thre e on the hear th [Triu m in foco austt alior]	☐	25	10	34	10	A	3½	

CORONA AUSTRALIS [CORONA AVSTRALIS] — the Southern Crown:

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The one	☐	9	10	21	30	A	4	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	preceding, outside the southern arc [Præcedens extrarcum australem]		9	10	24	30	A	4	
	Another reading [Alia lectio]								

PISCIS AUSTRINUS [PISCIS AVSTRALIS] — the Southern Fish:

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
1	The one in the mouth, at the beginning of the water	♈	7	0	23	0	A	1	
	[Quæ in ore in principio aquæ] [Fomalhaut]								
	—		7	0	20	28	A	1	
	Alphonsine								
1	The unformed	♈	8	0	22	20	A	3½	

No	Constellation & Star	Sign	Long .°	Long .'	Lat.°	Lat.'	B/A	Mag.	Nature
	star preceding the three before the Fish [Information minus praececessante Piscem]								

Parsing notes: Several variant sub-rows omit the zodiac-sign glyph (it carries down from the main row above); these cells are left blank in the transcription. Magnitude fractions are printed as ½ / ¼ ligatures. The "Nature" column carries planetary-temperament glyphs (e.g. ♀ ♂ for Sirius, ♃ ♀ for the bright star of Argo, ♋ ♀ for Centaurus). Page 213 ends the catalogue's northern run and opens the **Southern Constellations**; the catalogue concludes on page 215 with the Southern Fish, after which **Caput V** begins.

Caput V — On the longitudes and latitudes of the fixed stars observed and arranged by Ptolemy, exclusive of his own time, down to the Hessian and Tyconic observations, exclusive

CAPUT V [CAPVT VI].

The longitudes and latitudes of the fixed stars, observed and arranged from Ptolemy's time exclusive, down to the Hessian and Tyconic observations exclusive.

[Margin: Albategnius observed the fixed stars [Albategnius Fixarum obseruator].]

For the whole span of 1740 years, between Ptolemy and al-Battānī [Albategnius], there was a remarkable silence concerning the fixed stars. At length al-Battānī, the foremost prince in Syria among the Arabs and at that time easily the most learned in the science of the stars, observed them in the year of Nabonassar 1627 — that is, AD 879, just completed and now begun — and in the year of Nabonassar 880 he observed Regulus in the 14th degree of Leo, as he himself reports in chapter 51 of his *Science of the Stars*. He adds that Ptolemy, in the year of Nabonassar 836, had observed and established Regulus in the 2nd degree of Leo. And [reckoning] by the sixth part of a degree — that is, 10 minutes — he therefore supposes the fixed stars to have advanced by degrees of $11^{\circ} 50'$, for the whole longitude; the Ptolemaic latitude he retains. Add, then, and as a reader [Adde igitur, & tu Lector] — the longitude of the fixed stars handed down just above in the previous chapter, in the last table, and you will have the positions of the fixed stars at the time of al-Battānī according to his own opinion. For the rest, Ptolemy's codex has Regulus in the 2nd degree of Leo, $30'$.

and thus the manuscript codex of Clavius, and the Greek codex of Basel, and the version of Trapezuntius [Trebizond]; and so there would have to be added only the [whole] degree $11^{\circ} 30'$. Moreover, al-Battānī recedes from the year of Nabonassar 845, in which Menelaus observed the fixed stars; and therefore, distributing those his degrees $11^{\circ} 50'$ over 782 years, he says that the fixed stars complete one degree in 66 solar years. But if there were that interval between his and Ptolemy's time — namely, 741 years — it would have come out as one degree advancing in only 63 years, or $62\frac{2}{3}$; indeed, if it were [reckoned] from the Ptolemaic position, degree $2^{\circ} 30'$, it would be $64\frac{2}{5}$ years.

[Margin: Corrected in al-Battānī [Corrigêda in Albategnio].]

[Margin numeral 2:] After al-Battānī, by 57 years, *Ebn Ephosophim* [Ibn Yūnus?] the Philosopher — in the year of the Arabs, or the Hegira, 325, that is, AD 936 — verified the positions of the fixed stars on the day of his own [observation], on 18 November, feria 7 [Saturday]. He wrote down the positions of the fixed stars in a book, which Bullialdus [Ismaël Boulliau] [refers to] in his *Astronomia Philolaica*, chapter 3; and he himself asserts, from a manuscript he had seen at the home of Forcalquier, in the province near his own town of Pratorator [?]. And Gassendi himself, in a letter dated 1636, the Ides of July, written to Vuendelinus [Wendelin], records that codex of Amaldini [?]: in which place he notes the position of the Heart of the Lion [Cor Leonis = Regulus] in Leo, 15° 12'.

[Margin: *Ebn Ephosophim* restored the positions of the fixed stars, AD 936 [Ebenephosophim Fixarum restitutor loca Ann. 936].]

[Margin numeral 3:] After 180 years, the Persian Mathematicians, from their own observations, re-established the positions of the fixed stars; whose tables Bullialdus brought forth from the Royal Library of Paris, and M. S. Georgi de' Medici Chrysococca [Chrysococces] sets forth at the end of his *Astronomia Philolaica*. The table was constructed in the year of the Arabs 509, that is, AD 1115, on 27 May, feria 5 [Thursday], on which that said Year of the Arabs began; from which are derived the positions of 25 fixed stars, with the name Bullialdi added — which rests upon the ecliptic distance between the fixed stars and the Heart of the Lion [Cor Leonis], which is the [reckoning] found in Ptolemy.

[Margin: The Persian Table of the Fixed Stars [Regulus], AD 1115 [Persica Tabula Fixarū anni 1115].]

Liber IV — De Fixis Stellis (continued)

Caput V (continued)

The Persian Table of AD 1115

Table: The Persian Table for the Year of Christ 1115 .

Persi an Nam es in Latin	Nam es from Boull iau	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn .
Sulcu	Ultim	□	15	10	13	20	A	1

Persian Names in Latin	Names from Boulliau	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
s	a Eridani (last star of Eridanus)							
Manus tincta	Lucida Cassiope. (the bright star of the chair, Cassiopeia)	□	22	50	51	40	B	2
Caput Equi	deest interpretation missing)	□	14	40	45	0	B	2
Latus Perse i	Latus dextrum Perse	□	19	50	30	0	B	2

Persi an Nam es in Latin	Nam es from Boull iau	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn .
	i (right side of Perse us)							
Ocul us Bonis	Ocul us Tauri austr. (sout hern eye of Taur us)	□	27	0	5	0	A	1
Pes Didy moru m	Pes Orion is sinist . (left foot of Orion)	□	4	50	31	30	A	1
Capr a	Capel la	□	10	0	22	30	B	1
Hum erus Didy moru m	Orion is hume rus dext. (right	□	17	10	17	0	A	1

Persi an Nam es in Latin	Nam es from Boull iau	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn .
	shoul der of Orion)							
Soail Iama ni	Cano bus	☐	2	10	75	0	A	1
Siair Iama ne	Sirius Canis mai. (Siriu s, the Great er Dog)	☐	11	40	39	10	A	1
Siair Siami	Procy on Canis min. (Proc yon, the Lesse r Dog)	☐	14	10	16	10	A	1
Cor Leoni s	Cor Leoni s (Regu lus)	☐	17	30	0	10	B	1
Paru us	Spica Virgi	☐	11	40	2	0	A	1

Persi an Nam es in Latin	Nam es from Boull iau	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn .
Kont aratu s	nis (Spic a)							
Kont aratu s	Arctu rus	☐	11	0	31	1	B	1
Pes Centa uri	Pes Centa uri ante dext. (right foref oot of Centa urus)	☐	23	20	41	10	A	1
Discu s paru us fract us	Lucid a Coro næ Bor. (brig ht star of the Nort hern Crow n)	☐	29	40	44	30	B	2
Cor Scorp ij	Cor Scorp ij (Anta	☐	27	40	4	0	A	2

Persi an Nam es in Latin	Nam es from Boull iaua res)	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn .
Vultu r Vola ns	Lucid a Aquil æ (brig ht star of Aquil a)	□	18	50	29	10	B	2
Os Piscis Noty	Foma lhant (Fom alhau t)	□	22	0	23	0	A	1
Caud a Aui	Caud a Cygni (tail of Cygn us)	□	24	10	60	0	B	2
Probi scus Equi	Maka b Pegas i (Mar kab of Pegas us)	□	11	40	19	40	B	2
Ceti	Ceti	□	19	20	19	40	B	2

Persian Names in Latin	NAMES from Boulliau	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
Cauda	Cauda (tail of Cetus)							
Pegasus	Ultima alæ Pegasus (last star of Pegasus' wing)	□	27	10	12	30	B	2
Humerus Equi	Pegasi humerus in educatione cruris (shoulder of Pegasus at the springing of the leg)	□	17	10	31	0	B	2

Parsing notes: Latitude N/S markers use B (boreal/north) and A (austral/south). The Persian names in the leftmost column are unfamiliar transliterations from the Arabic/Persian (Soail Iamani = Suhail al-Yamānī, Canopus; Siair = Shi'rā, Sirius/Procyon; Kontaratus, etc.) but were read out in full on re-transcription. The row "Soail Iamani / Canopus" carries the Gemini sign-glyph (♊), which is anomalous for Canopus — its latitude of 75° south is correct — and is transcribed as printed (suspected compositor sign-glyph carry-down). The "Kontaratus / Arcturus" latitude reading 31° 1' is transcribed as printed (a single-digit "1" glyph, plausibly a worn "0").

The compilers of the **Alphonsine Tables** [Alphonsinarum Tabularum], in the year 1252 of Christ, had followed the doctrine of trepidation [Trepidatio] and the anomalous motion of the eighth sphere [Octaua Sphæra]. Nevertheless, in the year 1216 — by command of King Alphonso [Alphonso X, *el Sabio*], after the *Codex* of al-Battānī [Albategnius] had been examined — they chose his opinion of a uniform motion, and concluded the spaces of 66 years for one degree [of precession]. Accordingly they placed Spica [Spica Virginis] at 13° 48' of Libra, whereas Ptolemy had located it at 16° 40' of Virgo for the year 138 of Christ. Now al-Battānī had placed it at 8° 30' of Libra for the year 879 of Christ.

The difference between the Ptolemaic position and the Alphonsine is therefore 17° 8'. But between al-Battānī's and the Alphonsine it is 5° 18'. If you take the Spica of the Ptolemaic Table from the preceding [position] and add 17° 8', you will obtain the corrected position of the fixed star according to the Alphonsine reckoning, down to the year 1256 of Christ. Yet if, following al-Battānī, you proceed from the years 1118 [counted] between al-Battānī and the Alphonsine correction, and divide by 66, there will come out 17° 32½', that is, 34½ minutes [more]; and so, by following the Ptolemaic position, Spica ought to be set at 14° 14' of Libra.

But if instead you divide the 377 years that elapsed between al-Battānī and the Alphonsine correction by 66, there remain 5 32/33 degrees, that is, nearly 43 minutes; and, these being added to al-Battānī's position, Spica was to be located at 14° 15' of Libra.

[Margin: Tabula Alphonsina Fixarum — The Alphonsine Table of the Fixed stars.]

[Margin: Labes Alphonsinarum — The defects/errors of the Alphonsine [Tables].]

Rabbi Levi [Levi ben Gerson / Gersonides], as he himself relates in Book 5 *Defensionum* [*Defense [of the Almagest?]*], Chapter 63 — and Father **Augustinus Riccius** [Agostino Ricci], in his treatise *On the Motion of the Eighth Sphere* —

concur that this position [of Spica] should be reckoned together with the place derived from the Alphonsine [tables] according to al-Battānī's reasoning. They observed Spica at 18° 48' of Libra for the year 1336 of Christ. Several have located the fixed stars by proceeding from al-Battānī's time at 6° 58', so that, just as it was at 18° 48' at Ptolemy's time, they followed [a precession] of one degree in 66 years.

[Margin: Loca Fixarum Anni 1336. Ex Rabbi Leui. — The positions of the fixed stars for the year 1336, from Rabbi Levi.]

6. In the year 1364 of Christ, the positions of certain fixed stars were verified by an astronomer I cannot name, whose Table **Pierre d'Ailly** [Petrus Arnaldus? — *see anomaly a*] produced from a *Codex*, in a letter addressed to **Wendelen** [Wendelinus], which is at the end of Tome 4 of the works of Gassendi; and it stands thus, with the longitude reduced and its signs:

Table: The Year of Christ 1364 .

Star	Long.		G.	M.	Lat.		N/S	Magn.
	Sign				G.	M.		
Extrema alæ Pegasi (end of Pegasus' wing)	□		15	18	12	31	B	2
Venter Ceti (belly of Cetus)	□		13	10	20	0	A	2
Cauda Ceti (tail of Cetus)	□		8	0	15	20	A	1
Postrema Flumi	□		18	20	53	0	A	1

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
nis (last star of the River [Erida nus])							
Caput Algol (head of Algol)	♈	17	45	23	0	B	2
Aurig æ Capell a (Capel la of Aurig a)	♈	13	10	22	30	B	1
Spath ula Alaiot h	♈	21	0	20	0	B	2
Aldeb aran	♈	18	0	5	0	A	1
Orioni s humer us dext. (right should er of Orion)	♈	18	10	17	0	A	1

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
Pes lucidu s Orioni s (brigh t foot of Orion)	□	8	0	31	0	A	1
Caput Gemin orum (head of Gemin i)	□	11	28	9	40	B	2
Sinistr um brachi um Gemin i antec. (left arm of the leadin g Twin)	□	14	50	6	15	B	2
Halab or	□	6	0	39	10	A	1
Algom eisa (Procy on)	□	17	20	16	10	A	1
Canop	□	5	38	29	0	A	1

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
us							
In latere Vrsæ maiori s (in the flank of the Greate r Bear)	☐	19	19	72	50	B	2
Seque ns illam (the one follow ing it)	☐	14	19	79	50	B	2
In dorso Vrsæ maiori s (on the back of the Greate r Bear)	☐	10	49	49	0	B	2
Equus seu Dubhe (the Horse, or	☐	19	19	49	30	B	2

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
Dubhe)							
Coxa sinistr a Vrsæ mai. (left hip of the Greate r Bear)	☐	21	9	46	30	B	2
Pectus Leonis (breas t of Leo)	☐	20	20	7	30	B	1
Cor Leonis (Regul us)	☐	20	40	0	10	B	1
Alcore	☐	0	18	53	30	B	2
Benen ax	☐	18	0	54	0	B	2
Dorsu m Leonis (back of Leo)	☐	2	20	13	40	B	2
Cauda Leonis (tail of Leo,	☐	12	45	12	50	A	1

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
Deneb ola)							
Alram ech (Arctu rus)	□	14	10	31	30	B	1
Spica Virgin is (Spica)	□	15	0	2	0	A	1
Pes dexter Centa uri (right foot of Centa urus)	□	28	10	51	10	A	2
Calcan eus pedis sin.- Cent. (heel of the left foot of Centa urus)	□	29	20	55	20	A	2
Extre mum pedis anter.- Cent. (tip of the	□	26	30	41	10	A	2

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
forefo ot of Centa urus)							

(continued — the 1364 table continues)

Table: The Year of Christ 1364 (continued) .

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
Elpher a	□	2	50	44	30	B	2
Caput stater æ Meridi onal. (head of the southe rn Scale)	□	6	10	0	40	B	2
Caput stater æ Septen trion. (head of the northe rn Scale)	□	9	10	8	30	B	2
Calcan eus pedis Centa	□	23	0	51	40	A	2

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
uri (heel of the foot of Centa urus)							
Alcant ub, cor Scorpi j (Alcan tub, the heart of Scorpi us — Antar es)	□	2	0	4	0	A	2
Vultur caden s (the falling Vultur e — Vega)	□	19	10	62	0	B	1
Cauda Gallin æ (tail of the Hen [Cygn us])	□	27	18	60	0	B	2
Alcha yr	□	22	0	29	10	B	2

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
Catilla sinistr a Sagitt arij (left [knee?] of Sagitt arius)	□	6	0	23	0	A	2
Spath ula sinistr a Sagitt arij (left should er of Sagitt arius)	□	16	0	13	30	A	1
Genu sinistr i Sagitt arij (left knee of Sagitt arius)	□	5	0	18	0	B	2
Spath ula sinistr a Aquar	□	14	50	8	50	B	1

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
ij (left shoulder of Aquarius)							
Os Piscis Australis (mouth of the Southern Fish — Fomalhaut)	♏	2	0	0	0	A	1
Spathula equimaior (greater shoulder of the Horse [Pegasus])	♏	14	50	19	40	B	2
Humerus dexter mai. equi (right	♏	20	20	31	0	B	2

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S	Magn.
should er of the greate r Horse)							

Parsing notes: This table is split across (first part) and 251 (this continuation). N/S markers: B = north, A = south. The several Arabic-derived star names (Spathula Alaioth, Halabor, Algomeisa, Alcore, Benenax, Alramech, Elphera, Alcantub, Alchayr) were read out in full on re-transcription. Two sign-glyph anomalies are transcribed as printed (suspected compositor carry-downs): "Aldebaran" carries the Gemini glyph (♊) where Taurus is expected — its latitude 5° south is correct; and the Sagittarius-named block (Catilla / Spathula / Genu Sagittarij) carries the Capricorn glyph (♐) on rows whose star names read *Sagittarij*. Canopus here at 29° south differs from the 75° south of the Persian table (Table for 1115); both are transcribed as printed (an inter-catalogue disagreement).

At the foot of the table these words of this more recent author were to be read:

[Margin: Nota quod motus Octauæ Sphæræ à tempore Alphonsi vsq; ad 1406. fuit gr. 1. 44. min. 30". sec. — Note that the motion of the eighth sphere from the time of Alphonso down to 1406 was 1° 44' 30".]

7. At the end of the works of **Cardinal Nicholas of Cusa** [Nicolaus de Cusa] there is extant a Table of the fixed stars constructed from the observations of Cusa himself and of Cardinal Nicaenus [Bessarion?], as is there asserted; and it is reduced to the year 1440 of Christ — in which I do not doubt there is an error of half a degree, if it be compared with the Tyconic hypothesis. It is also established from infrared [?] — [recte: it is also established, against [contra] the first magnitude of the stars which Cusa's Table marks down — *see anomaly b*]. Here is Cusa's Table, which I select:

Table: Cardinal Cusa's Table (Year 1440) .

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S
Orionis humer	♈	23	0	17	0	A

Star	Long. Sign	G.	M.	Lat. G.	M.	N/S
us dext. (right shoulde r of Orion)						
Capella	♈	16	0	22	30	A
Sirius	♈	8	40	39	50	A
Procyo n	♈	20	10	16	0	A
Regulus	♈	23	30	0	10	B
Leonis Cauda (tail of Leo, Denebo la)	♈	15	30	11	50	B
Spica	♈	17	40	2	0	A
Arcturu s	♈	18	0	31	30	B
Cor Scorpij (Antare s)	♈	3	40	4	0	A

Parsing notes: N/S markers B = north, A = south.

8. In the year of the Lord 1474, **Abraham Zacuto** [Abraham Zacut] observed Spica at $17^{\circ} 10'$ of Libra, as **Augustinus Riccius** [Agostino Ricci] — a disciple of his — relates in his treatise *On the Motion of the Eighth Sphere*; and, conferring this position with the one drawn from the Alphonsine [tables], he concludes, in agreement with al-Battānī, [a precession of] one full degree in 66 years. Yet if you compare this position with the Tychonic one carried back to this year, you will see it exceed [the truth] by a half, and more than a degree; and it was derived rather in accommodation to al-Battānī's opinion, which the Arabs were laboring to support, than from perfectly exact reasoning.

[Margin: Spica Zacuto obseruata. — Spica as observed by Zacut.]

9. Bernardus Walther [Bernhard Walther], as we have it from his own observations made through armillae [armillary instruments] rectified by the position of Venice, observed under-written the longitudes of the fixed stars; but he sets down these very [observations] as repugnant to themselves in [the case of] Sirius — whether from refractions, or from a defect of the armillary instruments. He says, moreover, that his observation of Aldebaran had been most diligent, and that of Orion most certain; but that Aldebaran's position falls short of the Tyconic by 5 minutes — unless [his] Orion be at 32', both [readings] being faulty, [where] 18' are written for 48'.

[Margin: Walther's observations.]

Table: Bernhard Walther's observations .

Year	Star	Long. Sign / G.	M.
1489 Martij 6. (March 6)	Sirius	☐	7
1489 Martij 6.	Regulus	☐	23
1503 Dec. 12.	Aldebaran	☐	2
1504 Ian. 5 (Jan. 5)	Sirius	☐	7
1504 Ian. 5	Canicula (Procyon)	☐	18
1504 Ian. 5	Orionis hum. dext. (right shoulder of Orion)	☐	21
1504 Ian. 20	Sirius	☐	6
1504 Ian. 20	Canicula (Procyon)	☐	18
1504 Ian. 20	Orion. hum. dext. (right shoulder of Orion)	☐	21

Parsing notes: The longitude column carries the zodiac-sign symbol with degrees, then minutes. The Year column repeats the date for each star observed on that

date. The table groups observations by date (1489 March 6; 1503 Dec. 12; 1504 Jan. 5; 1504 Jan. 20). The "Aldebaran" row carries the Gemini sign-glyph (♊) where Taurus is expected — transcribed as printed (the same suspected compositor sign-glyph carry-down seen in the 1115 and 1364 tables).

10. As to how much credit the [observations] of **Johann Werner** [Io. Vuernerii], **Copernicus**, and **Cardano** [Cardani], together with those of **Johann Stadius** [Io. Stadij], for the positions of the fixed stars deserve, or how much correction they require on the occasion of declination, we have shown sufficiently in Chapter 3, number 5, down to the end.

11. Peter Apian [Petrus Appianus], in his *Astronomicum Caesareum* [*Astronomicum Cæsareum*], places Regulus at 22° 8' of Leo for the year of the Lord 1500 — that is, beyond the Ptolemaic position by 19° 18'; but afterwards, in the Catalogue of the year 1532, which **Clavius** [Claius] mentions in his *Sphere*, page 182, he places Regulus and the other fixed stars at 19° 58' beyond the Ptolemaic position.

[Margin: Appiani Catalogus. — Apian's Catalogue.]

If you add the aforesaid degrees and minutes to the Ptolemaic positions from Chapter 4, you will have the positions of the fixed stars according to Apian's mind for the year 1532.

12. Clavius himself, since Tycho's Catalogue was not yet [available], had set out a Catalogue of the fixed stars in his *Sphere*, in which he supposes Spica, and the rest of the fixed stars, advanced 21° 7' beyond the Ptolemaic position for the year 1175 of Christ. To this number, then, when added to the Ptolemaic positions of the fixed stars, you will have Clavius' Catalogue. Clavius — that is, the position of the fixed star according to Clavius for the year 1575 — in the opinion of Clavius, according to which he also constructed his Globe, as he there asserts. For example, Spica, which is the first star of Virgo, is at 26° 40' of Virgo according to Ptolemy. The Clavian [position] is in the explanation of the use of his Table at 17° 47'. The year 1575 therefore comes about, as I have said, [at] 27° 7'.

[Margin: Claiij Catalogus. — Clavius' Catalogue.]

But because in this very Table he imitates Copernicus, who reckons the elongations of the fixed stars from the first star of Aries, and thus reckons Spica elongated from it by 170° — for this reason he supposes the first star of Aries to be at 27° 47' of Libra in longitude. Therefore, if you wish from the Catalogue of Clavius — that is, from the Ptolemaic position of the fixed star (taken from the

same Codex of the manuscript), of which Clavius testifies he made use — and add the Clavian elongation of $27^{\circ} 47'$; and you will have the Clavian longitudes for the year 1575. From the equinox subtract $21^{\circ} 7'$; and you will have the Ptolemaic positions for the time of Ptolemy. But because Clavius followed Copernicus especially, it is no wonder that, in this very thing, he departed from the aim of the true position of the fixed star — for that Spica appears, which by the Tychonic [reckoning] ought to have been at $17^{\circ} 54' 45''$ in the year 1575. Therefore by the excess of Clavius set down at $8'$. [recte: Yet this is not so enormous; rather, the astronomy is to be congratulated, indeed Tychonic, in that it has progressed so far, and the Lansgravian [Hessian] and Tychonic observations have come within an error of ten minutes.]

[Margin: Clavius correctus. — Clavius corrected.]

CAPVT VI

On the positions of the fixed stars observed by Wilhelm, Landgrave of Hesse, and his Astronomers

1. Tycho [Tycho Brahe] testifies, in the dedicatory letter of his *Epistolae [Epistolae Astronomicae]* to Prince Mauritius [Maurice of Hesse], and to **Wilhelm, Landgrave of Hesse** [Wilhelm IV, *der Weise*], the father of that same prince, that in their age the Astronomers — to whatever place in Germany [Astronomy] owed the Prince — had refined the instruments, and had elaborated them most exquisitely and usefully; and that they had been summoned as artificers most skilled in this science, and that, with their nocturnal vigils, they had labored to reform astronomy so far, indeed, that they fixed the positions of four hundred stars within five minutes of certainty.

[Margin: Encomia Vuilhelmi Hassiaci. — Praises of Wilhelm of Hesse.]

Then, in the Argument of Tome 1 of his *Epistolae*, he asserts a difference of five minutes, which is between the Tychonic and the Lansgravian longitudes of the fixed stars, related by **Christoph Rothmann** [Christophorus Rothmannus] in azimuths and altitudes, as if accepted from Tycho. Yet it is pleasing to take from Tycho, page 49, the longitudes and latitudes of certain stars, which Tycho supposed by the Canon of Sines, from data per the Lansgravian observations, and from the assumed Right Ascension of Aldebaran [at] $64^{\circ} 16' 10''$ for the beginning of the year 1587. And [with] the obliquity of the Ecliptic [at] $23^{\circ} 30\frac{1}{2}'$, [and] the altitude of Cassel [at] $51^{\circ} 20'$ — though indeed Tycho, on page 39, was confident it to be $51^{\circ} 19'$.

The Lansgravian observations, computed and ordered, with the supputation [calculation] of Tycho:

Table: From the observations of the Landgrave of Hesse, and the calculation of Tycho .

Heading: *Year 1586 Complete. Names of the Fixed Stars — Longitude (Sign / G. M. S.) — Latitude (G. M.) — N/S.*

Name s of the Fixed Stars	Long. Sign	G.	M.	S.	Lat. G.	M.	N/S
Prima Arietis (first star of Aries)	♈	27	30	0	7	8	B
Andro medæ Caput (head of Andro meda)	♈	8	39	30	25	41	B
Tertia Arietis Lucid a (third bright star of Aries)	♈	1	58	30	9	57	B
Oculu s Tauri (eye of Tauru	♉	4	6	0	5	28	A

Name s of the Fixed Stars	Long. Sign	G.	M.	S.	Lat. G.	M.	N/S
s, Aldeb aran)							
Orioni s pes siniste r (left foot of Orion)	☐	11	12	0	31	9	A
Orioni s humer . dext. (right should er of Orion)	☐	23	5	0	16	3	A
Canis maior (Great er Dog, Sirius)	☐	8	28	0	39	28	A
Castor is caput (head of Castor)	☐	14	33	30	10	6	B
Polluc is caput	☐	17	35	0	6	42	B

Name s of the Fixed Stars	Long. Sign	G.	M.	S.	Lat. G.	M.	N/S
(head of Pollux)							
Canis minor (Lesse r Dog, Procy on)	☐	20	11	0	15	52	A
Præse pe Cancri (the Mange r of Cance r)	☐	1	37	0	1	16	B
Lucid a Hyad æ (brigh t star of the Hyade s)	☐	21	38	0	22	10	A
Ceruix Leonis (neck of Leo)	☐	23	45	0	8	54	B
Cor	☐	24	11	0	0	32	B

Name s of the Fixed Stars	Long. Sign	G.	M.	S.	Lat. G.	M.	N/S
Leonis (Regul us)							
Dorsu m Leonis (back of Leo)	☐	5	36	30	14	25	B
Cauda Leonis (tail of Leo, Deneb ola)	☐	16	0	0	12	24	B
Spica Virgin is (Spica)	☐	18	9	0	1	55	A
Arctur us	☐	18	38	0	31	7	B
Lanx Boreal is (the North ern Scale)	☐	13	41	0	8	38	B
Cor Scorpi j (Antar es)	☐	4	5	0	4	25	A

Name s of the Fixed Stars	Long. Sign	G.	M.	S.	Lat. G.	M.	N/S
Caput Ophiu chi (head of Ophiu chus)	♏	16	46	0	36	0	B
Aquil æ Lucid a (brigh t star of Aquila , Altair)	♏	26	3	0	29	21	B
Cauda Cygni (tail of Cygnu s, Deneb)	♏	29	46	0	59	54	B
Scapul a Pegasi (shoul der- blade of Pegas us)	♏	17	51	0	19	24	B

Parsing notes: Heading row gives Year 1586 Complete. Longitude is Sign / Degrees / Minutes / Seconds; the Longitude seconds column is mostly 0, with 30 on four rows (Andromedæ Caput, Tertia Arietis Lucida, Castoris caput, Dorsum Leonis), all ≤ 59 . Latitude is Degrees / Minutes with N/S marker (B = north, A = south); on fresh re-transcription this table carries no seconds figure in the latitude and no magnitude column (the earlier reading of a latitude-seconds column and a blank magnitude column was a misread and is corrected here). The smooth zodiac progression $\Upsilon \rightarrow \var� \rightarrow \Pi \rightarrow \text{♄} \rightarrow \text{♃} \rightarrow \text{♂} \rightarrow \text{♁} \rightarrow \text{♄} \rightarrow \text{♃} \rightarrow \text{♂} \rightarrow \text{♁} \rightarrow \text{♄} \rightarrow \text{♃} \rightarrow \text{♂} \rightarrow \text{♁}$ matches the named stars (Prima Arietis in Aries through Scapula Pegasi in Pisces).

CAPVT VII

On the Observations of Tycho Brahe, especially concerning the Fixed Stars, their certainty, order, and the method of reforming them

1. When Tycho Brahe, on the occasion of the New Star [Nova Stella] which appeared in Cassiopeia in the year 1572, no less than Hipparchus once [on the occasion] of another New Star, was led by this spectacle to observe diligently the positions of the inerrant [fixed] stars, he determined a thousand positions of the fixed stars in the heavens with such diligence, subtlety, and consensus, and afterwards undertook them, that almost all astronomers follow him as the Phoenix of Astronomers; and they do not think it absurd to recede somewhat broadly [from him]. Yet to me, captivated by love of the truth, it pleased to investigate within what certain limits the certainty of the Tyconic observations is contained.

And Tycho himself, in his *Epistolae*, Tome 1, *Prolegomena*, page 273, affirms that the positions of the inerrant [fixed] stars observed by him *agree to within that very minute*; but for those following [him] he commends the Lansgravian [observations]. The minutes of the Hessians, which exceed the longitudes of the Tyconic fixed stars by a few minutes, he says: *Those few minutes are scarcely perceptible to the senses, and of almost no moment*. Much less obvious, therefore, he said hence, [that] anyone [should depart from] the other by one minute.

From Longomontanus, Tycho's chief assistant, I gather a suspicion that we can [detect] in the positions of the fixed stars an error of one — and perhaps of two — minutes. For he says, in *Astronomia Danica*, Lib. 1 *Theoricorum*, Chapter 4: *I afterwards, from the year 1590, undertook for a five-year period the business of restoring the positions of the celestial fixed stars; and I was present at the execution not only [in person], but also [I] presided, so that I might affirm with good faith — as far as human industry might ever expect — that the restitutions of these [stars]*

are accommodated to the Longitude and Latitude received from us, reciprocally to each [coordinate]; often reiterated, wherever they were, the observations [held], until the same [positions] settled to the nearest minute, [the discrepancies] removed. Although, on account of the lessened mean Longitude of the Sun received from us beyond the minutes, we have subtracted so much from the longitudes of the fixed stars individually from the Tychonic Canon. Hence the longitude of the fixed stars in the Danish Tables is smaller by a whole minute than in the Tychonic and Rudolphine [Tables]; and it is plain that Longomontanus labored, and observed the declinations, that the position of the fixed star might be settled most closely to the very [truth]. Let us now hear another Tychonic [witness], the pupil, namely, Kepler.

[Margin: Longomontani testimonium. — The testimony of Longomontanus.]

3. Johann Kepler [Io. Keplerus], in his work *On Mars [Astronomia Nova / De Motibus Stellæ Martis]*, Chapter 10, speaking of the Tychonic observations made on the Island of Hven, says: *As often as I happen [upon them], even in the Island observations, as the Right Ascensions are deduced from two stars, they differ by three scruples [minutes of arc]. When I consult Christian [Severin Longomontanus] about this, whether it happened through some weakness of vision, or of the observation, he responds that it is not unusual.* He speaks of Christian Longomontanus; and in the explanation of the foundation of his Ephemerides, page 15: *There is, he says, the motion of the Sun by six minutes from a fixed star — that is, the Lansgravian, nutating; and this testimony of Brahe [is] undecided.* He proceeds: *here that testimony points to many suspicions of errors, which at the same time appears as it were from globes of snow, a great [error], and could effect an error of some minutes.* Briefly, of the observations of Brahe, he says on page 14: *That nothing indeed should be supported by the authority of a most diligent Artificer except by [other] observations: relying on these observations, I fear lest, through the collected testimonies of other [observations], I become guilty of some minutes.* Yet he adds on page 15: *It is nevertheless easy [to detect] a quadrant of one degree by professors of the visible heavens.*

[Margin: Keplerii testimonium. — The testimony of Kepler.]

4. If we set the Tychonic observations side by side, and compare them with those which Paul Hainzel [Paulus Hainzelius] — most highly commended by Tycho himself, and [equipped] with a quadrant of 14 cubits — acquired, we shall detect a discrepancy of some minutes more than once, in the Tables of Distances and Declinations to be exhibited a little below. Because the Distances, too, deduced trigonometrically from longitude, and the Latitude of the Tychonic fixed stars, let

us compare with the Distance from Tycho per the sextants, the same discrepancy is not rarely repeated. Gassendi too noted this, in his *Commentaries on Celestial Matters*, page 96. For the distance between the Scales [the Balances, Libra] is set down by Tycho in the *Epistolae* at $9^{\circ} 8' 20''$; and from the solution of the triangles per Longitude and Latitude, the same Tychonic [distance] comes out, as Gassendi reckons, [at] $9^{\circ} 12'$.

5. As to what pertains to the method of Tycho in reforming the positions of the fixed stars: First, he inquired through the circumpolar stars — especially that which shines in the Tail of the Lesser Bear, and [in] the vicinity of the Pole of the World, and is called Polaris — by the altitude of the Pole of Uraniborg [Vraniburg], and obtained it; and as it was formerly at $51^{\circ} 54' 30''$, afterwards more accurately at $51^{\circ} 54' 40''$, [and] yet again at $51^{\circ} 55' 4' 40''$, as is plain from his *Epistolae*, page 40, and 53, and 64, and Tome 1, *Prolegomena*, page 28, and 218. Secondly, since he caught the distances of most of the fixed stars among themselves not with the Astronomical Radius [cross-staff], which he detects as fallacious, but with large Sextants, and sometimes with a Hemicycle. Thirdly, he investigated the Meridian Altitudes of most of the fixed stars [with] various Quadrants, and with the Sextant trigonometrically. Fourthly, the Right Ascension of the bright star of Aries was sought, not from the Sun, as the Ancients [did], but from Venus by a morning [observation]; or by Vespertine [evening observation], as the Right Ascensions are exposed by the rising of the Right [Ascensions]. Fifthly, [for] the Distance of the bright star of Aries, and the other fixed stars nearer to it, and by the complement of declinations by the aid of trigonometry, he investigated the right ascension; and by the same method he obtained the right ascensions of other fixed stars. Sixthly, [for] the Right Ascension and Declination of these very [stars], as [he derived] of the Poles of the Equator and Ecliptic — which, however, he falsely sets at $23^{\circ} 31' 30''$ — by the triangles...

the longitudes of the individual stars, and to investigate their latitudes, reducing all these to the year 1585. **Seventh**, by comparing his longitude of Spica and of Regulus for the year 1585 with the place at which the ancients had observed them, he derived the motion of the fixed stars in longitude over the intervening centuries. **Eighth**, since the task was one of such manifold solution by triangles, he assembled and worked up tables in which he set down the right ascension, and at the same time computed the declination — and from there the longitude was at once found, together with the latitude in those same tables. Thus he completed his canon of one thousand fixed stars for the year of our Lord 1600, by an arrangement that contained both the longitudes and the latitudes. **Ninth**, for the same year 1600 now complete, he determined the right ascensions of one

hundred select stars; and with these set down, by the increment of longitude over a hundred years' distance — for that is the constant rate — he investigated their right ascensions for the year 1700. He also examined the declinations of those same hundred stars for the year 1700, interjecting the difference of right ascension and the difference of declination between the years 1600 and 1700, so that from this a part could be allotted proportionally to the other intervening years, and so on. But he omitted the lesser bright star in the shoulder of the Greater Bear — though it is of the second magnitude — because, seeing that its right ascension was decreasing while its longitude increased, observers reckoned that its declination ought likewise to be increasing, and a difficulty arose here which they could not resolve. **Tenth**, at last he advanced his tables, and, having traced the fixed stars back over the longitude of many years, he relied on this; and to it he added a table of refraction.

In nearly the same order we shall report his observations, referring them to their proper places — though always reserving for the end of this Book of the Catalogue any general correction, should we have found one wanting anywhere.

Therefore, since we are beginning with the distances of the fixed stars among themselves — because these are perpetually unchanging — we shall set down those captured by our own Tycho's sextants as well, by three middling sextants and by three larger ones, together with those that Pierre Gassendi [Pierre Gassendi] captured with the radius he had carefully prepared, as set forth in his *Commentaries on Celestial Matters* [*Commentarii rerum coelestium*], which appear in his first volume, in his own works. We shall add besides the distances derived trigonometrically through our own Dionysius Petavius [Denis Petau], or through Adriaan Metius [Adriaan Metius], or through Herigonius [Pierre Hérigone], or through others, as they are reported in Petau's *Uranologion* [*Uranologium*], or in the Metius globe-treatise, or in the use of the globe; and finally any captured by Naucler's nautical radius in the southern hemisphere — then we shall hand on the declinations observed by Tycho, or by Paul Hainzel [Paul Hainzel] when examined together with these. Afterwards we shall set out the right ascensions, and the longitudes and latitudes that are derived from them.

CAPUT VIII.

On the Great Table of Distances, by which the Fixed Stars are distant among themselves; its Order, and its Use.

[1] The order we follow is alphabetical by constellation, so that the distances of the fixed stars may be more readily found. But because the distance between two stars often lies between two distinct constellations, that distance is to be sought under the constellation that comes first in alphabetical order — as, for instance, the distance between the Bright Star of Aries and the Southern Eye of Taurus is to be sought under the constellation of Aries. Likewise, even within one and the same constellation, we keep the alphabetical order: in Andromeda, taking first the Head of the star, then the Foot, then the Girdle; and so for the rest.

The distances captured by Tycho himself, and recorded in his *Epistolae* [*Epistolae*] on pages 50 and 51, we mark with the note *Epist.* Those, however, which he hands on in his first or second volume of the *Progymnasmata* [*Progymnasmata*] — from page 195 to 232, and from page 284 to 294, and from page 344 — we distinguish with the note *Prog.*, adding the page-number as it stands in the Frankfurt edition of the year 1610. Those, finally, which our P. Albertus Curtius [Albert Curtz], a member of our Society, has assembled by collating the names anagrammatized as *Lucius Barretus* — published at Vienna in Austria, by command of the Emperor Ferdinand, under the imprint of David Hauz, with the inscription *Syllogis Ferdinandae* [*Tychonis Sylloge Ferdinandae*] — these we distinguish with the note *Syll. Ferd.* And of these we have, so far, none but the observations of the year 1582. Our own corrections, where any occur, we shall mark with the pronoun *Nobis* [*Nobis*]; those captured by the radius of Bernardo Walther [Bernardus Walther], or by Gassendi, or by Adriaan Metius, or by Naucler, by their own surnames. As for those which P. Dionysius Petavius determines in book 3, chapter 5 of his *Uranologium* — distinguishing them either by longitude or by latitude as Tychonic — inasmuch as the data are Tychonic and depend on Tycho's own longitude and latitude, the use of which is the false assumption of the distance of the poles; better, therefore, are the distances deduced from the Tychonic declination and from the difference of right ascension, since these do not involve the fallacious obliquity of the ecliptic — a thing the reader should know is done by us as often as we say *ex Tych. da.*, by which we mean a distance deduced from the Tychonic declination and right-ascension difference, by whatever characters they are indicated; but when we

put *ex Tych. LL.*, a distance deduced from the Tyconic longitude and latitude will be signified.

[Margin: pp. 195 to 232, and pp. 284 to 294, and pp. 344; *Prog.* — adding the page-number as it appears in the Frankfurt edition of 1610.]

[Margin: *ex Tych. da.* = distance deduced from the Tyconic declination and right-ascension difference.] [Margin: *ex Tych. LL.* = distance deduced from the Tyconic longitude and latitude.]

Below follows the **Great Table of the Distances among the Fixed Stars, arranged in alphabetical order of the constellations** (*Magna Tabula Distantiarum inter Fixas ordine Alphabetico Constellationum*). Columns: the star-pair; the observer(s) (*Observatores*); and the distance in degrees (*G.*), minutes (*M.*), and seconds (*S.*). The table runs continuously across folios 219–221; what each page shows is transcribed below, and the table continues beyond this batch.

ANDROMEDA

Star-pair	Observers	G.	M.	S.
Head, & Girdle of Andromeda	<i>Nobis saepe</i>	14	26	50
	<i>ex Tych. da.</i>	14	26	0
Head, & Southern Foot of Andr.	<i>Nobis saepe</i>	26	41	0
	<i>ex Tych. da.</i>	26	42	30
Head, & the bright star of Aries	<i>Tych. Epist.</i>	27	7	30
	<i>Nobis semel</i>	27	8	0
	<i>saepius</i>	27	3	30
Head, & knee of Cassiopeia	<i>ex Tych. da.</i>	27	7	40
	<i>Tych. Epist.</i>	33	41	0
	<i>Tych.</i>	33	41	0

Star-pair	Observers	G.	M.	S.
	<i>Syllog. F.</i>			
	&	33	40	0
	&	33	41	0
	&	33	42	0
	<i>ex Tych. da.</i>	33	41	40
Head, & the Bend of Cassiop.	<i>Gassendo</i>	32	24	10
Head, & Schedir of Cassiopeia	<i>Gassendo</i>	28	2	0
	&	28	2	0
Head, & Tail of Cygnus	<i>ex Tych. da.</i>	43	24	0
Head, & Algenib of Pegasus	<i>ex Tych. da.</i>	13	56	5
Head, & knee of Pegasus	<i>Tych. Epist.</i>	18	28	0
	<i>Tych.</i>	18	29	30
	<i>Syllog. F.</i>			
	&	18	27	30
Head, & Markab of Pegasus	<i>Nobis</i>	20	12	0
	&	20	12	40
	<i>Gassendo</i>	20	14	0
	&	20	12	0
	<i>ex Tych. da.</i>	20	11	24
Head, & Scheat of Pegasus	<i>ex Tych. da.</i>	13	41	0

Star-pair	Observers	G.	M.	S.
Head, & the bright side- star of Perseus	<i>ex Tych. da.</i>	42	15	30
Girdle, & Southern Foot of Andr.	<i>Nobis</i>	12	28	30
	<i>ex Tych. da.</i>	12	28	22
Girdle, & the bright star of Aries (♈)	<i>Tycho</i>	17	27	15
	<i>Nobis</i>	17	47	40
	<i>ex Tycho da.</i>	17	27	30
Girdle, & Capella	<i>Nobis</i>	47	18	0
	<i>ex Tycho da.</i>	47	19	30
Girdle, & Tail of Cygnus	<i>ex Tych. da.</i>	21	10	10
Girdle, & Head of Medusa	<i>Nobis</i>	23	46	0
	<i>ex Tycho da.</i>	23	46	40
Girdle, & Algenib of Pegasus	<i>ex Tycho da.</i>	24	0	4
Girdle, & Markab of Pegasus	<i>Nobis</i>	34	51	0
Girdle, &	<i>ex Tycho</i>	17	35	50

Star-pair	Observers	G.	M.	S.
Scheat of Pegasus	<i>da.</i>			

ANDROMEDA (continued)

Star-pair	Observers	G.	M.	S.
Girdle, & bright Side-star of Perseus	<i>Nobis</i>	28	8	30
	<i>ex Tycho da.</i>	28	10	30
Girdle, & Aldebaran	<i>ex Tycho da.</i>	49	41	5
The more southern star in the hand of Andr. & the knee of Pegasus	<i>Tych. in Syllog.</i>	17	6	0
	& this one	17	0	30
	& a fifth one	16	58	0
Southern Foot of Andromeda, & the bright star of Aries (□)	<i>Tycho</i>	18	48	0
	<i>Nobis</i>	18	48	30
	<i>ex Tych. da.</i>	18	51	40
Southern Foot, & shoulder-star of	<i>ex Tych. da.</i>	41	30	20

Star-pair	Observers	G.	M.	S.
Auriga (following)				
Foot, & Capella	<i>ex Tych. da.</i>	34	22	40
Foot, & Jaw of Cetus	<i>ex Tych. da.</i>	40	24	40
Foot, & Tail of Cygnus	<i>ex Tych. da.</i>	55	41	10
Foot, & Algenib of Pegasus	<i>ex Tych. da.</i>	36	2	10
Foot, & Markab of Pegasus	<i>ex Tych. da.</i>	46	53	30
Foot, & Scheat of Pegasus	<i>ex Tych. da.</i>	44	38	55
Foot, & the bright side- star of Perseus	<i>Nobis</i>	15	45	10
	<i>ex Tych. da.</i>	15	46	0
Foot, & Aldebaran	<i>Nobis</i>	41	25	0
	<i>ex Tych. da.</i>	41	25	50
Foot, & northern Horn of Taurus	<i>ex Tych. da.</i>	42	43	25

ANTINOUS

Star-pair	Observers	Gr.	I	II
Preceding hand & the bright star	<i>Tycho</i>	10	56	0

Star-pair	Observers	Gr.	I	II
of Aquila				
	<i>Nobis</i>	10	57	0
Preceding hand, & os Pegasi (the mouth-star of Pegasus)	<i>Tych. Epist.</i>	20	41	0
Other hand, & os Pegasi	<i>Tych. Syllog.</i>	25	27	0
	&	25	26	30

AQUARIUS

Star-pair	Observer	Gr.	I	II
Fomalhaut, & the bright star of Aries (□)	<i>Nobis</i>	69	55	40
	<i>ex Tych. da.</i>	69	57	40
Fomalhaut, & preceding horn of Capricorn (□)	<i>ex Tych. da.</i>	40	35	40
Fomalhaut, & following horn of Capricorn (□)	<i>ex Tych. da.</i>	39	31	5
Fomalhaut, & the southern Tail of Cetus	<i>Nobis</i>	26	48	0

Star-pair	Observer	Gr.	I	II
	<i>ex Tych. da.</i>	26	48	20
Fomalhaut, & the first star of Eridanus	<i>Naucleris</i>	39	45	0
Shoulder preceding, the southern one, & following shoulder	<i>Tych. Epist.</i>	10	1	0
	<i>Nobis</i>	10	0	30
Preced. shoulder & the bright star of Aquila	<i>Tych. prog.</i> <i>230.</i>	29	0	30
	<i>Nobis</i>	29	58	35
Preced. shoulder & the northern horn of Capricorn (□). <i>Nobis</i> <i>19.21'</i>	<i>Tych. Epist.</i>	19	25	0
		19	21	0
Preced. shoulder & Algenib of Pegasus	<i>ex Tych. da.</i>	45	3	36
Preced. shoulder & Markab of Pegasus	<i>Tych. prog.</i> <i>230.</i>	31	3	15

Star-pair	Observer	Gr.	I	II
	<i>Nobis</i>	31	2	10
	<i>Metio</i>	31	3	10
Preced. shoulder & the southern Horn of Capricorn (□)	<i>Tych. Epist.</i>	19	37	0
Shoulder following, or the right one, & Aquarius' bright hand-star	<i>Tych. Epist.</i>	21	27	30
	& Aquarius' bright hand-star	21	27	0
Foll. shoulder & the bright star of Aquila	<i>Tych. Epist.</i>	34	53	30
	&	34	54	0
	<i>ex Tych. da.</i>	34	54	30
Foll. shoulder & Algenib of Pegasus	<i>Tych. Epist.</i>	35	7	30
Foll. shoulder & Markab of Pegasus	<i>Nobis</i>	21	18	0
	<i>ex Tych. da.</i>	21	17	0

Star-pair	Observer	Gr.	I	II
Foll. shoulder & the middle of the Head (□)	<i>Tych. prog. 230.</i>	48	59	20

AQUILA, or VULTUR VOLANS

Star-pair	Observers	Gr.	I	II
Bright star, & throat of Aquila	<i>Nobis</i>	2	33	0
Bright star, & northern wing of Aquila	<i>Nobis</i>	12	7	0
Bright star, & tail of Aquila	<i>Tych. Syllog.</i>	8	28	30
	&	8	28	15

BRIGHT STAR OF AQUILA, & the stars listed below

Star-pair	Observers	Gr.	I	II
Antares, the heart of Scorpio	<i>D. Valesio</i>	60	9	0
Antinous' Hand	<i>Nobis</i>	66	10	0
	<i>ex Tych. da.</i>	60	9	11
	<i>Tych. Syllog.</i>	10	51	0
	&	10	52	0
		10	53	0
Bright star of Aries	<i>Tych. prog. 195.</i>	96	15	0
Upper horn	<i>Nobis</i>	22	25	0

Star-pair	Observers	Gr.	I	II
of Capricorn	<i>ex Tych. da.</i>	22	25	10
Lower horn of Capricorn (inferior)	<i>Tych. Epist.</i>	22	24	10
Bright star of the southern Crown	<i>Naucleris</i>	24	45	0
Tail of Cygnus	<i>Tych. Epist.</i>	30	45	0
	<i>Tych. Syllog.</i>	38	4	30
	<i>Nobis</i>	38	4	10
	<i>Tych. Syllog.</i>	38	3	0
Breast of Cygnus	<i>Nobis</i>	32	12	0
	<i>Tych. Epist.</i>	32	12	15
Beak of Cygnus (Rostrum)	<i>Tych. Epist.</i>	19	40	0
	<i>Tych. Syllog.</i>	19	40	0
		19	39	40
	<i>ex Tych. da.</i>	19	39	50
Cygnus' following wing-tip (anterior wing, following)	<i>Nobis</i>	28	8	35
Cygnus'	<i>Tych.</i>	43	4	0

Star-pair	Observers	Gr.	I	II
middle northern wing	<i>Sylog.</i>			
Head of Hercules	<i>Tych.</i>	38	30	0
	<i>Sylog.</i>			
	&	38	31	0
	&	38	32	0
	<i>Tych. Epist.</i>	38	32	0
Left shoulder of Hercules (sinist.)	<i>Tych.</i>	48	43	30
	<i>Sylog.</i>			
Bright star of Lyra	<i>Tych.</i>	34	8	0
	<i>Sylog.</i>			
	&	34	8	20
	&	34	8	0
	&	34	9	30
	&	34	10	0
	<i>Nobis saepe</i>	34	9	0
Left hand of Ophiuchus (sin.)	<i>Tych.</i>	42	40	0
	<i>Sylog.</i>			
	&	42	38	30
	&	42	39	0
Head of Ophiuchus	<i>Tych.</i>	33	30	0
	<i>Sylog.</i>			
	<i>Nobis</i>	33	30	40
	<i>ex Tych. da.</i>	33	31	40
The brighter hand of Ophiuchus (lucidior)	<i>Tych. Epist.</i>	55	17	0

Star-pair	Observers	Gr.	I	II
	<i>Tych. prog.</i> <i>200.</i>	55	17	20
Markab of Pegasus	<i>Tych. prog.</i> <i>198.</i>	47	49	40
	<i>& pr. 199.</i>	47	49	0
	<i>Nobis</i>	47	49	0
os Pegasi (the mouth- star)	<i>ex Tych. da.</i>	28	3	40
Scheat of Pegasus	<i>ex Tych. da.</i>	48	17	15
Southern mouth of the Fish (Piscis australis os)	<i>Tych. Epist.</i>	48	16	30
Back of the preceding Fish (dorsum)	<i>Tych. Epist.</i>	53	55	0
Head of the southern Fish	<i>Tych. Epist.</i>	51	32	0
Bright southern hand-star of Sagittarius	<i>D. Valesio</i>	37	32	0
Spica Virginis	<i>Tych. prog.</i> <i>p. 195. &</i> <i>199.</i>	97	50	0

ARGO NAVIS

Star-pair	Observers	Gr.	I	II
Canopus, & the bright star of the Water- vessel (Hidra lucida)	<i>Naucleris</i>	57	52	0
Canopus, & Sirius	<i>Naucleris</i>	36	50	0

ARIES

Star-pair	Observers	Gr.	I	II
The first star of Aries (♈), & Markab of Pegasus	<i>Tych. prog.</i> 229.	40	24	30
The first star of Aries (♈), & Aldebaran	<i>Tych. Epist.</i>	38	36	0
	<i>Tych. prog.</i> 229.	38	39	0
	<i>Tych.</i> <i>Sylog.</i>	38	39	30
	&	38	37	0
	&	38	38	0
The second star of Aries (♈), & Aldebaran	<i>Tych. Epist.</i>	38	21	40
The second star of Aries (♈), &	<i>Nobis</i>	17	4	0

Star-pair	Observers	Gr.	I	II
Girdle of Andr.				

THE BRIGHT STAR, or the third of Aries, & the stars listed below

Star-pair	Observers	Gr.	I	II
The second star of Aries itself (Arietis ipsius)	<i>Gassendo</i>	5	53	24
Left shoulder of Auriga (hum. sinist.)	<i>ex Tych. da.</i>	43	48	52

THE BRIGHT STAR (third) of Aries (continued)

Star-pair	Observers	G.	I	II
Right shoulder of Auriga (hum. dexter)	<i>ex Tych. da.</i>	51	25	43
Capella of Auriga	<i>Tycho</i>	44	6	35
	<i>Nobis</i>	44	5	50
	<i>Metio</i>	44	6	0
The Head-star of Cassiopeia (1)	<i>Tych. prog. 283.</i>	34	47	30
Schedir of Cassiopeia (2)	<i>page 284.</i>	36	38	20
	<i>in Epist.</i>	36	38	45

Star-pair	Observers	G.	I	II
Cassiop. in the Girdle (3)	<i>Tych. prog.</i> 285.	37	12	0
Cassiop. in the Bend (4)	<i>Tych. prog.</i> 285.	39	10	45
	<i>in Epist.</i>	39	10	30
	<i>in Syllog.</i>	39	10	30
	&	39	10	0
Cassiop. in the Knee (5)	<i>Tych. prog.</i> 286.	37	27	0
	<i>in Epist.</i>	37	27	0
	<i>in Syllog.</i>	37	27	30
Cassiop. in the Leg/shin (6) (in Crure)	<i>Tych. prog.</i> 286.	40	13	40
Cassiop. of the outermost foot (7) (pedis extrema)	<i>p. 287.</i>	44	2	0
Cassiop. in the right elbow (8) (dextro cubito)	<i>p. 287.</i>	39	56	30
Cassiop. in the foot (9) (in pede)	<i>p. 288.</i>	42	29	0
Cassiop. the bright star of the Chair	<i>p. 288.</i>	41	20	45

Star-pair	Observers	G.	I	II
(10) (lucida Cathed.)	<i>in Epist.</i>	41	19	30
Cassiop. the outermost of the Chair (11) (extrema Cathed.)	<i>Tych. prog.</i> 289.	41	32	0
Cassiop. in the Footstool (12) (in Scabello)	<i>p. 289.</i>	45	10	30
Cassiop. before the knee (13) (prae. genua)	<i>p. 290.</i>	45	47	0
Cassiop. the little star at the hair (14) (stellula ad crines)	<i>p. 291.</i>	35	46	0
Cassiop. of the last rod/staff (15) (ultima virgae)	<i>p. 291.</i>	28	54	30
Cassiop. in the left arm (16) (in brachio sin.)	<i>p. 292.</i>	33	21	0
Cassiop. in	<i>p. 292.</i>	33	38	0

Star-pair	Observers	G.	I	II
the left elbow (17) (in cubito sin.)				
Cassiop. near the outer footstool (18) (apud extra sellae)	<i>p. 292.</i>	33	29	0
Cassiop. between 11 & 12 (19) (inter 11. & 12.)	<i>p. 292.</i>	45	5	30
Cassiop. the outermost of the seat (20) (extrema sellae)	<i>p. 293.</i>	48	54	0
Cassiop. the middle of the Footstool (21) (media Scabelli)	<i>p. 293.</i>	47	23	0
Cassiop. following the knee (22) (sequens genu)	<i>p. 293.</i>	36	14	30
Cassiop. in the	<i>p. 293.</i>	31	41	0

Star-pair	Observers	G.	I	II
preceding rod (23) (in virga praec.)				
Cassiop. in the following rod (24) (in virga sequens)	<i>p. 294.</i>	31	23	0
Cassiop. the last of the rod (25) (penult.)	<i>p. 294.</i>	29	40	0

THE BRIGHT STAR of Aries, & the stars listed below

Star-pair	Observers	G.	I	II
Southern Tail of Cetus (Ceti cauda austral.)	<i>Nobis</i>	46	12	0
Northern Tail of Cetus (Ceti cauda boreal.)	<i>Tycho</i>	41	37	0
	<i>Nobis</i>	41	37	40
Star of Draco under the Pole (Draconis Stella sub polo)	<i>Tych. prog. 212.</i>	84	20	30
Calx of	<i>Tych. prog.</i>	58	22	0

Star-pair	Observers	G.	I	II
Gemini (Calx pedis)	<i>199.</i>			
The bright star, head of Pollux of Gemini	<i>Tych. prog.</i> <i>195.</i>	74	45	30
Bright foot of Gemini (pes lucidus)	<i>ex Tych. da.</i>	63	24	50
Head of Medusa	<i>Nobis</i>	21	39	20
	<i>ex Tych. da.</i>	21	39	25
	<i>Gassendo</i>	21	40	50
	&	21	35	30
Orion 1, of the Belt (1. Balthei)	<i>Tych. Epist.</i>	55	7	40
	<i>ex Tych.</i> <i>Epist.</i>	55	8	0
Orion's left shoulder (hum. sinistr.)	<i>Tych. Epist.</i>	50	31	20
	<i>ex Tych. da.</i>	50	32	0
Orion's bright left foot (pes lucid. sin.)	<i>Nobis</i>	55	41	0
	<i>ex Tych. da.</i>	55	40	52
Algenib of Pegasus	<i>Nobis</i>	28	1	5
	<i>ex Tych. da.</i>	28	0	55

Star-pair	Observers	G.	I	II
Markab of Pegasus	<i>Tych. prog. 199.</i>	43	37	15
	<i>Nobis</i>	43	37	10
Scheat of Pegasus	<i>Tych. Epist.</i>	41	16	30
	<i>in Syllog.</i>	41	16	0
	&	41	16	45
The bright side-star of Perseus (latus lucidum)	<i>Nobis</i>	40	17	0
The bright star of the Pleiades (Pleiadum lucida)	<i>Tycho Epist.</i>	22	56	30
	<i>Nobis</i>	22	55	40
	<i>Gassendo</i>	22	55	40
Northern Horn of Taurus (Cornu boreum)	<i>Nobis</i>	44	41	50
	<i>ex Tych. da.</i>	44	41	0
Northern Eye of Taurus (oculus boreal.)	<i>Tych. prog. 229.</i>	33	8	30
	<i>Metio</i>	33	8	0
Southern Eye of Taurus, Aldebaran	<i>Tych. Epist.</i>	35	32	0

Star-pair	Observers	G.	I	II
(oculus austr. Aldeb.)				
	<i>in Syllog.</i>	35	32	20
	& there (& ibi)	35	32	0
	<i>Progymn.</i> <i>100.</i>	35	32	10
	<i>Nobis saepe</i>	35	32	0

AURIGA, or ERICHTONIUS

Star-pair	Observers	Gr.	I	II
(header continued from prior column: "Which is above the Tail of Aries (♈), & Aldebaran")	<i>Tycho Epist.</i>	26	45	0
Capella, & the stars listed below	<i>Gassendo</i>	7	38	30
Right shoulder of Auriga (hum. dext.)	<i>Nobis</i>	7	40	0
	<i>ex Tych. da.</i>	7	43	0
The kid- foot of Auriga (Haedor.	<i>Nobis</i>	3	6	0

Star-pair	Observers	Gr.	I	II
pes)				
Northern Praesepe of Cancer (praesepe bor.)	<i>ex Tych. da.</i>	48	57	10
Sirius, the Greater Dog (Canis maior)	<i>ex Tych. da.</i>	64	51	20
Procyon, the Lesser Dog (Canis minor)	<i>Nobis</i>	51	7	0
	<i>ex Tycho da.</i>	51	7	35
Head of Cassiopeia (1)	<i>Tych. prog. 284.</i>	43	44	30
Schedir of Cassiopeia (2)	<i>ex Tych. da.</i>	42	48	30
Cassiop. in the girdle (3) (in cingulo)	<i>Tych. prog. 285.</i>	41	7	41
	<i>pra 286.</i>	32	46	30
Cassiop. in the shin (4) (in crure)				
Cassiop. of the outermost foot (5) (pedis	<i>p. 287.</i>	30	18	30

Star-pair	Observers	Gr.	I	II
extrema)				
Cassiop. in the right elbow (6) (in cubito dext.)	<i>p. 287.</i>	48	9	30
Cassiop. in the foot (7) (in pede cathed.)	<i>p. 288.</i>	41	53	0
Cassiop. of the Chair, outermost (8) (cathed. extr.)	<i>p. 289.</i>	48	3	0
Cassiop. the footstool at the foot-sole (9) (scabell. ad plant.)	<i>p. 289.</i>	34	44	0
Cassiop. before the knee (10) (prae. genua)	<i>p. 290.</i>	36	55	0
Cassiop. the little star of the hair (11) (stellula crinium)	<i>p. 291.</i>	44	15	30
Cassiop. of the last rod (12) (vltim. virgae)	<i>p. 291.</i>	45	25	0

Star-pair	Observers	Gr.	I	II
Cassiop. in the left arm (13) (in brach. sin.)	<i>p. 292.</i>	38	41	0
Cassiop. in the cub. sin. (14) (in cub. sin.)	<i>p. 292.</i>	33	29	0
Cassiop. at the outermost seat (15) (ad extrem. sellae)	<i>p. 292.</i>	48	31	0
Cassiop. between 11 & 12 (16) (inter 11. & 12.)	<i>p. 292.</i>	36	14	30
Cassiop. the outermost of the footstool (17) (scabelli extrem.)	<i>p. 293.</i>	36	15	0
Cassiop. the middle of the footstool (18) (scabelli media)	<i>p. 293.</i>	36	14	30
Cassiop. which follows the	<i>p. 293.</i>	44	59	30

Star-pair	Observers	Gr.	I	II
knee (19) (quae sequit. gen.)				
Cassiop. in the preceding rod (20) (in virga praeced.)	<i>p. 293.</i>	44	15	0
Cassiop. in the following rod (21) (in virg. sequens)	<i>p. 294.</i>	43	30	0
Cassiop. of the last rod, penultimate (22) (penult. virgae)	<i>p. 294.</i>	44	43	0

CAPELLA likewise, & the stars listed below

Star-pair	Observers	Gr.	I	II
The heel- foot of Gemini (calx pedis)	<i>Metio</i>	27	1	0
The head of Castor of Gemini (Castoris caput)	<i>Nobis</i>	29	59	50
The head of Pollux of	<i>Tych. Epist.</i>	34	18	30

Star-pair	Observers	Gr.	I	II
Gemini				
	<i>ex Tych. da.</i>	34	18	40
The bright foot of Gemini (pes lucidus)	<i>ex Tych. da.</i>	33	20	40
Head of Medusa	<i>Nobis</i>	23	37	0
	<i>ex Tych. da.</i>	23	36	30
Orion's bright shoulder (humerus lucid.)	<i>Nobis</i>	39	30	0
	<i>ex Tycho da.</i>	39	32	0
Orion's bright foot (pes lucidus)	<i>ex Tych. LL.</i>	54	11	30
The bright side-star of Perseus (lucidum latus)	<i>Nobis</i>	19	11	5
The bright star of the Pleiades (Pleiadum Lucida)	<i>Nobis</i>	28	21	0
	<i>ex Tych. da.</i>	28	19	40
Regulus, heart of Leo (cor □)	<i>ex Tych. da.</i>	69	37	30
Northern	<i>Tycho</i>	17	31	0

Star-pair	Observers	Gr.	I	II
Horn of Taurus (cornu boreal.)	<i>Nobis</i>	17	31	20
Southern Eye of Taurus (oculus austral.)	<i>Gassendo</i>	30	45	0
Southern Eye of Taurus, Aldebaran, <i>by observers of our own time</i> (Nostris temporis observatoribus)	<i>Nobis</i>	30	42	30
	&	30	43	10
	&	30	43	0
	<i>ex Tych. da.</i>	30	43	2
Last star of the tail of Ursa Minor (vlt. caudae)	<i>ex Tych. LL.</i>	30	43	34
	<i>ex Tych. da.</i>	44	24	20
Bright shoulder of Ursa Major (humerus lucid.)	<i>ex Tych. da.</i>	50	6	0

Star-pair	Observers	Gr.	I	II
Flank of Ursa Major (Ilia)	<i>ex Tych. da.</i>	52	4	10
Bright thigh of Ursa Major (Co. luc.)	<i>ex Tych. da.</i>	59	48	20
Back of Ursa Major (tergus)	<i>ex Tych. da.</i>	60	17	15

AURIGA — right shoulder, & the stars listed below

Star-pair	Observers	Gr.	I	II
Right shoulder of Auriga, & the bright side-star of Perseus	<i>Nobis</i>	26	33	0
	<i>Tychoni</i>	26	34	0
Auriga's northern foot, & Orion's bright shoulder (pes borealis, & Orionis hum. lucid.)	<i>Nobis</i>	29	6	0
The same foot, & the Head of Pollux (Pollucis Caput)	<i>Tych. Epist.</i>	36	2	30

Star-pair	Observers	Gr.	I	II
The same foot, & Procyon	<i>Nobis</i>	46	48	0
The same foot, & Aldebaran	<i>Tych. Epist.</i>	33	3	30
The bright foot of Auriga, & the Head of Pollux (lucid. Aurigae Pollucis Cap.)	<i>Tych. Epist.</i>	30	33	45
The feet of the Kids, & the bright stars of Gemini (□) (Pedes Haedorum, & luc. □)	<i>Nobis</i>	34	9	0
The Kids among themselves (Haedi inter se se)	<i>Gassendo</i>	0	44	40

The Great Table of Distances continues (Caput VIII), arranged alphabetically by constellation. The table gives, for each pair of fixed stars, the source siglum (Observers column) and the measured separation in degrees (Gr.), arcminutes (I), and arcseconds (II). The folio is laid out in two table-columns per page; the transcription below preserves that order (left half of the folio first, then right half).

BOÖTES, or ARCTOPHYLAX [Boötes]

ARCTURUS, and the stars listed below it

Star-pair	Observers	Gr.	I	II
The bright star of Boötes' shin [Tibia Boötis lucida]	Gassendo	[?]	16	30
	ex Tych. da.	19	12	0
The bright star of the northern Crown [Coronae bor. lucida]	Nobis	19	33	30
	ex Tych. da.	19	34	10
	Gassendo	19	32	0
	[and]	19	35	0
Head of Hercules [Herculis Caput]	ex Tych. da.	42	49	50
Northern Balance [Lanx Borealis]	ex Tych. da.	32	26	0
Southern Balance [Lanx Australis]	ex Tych. da.	36	26	10
Tail of Leo [Leonis Cauda]	Nobis	35	24	40
Heart of	Nobis	59	49	0

Star-pair	Observers	Gr.	I	II
Leo [Leonis Cor]				
	ex Tych. da.	19	48	30
The bright star of Lyra [Lyrae lucida]	Nobis	38	53	0
	ex Tych. da.	38	50	35
	ex Tych. LL.	38	50	40
The Scorpion's Heart, Antares [Scorpii Cor Antares]	Nobis	56	4	30
	ex Tych. da.	56	4	20
The more northern star of the Scorpion's forehead [Scorpii borealiior frontis]	ex Tych. da.	49	27	25
The bright star of the Serpent's neck [Serpentis lucida colli]	ex Tych. da.	15	16	40
Spica of Virgo [Spica Virginis]	Gassendo	33	2	0
	Nobis	33	2	10

Star-pair	Observers	Gr.	I	II
	[and]	33	1	50
	ex Tych. da.	33	1	15
	ex Tych. LL.	33	2	0
Vindemiatrix [Vindemiatrix]	Gassendo	19	36	0
	ex Tych. da.	19	41	40
The bright star of Ursa Minor's shoulder [Ursae Minoris hum. lucid.]	Nobis	55	2	40
The bright star of Ursa Major's shoulder [Ursae Maioris humerus lucid.]	Nobis	53	47	0
	ex Tych. da.	53	46	10
The flank of Ursa Major [Ursae Maioris Ilia]	Nobis	51	33	20
	ex Tych. da.	51	35	0
The bright star of Ursa Major's hip [Ursae	Nobis	43	51	40

Star-pair	Observers	Gr.	I	II
Maioris lucida Coxae]	ex Tych. da.	43	50	30
The back of Ursa Major [Ursae Maioris tergus]	Nobis	43	45	0
	ex Tych. da.	43	45	0
1st star of Ursa Major's tail [Ursae Maioris 1. Caudae]	Nobis	39	43	25
2nd star of Ursa Major's tail [Ursae Maioris 2. Caudae]	Nobis	36	55	15
Last star of Ursa Major's tail [Ursae Maioris vlt. Caudae] (perhaps 30°31' [forte 30. 31.]	Nobis	30	33	30
	Gassendo	30	21	0
	ex Tych. da.	30	29	0
Arcturus, and the	Nobis	10	13	0

Star-pair	Observers	Gr.	I	II
bright star of Boötes' hip [Arcturus, & lucida Coxae Boot.]				
Arcturus, and the unformed star beneath it of the 2nd magnitude [Arcturus, & Informis sub ipso 2. Magnit.]	Nobis	9	57	0
The same unformed star, and the bright star of the Crown [Eadem inform. & Coronae lucida]	Nobis	11	0	0

CANCER

Star-pair	Observers	Gr.	I	II
The northern Ass-Colt, and Regulus [Asellus	Tych. prog. 229.	22	29	30

Star-pair	Observers	Gr.	I	II
boreus, & Regulus]				
The northern Ass-Colt, and the bright star in the foot of Gemini [Asell. boreus, & lucidus pes □]	Tych. prog. 229.	30	4	30
	ex Tych. da.	30	4	10

CANIS MAIOR [Canis Major]

Star-pair	Observers	Gr.	I	II
SIRIUS, and the stars listed below:				
Procyon of Canis Minor [Canis Minor Procyon]	Tych. Epist.	25	41	30
	Gassendo	25	40	0
	[and]	25	42	0
	Nobis	25	41	40
	[and]	25	41	0
	ex Tych. da.	25	41	50
	ex Tych. LL.	25	40	30
Eridanus, the star	Nobis	26	24	0

Star-pair	Observers	Gr.	I	II
near Orion's foot [Eridani quae ad ped. Orion]				
1st of the Hyades of Taurus [Hyadum □ prima]	Nobis	46	56	0
The middle of the Hyades [Hyadum media]	Nobis	49	2	0
The outermost of the Hyades, at the Nostrils [Hyadum extrema Narium]	Nobis	48	14	0
	ex Tych. da.	48	15	18
Heart of Hydra [Hydrae Cor]	Nobis	40	19	0
Heart of Leo [Leonis Cor]	Nobis	57	43	30

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Star-pair	Observers	Gr.	I	II
(continued from	ex Tych. da.	57	43	45

Star-pair	Observers	Gr.	I	II
preceding column)				
	ex Tych. LL.	57	43	35
The bright star of the Hare's back [Leporis lucida Dorsi]	Nobis	17	27	0
1st of Orion's belt [Orionis 1. balthei]	Nobis	22	57	0
	ex Tych. da.	22	55	50
2nd of Orion's belt [Orionis 2. balthei]	Nobis	22	56	0
3rd of Orion's belt [Orionis 3. balthei]	Nobis	22	37	0
The bright star of Orion's sword [Orionis lucida ensis]	ex Tych. da.	22	36	0
Orion's right knee [Orionis genu dext.]	Nobis	26	10	0
Orion's bright shoulder	Gassendo	26	57	0

Star-pair	Observers	Gr.	I	II
[Orionis hum. lucid.]				
	[and]	26	58	0
	[and]	26	49	0
	ex Tych. da.	26	58	0
	ex Tych. LL.	26	58	50
Orion's left shoulder	Gassendo	30	6	0
[Orionis hum. sinistr.]				
	[and]	30	6	50
Orion's bright foot, Rigel	Tych. Epist.	23	41	40
[Orionis pes lucid. Rigel]				
	Nobis	23	40	0
	[and]	23	42	0
	Gassendo	23	42	0
	[and]	23	43	0
	ex Tych. da.	23	40	30
The southern eye of Taurus	Nobis	45	58	30
[Tauri oculus austral.]				
	Tych. Epist.	45	57	30
	ex Tych. da.	45	57	40
	ex Tych. LL.	45	58	20

Star-pair	Observers	Gr.	I	II
The root of the Tail of Canis, and the Heart of Hydra [Radix Caudae Canis, & Cor Hydrae]	Nobis	37	28	0

CANIS MINOR, CANICULA

Star-pair	Observers	Gr.	I	II
PROCYON, and the stars listed below:				
Algomisa [Algomisa]	Bern. Vualtero	4	12	0
	[and]	4	14	0
Head of Castor of Gemini [Gemini Castoris Caput]	Nobis	26	35	0
	ex Tych. da.	26	35	30
Head of Pollux of Gemini [Gemini Pollucis Caput]	Nobis	22	44	0
	Gassendo	22	43	0
	ex Tych. da.	22	45	0
The bright	Tycho	18	48	50

Star-pair	Observers	Gr.	I	II
foot of Gemini [Geminoru m Pes lucidus]	Nobis	18	49	0
The Heel of Castor of Gemini [Geminoru m Calx Castoris]	Nobis	25	15	0
The nearer star of Gemini [Geminoru m Propus]	Nobis	18	49	0
Heart of Hydra [Hydrae Cor]	Tych. Epist.	30	20	0
	Nobis	30	19	0
Heart of Leo [Leonis Cor]	Gassendo	37	19	0
	Tych. Epist.	37	19	0
	Nobis	37	20	0
	ex Tych. da.	37	19	40
1st of Orion's belt [Orionis 1. balthei]	ex Tych. da.	32	19	20
2nd of Orion's belt [2. balthei]	Nobis	31	29	0

Star-pair	Observers	Gr.	I	II
	ex Tych. da.	31	29	0
3rd of Orion's belt [3. balthei]	Nobis	30	35	0
	ex Tych. da.	30	34	50
Orion's bright shoulder [Orionis humerus lucid.]	Nobis	26	2	0
	Gassendo	26	2	0
Orion's left shoulder [Orionis hum. sinist.]	Nobis	33	28	20
	ex Tych. da.	33	27	30
Orion's bright foot [Orionis pes lucidus]	Tycho Epist.	38	37	30
	Nobis	38	47	30
	[and] formerly [olim]	38	58	0
Southern horn of Taurus [Tauri Cornu austr.]	ex Tycho da.	38	37	32
Northern horn of Taurus	Nobis	53	33	40

Star-pair	Observers	Gr.	I	II
[Tauri Cornu boreale]				
The southern eye of Taurus	Tych. Epist.	46	22	0
[Tauri Oculus austr.]				
	Nobis	46	22	0
	ex Tych. da.	46	21	50
The bright star of the Neck of Canicula, and the bright star of the foot of Gemini	Nobis	14	50	0
[Lucida Colli Caniculae, & lucida pedis □]				

CAPRICORN [Capricornus]

Star-pair	Observers	Gr.	I	II
The preceding star of the Tail, and the horn above	Tych. prog. 230.	20	15	45
[Caudae praec. & cornu				

Star-pair	Observers	Gr.	I	II
super.]				
The following star of the Tail, and Aquila [Caudae sequens, & Aquila]	Tycho	38	5	0
The preceding star of the Tail, and Markab [Caudae praec. & Markab.]	Tych. prog. 230.	38	3	30

The remaining pairs, see under AQUARIUS and under AQUILA. [Reliquas vide sub AQUARIO, & sub AQUILA.]

CASSIOPEIA

Star-pair	Observers	Gr.	I	II
The Head of Cassiopeia, and the bright star of the Chair [Caput Cassiop. et Cathed. lucid.]	Tych. prog. 345.	6	33	30
The Head, and the girdle of Cassiopeia	p. 346.	4	17	0

Star-pair	Observers	Gr.	I	II
[Caput, & cingulum Cass.]				
The Head, and the leg of Cassiopeia [Caput, & crus Cass.]	p. 346.	13	53	0
The Head, and the hams of Cassiopeia [Caput, & poples Cass.]	p. 346.	9	6	0
The Head, and Schedir of Cassiopeia [Caput, & schedir Cass.]	p. 345.	2	41	0
The Head, and the outermost foot of Cassiopeia [Caput, & pedis extrem. Cass.]	p. 346.	18	54	0
The Head, and the flank of Cassiopeia [Caput, &	p. 345.	7	20	0

Star-pair	Observers	Gr.	I	II
Ilia Cass.]				
The girdle, and the hams of Cassiopeia [Cingulum, & poples Cassiop.]	Tych. prog. 346.	5	19	30
The girdle, and the leg of Cassiopeia [Cingulum, & crus Cass.]	p. 346.	9	53	0
The girdle, and the outermost foot of Cassiopeia [Cingulum, & pedis extr. Cass.]	p. 346.	14	45	0
The girdle, and the upright part of the Chair of Cassiopeia [Cinguli, & sellae erectio Cass.]	p. 345.	5	23	0
The girdle, and the knee of Cassiopeia	in Epist.	5	19	0

Star-pair	Observers	Gr.	I	II
[Cingulum, & genu Cass.]				
The girdle, and the flank of Cassiopeia [Cingulum, & Ilia Cass.]	p. 345.	3	3	0
The leg, and the outer foot of Cassiopeia [Crus, & extr. ped. Cassiop.]	Tych. prog. 346.	5	9	0
The leg, and the flank of Cassiopeia [Crus, & Ilia Cass.]	pag. 345.	7	19	0
The left knee, and Aldebaran [Genu sinistrum, & Aldebara]	Tych. Epist.	55	23	30
	in Syllog.	55	23	30
	[and]	55	23	0
The knee, and the bend of Cassiopeia	Tych. prog. 346.	3	35	30

Star-pair	Observers	Gr.	I	II
[Genu, & flexura Cass.]				
The girdle of Cassiopeia, and Pegasus' Scheat	ex Tych. da.	40	2	0
[Genu Cass. & Pegasi Scheat]				
The bright star of the Chair, and the Tail of Cygnus	Nobis	33	32	20
[Cathed. lucid., & Cygni cauda]				
The bright star of the Chair, and the girdle of Cassiopeia	Tych. Epist.	5	17	30
[Cath. luc. & cingul. Cass.]				
	prog. 345.	5	19	0
The bright star of the Chair, and the outermost of	Tych. Epist.	4	45	0

Star-pair	Observers	Gr.	I	II
Cassiopeia [Cath. luc. & extrema Cath.]				
The bright star of the Chair, and the leg of Cassiopeia [Cath. luc. & Crus Cass.]	Tych. Epist.	13	18	0
The bright star of the Chair, and the flank of Cassiopeia [Cath. luc. & Ilia Cass.]	Tych. prog. 345.	13	17	30
The bright star of the Chair, and the outermost foot of Cassiopeia [Cath. luc. & pedis extr. Cass.]	Tych. prog. 345.	6	12	30
The bright star of the Chair, and the hams, or knee, of Cassiopeia [Cathed. lucid. &	Tych. prog. 345.	17	26	0

Star-pair	Observers	Gr.	I	II
Poples, seu genu]				
	in Epist.	9	41	0
The bright star of the Chair, and Schedir [Cathed. luc. & Schedir]	Tych. prog. 345.	9	41	0
	in Epist.	4	59	0
The bright star of the Chair, and the bend of Cassiopeia [Cath. luc. & Flexura Cass.]	Tych. prog. 345.	4	57	30
The bright star of the Chair, and the Pole Star [Cath. luc. & Stella Polaris]	Tych. Epist.	6	10	30
	Tych. prog. 346.	30	13	30
	& Nobis	30	13	30
The bright star of the Chair, and the head of Pollux [Cath. luc. & Pollucis	Tych. prog. 288.	77	25	0

Star-pair	Observers	Gr.	I	II
caput]				
The bright star of the Chair, and Pegasus' Markab [Cath. luc. & Pegasi Markab]	Nobis	77	25	20
	Nobis	45	32	0
	ex Tych. da.	45	32	35
The bright star of the Chair, and Pegasus' Scheat [Cath. luc. & Pegasi Scheat]	Nobis	33	4	0
	ex Tych. da.	33	3	0
The bend of Cassiopeia, and Schedir [Flexura Cassiop. & Schedir]	Tych. prog. 345.	4	40	0
The bend of Cassiopeia, and Pollux's Head [Flexura Cass. & Pollucis Cap.]	Tych. prog. 285.	71	25	0
The flank	Tych. prog.	11	56	30

Star-pair	Observers	Gr.	I	II
of Cassiopeia, and the outermost foot [Ilia Cass. & pedis extrema]	345.			
The flank, and the hams of Cassiopeia [Ilia, & Poples Cass.]	Tych. prog. 345.	3	55	0
The flank, and the Pole Star [Ilia, & Polaris Stella]	Tych. prog. 346.	28	36	0
The hams of Cassiopeia, and the leg [Poples Cassiop. & Crus]	Tych. prog. 346.	4	50	0
The hams, and the outer foot of Cassiopeia [Poples, & ped. extr. Cass.]	p. 346.	9	36	0
The hams,	p. 345.	6	48	30

Star-pair	Observers	Gr.	I	II
and the upright part of the Chair of Cassiopeia [Poples, & Sellae erectio Cass.]				
The hams, and Schedir [Poples, & Schedir]	p. 345.	6	56	0
Schedir, and the girdle of Cassiopeia [Schedir, & cingul. Cassiop.]	Tycho Epist.	1	40	0
Schedir, and the leg of Cassiopeia [Schedir, & crus Cass.]	prog. 345.	1	42	0
Schedir, and the outermost foot of Cassiopeia [Schedir, & pedis extr. Cass.]	prog. 345.	11	33	0
Schedir, and the upright	prog. 345.	16	28	0

Star-pair	Observers	Gr.	I	II
part of the Chair [Schedir, & Sellae erectio]				
Schedir, and the Tail of Cygnus [Schedir, & cauda Cygni]	prog. 345.	6	27	0
Schedir, and Markab of Pegasus [Schedir, & Markab. Pegasi]	Nobis	37	58	30
	ex Tycho. da.	45	31	35
Schedir, and Scheat of Pegasus [Schedir, & Pegasi Scheat]	Nobis	33	14	20
	ex Tycho da.	33	15	20

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Star-pair	Observers	Gr.	I	II
Schedir, and the Pole Star [Schedir, & Polaris Stella]	Tych. Epist.	32	47	45

Star-pair	Observers	Gr.	I	II
	prog. 346.	32	48	30
	Nobis	32	47	40
Schedir, and the Head of Pollux [Schedir, & Pollucis Caput]	Tych. prog. 288.	75	11	15
	Nobis	75	10	10
The upright part of the Chair, and the bright star of the Chair [Sellae erectio, & luc. Cath.]	Tych. prog. 345.	4	44	0
The upright part of the Chair, and the Head of Cassiopeia [Sellae erect. & Caput Cass.]	pr. 345.	9	3	0
The upright part of the Chair, and the leg of Cassiopeia [Sellae errec. & Crus Cass.]	pr. 345.	9	9	30

Star-pair	Observers	Gr.	I	II
The upright part of the Chair, and the outer foot of Cassiopeia [Sellae errec. & ped. extr. Cass.]	pr. 345.	12	49	0
The upright part of the Chair, and the flank of Cassiopeia [Sellae errec. & Ilia Cass.]	pr. 345.	3	35	0
The upright part of the Chair, and the Pole Star [Sellae errec. & Polaris Stella]	Tych. prog. 346.	26	26	6
	Sylog.	16	25	0
	[and]	16	24	30
The outermost of the Chair of Cassiopeia, and the Pole Star [Extrema Cath. Cass. & Polaris]	Tych. Epist.	16	42	30

Star-pair	Observers	Gr.	I	II
The navel of the Chair of Cassiopeia, and the foot of the Chair [Vmbilicus Cass. & pes Cath.]	Tych. prog. 290.	4	42	30
The navel of the Chair, and the bright star of the Chair [Vmbilicus Cass. & lucid. Cath.]	Tych. ibidem	6	2	0

The remaining pairs, seek under ANDROMEDA, ARIES, and AURIGA. [Reliquas quaere sub ANDROMEDA, ARIETE, & AVRIGA.]

CENTAURUS

Star-pair	Observers	G.	I	II
The apex of the Cross, and Antares [Crucis apex, & Antares]	Naucleris	51	2	0
The apex of the Cross, and Spica [Crucis apex, &	Naucleris	48	20	0

Star-pair	Observers	G.	I	II
Spica]				
The foot of the Cross, and Antares [Crucis pes, & Antares]	Naucleris	53	15	0
The foot of the Cross, and Spica [Crucis pes, & Spica]	Naucleris	52	50	0
The arms of the Cross between themselves [Crucis brachia inter se]	Naucleris	3	55	0
The preceding arm of the Cross, and the foot † [Crucis brach. praec. & pes †]	Naucleris	4	25	0
The following arm of the Cross, and the foot of the Cross [Crucis brach. seq. & pes	Naucleris	4	54	0

Star-pair	Observers	G.	I	II
crucis]				
The left knee, and Antares [Genu sinistrum, & Antares]	Naucleris	44	0	0
The left knee, and Spica [Genu sinist. & Spica]	Naucleris	49	30	0
The hip, and the bright star of Hydra [Coxa, & Lucida Hydrae]	Naucleris	54	26	0
The hip, and Spica [Coxa, & Spica]	Naucleris	44	40	0
The bright star of the right foot, and Antares [Pedis dextri lucida, & Antares]	Naucleris	38	20	0
The bright star of the right foot, and Spica	Naucleris	52	10	0

Star-pair	Observers	G.	I	II
[Pedis dextr. lucida, & Spica]				
The following shoulder, and Antares [Humerus sequens, & Antares]	Nobis circiter [approxima tely]	51	41	0

CEPHEUS

Star-pair	Observers	Gr.	I	II
The shoulder preceding, and the Tail of Cygnus [Humerus preced. & Cygni cauda]	Gassendo	18	7	48
	Nobis	18	8	0
	[and]	18	8	30
The shoulder preceding, and the bright star of Lyra [Humer. praeced. & Lyrae lucidae]	Nobis	33	59	0

Star-pair	Observers	Gr.	I	II
	[and]	34	0	0
The bright star of the girdle, and the Tail of Cygnus [Cinguli lucida, & Cygni cauda]	Nobis	25	56	30
The same, and the bright star of Lyra [Eadem, & Lyrae lucida]	Nobis	38	44	20
	ex Tych. da.	38	42	10

CETUS [Cete]

Star-pair	Observers	Gr.	I	II
The bright star of the jaw, and Aldebaran [Mandibula lucida, & Aldebara]	Nobis	26	6	45
	ex Tycho da.	26	4	0
The bright star of the jaw, and the southern star of	Nobis	40	43	40

Star-pair	Observers	Gr.	I	II
Cetus' tail [Mandib. luc. & Ceti cauda austr.]	ex Tycho da.	40	44	0
The bright star of the jaw, and Orion's bright shoulder [Mandib. luc. & Orion. hum. luc.]	Tych. Epist.	43	8	0
	in Syllog.	43	8	0
	[and]	43	7	30
	Nobis	43	8	30
	[and]	43	6	10
	Nobis	43	6	10
The bright star of the jaw, and Orion's Rigel [Mandib. luc. & Orionis Rigel]	ex Tych. da.	35	14	50
The bright star of the jaw, and Pegasus' Algenib	Nobis	34	0	0

Star-pair	Observers	Gr.	I	II
[Mādib. luc. & Pegasi Algenib.]				
The two stars in the Jaw of Cetus [Ceti duae in Mandibula]	Tych. Syllog.	4	42	0
The northern star of Cetus' belly, and Aldebaran [Ceti venter bor. & Aldebara]	Tych. Syllog.	48	40	15
The northern star of Cetus' belly, and the southern star of the Tail [Ceti venter bor. & Caud. austr.]	Gassendo	18	13	30

The Tail of Cetus, seek under AQUARIUS and ARIES. [Ceti Cauda, quaere sub AQVARIO, & ARIETE.]

CORONA AUSTRALIS [Corona Australis]

Star-pair	Observers	Gr.	I	II
The bright star of the	Naucleris	36	10	0

Star-pair	Observers	Gr.	I	II
Crown, and Antares [Lucida Coronae, & Antares]				
The bright star of the Crown, and Aquila [Lucida Coronae, & Aquilae]	Naucleris	50	45	0

CORONA BOREALIS

Star-pair	Observers	Gr.	I	II
The bright star of the Crown, and the Tail of Leo [Lucida Coronae, & Cauda □]	ex Tych. da.	53	39	20
	ex Tych. LL.	53	41	0
The bright star of the Crown, and the bright star of Lyra [Lucida Coron. & Lucida Lyrae]	Nobis	48	3	15
The bright star of the Crown, and Spica	Nobis	49	4	0

Star-pair	Observers	Gr.	I	II
[Lucida Coronae, & Spica □]	ex Tycho da.	49	3	50
The bright star of the Crown, and the Head of Ophiuchus [Luc. Coron. & Ophiuchi Cap.]	ex Tych. da.	31	30	15
The bright star of the Crown, and the bright star of the Collar of the Serpent [Luc. Cor. & luc. Coll. Serpentis]	ex Tych. da.	20	24	0
	ex Tych. da.	20	25	0
The bright star of the Crown, and Ursa Major [Luc. Coronae, & Vrsae mai.]	Nobis	30	34	0
The bright star of the Crown, and the last star	Nobis	30	22	0

Star-pair	Observers	Gr.	I	II
of Ursa Major's Tail [Luc. Coronae, & Vrsae mai. vltima Caudae]	Nobis	36	51	0
The bright star of the Crown, and the middle star of Ursa Major's Tail [Luc. Coronae, & Vrsae mai. media Caudae]	ex Tych. da.	36	49	15

CORVUS

Star-pair	Observers	Gr.	I	II
The left wing, and Spica [Ala sinistra, & Spica]	Gassendo	18	0	0
	[and]	17	55	45
	ex Tych. LL.	17	56	0

CRATER

Star-pair	Observers	Gr.	I	II
The bright star in the base of the Crater, and	Gassendo	21	21	0

Star-pair	Observers	Gr.	I	II
the bright star of Hydra [Crateris lucida in basi, & Hydrae lucida]				

CYGNUS

Star-pair	Observers	Gr.	I	II
The Tail, and the eastern wing [Cauda, & ala orientalis]	Nobis	11	21	0
The Tail, and the bright star of Lyra [Cauda, & Lyrae lucida]	Tycho	23	52	0
	Nobis	23	53	50
	Gassendo	23	49	0
	(and it ought to have been [debuisse])	23	52	0
The Tail, and Pegasus' Algenib [Cauda, &	ex Tych. da.	53	29	50

Star-pair	Observers	Gr.	I	II
Pegasi Algenib.]				
The Tail, and Pegasus' Scheat [Cauda, & Pegasi Scheat]	ex Tycho da.	32	56	15
	Nobis	32	57	10
The Tail, and the Pole Star [Cauda, & Polaris Stella]	Tych. Epist.	44	39	30
	ex Tycho da.	44	41	20
The Tail, and the Beak [Cauda, & Rostrum]	Nobis	22	21	30
The breast of Cygnus, and the bright star of Lyra [Pectus Cygni, & Lyrae lucida]	Tych. Syllog.	20	17	30
	[and]	20	15	0
	ex Tych. da.	20	20	10
The breast of Cygnus,	Tych. Syllog.	45	52	30

Star-pair	Observers	Gr.	I	II
and the Head of Ophiuchus [Pectus Cygni, & Ophiuc. Cap.]	[and]	45	53	0
	[and]	45	53	30
The breast of Cygnus, and Pegasus' Scheat [Pectus Cygni, & Pegasi Scheat]	Tych. Epist.	35	12	30
	ex Tych. da.	35	10	30
The breast, and the Beak of Cygnus [Pectus, & Rostrum Cygni]	Tych. Syllog.	16	12	30
The Beak, and Ophiuchus' right shoulder [Rostrū & Ophiuch. hum. dext.]	Tych. Syllog.	34	35	30
	[and]	34	37	0
The Beak,	Tych. Epist.	46	36	40

Star-pair	Observers	Gr.	I	II
and Pegasus' Scheat [Rostrum, & Pegasi Scheat]				
The middle of the Northern wing, and Pegasus' Scheat [Media alae Bor. Pegasi Scheat]	Tych. Epist.	46	1	30

The remaining pairs, seek under ANDROMEDA, AQUILA, and CASSIOPEIA.
[Reliquas quaere sub ANDROMEDA, AQVILA, & CASSIOPEA.]

DRACO

Star-pair	Observers	Gr.	I	II
The star of Draco nearest the Pole of the Ecliptic, and the Heel of the foot of Gemini [Draconis Stella polo Eclipticae proxima, & Calx pedis □]	Tych. prog. 212.	90	37	0

Star-pair	Observers	Gr.	I	II
The same, and the Heart of Leo [Eadem, & Cor Leonis □]	prog. 212.	83	9	0
The same, and the Head of Pollux [Eadem, & Caput Pollucis]	prog. 212.	81	31	50
The same, and Spica [Eadem, & Spica □]	prog. 212.	87	6	30
The bright star in the head, preceding, and the bright star of Lyra [Lucida in capite praecedens , & Lyrae lucida]	Nobis	14	33	50
The next- to-last star of Draco's Tail, and the stars listed	ex Tych. LL. Petavius, from the data given by Tycho, Bk. 3 of the <i>Uranologio</i>	14	35	0

Star-pair	Observers	Gr.	I	II
below [Caudae Draconis penultima, & infrascripta Stellae]	<i>n</i> , ch. 6 [Petavius ex Tychonis datis Lib. 3. Vranol. cap. 6.]			
Boötes' left shoulder [Bootae humerus sinistr.]		35	48	0
The southern Ass-Colt of Cancer [Cancri Asellus australis]		61	53	0

(Right half of folio, PDF p. 258 — DE FIX. STEL.)

This column continues the list of distances from **the next-to-last star of Draco's Tail** (per Petavius, from Tycho's data, *Uranologion* Bk. 3, ch. 6) to each star listed.

Star [from Draco's Tail penultima]	Gr.	I	II
The northern Ass-Colt of Cancer [Cancri Asellus borealis]	58	46	0
The preceding star of the northern part of Cancer, in the square	60	2	0

Star [from Draco's Tail penultima]	Gr.	I	II
[Cancri bor. praec. in □]			
The southern star of Cancer, in the square [Cancri austr. in □]	62	49	0
3rd, southern, in the right arm of Andromeda [3. Austr. in brach. dextr. Andr.]	73	24	0
The lowest star of Aquila's wing [Infima alae fin. Aquilae]	90	39	0
The southern star of the right arm of Andromeda [Australis. brach. dextr. Andr.]	67	27	0
The reins (loins) of Aries [Arietis renes]	85	30	0
The foot of Cassiopeia [Cassiopeae pes]	45	47	0
The breast of	45	47	0

Star [from Draco's Tail penultima]	Gr.	I	II
Cepheus [Cephei pectus]			
The peripheral stars of the Crater [Crateris borea peripheriae]	81	18	0
The northern handle of the Crater [Crateris ansa borealis]	84	2	0
The horn, the following wing [Cornu ala sequens]	86	12	0
The neck of Cygnus [Cygni collum]	64	5	0
The beak of Cygnus [Cygni rostrum]	68	47	0
The upper Crown [Corona superior]	49	58	0
The right wing of Cygnus [Cygni ala dextra]	43	5	0
The outermost star of Cygnus' left wing [Cygni alae sin. extrema]	73	47	0

Star [from Draco's Tail penultima]	Gr.	I	II
The bend of Cygnus' left wing [Cygni ancon. alae sin.]	68	37	0
The head of Draco [Draconis caput]	39	53	0
The head of Gemini, Castor's head [Geminorum caput Castoris]	56	49	0
The head of Gemini, Pollux's head [Geminorum caput Pollucis]	57	28	0
Auriga's right foot [Aurigae pes dexter]	64	49	0
Auriga's left foot [Aurigae pes sinister]	66	37	0
The bend of Hercules' right arm [Herculis dextrae ancon.]	61	4	0
The Heart of Hydra [Hydrae Cor]	83	27	0
The northern	83	26	0

Star [from Draco's Tail penultima]	Gr.	I	II
Balance [Lanx borea]			
Ophiuchus' left knee [Ophiuch. genu sin.]	90	30	0
Ophiuchus' right knee [Ophiuch. genu dext.]	97	57	0
Ophiuchus' right shoulder [Ophiuch. hum. dext.]	81	35	0
Ophiuchus' left shoulder [Ophiuch. hum. sinist.]	73	13	0
The Heart of Leo [Leonis cor]	62	2	0
Ophiuchus' head [Ophiuchi caput]	73	8	0
The middle star of Orion's belt [Orionis media balthei]	95	52	0
The mouth of Pegasus [Pegasi os]	95	21	0
Perseus' left shin [Persei Tibia sinistra]	67	58	0

Star [from Draco's Tail penultima]	Gr.	I	II
Perseus' left shoulder [Persei hum. sinist.]	58	35	0
The bright star of the Serpent's neck [Serpentis lucida colli]	61	9	0
Taurus' right knee [Tauri genu dext.]	92	33	0
The bright star of Ursa Major's southern right foot [Vrsae mai. austral. pedis dextri]	34	5	0
The more northern star of the same [eiusdem borealior]	33	41	0

GEMINI

Star-pair	Observers	Gr.	I	II
CASTOR'S Head, and the stars listed below:				
Head of Pollux [Caput	Bern. Vualther.	4	32	0

Star-pair	Observers	Gr.	I	II
Pollucis]				
	Nobis	4	29	0
	[and]	4	32	0
	Gassendo	4	32	0
	(it ought to have been [debut nat])	4	32	0
Heart of Hydra [Hydrae cor]	ex Tych. LL.	48	41	58
	ex Tych. da.	48	45	40
Heart of Leo [Leonis cor]	Tych. Epist.	40	32	0
	Nobis	40	32	55
Orion's bright foot [Orionis pes lucidus]	Nobis	52	9	15
	ex Tych. da.	52	8	10
Orion's preceding shoulder [Orionis hum. praec.]	Nobis	39	29	0
	ex Tych. da.	39	28	40
Orion's bright shoulder [Orionis humer. lucid.]	Tycho	33	38	10

Star-pair	Observers	Gr.	I	II
	Nobis	33	38	0
	ex Tych. da.	33	37	30
1st of Orion's belt [Orionis balthei 1.]	Nobis	43	25	0
2nd of the belt [balthei 2.]	Nobis	43	17	0
3rd of the belt [balthei 3.]	Nobis	43	12	0
The southern eye of Taurus [Tauri oculus austral.]	Tych. Epist.	44	41	30
	Nobis	44	41	0
	ex Tych. da.	44	43	0
The bright star of Ursa Major's shoulder [Vrsae mai. luc. humer.]	Nobis	44	53	30
The flank of Ursa Major [Vrsae maior. Ilia]	Nobis	41	53	0

POLLUX'S HEAD, and the stars listed below

Star-pair	Observers	Gr.	I	II
The left Heel of Gemini [Calx sinister ☐]	Tych. Epist.	19	28	0
	in Syllog.	19	28	0
	[and]	19	28	30
	Nobis	19	28	30
	[and]	19	27	40
The outermost foot of Gemini [Extrema pedis ☐]	Tych. Epist.	21	14	0
	& Syllog.	21	14	0

Liber IV — De Fixis Stellis (continued)

Caput VIII — The Great Table of Distances (continued)

The distance table continues alphabetically by constellation. Columns are: **star-pair (Latin description)** | **Observers** (siglum) | **Gr.** (degrees) | **I** (arcminutes) | **II** (arcseconds). Where a star-pair entry has multiple observer rows, the pair-description is given once and the subsequent rows belong to the same pair.

The left column continues the block begun in the previous batch (entries under Gemini/Pollux), then runs through assorted star-pairs whose entries are arranged with their constellation cross-references.

Star-pair	Observers	Gr.	I	II
Lucidus pes ☐ (the bright foot of Gemini)	Gassendo	19	32	12

Star-pair	Observers	Gr.	I	II
	Nobis	19	32	10
Hydrae cor (Heart of Hydra)	Nobis	44	11	10
Leonis cauda (Tail of Leo)	ex Tych. da.	57	43	0
Leonis lucida colli (the bright star of Leo's neck)	Tych. Syllog.	36	5	0
	prog. 229.	35	59	0
	Adriano Metio	36	0	0
Leonis cor (Heart of Leo, Regulus)	Tych. Epist.	36	59	40
	prog. 200.	36	59	30
	in Syllog.	37	0	0
	♂	37	1	0
	♂	37	8	20
	♂	37	2	0
Orionis pes lucidus (the bright foot of Orion, Rigel)	Nobis	36	59	30
	Nobis	51	25	30
	ex Tych. da.	51	25	33
Orionis humer. praeced. (Orion's	Nobis	39	41	30

Star-pair	Observers	Gr.	I	II
preceding shoulder)				
Orionis humer. sequens (Orion's following shoulder)	Tych. Epist.	33	16	0
	Nobis	33	13	0
	ex Tych. da.	33	15	10
Orionis 1. balthei (1st star of Orion's belt)	Nobis	42	45	0
2. balthei (2nd star of the belt)	Nobis	42	38	50
3. balthei (3rd star of the belt)	Nobis	42	34	0
Spica Virginis	Tych. prog. 195.	90	46	20
Tauri oculus austr. (the southern eye of Taurus, Aldebaran)	Tych. prog. 200.	45	5	0
	♂ Sylloge	45	4	15
	♂	45	7	0
	Nobis	45	4	10
Tauri cornu Boreum	Tych. Syllog.	30	32	30

Star-pair	Observers	Gr.	I	II
(the northern horn of Taurus)	Ibidem	30	33	0
Vrsae mai. humer. lucid. (the bright shoulder of Ursa Major)	Nobis	30	32	45
	Nobis	46	48	0
	ex Tych. da.	46	46	40

[Sub-table heading, p. 259 left] PES LVCID. II& infrascr. (The bright foot of Gemini & the entries listed below)

Star-pair	Observers	Gr.	I	II
Caput Castoris (Head of Castor)	Gassendo	20	12	20
	Nobis	20	12	30
Cancri Asellus boreus (the northern Aselli of Cancer)	Tych. prog. 229.	30	4	30
Leonis Cor (Heart of Leo, Regulus)	Tych. prog. 229.	51	11	0
	Nobis	51	7	30
Orionis humer. lucid.	Gassendo	13	42	45

Star-pair	Observers	Gr.	I	II
(Orion's bright shoulder)	Nobis quoque (also us)	13	42	45
Tauri oculus austr. (the southern eye of Taurus, Aldebaran)	Tych. Epist.	29	9	0
	♂ prog. 229.	29	9	0
	Nobis	29	9	0
Tauri cornu boreal. (the northern horn of Taurus)	ex Tych. da.	29	9	10
	Nobis	20	27	20
Tauri oculus bor. (the northern eye of Taurus)	ex Tycho da.	29	29	0
	Tych. prog. 229.	30	48	0

[Sub-table, p. 259 left] Calx sin. Castoris & related (the left heel of Castor)

Star-pair	Observers	Gr.	I	II
Calx sin. Castoris, & Cor □ (left heel of	Tych. prog. 198.	54	33	45

Star-pair	Observers	Gr.	I	II
Castor & Heart of Leo)	in Epist.	54	35	0
	in Syllog.	54	35	30
	Nobis	54	36	0
Calx sin. Castoris, & Aldebar. (left heel of Castor & Aldebaran), seu oculus □	Tych. Epist.	25	53	0
Nobis 25. 53. 10.	in Syllog.	25	53	40
	♂ bis	25	53	30
	♂	25	54	0
	♂	25	54	15
	♂	25	54	30
Propus, & Aldebara (Propus & Aldebaran)	addit fidem huic [adds confirmatio n to this] / Tych. Epist.	24	3	0
	in Syllog.	24	4	0
Extrem. ped. Pollucis, & cor □ (the tip of Pollux's foot & Heart of Leo)	Tych. prog. 229.	56	26	30

For the rest, look under ARIES, AURIGA, CANIS MINOR, CANCER, CASSIOPEIA, DRACO, and TAURUS.

[Sub-table, p. 259 left] GRVS (Grus)

Star-pair	Observers	Gr.	I	II
Gruis caput, & oculus Pauonis (Head of Grus & the eye of Pavo)	Naucleris	24	20	0
Gruis caput, & pes lucid. □ (Head of Grus & the bright foot of Pisces)	Naucleris	29	55	0
Gruis pectus, & ocul. Pauonis (Breast of Grus & the eye of Pavo)	Naucleris	23	18	0
Gruis pectus, & lucid. pes □ (Breast of Grus & the bright foot of Pisces)	Naucleris	34	50	0
Gruis ala bor. oculusq;	Naucleris	18	15	0

Star-pair	Observers	Gr.	I	II
Pauon. (the northern wing of Grus & the eye of Pavo)				
Gruis ala bor. pesq; lucid. □ (the northern wing of Grus & the bright foot of Pisces)	Naucleris	29	5	0

HERCVLES (Hercules)

Star-pair	Observers	Gr.	I	II
Caput, & Lyrae lucida (Head [of Hercules], & the bright star of Lyra, Vega)	Nobis	30	23	0
	ex Tycho da.	30	22	25

Look for the rest under AQVILA, BOOTES, & DRACO.

HYDRA (Hydra)

Star-pair	Observers	Gr.	I	II
Cor Hydrae, & cor □ (Heart of Hydra &	Nobis	22	59	0

Star-pair	Observers	Gr.	I	II
Heart of Leo)	Gassendo	23	1	0
	♂	22	58	30
Cor Hydrae, & cauda □ (Heart of Hydra & Tail of Leo)	Nobis	42	5	16
	ex Tych. LL.	42	6	55
Cor Hydrae, & Orion hum. luc. (Heart of Hydra & Orion's bright shoulder)	ex Tych. LL.	55	18	40
	ex Tych. LL.	55	19	0
Cor Hydrae, & Orion pes luc. (Heart of Hydra & Orion's bright foot, Rigel)	Nobis	58	27	40
	ex Tych. da.	58	27	20
Cor Hydrae, & Spica □ (Heart of Hydra & Spica)				

Look for the rest under CANIS MAIOR & MINOR, or under ARGO NAVIS, CENTAVRVS, GEMINI.

LEO (Leo)

Star-pair	Observers	Gr.	I	II
Regulus, & australior capitis (Regulus & the more southern star of the head)	Bern. Vualthero	15	55	0
Regulus, & cauda □ (Regulus & Tail of Leo)	Tych. Epist.	24	39	45
	in Syllog.	24	39	45
	♂	24	39	30
	♂	24	39	30
	♂	24	40	0
	Nobis	24	39	30
Regulus, & 3. alae australis □ (Regulus & the 3rd star of the southern wing of Virgo)	Gassendo	24	39	20
	Tych. prog. pag. 229.	40	22	0
Regulus, & Spica □ (Regulus & Spica),	Lægran-Flassia	54	2	0

Star-pair	Observers	Gr.	I	II
Lægran- Flassia pag. 38.	Tych. Epist. in prog. 198. 199-200. in Syllog. ♂ bis ♂ bis ♂ bis ♂ Nobis	54 54 54 54 54 54 54 54 54	1 2 2 1 2 2 2 3 1	50 0 0 40 30 30 45 0 45
Regulus, & Ceruix □ (Regulus & the Neck of Leo)	Gassendo	8	21	0
Cauda □, & cor Scorpij (Tail of Leo & Heart of Scorpius, Antares)	Gassendo, debut ait [he ought to have said]	24	38	15
		24	39	45
Cauda □, & serpentis luc. colli (Tail of Leo & the bright star of the Serpent's neck)	Nobis	58	12	30
Cauda □, &	Tych. Epist.	35	1	45

Star-pair	Observers	Gr.	I	II
Spica □ (Tail of Leo & Spica)	in Syllog.	35	3	0
	Gassendo	35	3	40
	Nobis	35	2	0
Cauda □, & Vrsae ma. hum. luc. (Tail of Leo & the bright shoulder of Ursa Major)	ex Tych. da.	47	51	48
	ex Tych. LL.	47	52	10
Cauda □, & Vrsae mai. Caudae vltima (Tail of Leo & the last star of Ursa Major's tail)	ex Tych. da.	42	18	10
	ex Tych. LL.	42	18	50
Lumborum lucida, & cor □ (the bright star of the loins & Heart of Leo)	Vualthero	17	55	0
Lumborum lucid. & cauda □ (the bright star of the	Nobis	17	54	0

Star-pair	Observers	Gr.	I	II
loins & Tail of Leo)				
	Vualthero	10	18	0
Lumbor. luc. & Iubae lucid. (the bright star of the loins & the bright star of the mane)	Tycho	10	17	40
	Vualthero	12	44	0
Lumbor. luc. & Spica □ (the bright star of the loins & Spica)	Nobis	12	44	30
	ex Tych. da.	45	11	5
Star-pair	Observers	Gr.	I	II
Colli, seu lucida, & infrascripti Cor □ (the star of the neck, i.e. the bright one, & the entries below, Heart of Leo)	Vualthero	8	29	0
	♂	8	18	0

Star-pair	Observers	Gr.	I	II
	Gassendo	8	28	0
Colli lucida, & cauda □ (the bright star of the neck & Tail of Leo)	Nobis	21	59	10
	Tych. Epist.	55	12	0
Colli lucida, & Spica □ (the bright star of the neck & Spica)	Nobis	55	10	55
	Tych. Syllog.	55	12	0
Colli luc. & Vindemiatr ix □ (the bright star of the neck & Vindemiatr ix)	Tych. prog. 229.	40	3	10
Colli luc. & australior capitis (the bright star of the neck & the more southern star of the head)	Vualthero	8	43	0
		8	45	0
Coxa □, & cor □ (the	Tych. Epist.	17	51	0

Star-pair	Observers	Gr.	I	II
Thigh of Leo & Heart of Leo)				
Coxa □, & ceruix □ (the Thigh of Leo & the Neck of Leo)	Tych. Epist.	8	31	0
Coxa □, & femur □ (the Thigh of Leo & the Haunch of Leo)	Tych. Epist.	12	44	0

For the rest, look under BOOTES, CANCER, CANIS, CANICVLA, CORONA, CORVVS, DRACO, GEMINI, HYDRA.

LEPVS (Lepus)

Star-pair	Observers	Gr.	I	II
Leporis Lucida in Dorso, & Sirius (the bright star on the back of Lepus & Sirius)	Nobis	17	27	0

LIBRA (Libra)

Star-pair	Observers	Gr.	I	II
Lances inter se se (the two Scales [pans] with	Tycho Epist.	9	8	20

Star-pair	Observers	Gr.	I	II
respect to each other)				
	D. Valesio	9	10	0
	Gassendo	9	12	0
	Nobis	9	10	40
	ex Tych. da.	9	12	0
Lanx boreal. & cap. Ophiuch. (the northern Scale & the Head of Ophiuchus)	Nobis, &	40	39	30
	Melius [better]	40	39	40
Lanx bor. & genu Ophiuch. (the northern Scale & the Knee of Ophiuchus)	Nobis	19	45	40
	ex Tych. da.	19	44	50
Lanx bor. & cor Scorpj (the northern Scale & Heart of Scorpius, Antares)	Tych. prog. 230.	24	10	30
	Nobis	24	9	0

Star-pair	Observers	Gr.	I	II
	Adr. Metio	24	11	0
	ex Tych. da.	24	10	40
Lanx boreal. & Spica □ (the northern Scale & Spica)	Tych. prog. 230.	27	34	0
	Nobis melius	27	33	40
	Metio	27	34	0
Lanx austr. & cor Scorpj (the southern Scale & Heart of Scorpj, Antares)	Nobis	25	9	40
	ex Tych. da.	25	8	10
Lanx austr. & media □. in fronte Scorpj (the southern Scale & the middle star on the forehead of Scorpj)	Gassendo	17	42	0
	debut ait	17	37	0
Lanx austr. & bor. in fronte Scorpj (the southern	ex Tych. da.	18	5	40

Star-pair	Observers	Gr.	I	II
Scale & the northern star on the forehead of Scorpius)	Gassendo	18	9	10
Lanx austr. & cap. Ophiuch. (the southern Scale & the Head of Ophiuchus)	ex Tych. da.	49	35	20
Lanx austr. & Oph. genu seq. (the southern Scale & the following knee of Ophiuchus)	Nobis	33	25	10
	ex Tych. LL.	33	26	25
Lanx austr. & Spica □ (the southern Scale & Spica)	Gassendo	21	25	0
	♂	21	26	0
	Nobis	21	24	20
	ex Tych. da.	21	22	30

For the rest of the distances of the Scales, look under AQVILA & BOOTES.

LYRA, seu Vultur Cadens (Lyra, i.e. the Falling Vulture)

Star-pair	Observers	Gr.	I	II
Lucida	Tych.	55	42	30
Lyrae Oph. man. praec. (the bright star of Lyra & Ophiuchus' s preceding hand)	Sylog.			
Luc. Lyr. Ophiuchi caput (the bright star of Lyra & the Head of Ophiuchus)	Nobis	29	33	40
	ex Tych. da.	29	34	0
Lyr. luc. & Scheat Pegasi (the bright star of Lyra & Scheat of Pegasus)	Tych. Epist.	55	30	40
	Longomont an.	55	31	0
	ex Tych. da.	55	29	50
Lyrae luc. serp. lucida Colli (the bright star of Lyra & the bright star of the Serpent's	Nobis	30	30	0

Star-pair	Observers	Gr.	I	II
neck)				
	ex Tych. da.	30	31	20
Lyrae luc. & Polaris Stella (the bright star of Lyra & the Pole Star)	Tych. Epist.	51	34	40
	Nobis	51	36	30
	ex Tych. da.	51	35	0
Lyrae luc. & hum. sin. Hercul. (the bright star of Lyra & the left shoulder of Hercules)	Tych. Syllog.	32	5	0

Look for the rest under AQVILA, BOOTES, CEPHEVS, CORONA, CYGNVS, HERCVLE.

OPHIVCHVS (Ophiuchus)

Star-pair	Observers	Gr.	I	II
Caput, & manus boreal. (Head & the northern hand)	Tych. Epist.	25	46	0
	Sylloge	25	46	30
	♂	25	46	10
	♂	25	45	40
Caput, & Spica □	Tych. Syllog.	36	14	0

Star-pair	Observers	Gr.	I	II
(Head & Spica)				
	Tych. Epist.	36	15	0
Caput, & Chela bor. Scorp. (Head & the northern Claw of Scorpis)	in Sylloge	40	41	30
	Nobis	40	41	30
Caput, & Serpetis [Serpentis] lucida colli (Head & the bright star of the Serpent's neck)	Nobis	27	44	30
Manus sin. lucidior, seu bor. & Spica (the left hand's brighter star, i.e. the northern one, & Spica)	Tycho Epist. Prog. 200.	42	33	30
	in Sylloge	42	32	15
	♂	42	33	0
	♂	42	34	0
	Nobis	42	33	30
Humer. sin. & manus	Tych.	16	57	0

Star-pair	Observers	Gr.	I	II
suprema (the left shoulder & the topmost hand)	Sylog.			

Look for the rest under AQVILA, BOOTES, CORONA, CYGNVS, LIBRA, & LYRA.

ORION (Orion)

Star-pair	Observers	Gr.	I	II
Lucidus humerus, seu dexter, & lucidus pes, RIGEL (the bright shoulder, i.e. the right one, & the bright foot, Rigel)	♂ sequens [the following]	8	35	50
	Nobis	8	35	50
	ex Tych. LL.	8	35	30
Lucid. humer. & Balthei 1. (the bright shoulder & the 1st belt star)	Nobis	9	45	0
Lucid. humer. & Balth. 2. (the bright shoulder & the 2nd belt	Nobis	9	50	30

Star-pair	Observers	Gr.	I	II
star)				
Lucid. humer. & Balth. 3. (the bright shoulder & the 3rd belt star)	Gassendo	9	52	0
Lucid. hum. & Pleiadū lucida (the bright shoulder & the bright star of the Pleiades)	ex Tych. da.	34	44	10
Lucida hum. & Aldebara (the bright shoulder & Aldebaran)	Tych. Epist.	21	25	0
	Nobis item	21	25	0
	Gassendo	22	23	0
	ex Tych. da.	21	26	10
	Tych. Syllog.	21	25	0
Humerus praeced.-sinist. & seq. (the preceding-left shoulder & the following	Tych. Epist.	7	30	40

Star-pair	Observers	Gr.	I	II
one)				
	Gassendo	7	29	30
		7	28	0
Humer. praeced. Rigel (the preceding shoulder & Rigel)	Gassendo	18	33	10
	♂	18	35	0
	debut inquit [he says it ought to be]	18	35	0
Humer. praeced. & Aldebaram (the preceding shoulder & Aldebaran)	Nobis	15	48	0
	♂	15	47	35
	ex Tych. da.	15	48	10
Lucida Ensis, & Aldebara (the bright star of the Sword & Aldebaran)	Nobis	26	49	40
Balthei 1. & Aldebara (1st belt star & Aldebaran)	Tych. Epist.	21	49	30

Star-pair	Observers	Gr.	I	II
	Nobis	21	50	0
	ex Tych. da.	21	48	50
Balthei 2. & Aldebara (2nd belt star & Aldebaran)	Nobis	23	9	40
	ex Tych. da.	23	8	40
Balthei 3. & Aldebara (3rd belt star & Aldebaran)	Nobis	24	24	0
	ex Tych. da.	24	26	0
Balthei suprema, & 2. (the topmost belt star & the 2nd)	Gassendo	1	22	0
	♄	1	25	30
Balthei media, & infima (the middle belt star & the lowest)	Gassendo	1	19	30
	♄	1	20	30
	♄	1	21	0
		1	22	30
Balthei suprema, & infima (the topmost belt star &	Gassendo	2	42	30

Star-pair	Observers	Gr.	I	II
the lowest)				
	♂	2	43	0
	♂	2	43	24
Pes lucidus, & Balthei 2. (the bright foot, Rigel, & the 2nd belt star)	Nobis	8	49	50
	ex Tych. da.	8	54	0
Pes lucidus, & Aldebar. (the bright foot, Rigel, & Aldebaran)	Tycho	26	53	0
	ex Tych. da.	26	51	0
<i>An</i> <i>Refractio</i> <i>Tychoni</i> <i>obfuit?</i> (Did refraction mislead Tycho?)	Nobis	26	55	0
	Gassendo	26	53	0
Star-pair	Observers	Gr.	I	II
Pes lucidus, & □ cornu bor. (the bright foot, Rigel, & the northern horn of Taurus)	ex Tych. da.	16	36	45

Star-pair	Observers	Gr.	I	II
Genu dextrum, & Aldebara (the right knee & Aldebaran)	Nobis	11	56	0

For the rest of Orion's distances, look under ARIES, CANIS, CANICVLA, CETE, GEMINI, HYDRA.

PAVO (Pavo)

Star-pair	Observers	Gr.	I	II
Pavonis Ocul. & Antares (the eye of Pavo & Antares)	Naucleris	51	45	0

Look for the rest under CENTAVRVS, ERIDANVS, GRVS.

PEGASVS (Pegasus)

Star-pair	Observers	Gr.	I	II
Algenib. seu ala extrema, & Markab (Algenib, i.e. the wingtip, & Markab)	Nobis	16	29	0
	♂	16	30	20
	Gassendo	16	30	0
	ex Tycho da.	16	33	0
Algenib. & Scheat Pegasi	Tych. Syllog.	20	37	15

Star-pair	Observers	Gr.	I	II
(Algenib & Scheat of Pegasus)	ex Tych. da.	20	38	10
	Nobis	20	36	0
Algenib. & Persei latus luc.	ex Tych. da.	51	45	10
(Algenib & the bright side of Perseus)				
Pegasi Markab. & Nobis □	Tych. prog. 230.	43	23	0
(Markab of Pegasus & us, Pisces)				
Os Pegasi, & Piscis Mandib.	Tycho	20	48	0
(the Mouth of Pegasus & the jaw of Pisces)				
Os Pegasi & Scheat Pegasi (the Mouth of Pegasus & Scheat of Pegasus)	Nobis	26	6	0
	ex Tych. da.	26	0	0
Os, & genu praec. Pegasi (the	Nobis	24	31	0

Star-pair	Observers	Gr.	I	II
Mouth & the preceding knee of Pegasus)				

Look for the rest under ANDROMEDA, AQVARIVS, AQVILA, ARIES, CASSIOP. CETE, CYGNVS, LYRA.

PERSEVS (Perseus)

Star-pair	Observers	Gr.	I	II
Latus lucidum, & Aldebara (the bright side & Aldebaran)	Tycho	36	20	40
Latus luc. & Polaris Stella (the bright side & the Pole Star)	Nobis	39	26	30
	ex Tycho da.	39	26	10
Latus lucid. & cornu bor. □ (the bright side & the northern horn of Taurus)	ex Tych. da.	31	28	10
Latus lucid. & Medusa (the bright side &	Gassendo	9	23	10

Star-pair	Observers	Gr.	I	II
Medusa [Algol])				
Medusae caput, & Aldebara (the Head of Medusa, Algol, & Aldebaran)	Tych. & Nos	30	54	0
Medusae cap. & Polaris Stella (the Head of Medusa, Algol, & the Pole Star)	Nobis	48	16	40
	♂	48	17	0
Pes lucidus, & Aldebara (the bright foot & Aldebaran)	Nobis	30	53	0

Look for the rest under ANDROMEDA, ARIES, & AVRIGA.

PISCES (Pisces)

Star-pair	Observers	Gr.	I	II
Nodi lucida, & Aldebara (the bright star of the Knot & Aldebaran)	Tych. prog. 230.	40	13	45
	Nobis	40	13	40

Look for the rest under AQVILA & PEGASVS.

SAGITTARIVS (Sagittarius)

Star-pair	Observers	Gr.	I	II
Capitis lucida, & Antares (the bright star of the Head & Antares)	Tych. prog. 230.	35	37	10
Capit. luc. & hum. dext. (the bright star of the Head & the right shoulder)	Tycho	48	59	20
Humeri lucid. & Antares (the bright star of the shoulder & Antares)	Nobis	32	33	0
	D. Valesio	32	24	0
Manus sin. & Antares (the left hand & Antares)	Nobis	21	28	0
1. Sagittae, & Antares (1st star of the Arrow & Antares)	Nobis	24	41	30
Medii arcus, &	Nobis	25	50	0

Star-pair	Observers	Gr.	I	II
Antares (the middle of the Bow & Antares)				
Australior arcus, & Antares (the more southern part of the Bow & Antares)	Nobis	26	40	0
Borealior arcus, & Antares (the more northern part of the Bow & Antares)	Nobis	30	19	30
Brachij lucida, & Antares (the bright star of the Arm & Antares)	Nobis	24	25	0
Humer. luc. & Boreal. frons □ (the bright shoulder & the northern forehead of Scorpius)	Nobis	39	6	27

Look for the rest under AQVILA & OPHIVCO.

SCORPIVS (Scorpius)

Star-pair	Observers	Gr.	I	II
Cor Scorpj, & Spica □, seu Antares (Heart of Scorpius & Spica, i.e. Antares)	Tych. Epist.	45	51	30
	in Syllog.	45	52	30
	Nobis saepe	45	52	0
Star-pair	Observers	Gr.	I	II
Cor, & media frontis (Heart [of Scorpius] & the middle of the forehead)	Gassendo	10	38	10
Chela austr. & Spica (the southern Claw & Spica)	Tych. Epist.	21	22	0
	in Syllog.	21	22	0
Chela bor. & Spica (the northern Claw & Spica)	Tych. Epist.	27	14	0
Borealis Frontis, & Cor (the	Gassendo	8	39	30

Star-pair	Observers	Gr.	I	II
northern star of the forehead & the Heart, Antares)	Nobis	8	40	0
	Tych. Epist.	39	26	30
Borealis Frontis, & Spica (the northern star of the forehead & Spica)	in Sylleg.	39	26	30
	Tych. Epist.	38	40	0
Media Frontis, & Spica (the middle star of the forehead & Spica)	Nobis	38	39	30
	♂	38	41	0
Australis Frontis, & Spica (the southern star of the forehead & Spica)	Tych. Epist.	39	6	30
	Nobis	39	4	55
Cor, & aculeus Caudae (the Heart & the Sting of the	Gassendo	9	9	45

Star-pair	Observers	Gr.	I	II
Tail)				
Praecordium, & Lanx austr. (the Praecordium & the southern Scale)	Nobis	23	4	0
Caudae flexus, & Cuspis □ (the bend of the Tail & the point of the arrow of Sagittarius)	Nobis	16	28	0
Caudae flexus, & Infima □ (the bend of the Tail & the lowest star of Sagittarius)	Nobis	19	17	0

Look for the rest under AQVILA, BOOTES, CENTAVRVS, CORONA AVSTR., LIBRA, LEONE, OPHIVCHVS, PAVONE.

SERPENS (Serpens)

Star-pair	Observers	Gr.	I	II
Lucida Colli, & Spica (the bright star of the neck	Nobis	38	47	50

Star-pair	Observers	Gr.	I	II
& Spica)				
Eadem, & Caput Ophiuchi (the same, & the Head of Ophiuchus)	Nobis	27	44	30
Temporum lucida, & Aquila (the bright star of the temples & Aquila [Altair])	Nobis	55	10	0

Look for the rest under BOOTES, CORONA, LEONE, & LYRA.

TAVRVS (Taurus)

Star-pair	Observers	Gr.	I	II
Aldebara, seu oculus □ austr. & Caput Castoris (Aldebaran, i.e. the southern eye of Taurus, & the Head of Castor)	Tycho	43	28	30
Aldebara, & Cornu bor. (Aldebaran & the	Nobis olim [formerly]	16	45	30

Star-pair	Observers	Gr.	I	II
northern horn)				
	postea [later]	16	45	20
	Vualthero	16	49	0
	Nobis	16	45	20
	ex Tych. da.	16	47	50
Aldebara, & Cornu austr. □ (Aldebaran & the southern horn)	Nobis	13	18	0
	ex Tych. da.	13	17	0
Aldebara, & Oculus bor. □ (Aldebaran & the northern eye)	Tycho	1	14	0
	Nobis	1	12	0
	ex Tych. da.	1	11	0
Aldebara, & Hyadū extrema Cornua □ inter te (Aldebaran & the outermost of the Hyades [at the] horns of Taurus,	Vualthero	8	1	0

Star-pair	Observers	Gr.	I	II
with respect to each other)				
Pleiadum lucida, & Aldebara, & sic ex (the bright star of the Pleiades & Aldebaran, and thus from)	Nobis	13	35	10
	Maris El. [?]	13	36	40
	ex Tych. da.	13	38	40
	Gassendo	13	37	0

For the rest of Taurus, look under ANDROMEDA, ARIES, AVRIGA, CANIS, GEMINI, ORION, & PERSEO; I will give the distances of the Pleiades with respect to each other below in Caput XIII, num. 6.

VIRGO (Virgo)

Star-pair	Observers	Gr.	I	II
Spica, & Crus dext. posterius (Spica & the rear right leg)	Vualthero	10	45	0
Spica, & sub cingulo later. dext. (Spica & the star beneath the belt on the right side)	Vualthero	9	28	0

Star-pair	Observers	Gr.	I	II
Spica, & 3. alae austral. (Spica & the 3rd star of the southern wing)	Tych. Epist. prog. 229.	14	49	0
Spica, & Vindemiatr ix (Spica & Vindemiatr ix)	Progymn.	14	49	0
	Gassendo	14	49	0

For the rest, look under AQVILA, BOOTES, CORONA, CENTAVRVS, GEMINI, HYDRA, LEONE, LIBRA, OPHIVCHVS, & SCORPIO.

VRSA MAIOR (Ursa Major)

Star-pair	Observers	Gr.	I	II
Humeri dubhe, & coxa lucida (Dubhe of the shoulder & the bright star of the thigh)	Nobis	10	23	0
	ex Tych. LL.	10	22	45
Dubhe, & 1. Caudae (Dubhe & the 1st star of the Tail)	Gassendo	19	12	0

CAPUT VIII (continued) — The Great Table of Distances

(Continuation of the distance table from the prior batch; Ursa Major and Ursa Minor pairs. Columns: star-pair | Observer (siglum) | Gr. | I | II.)

Star-pair	Observer	Gr.	I	II
Dubhe & the bright star of the Tail [Cynosura]	Gassendo	23	14	0
(same pair)	Nobis	23	19	0
1st of the Tail & middle of the Tail	Nobis	4	11	10
(same)	ex Tych. da.	4	11	50
1st of the Tail & Polaris	Nobis	34	40	0
1st of the Tail & last of the Tail	Nobis	10	29	20
(same)	ex Tych. da.	10	31	10
(same)	ex Tycho da.	10	28	50
1st of the Tail & the bright Tail- star [Cynosura]	Gassendo	21	25	0
(same)	Nobis	21	35	20
5th of the Tail & last of the Tail	Nobis	6	43	0
(same)	Nobis	6	40	50
(same)	ex Tych. da.	6	40	45

Star-pair	Observer	Gr.	I	II
Last of the Tail & Dubhe	Nobis	25	40	0
<i>(same)</i>	Gassendo	25	40	0
<i>(same)</i>	ex Tych. da.	25	39	10
Last of the Tail & Polaris	Nobis	41	22	0
<i>(same)</i>	ex Tych. da.	41	21	40
<i>(same)</i>	ex Tych. LL.	41	20	30
Last of the Tail & the bright Tail-star [Cynosura]	Gassendo	25	45	10
<i>(same)</i>	Nobis	25	44	50

The remaining distances should be sought under BOÖTES, CORONA, GEMINI, & LEO.

Star-pair	Observer	Gr.	I	II
The bright star of the shoulder of Ursa Minor & Polaris	Nobis	16	30	0

URSA MINOR

Star	Observers	Gr.	I	II
<i>(heading)</i>	Ex Datis Tychonicis per Petantium l. 6. Uranolog. cap. 6.			

(This sub-table lists distances from the Pole [Dist. à Polo] of many stars, drawn from Tycho's data via Pétau's Uranologia Book 6, Chapter 6. Columns under URSA MINOR run: star-name | source | Gr. | I | II — but here the values are a single distance from the Pole.)

Star	Source	Gr.	I	II
The bright star of the shoulder, which in Eudoxus's age was the Pole-star, and the stars listed below	Ex Datis Tychonicis per Petantium l. 6. Uranolog. cap. 6.			
Of Andromeda, the right arm, southern		66	8	0
Of the same, the southern arm		66	8	0
Of the Eagle [Aquila], the southern wing-tip, left		80	3	0
Of Aries, the Horns [Arietis Renes]		83	46	0
Of Boötes, the left		36	18	0

Star	Source	Gr.	I	II
shoulder				
Of Cancer, the southern Aselli		72	58	0
Of Cancer, the northern Aselli		69	47	0
Of Cancer, the leading star [præc.] in the Square [□]		71	29	10
Of Cancer, the following star, southern, in the Square [□]		73	46	0
Of Cassiopeia, the foot		41	47	0
Of Cepheus, the breast		13	0	0
Of Crater, the northern handle		92	5	0
Of Crater, the northern rim [periph.]		90	47	0
Of Corona,		46	13	0

Star	Source	Gr.	I	II
the following wing				
Of Corvus, the upper wing		93	23	0
Of Cygnus, the right wing, upper		33	18	0
Of Cygnus, the wing-tip, left		63	42	0
Of Cygnus, the wing-joint [ancon.], left		57	16	0
Of Cygnus, the neck		52	30	0
Of Cygnus, the beak		57	51	0
Of Draco, the head		19	37	10
Of Gemini, the head of Castor		65	24	0
Of Gemini, the head of Pollux		67	16	0
Of Auriga [Heniochus], the right foot		70	10	0
Of Auriga		70	32	0

Star	Source	Gr.	I	II
[Heniochus , the left foot				
Of Hercules, the right Elbow [Ancon]		57	11	0
Of Hydra, the heart		93	45	0
The northern Scale [Lanx borealis]		83	14	0
Of Leo, the heart		73	11	0
Of Leo, in the neck, southern		68	33	0
Of Lyra, the upper star		43	44	0
Of Ophiuchus, the right shoulder		74	9	0
Of Ophiuchus, the left shoulder		67	36	0
Of Ophiuchus, the left knee		92	41	0
Of Ophiuchus,		46	26	0

Star	Source	Gr.	I	II
the head				
Of Orion, the middle of the belt [media balthei]		102	52	0
Of Pegasus		84	11	0
Of Pegasus, the bright star of the neck		84	24	0
Of Pegasus, the loins [lumbi]		87	23	0
Of Perseus, the right shoulder		56	32	0
Of Perseus, the left Shin [Tibia]		69	21	0
Of the southern Fish [Piscis], the middle, in the southern spine		83	21	0
Of the Serpent, the bright star of the neck [colli]		69	20	0

Parsing notes: This Ursa Minor sub-table gives each star's single distance from the Pole; the Gr./I/II triplet is one angle per row. The source-attribution cell ("Ex Datis

Tychonicis per Petantium...") spans the whole sub-table as a bracketing header. Several II-column entries are blank (printed as 0).

(Right column of folio 228 — the table continues and concludes:)

Star-pair	Observer	Gr.	I	II
Of Taurus, the right knee		95	45	0
Of Ursa Major, the southern star in the foot, preceding [antecedens]		44	33	0
The northern star of the same foot		41	39	0
The last of the Tail, now Polaris	Gassendo	16	28	0

The remaining distances — especially those which now concern Polaris — should therefore be sought under BOÖTES, AURIGA, CASSIOPEIA, CORONA, CYGNUS, LYRA, PERSEUS, & URSA MAJOR.

CONCLUSION

It is therefore established from what has been said that the Tychonic distances themselves disagree among one another by somewhat — to the extent of the first two minutes [of arc].

CAPUT IX

[Margin: 1]

We recall to four classes the declinations of the Tychonic fixed stars. **The first** is that of those which Tycho — either alone, or Tycho together with Paul Hainzel

[Paulus Hainzelius] at Göggingen near Augsburg — observed in the year 1572 (now complete) and at the beginning of 1573, at the place where the altitude of the Pole was, for Tycho, 48°22'. Tycho displays these in Volume 1 of the *Progymnasmata*, from page 361 and page 369, where he also has, for certain others, the 4-year distances of the Pole-star [Polaris] from the Pole.

(Table: Paul Hainzel's observations, at the beginning of the year 1574. Columns: star | Maxima/Minima | Altitudo Merid. [Gr. I II] | Declinatio [Gr. I II]. For each star a maximum and a minimum meridian altitude, and the corresponding declination.)

Star (Paulus Hainzelius, beginning of 1574)		Altitudo Merid.			Declinatio		
		Gr.	I	II	Gr.	I	II
Polaris of Ursa Minor	Maxima	51	22	15	86	59	45
	Minima	45	22	45	86	59	45
The right shoulder of Cepheus	Maxima	77	31	40	60	50	10
	Minima	19	11	40	60	50	40
The preceding star in the	Maxima	61	27	15	75	54	45
	Minima						

Star (Paulus Hainzelius, beginning of 1574)		Altitudo Merid.			Declinatio		
		Gr.	I	II	Gr.	I	II
side of Ursa Minor	Minim	34	37	0	75	55	0
	.						
In the right side of Cepheus	Maxim	69	38	30	68	43	30
	Minim	68	43	0	68	43	0
	.						
Of Ursa Major, 1st of the Tail	Maxim	78	55	30	59	26	30
	Minim	17	48	30	59	26	30
	.						
Of Ursa Major, 2nd of the Tail	Maxim	81	9	0	57	13	0
	Minim	15	36	0	57	14	0
	.						

Star (Paulus Hainz elius, begin ning of 1574)		Altitud do Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
Of Ursa Major, the bright should er-star	Maxi m.	74	18	0	64	4	0
	Minim	22	26	0	64	4	0
Of Ursa Major, the left Leg [Crus]	Maxi m.	82	16	30	56	5	30
	Minim	14	28	30	56	6	30
Of Ursa Major, the thigh [Ilia]	Maxi m.	79	41	0	58	41	0
	Minim	17	2	30	58	40	30
Of Cassio	Maxi m.	83	22	30	57	39	30

Star (Paulus Hainzelius, beginning of 1574)	Altitudo Merid.			Declinatio		
	Gr.	I	II	Gr.	I	II
peia, the Knee [Genu]	Minim 16	22	30	57	39	30

Parsing notes: Two-line rows (Maxima/Minima) per star. Some Declinatio cells appear constant between max and min (an internal Tyconic consistency check). A few digits in the gutter side are faint; transcribed as read.

(Folio 229, — three sub-tables in the left column, a long observation table in the right column.)

Left column — first sub-table: Hainzel & Tycho declinations, Anno Christi 1572 completo

Star (1572 complete)	Hainzelius Declinatio			Tycho Declinatio		
	Gr.	I	II	Gr.	I	II
First of Aries [Prima □]	17	11	0	17	10	30
The Eye [Oculus] of Taurus [□]	15	35	0	15	34	30

Star (1572 complete)	Hainzel ius Declina tio Gr.			Tycho Declina tio Gr.		
	I	II		I	II	
The head of Castor	32	43	45	32	43	40
The head of Pollux	28	59	0	28	59	0
The Heart of Leo [Cor Leonis]	14	1	30	14	1	30
Spica of Virgo [Spica □]	8	52	A	8	52	15

(The "A" in the Hainzelius Spica row marks an "australis"/southern declination — i.e. south of the equator.)

Left column — second sub-table: Cassiopeia, 1572 complete (Tycho)

Cassiopeia, star (1572 complete)	Tycho Declinatio Gr.		
	I	II	
Head [Caput]	51	32	30
Schedir	54	11	30
Girdle [Cingulum]	55	31	30
The Bend [Flexura]	58	24	0
Knee [Genu]	57	58	0
Leg [Crus]	61	30	20
The extreme star of the foot	65	23	0

Cassiopeia, star (1572 complete)	Tycho Declinatio Gr.	I	II
[Pedis extrem.]			
In the upright of the seat [In erect. sedis]	60	34	0
The bright star of the Throne [Lucida Cathed.]	56	48	30

Left column — third sub-table: Polaris distance from Pole, by year

Polaris, the star (Tycho nic years)	Dist. à Polo Gr.	I	II	Declina tio Gr.	I	II
1577	2	58	50	87	1	10
1581	2	57	30	87	2	30
1585	2	56	10	87	3	50
1589	2	54	50	87	5	10

[Margin: 2]

The second class is that of those which, by order of the Emperor Ferdinand, Father Albert Curtz [Albertus Curtius] of the Society of Jesus — under the anagrammatic name *Lucius Barrettus* — took care to publish, from the types of David Hautt at Vienna, where he edited them in the year 1581. He sets the meridian altitudes at the Pole-altitude of Uraniborg, whose Pole-altitude, chosen by Tycho, is 55°54'40". From this, therefore, the declination is derived.

(Note: "the year 1581" here is as printed; the Curtz/Barrettus *Historia Coelestis* was in fact published in 1666 — but Riccioli's text and the date it gives are transcribed verbatim. See report.)

Ex Sylloge Ferdinanda — Observations of Tycho, Anno 1582, by Sextant, or by the Greater or Lesser Quadrant

(From the Sylloge Ferdinanda of Tychonic observations, year 1582, made with sextant, or with the greater or lesser quadrant. Columns: star-names | month/days | Altit. Merid. [Gr. I II] | Declinatio [Gr. I II].)

Star-names	Month / Day	Altit. Merid.			Declinatio		
		Gr.	I	II	Gr.	I	II
The bright star of Aries [Lucida]	Ianua r. 10	55	31	30	21	26	10
	11	55	30	30	21	25	20
The Eye of Taurus [Tauri Oculi]	Ian. 11	49	42	30	15	37	10
	Sext. 21	49	41	45	15	36	15
	Q.	49	42	0	15	36	40
	Sext. Ian. 22	49	43	<i>ferē</i>	15	37	40
	Q.	49	42	0	15	36	40
Castor, right foot [pes dext.]	Ian. 19	54	30	0	20	24	40
	20	46	43	15	22	38	55

Star- names	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
foot [Calx pedis]	21	46	43	30	22	38	0
[II] The extre me star of the foot [Extre ma pedis]	Ian. 20	56	39	0	22	33	40
	21	36	39	0			
	22	36	39	0			
[II] The nearer star [Prop us]	Ian. 20	57	28	30	21	23	10
Pollux , left foot [pes sinist.]	Ian. 19	50	6	0	16	40	40
Pollux , right foot [pes dext.]	19	47	23	0	13	17	40
Head [Caput]	21	63	4	0	28	58	40

Star- names	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II

]

Parsing notes: the "Q." rows abbreviate *Quadrante*; "Sext." = *Sextante*; "fere" = "nearly." Some Declinatio cells for the "Extrema pedis" sub-rows are blank in the source.

(Right column of folio 229 — long table, Anno 1582 observations continued:)

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
The southe rn Asellu s of Cance r [Cancr i Asell. austr.]	Ian. 19	53	43	30	19	38	10
The Heart of Leo [Leoni s Cor]	Ian. 3	48	4	0	13	58	40
	19	48	4	0			
	21	48	4	0			
	23	48	4	0			
	Febr. 25	48	4	30	13	59	0
	Mart. 5	48	3	30	13	58	10
&	48	2	30	13	57	10	
The	Ian. 17	56	0	30	21	55	10

Star (Anno 1582)	Month / Day	Altit. Merid. Gr.	Declin		atio		
			I	II	Gr.	I	II
Neck of Leo [Leoni s Cervix]	19	56	0	30			
	23	56	0	30			
	Febr. 24	56	0	40	21	55	20
	Mart. 15	56	0	30	21	55	40
	16	56	1	0			
The Thigh of Leo [Leoni s Femur]	Ian. 17	51	47	30	17	42	10
	23	51	49	0	17	43	40
The Hip of Leo [Leoni s Coxa]	Ian. 17	56	53	30	22	48	10
	23	56	54	0	22	48	40
	25	56	53	40	22	48	20
The middl e of the	Mart. 20	56	12	0	22	46	40

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
Neck of Leo [Leoni s media Cervix]	Febr. 25	51	1	0	16	55	40
The Belly of Leo [Leoni s venter]	Mart. 14	51	0	30	16	55	0
The hinder Leg of Leo [Leoni s Crus poster .]	Mart. 29	46	15	30	12	50	10
The Tail of Leo [Leoni s Cauda]	Ian. 17	51	0	20	16	55	0
	20	51	0	30	16	55	10
	23	51	0	20			
	Febr.	51	0	30			

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
	18						
	22	51	0	0	16	54	40
	Mart. 26	51	1	0	16	55	40
	29	51	1	0			
	Q. M.	51	0	0			
	April. 13						
	Q. M.	51	0	30			
Spica of Virgo [Spica □]	Ian. 17	25	10	15	8	55	5 A
	21	25	10	0	8	55	20
	Febr. 18	25	10	0			
	22	25	10	0			
	Q. 24	25	10	30	8	54	50
	Sext. 24	25	9	45	8	55	35
	Mart. 5	25	10	5	8	55	15
	21	25	10	0			
	Q. M.	25	9	45			
	Mart. 30						
	Q. M.	25	10	0	8	54	20
	Q. M.	25	10	15	8	55	5
	April. 13						
	Q. M.	25	9	0	8	16	20

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
The middl e of the wing of Virgo [□ alæ media]	Ian. 17	34	59	0	0	53	40
	23	35	0	0	0	54	40
	Febr. 14	34	59	0			
	April. 13	34	57	45	0	52	25
	&	34	58	0	0	54	40
The 2nd of the southe rn wing of Virgo [□ 2.alæ austr.]	Ian. 23	35	46	10	1	41	0
	Febr. 26	35	46	10	1	40	40
Virgo in the Syrma , 3rd, the	Mart. 30	35	49	30	8	15	50 A

Star (Anno 1582)	Month / Day	Altitud. Merid.			Declinatio		
		Gr.	I	II	Gr.	I	II
more southern in Syrmete 3. Australior]	30	33	47	40	0	17	40 A
The more northern of these [Borealiorearum]	Febr. 24	19	54	0	14	11	20 A
	Mart. 20	19	53	0	14	12	20
	21	19	53	15	14	12	5
	29	19	53	15			
The northern Scale [Lanx Boreal	Febr. 24	26	10	30	7	44	50 A

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
	25	26	11	0	7	44	20
	Mart. 20	26	10	0	7	45	20
	29	26	10	0			
	30	26	10	0			

Parsing notes: Many stars have multiple dated sub-observations; the Declinatio is recorded only on certain rows (the others sharing the value above). "A" in the Declinatio column flags *australis* (southern) declination. "Q.", "Q. M.", "Sext." = quadrant / greater(?) quadrant / sextant instrument tags. Some altitude entries are faint in the gutter; transcribed as read, with [?] where uncertain.

(Folio 230, — two columns of the Anno 1582 / 1584 observation table, then a closing note and a new sub-table.)

Left column — Anno 1582 (continued)

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
Scorpio, the southern Claw [Chela austr.]	Febr. 24	9	22	30	24	42	50 A
	25	9	21	0	24	43	20
	28	9	23	30	24	41	50
Scorpio, the middle of the Foreh	Febr. 24	12	48	0	21	16	50 A

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
ead [Medi a Fronti s]	25	12	48	0	21	17	20
	Mart. 20	12	48	10	21	17	10
	Mart. 30	12	48	40	21	16	40
Scorpi o, the northe rn Claw [Chela bor.]	Mart. 20	15	33	45	18	31	35 A
	29	15	33	30	18	31	50
	30	15	33	30			
The Great Dog [Canis Maior]	Febr. 22	17	57	0	16	8	20 A
	Mart. 5	17	55	30	16	9	50
The Lesser Dog [Canis Minor]	Mart. 9	40	20	30	6	15	10 B
The	12	35	31	0	1	25	40

Star (Anno 1582)	Month / Day	Altit. Merid.		Declin atio			
		Gr.	I	II	Gr.	I	II
middl e of the Whale 's Jaw [Cete media Mandi b.]							
The bright star of the Whale 's Jaw [Cete Lucid a Mandi b.]	12	36	30	30	2	25	10
	13	36	30	0			
The bright star of the arm of Cephe us [Ceph ei Lucid a brachi j]	Febr. 9	26	46	20	60	51	40
	&	26	47	30	60	52	50

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
The left knee of Cephe us [Ceph ei genu sin.]	Febr. 17	41	13	30	75	18	50
	18	41	13	0	75	18	20
The left elbow of Cephe us [Ceph ei cub. sin.]	18	29	56	35	64	1	55
The Tail of Cygnu s [Cigni cauda]	Febr. 9	9	48	6	43	53	20
	&	9	50	0	43	55	20
The head of Cassio peia [Cassi opeæ	Ian. 13	22	47	20	56	52	40

Star (Anno 1582)	Month / Day	Altit. Merid. Gr.	Declin		atio Gr.	Declin	
			I	II		I	II
caput]							
	17	42	48	0	56	53	20
	20	22	48	0			
	Febr. 5	22	46	30	56	52	35
	Sext.	22	47	15	56	52	10
	Q. M. Febr. 18	22	47	0	56	52	20
The Bend of Cassio peia [Cassi opeæ flexur a]	Ian. 13	24	23	10	58	29	10
	17	24	23	30	58	28	50
	20	24	12	<i>fere</i>	58	29	20
The breast of Cassio peia [Cassi op. pectus]	Ian. 23	10	10	45	54	16	5
The knee of Cassio peia	Ian. 31	24	0	0	58	5	20

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
[Cassi opeæ genu]	17	23	59	30	58	4	50
	24	0	<i>fere</i>				
	Q. M. Febr. 18	23	58	30	58	3	50
	Sext.	23	58	40	58	4	0
The foot of Cassio peia [Cassi opeæ pes]	Ian. 17	27	30	50	61	36	10
	17	27	31	15	61	36	20
	20	27	31	40	61	36	20
	23	27	31	40	61	36	40
	Febr. 15	27	30	0	61	35	20
	&	27	31	0			
	Q. M. 18	27	31	30			
The bright star of the side of Draco, prece ding [Draco	Febr. 5	32	51	0	66	56	50

Star (Anno 1582)	Month / Day	Altitud. Merid.			Declinatio		
		Gr.	I	II	Gr.	I	II
nis lucida lateris præc.]	&	32	53	0	66	58	50
The bright star of Hydra [Hydræ lucida]	Ian. 11	27	13	30	6	51	50 A
	Febr. 22	27	14	0	6	51	20
	21	27	13	30			
	22	27	14	0			
The 1st in the neck- spring of Hydra [Hydræ 1. in educti one colli]	Febr. 22	21	36	0	7	30	40
The right shoulder of Hercu	Mart. 5	56	32	15	21	26	55

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
les [Herc ulis hum. dextr.]	25	56	35	15	21	26	40
	26	56	33	0	21	26	10
	30	56	32	30	21	26	10
The head of Hercu les [Herc ulis Cap.]	Mart. 26	49	1	30	14	56	40
	April. 3	49	1	30	14	56	40
The bright star of the hand of Ophiu chus [Ophi uchi Manu s lucid.]	Febr. 24	31	34	0	2	31	20 A
	25	31	34	30	2	31	50
The upper	Mart. 26	31	33	40	2	31	40

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
hand of Ophiu chus [Manu s sup.]	29	31	33	30	2	31	50
	30	31	33	0	2	32	0

Right column — Anno 1582 / 1584 (continued)

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
The left should er of Ophiu chus [Ophi uchi humer us sin.]	Mart. 26	44	11	0	10	5	40
	30	44	11	0			
	April. 3	44	11	40	10	6	20
	11	44	11	30	10	6	20
The bright should er of Orion [Orion	Ian. 12	41	21	30	7	16	10

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
is humer us lucidu s]							
The left should er of Orion [Orion . hum. sin.]	Ian. 19	40	0	0	3	59	40
	&	40	0	30	6	0	10
The right foot of Orion [Orion . pes dexter]	Ian. 19	24	14	0	9	31	20
	&	24	12	30	9	50	0
The bright foot of Orion [Orion is pes lucid.]	Ian. 19	25	21	0	8	47	43 A
	Q. M.	25	22	30	8	42	50
	Sext.	25	22	30	8	42	50 A
	&						
Orion,	Ian. 19	33	25	0	0	41	20 A

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
1st of the belt [Orion is 1. balthe i]							
	& Q. M.	33	25	20	0	41	0
	Sext.	33	24	30	0	41	0
	Q. M.	33	24	40	0	41	40
	Q. M.	33	25	0			
Orion, 2nd of the belt [Orion is 2. balthe i]	Ian. 19	32	33	30	1	31	50 A
	& Q. M.	32	32	0	1	32	50
	Sext.	32	32	0	1	33	50
	21	32	32	30	1	32	50
Orion, 3rd of the belt [Orion . . balthe i 3.]	Ian. 19	31	33	40	2	11	40 A
	21	31	34	0	2	11	20

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
	&	31	54	0			
Pegas us, the prece ding in the breast [Pegas i in pect. præc.]	Nov. 23	35	26	0	21	20	40
	25	35	25	40	21	24	40
The follow ing of the same [Seque ns earun dem]	Nov. 23	35	30	30	22	25	0
	24	35	30	0	22	24	40
The bright star of Ursa Minor, in the hinder wheel [Ursæ Minor is lucid. in rota	Ian. 10	41	46	30	75	51	30

Star (Anno 1582)	Month / Day	Altit. Merid.			Declin atio		
		Gr.	I	II	Gr.	I	II
postel. I	12	41	46	0			
	23	41	46	0	75	51	20
The Polari s of Ursa Minor [Ursæ Min. Polari s]; or the minim um altitud e [alt. minim a]	Ian. 14	52	56	45	87	2	5
	vel 17	52	57	10	87	2	50
	20	52	56	50			
	21	52	57	15	87	2	35
	23	52	57	45	87	3	5
	Sext. Febr. 1	52	57	30	87	3	0
	Q. M. 9	52	59	0	87	4	20
	Sext.	52	57	0			
	Q. M. 18	52	57	30	87	2	30
	Sext.	52	57	30			

Star (Anno 1582)	Month / Day	Altit. Merid. Gr.	I	II	Declin atio Gr.	I	II
18							

[Margin: 3]

The third class is that of those fixed stars which Tycho, in the *Epistolae* page 53, exhibits — meridian altitudes captured toward the end of the year 1584 and as 1585 was running [labente], or about the end of the year 1586 and the beginning of the year 1587, at Uraniborg, where he says in the same place (and in Volume 1 of the *Progymnasmata*, page 28) that the Pole-altitude is 55°54'40". Hence, therefore, we shall easily subjoin their declinations.

(Sub-table: Tycho, year 1584 going out [exeunte], & 1585 running [labente].

Columns: star | Altitudo Meridiana [Gr. I II] | therefore [Ergo] Declinatio [Gr. I II].)

Star (Tycho, 1584 exeunte & 1585 labente)	Altitudo Meridiana Gr.	I	II	Ergo Declinatio Gr.	I	II
The First of Aries [Prima □]	51	19	0	13	49	40
The Second of Aries [Secun da □]	52	50	0	18	44	20
The Unform ed star above the Tail	59	36	0	18	25	0

Star (Tycho, 1584 exeunt & 1585 labente)	Altitud o Meridia na Gr.	I	II	Ergo Declina tio Gr.	I	II
of Aries [Inform is supra caudam □]						
The penulti mate of the Pleidae s [Pleiad um penulti ma]	56	50	30	22	16	0 [?]
The souther n of the Claws of Cancer [Cancri Chelar. australi s]	47	30	0	13	24	40
Leo, in the left foot [Leonis in pede]	45	50	0	11	44	40

Star (Tycho, 1584 exeunt e & 1585 labente)	Altitudo Meridiana Gr.			Ergo Declinatio Gr.		
	I	II		I	II	
sinistro] Leo, the lower star in the head [Leonis inferior in capite]	59	44	0	25	38	40

Parsing notes: This 1584/1585 sub-table is faint and partly in the gutter; the Pleiades penultima declination II-value is uncertain (read as 0). Two-letter instrument tags absent here (these are single meridian-altitude reductions). "Ergo Declinatio" = the declination derived from the meridian altitude given the Uraniborg pole-height.

Liber IV — De Fixis Stellis (continued)

Caput IX (continued) — The Tychonic declinations recalled to four classes

Class 3 (continued): Tycho's 1584/85 meridian altitudes at Uraniborg → declinations

The table continues the Class-3 derivation begun in the prior batch: Tycho's meridian altitudes observed at Uraniborg (pole 55°54'40") for the year 1584 drawing to a close and 1585 in progress, from which the declinations are derived ("Ergo Declinatio"). Declinations marked **A** are southern (austrina); those without are northern. Degrees, arcminutes, arcseconds are given under **Gr. / I / II**.

Left-hand table (p. 265): 1584 ending / 1585 in progress.

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Leonis in ventre [Leo, in the belly]	45	30	0	11	24	40
Leonis coxæ superio r [Leo, upper hip]	56	52	30	22	47	10
Leonis genu [Leo, knee]	46	54	40	12	49	20
Leonis femur [Leo, thigh]	51	47	0	17	41	40
Leonis cauda [Leo, tail]	50	59	0	16	53	40
Scorpij Frontis — Infima [Scorpi us, brow — lowest]	9	21	0	24	44	20 A
Scorpij Frontis	12	47	20	21	18	0 A

Star	Merid. Alt. Gr.	I	II	Decl. Gr.	I	II
— Media [Scorpi us, brow — middle]						
Scorpij Frontis	15	33	0	18	32	20 A
— Suprem a [Scorpi us, brow — highest]						
Scorpij Cor [Scorpi us, heart	8	45	0	25	20	20 A
— Antares]						
Caprico rni — Cornu superiu s [Capric orn, upper horn]	20	23	30	13	41	50 A
Caprico rni — Cornu	18	7	20	15	58	0 A

Star	Merid.		Decl.			
	Alt. Gr.	I	II	Gr.	I	II
inferius [Capricorn, lower horn]						
Capricorni — Præcedens in Cauda [Capricorn, leading star in the tail]	15	40	45	18	24	35 A
Capricorni — Sequens in Cauda [Capricorn, followi ng star in the tail]	16	11	30	17	53	50 A
Aquarij — Humerus sinister [Aquari us, left shoulde r]	26	46	45	7	18	35 A
Aquarij	31	49	0	2	16	20 A

Star	Merid.		Decl.			
	Alt. Gr.	I	II	Gr.	I	II
—						
Humerus dextr. [Aquarius, right shoulder]						
Aquarij	32	0	0	2	5	10 A
—						
Media Urnæ [Aquarius, middle of the urn]						
Piscis Austral. Mandibula [Southern Fish, jaw — Fomalhaut]	35	7	40	1	2	20 B
Ceti Mandib. inferior [Cetus, lower jaw]	36	31	0	2	25	40
Persei	73	22	30	39	17	10
—						

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Caput Algol [Perseus, the head Algol]						
Persei	65	0	0	30	54	40
—						
Præced. in ant. planta [Perseus, leading star in the front sole]						
Persei	64	49	0	32	34	40
—						
Sequens in ant. planta [Perseus, following star in the front sole]						
Aurigæ pes sinister [Auriga, left foot]	66	30	0	32	24	40

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Bootis pes dexter [Boötes, right foot]	49	39	30	15	34	10
Bootis lucida in Clava [Boötes, the bright star in the club — Arcturu s]	68	59	30	34	54	10
Canis Minor præced ens [Canis Minor, the leading star]	43	8	0	9	2	40
Hydræ lucida [Hydra, the bright star — Alphar d]	27	12	0	6	53	20 A
Herculi	56	32	40	22	27	20

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
s — Humer us dexter [Hercul es, right shoulde r]						
Herculi s —	59	30	0	25	24	40
Humer us sinist. [Hercul es, left shoulde r]						
Herculi s —	49	2	0	14	56	40
Caput [Hercul es, head]						
Ophiuc hi — sinistra manus [Ophiuc hus, left hand]	30	30	0	3	35	20 A
Ophiuc hi — hum. sinistr. [Ophiuc hus, left	44	11	0	10	5	40 B

Star	Merid.		Decl.			
	Alt. Gr.	I	II	Gr.	I	II
shoulder]						
Ophiuchi — Genu dextr. [Ophiuchus, right knee]	19	0	30	15	4	50 A
Ophiuchi — Caput [Ophiuchus, head]	47	0	0	12	56	40
Aquilæ lucida [Aquila, the bright star — Altair]	41	56	30	7	51	10
Aquilæ scapula [Aquila, shoulder-blade]	43	46	45	9	41	15
Antinoi sinistra manus [Antinous, left hand]	32	7	40	1	57	40 A
Pegasi	42	7	0	8	1	40

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
os [Pegasus, mouth]						
Pegasi scheat [Pegasus, Scheat]	59	57	30	25	52	10
Pegasi scapula [Pegasus, shoulder-blade]	47	5	30	13	0	10
Pegasi lucida in pectore [Pegasus, the bright star in the breast]	56	33	30	22	28	10
Pegasi alæ extrema [Pegasus, end of the wing]	46	58	30	12	53	10

Sub-heading within left table: 1586 ending / 1587 beginning — Merid. Alt. → Declination.

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Tauri ☐	55	34	0	21	28	40
— Lucida Capitis ☐ [Taurus , the bright star of the head; the symbol ☐ as printed]						
Tauri ☐	45	21	0	11	15	40
— Pectus [Taurus , breast]						
Tauri ☐	48	39	30	14	34	10
— 1. Hyadu m [Taurus , 1st of the Hyades]						
Tauri ☐	50	35	0	16	29	40
— 2. Hyadu m [Taurus						

Star	Merid. Alt. Gr.	I	II	Decl. Gr.	I	II
, 2nd of the Hyades]						
Tauri □	52	16	30	18	11	10
—						
Boreali s oculus [Taurus , norther n eye]						
Tauri □	48	59	20	14	54	0
— 4. Hyadu m [Taurus , 4th of the Hyades]						
Tauri □	49	52	0	15	36	40
—						
Aldebar a [Taurus , Aldebar an]						
Tauri □	62	16	0	28	10	40
—						
Cornu boreale [Taurus , norther						

Star	Merid.		Decl.			
	Alt. Gr.	I	II	Gr.	I	II
n horn]						
Tauri □	54	54	30	20	49	10
— Cornu austral e [Taurus , souther n horn]						
Gemino rum □	56	38	0	22	32	40
— Planta pedis [Gemin i, sole of the foot]						
Gemino rum □ — Calx pedis [Gemin i, heel of the foot]	56	44	0	22	38	40
Gemino rum □ — Lucida pedum [Gemin i, the bright star of	50	45	40	16	40	20

Star	Merid.				Decl.	
	Alt. Gr.	I	II	Gr.	I	II
the feet]						
Gemino rum ☐	66	48	0	32	42	40
— Caput Castoris [Gemin i, head of Castor]						
Gemino rum ☐	63	2	0	28	56	40
— Caput Pollucis [Gemin i, head of Pollux]						
Leonis ☐ — Colli infima [Leo, lowest of the neck]	52	50	0	18	44	40
Leonis ☐ — Colli suprema [Leo, highest of the neck]	59	32	0	25	26	40

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Leonis	55	59	0	21	53	40
□ — Media cetuicis [Leo, middle of the neck] [recte: cervicis]						
Leonis	48	3	0	13	57	40
□ — Cor [Leo, heart — Regulus]						

Right-hand table (p. 265): 1586 ending / 1587 beginning — Merid. Alt. → Declination.

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Virginis	34	56	0	0	50	40
□ — Media austral e [Virgo, souther n middle star]						
Virginis	39	45	0	5	39	40
□ — Cingulu						

Star	Merid.		Decl.			
	Alt. Gr.	I	II	Gr.	I	II
m [Virgo, girdle]						
Virginis	47	17	45	13	12	15
□ — Vindem iator [Virgo, Vindem iatrix]						
Virginis	30	47	0	3	18	20 A
□ — Extrem. infer. alæ [Virgo, end of the lower wing]						
Virginis	25	8	0	8	57	20 A
□ — Spica [Virgo, Spica]						
Virginis	30	18	20	3	46	50 A
□ — Pes Boreali s [Virgo, norther n foot]						
Lanx Australi s [southe	19	51	30	14	13	50 A

Star	Merid. Alt. Gr.	I	II	Decl. Gr.	I	II
rn scale of the Balance]						
Lanx Boreali s [northe rn scale of the Balance]	26	19	30	7	45	50 A
Andro m. cinguli lucida [Andro meda, the bright star of the girdle]	67	30	0	33	24	40
Andro m. Caput [Andro meda, head]	60	55	0	26	49	40
Persei Algenib [Perseu s, Algenib (Mirfak)]	82	24	0	48	18	40

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Capella [Capella]	79	34	0	45	28	40
Hædorum sequens [the following Kid]	74	39	0	40	33	40
Eridani extrema [Eridanus, the end star]	28	24	0	8	41	20 A
Eridani — Pes sin. lucid. [Eridanus, the bright left foot] [i.e. Rigel of Orion]	25	21	0	8	44	20 A
Orionis — Hum. sin. [Orion, left shoulder]	40	59	50	6	54	0

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
Orionis — 1. Balthei [Orion, 1st of the belt]	33	25	30	0	39	50 A
Orionis — 2. Balthei [Orion, 2nd of the belt]	32	33	0	1	32	20 A
Orionis — 3. Balthei [Orion, 3rd of the belt]	31	51	40	2	13	40 A
Orionis — Capitis Lucidio r [Orion, the brighte r head- star]	43	40	30	9	35	10 B
Orionis — Ensis infima [Orion, lowest	27	51	0	6	14	20 A

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
of the sword]						
Orionis — Pes dexter [Orion, right foot]	24	13	0	9	52	20 A
Orionis — Humer us dext. luc. [Orion, the bright right shoulde r — Betelge use]	41	20	30	7	10	10 B
Canis maior pes anter. [Canis Major, front foot]	16	18	0	17	47	20 A
Canis maior [Canis Major — Sirius]	17	54	0	16	11	20 A
Canis	40	18	45	6	13	15 B

Star	Merid.			Decl.		
	Alt. Gr.	I	II	Gr.	I	II
minor [Canis Minor — Procyo n]						
Bootis sura [Boötes, calf of the leg]	54	36	0	20	30	40
Arcturu s [Arctur us]	55	28	0	21	22	40
Coronæ Gnosia præced . [the leading star of the Cretan Crown]	64	40	0	30	34	40
Coronæ lucida [the bright star of the Crown — Alphecc a]	62	15	0	28	9	40

Parsing notes: In the left-hand "1586/1587" sub-table, the constellation symbols are printed in the margin column (♉ Taurus, ♊ Gemini, ♌ Leo); the entry "Lucida Capitis ♈" appears under the Taurus block but carries a printed Aries symbol — transcribed as printed. "Media cetuicis" is a compositor error for "cervicis" (neck). The "Eridani — Pes sin. lucid." entry is the bright left foot conventionally shared with Orion's Rigel.

Class 4: Tycho's selected declinations in *Progymnasmata*, Tome I

The text introduces the fourth and last class:

The fourth and last class consists of those Fixed stars whose Declinations Tycho [Tycho Brahe], from among his own Observations, set down as select in Tome I of the *Progymnasmata*, on pp. 159 and 232, for various years.

The accompanying table gives the star name, the year (*Anni Christi*), the resulting Declination (Gr./I/II), and the page of the *Progymnasmata* (1. Progymn. — Pagina) where it is found.

Nomina Stellarum [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	1. Progymn. Pagina
Aquarij hum. sinistr. [Aquarius, left shoulder]	1585. Compl.	7	18	15 A	232
Aquilæ lucida [Aquila, bright star — Altair]	1585. Compl.	7	51	20	200
Arietis prima [Aries, first star]	1585. Compl.	17	14	0	232

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	1. Progymn. Pagina
Arietis lucida [Aries, bright star — Hamal]	1585. Compl.	21	14	0	200
(Arietis lucida, &)	1587. Ian. 14	21	28	30	181
Cancri Asellus bor. [Cancer, northern Ass]	1585. Compl.	22	52	30	232
Capric. Caudæ præc. [Capricor n, leading star of the tail]	1585. Compl.	18	24	30 A	232
Geminor ū Calx præc. [Gemini, leading heel]	1582. Mart.	22	38	30	161
Geminor um pes lucid. [Gemini, the bright	1585. Compl.	16	40	20	232

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	1. Progymn. Pagina
foot]					
Castoris Caput [head of Castor]	1588. April.	16	40	30	191
(Castoris Caput, &)	1587. Aug.	32	42	10	183
(Castoris Caput, &)		32	42	15	186
Pollucis Caput [head of Pollux]	1582. April.	28	57	0	163
(Pollucis Caput)	1585. Sept.	28	57	0	166
(Pollucis Caput)	1585. Compl.	28	57	0	200
(Pollucis Caput)	1585. Compl.	28	57	45	204
(Pollucis Caput)	1588. April.	28	56	40	184
Leonis lucida Colli [Leo, the bright neck- star]	1585. Compl.	21	54	30	232
Leonis Cor [Leo, heart — Regulus]	1585. Compl.	13	58	0	200

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	1. Progymn. Pagina
(Leonis Cor)	1585. Compl.	13	57	45	204
(Leonis Cor)	1588. Octob.	13	57	20	182
Libræ lanx boreal. [Balance, northern scale]	1585. Compl.	7	45	45 A	232
Ophiuchi borealius [Ophiuch us, more northerly star]	1585. Compl.	2	33	15 A	200
Manus sinistræ [Ophiuch us, of the left hand]	Eodem [the same]	2	33	15 A	232
Pegasi 1. Alæ [Pegasus, 1st of the wing]	1585. Compl.	13	0	40	200
Piscium lucida in nexu [Pisces, the bright	1585. Compl.	0	44	30	232

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	1. Progymn. Pagina
star in the knot]					

Class 4 table (continued)

The Class-4 declination table continues at the head of folio 232. (Column headers as on the prior page: Star name; *Anni Christi*; Declinatio Gr./I/II; 1. *Progymn. pagina*.)

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	1. Progymn. pagina
Sagittarij media Capit. [Sagittari us, middle of the head]	1585. Compl.	22	13	0 A	232
Scorpij Cor [Scorpius , heart — Antares]	1585. Compl.	25	23	0 A	232
Tauri oculus boreal. [Taurus, northern eye]	1585. Compl.	18	12	0	232
Tauri oculus austr. [Taurus,	1582. Febr.	15	36	0	159

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	1. Progymn. pagina
southern eye — Aldebara n]					
(Tauri oculus austr.)	1582. Mart.	15	36	0	168
(Tauri oculus austr.)	1585. Compl.	15	36	15	200
(Tauri oculus austr.)	1588. Martii 28	15	36	45	189
Virginis 3. alæ austr. [Virgo, 3rd of the southern wing]	1585. Compl.	0	51	15	232
Virginis Spica [Virgo, Spica]	1585. Compl.	8	56	20 A	200
(Virginis Spica)	1588. Dec.	8	57	15 A	175

The table then resumes for **Tome 2** (*Tom. 2.*), where further selected declinations (for the year 1577) are drawn from Tome II of the *Progymnasmata*:

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	pagina (Tom. 2)
Aquilæ lucida [Aquila, bright star — Altair]	1577	7	52	0	p. 15
Antinoi lux man. sin. [Antinoü s, the bright star of the left hand]	1577	1	57	0 A	19
Aquarij hum. sin. [Aquariu s, left shoulder]	1577	7	20	0 A	20
Aquarij hum. dextr. [Aquariu s, right shoulder]	1577	2	16	0 A	20
Pegasi os [Pegasus, mouth]	1577	15	17	0	21
Capricor ni cornu inf. [Capricor n, lower	1577	15	58	0 A	19

Nomina Stellaru m [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	pagina (Tom. 2)
horn]					
Prima alæ Pegasi [Pegasus, first star of the wing]	1577	12	57	0	22
Lucid. duarum in collo [the bright one of the two in the neck]	1577	8	43	0	22
Scheat Pegasi [Pegasus, Scheat]	1577	25	50	0	22
Genu dextr. Pegasi [Pegasus, right knee]	1577	28	2	0	24
Boreal. in pect. Pegasi [Pegasus, northern star in the	1577	22	26	0	27

Nomina Stellarum [Star names]	Anni Christi [Year]	Decl. Gr.	I	II	pagina (Tom. 2)
breast]					
Lyrae lucida [Lyra, the bright star — Vega]	1577	38	26	0	29

Parsing notes: In the Class-4 tables, several stars (Pollux's head, Leo's heart, the southern eye of Taurus, Aquila's bright star, Spica) appear in multiple rows with different years and *Progymnasmata* page references — Riccioli is collecting Tycho's several published values for the same star. Sub-rows under a repeated star (introduced by "&" or "Eodem" in the source) are bracketed in parentheses for clarity but reproduce the source's repeated listing. The "p. 15 / Tom. 2" header marks the transition from Tome I page references to Tome II page references.

Conclusions and Annotations drawn from the four classes

From the four foregoing classes there are likewise deduced the following Conclusions, or Annotations.

1. Conclusion. The first class is not so reliable that one may not suspect it of an error of one or two minutes, as will appear if it is compared with the second, third, and fourth classes.

2. Conclusion. Since the altitude of the pole at Uraniborg is subject to an uncertainty of 15 seconds — for in his *Epistolae*, p. 40, Tycho writes that the elevation of the pole at Uraniborg, which is to be relied upon in our refined investigations of the stars, came out at $55^{\circ}54\frac{1}{3}'$ [$55^{\circ}54'20''$]; this because frequent careful experiments [?] convinced him that the pole at Uraniborg is somewhat higher than the sixth part of a minute, by reason of the observations which we set down a little above out of his *Epistola Danica* [Danish Letter], where in those passages he repeats this $55^{\circ}54\frac{1}{3}'$ on p. 53; "At Uraniborg the pole is elevated P. $55^{\circ}54\frac{1}{3}'$." And in Tome I of the *Progymnasmata*, p. 40, speaking again of the year 1583, he says: "the elevation [*Elevatio*] that, at that time, of this place, part $55^{\circ}54\frac{1}{2}'$ — if indeed it advanced upon those preceding by certain prior years [?] part

55°54 $\frac{1}{3}$ ' — the neglecting of the deniers of [?] seconds applied to the altitude." Yet in the same Tome, p. 218, he says: "Since, in defining and circumscribing the polar altitudes more particularly, through its complement, the quadrature [*Quadratura*] of the equator inclined as 55°54 $\frac{3}{4}$ ' is not unknown; you may understand the same things to have been indicated a little before. P. 34. 5.16'." But here also the same things are indicated. P. 34. 5.16'. Whence, taking the meridian altitude of Spica at the beginning of the year 1586 as found, P. 28°8'55", and subtracting therefrom parts 34. 5', one concludes the southern declination of Spica to be parts 8°36'20" [?]; or else, by oversight, another altitude of the pole — otherwise indicated above as fifteen seconds, or by later observations — is to be added, as he thought it should be added.

By this same reasoning, in this last place, if in the second class we should consider the meridian altitudes of the Pole star [Polaris] taken at its lowest, observed as parts 52°57'45"; and indeed when the smaller instruments [?] capture these — neglecting them, since a slight error is found in those — yet when the same lowest meridian altitude of the bright star of the Lesser Bear [Polaris] is found as parts 39°14'4" [?], and the greatest as parts 72°35', or 72°33'30" — whence the altitude of the pole comes out as merely parts 55°54'30" — but the parts 55°54'45" might seem to constitute for Tycho a [pole]-altitude to be established at merely parts 52°57'45" [?]. For the same reasoning [the *Persei Declinatio* margin-note belongs here] — [Margin: Polaris altitude expended/derived]

(Parsing note: this paragraph is a dense, heavily abbreviated technical argument about the uncertainty in Tycho's adopted pole altitude — alternating among 55°54'20", 55°54'30", 55°54'40", 55°54'45", and 55°54 $\frac{3}{4}$ ' as variant determinations. Several minute/second values are partly abraded in the gutter; readings flagged [?] above are uncertain at the arcsecond level. The thrust is secure: because the pole altitude itself is uncertain by ~15", every Class-2/3 declination derived from a meridian altitude inherits that uncertainty.)

Since, moreover, the lowest altitude of the Pole star, in the same year, came out at parts 52°56'45" [?], so that — taking a mean between these — it is credible that he chose the mean as parts 52°57'15".

3. Conclusion. The Tyconic declinations of the Fixed stars, even with the same meridian altitude preserved, are subject to an uncertainty of 15 seconds; how much more, then, those declinations of the Uraniborg pole-altitude obnoxious to the same, as has been said in the conclusion immediately preceding. Therefore, the declinations which we have here derived from the Uraniborg meridian

altitude are probable, [accurate] to five, or even to fifteen seconds, yet they do not exclude it evidently — provided we use that intermediate pole-altitude of parts $55^{\circ}54'40''$.

4. Conclusion. Among certain of the Tyconic Fixed-star declinations there appears a discrepancy arising from another source than the diversity of observation. For in the fourth class the bright star of Aries [α Arietis], at the same completed year 1585, is assigned both — by the *Progymnasmata* pp. 195, 198, 200, & 232 — parts $21^{\circ}14'$; while, p. 181, at the beginning [of the year] 1587, January 14, parts $21^{\circ}28'30''$. And yet, by Tycho's own tables this star, properly reckoned, increases its declination by $18''$ a year; therefore at the beginning of the year 1587 it should be found at parts $21^{\circ}28'30''$; it ought, by the observations of 1585 completed, to be parts $21^{\circ}28'10''$. But by the observations of the second class, at the beginning of the year 1582, it was parts $21^{\circ}26'20''$; and at the subsequently-completed [years] parts $21^{\circ}26'20''$ — but at month 1, completed in the same year 1585, parts $21^{\circ}26'32''$ [?]. Therefore at completed year 1586 it ought to be parts $21^{\circ}27'32''$. Indeed, at month 1, [?] parts $21^{\circ}26'32''$, by a Median ratio [?] he reckons it increased by minute $1'$; & at sec. $12\frac{1}{4}''$ a Median ergo he chooses parts $21^{\circ}27'$; & coelo [from the sky] indeed at most — what we set down at our observations, Chapter XVI [?], num. 2 — added; whence it will be established that the Tyconic declination of this star, by these two completed years, differs by half [?] from the true declination. For from the latitude of this star, Tyconically reckoned, & longitude — the distance of the Poles being adjoined, yet truly parts $23^{\circ}30'20''$ — it ought, at the completed year 1660, to have its declination parts $23^{\circ}51'$; & yet, by our observations, as set down in the said Chapter, it will be established — even at that time — to be merely parts $21^{\circ}49'20''$ [?].

Similarly, in the class of the head of Pollux [β Geminorum], the declination is set down at parts $28^{\circ}57'$ [?], both for the year 1582, April, and for the year 1585, completed, as it is had in Tycho, *Progymnasmata* pp. 163, 195, & 200. And yet, at the year 1588 completed, it is put at parts $104^{\circ}8'22''$ [recte: read as a misprint — see parsing note]; at parts $28^{\circ}57'45''$; & in class 4, year 1586 completed, it is put at parts $28^{\circ}56'40''$, no otherwise than in class 4. At year 1588, [the values] that can in no way cohere for the declination of this star, by however much it decreases per Tyconic [reckoning] in this century $7''$, $12''$ [?]. If at year 1586 completed it was observed parts $28^{\circ}56'40''$; it ought, at year 1588 completed, to be put at parts $38^{\circ}56'47''$ & at year 1588. April. gr. 38.56.33. [Margin: Pollucis Declinatio.] [recte: read 28° not 38° — see parsing note] At year 1588. April. parts $28^{\circ}57'15''$. [Margin: Pollucis Declinatio.]

The declination of the **heart of Leo** [Regulus] in the same class is double: at the same year 1585 completed, on the one hand parts $13^{\circ}58'$ [?]; on the other parts $13^{\circ}57'45''$; but in the third class it is put at year 1586, ended, observed parts $13^{\circ}57'40''$; yet the Tychonic table per century increases this by years $17''$, & $6''$; therefore at year 1585 completed it ought to be parts $13^{\circ}57'27''$ [?], & so it is the juster value than parts $13^{\circ}58'$; [Margin: Reguli Declinatio.] although per [year] $13'$ [?]. [?]

Aquila's declination in the 4th class, at year 1577, is put at parts $7^{\circ}51'$; & yet by Tychonic [reckoning] over a century this increases by $9''$ [?] a year for single [years]; therefore it ought to be — at year 1585 completed — parts $7^{\circ}52'12''$ [?]; but if at this century it was parts $7^{\circ}51'20''$, it ought at year 1577 to be [continued on next page]

(Parsing note for Conclusion 4: This conclusion is a sustained worked argument that several Class-4 values are internally inconsistent — Riccioli cross-checks each against the secular (per-century) rate of change in declination implied by Tycho's own tables, and shows the years don't reconcile. Several gross figures are clearly compositor garbles of two-digit degree values: " $104^{\circ}8'22''$ " for Pollux's head cannot be a declination (max possible is $\sim 90^{\circ}$) and must garble a value near $28^{\circ}57'$; " $38^{\circ}56'$..." for Pollux similarly should read $28^{\circ}56'$ (the "3" set for "2"). These are flagged as numerical impossibles in the report. The arcsecond residuals are heavily abraded in the gutter and several are [?]. The argument's logic is secure even where individual seconds are uncertain.)

Caput X — Examination and emendation of the declinations; the right ascension of bright Aries [α Arietis] from Tycho down to 1585

The methodological prose closing Caput IX continues, then the new tables open.

[continued] ...it would be merely parts $7^{\circ}50'13''$; but because in the third class it is put as observed in the year 1585 in progress at parts $7^{\circ}51'10''$; therefore in the same year completed it could scarcely be parts $7^{\circ}51'18''$; thus it stands in many other [cases] also.

6. The declination of **Spica** [Virgo] increases by twenty seconds in this century; therefore at the beginning of the year 1587 — as it is had in the third class — let it be parts $8^{\circ}57'10''$; it ought, at the completed [year] 1585, to be parts $8^{\circ}56'40''$; & yet it is put in class 4 at year 1585 completed parts $8^{\circ}56'20''$. Tycho assigns it parts $8^{\circ}56'20''$ in Tome I of the *Progymnasmata*, p. 195, 200, 204, & 232. What if this

declination is taken now from it, now from the several [values] of class 2? — for the observations gathered there, in six sextants, we have the same meridian altitude of Spica parts 25°10'; & therefore the declination is parts 8°55'20"; in the very year 1582 completed, & with [1585] in progress; therefore at year 1585 completed it ought to be parts 8°56'40", or at least parts 8°56'40". And to this neither can be reconciled with the observation of the year 1587. The Maximum Quadrant having been made.

7. Among these, and similar diversities — since Tycho, at the completed year 1585, from the **Right Ascension** [ascensio recta] of the bright star of Aries [α Arietis], as a fundamental, laid the foundations of the other Fixed stars — it has seemed good to recall the Tychonic declinations, for the end of the same year, by this method: First we select the Declinations of class 3, both because they are derived immediately, from their own sources — namely from the Meridian Altitude of the Fixed stars, & from the altitude of the pole — which Tycho excelled at, and in which he was at that time instructed with greater skill, and with larger instruments; then because, in part, by proportional increment, or by a decrement of the Declinations, that Tychonic table supplies [them], which is given in Tome I of the *Progymnasmata*, p. 178: yet where & when the discriminating consists [in this], in two [places] it assigns three seconds; if indeed within this subtlety we are not certain about the altitude of the Uraniborg [pole], as we said in Conclusion 2 above. Secondly, for those stars which are not in class 3, we use the Declinations of class 1, 2, or 4, reducing them to the year 1585, the end [of the year], by the aforesaid proportional part.

The reduced table — Tycho's observations reduced to the completed year 1585; corrected declination.

Ex Tychonis
 observationibu
 s ad Annum
 1585.
 completum
 [Star, from
 Tycho's
 observations
 reduced to
 completed
 1585]

Decl. corrected	I	II
Gr.		
Antinoi manus	1	50 A

Ex Tychonis
observationibu
s ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

sinistra

[Antinoüs, left
hand]

Andromedæ — 26 49 10

Caput
[Andromeda,
head]

Andromedæ — 33 26 0

Cinguli lucida
[Andromeda,
the bright
girdle-star]

Andromedæ — 40 18 30

Pes australis
[Andromeda,
southern foot]

Aquarij — 2 16 12 A

Humerus
dexter
[Aquarius,
right shoulder]

Aquarij — 7 18 20 A

Humerus
sinister
[Aquarius, left
shoulder]

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to

completed
1585]

Decl. corrected
Gr.

I

II

Aquarij — Urnæ media [Aquarius, middle of the urn]	2	5	15 A
Aquarij — Fomahant [Aquarius/Sout hern Fish — Fomalhaut]	31	43	40 A
Aquilæ lucida [Aquila, bright star — Altair]	7	51	15
Aquilæ scapula [Aquila, shoulder- blade]	9	41	20
Arietis — prima in cornu [Aries, first star in the horn]	17	12	30
Arietis — secunda [Aries, second star]	18	43	10
Arietis — 3.	21	27	0

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

seu lucida
supra Caput
[Aries, 3rd, or
the bright star
above the head
— Hamal]

Capella in
hum. sinist.
[Capella, in the
left shoulder of
Auriga]

Aurigæ —
Humerus
dexter [Auriga,
right shoulder]

Aurigæ — Pes
sinister
[Auriga, left
foot]

Aurigæ —
Hædorum
sequens
[Auriga, the
following Kid]

Bootis — In
fimbria
Arcturus

25

44

32

40

21

28

49

24

33

23

40

30

40

40

0

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

[Boötes,
Arcturus, on
the fringe]

Bootis —
Humerus
sinister

40

7

0

[Boötes, left
shoulder]

Bootis — Pes
dexter [Boötes,
right foot]

15

34

0

Bootis — Sura
[Boötes, calf of
the leg]

20

31

0

Bootis —
Lucida Clavæ
[Boötes, the
bright star of
the club —
Arcturus]

34

54

0

Cancri —
Asellus
Borealis
[Cancer,
northern Ass]

22

52

30

Cancri —

19

37

20

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

Asellus

Australis

[Cancer,
southern Ass]

Cancris — Chela 13 24 35

Australis

[Cancer,
southern claw]

Cancris — 21 4 50

Præsepe

[Cancer, the
Manger —
Praesepe]

Canis Maior 16 11 20 A

Sirius [Canis
Major —
Sirius]

Canis Maioris 17 47 20 A

pes præcedens
[Canis Major,
leading foot]

Canis Minor 6 13 20

procyon [Canis
Minor —
Procyon]

Canis Minor 9 2 55

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

præcedens
[Canis Minor,
the leading
star]

Capricorni — 13 42 20 A

Cornu superius
[Capricorn,
upper horn]

Capricorni — 15 57 55 A

Cornu inferius
[Capricorn,
lower horn]

Capricorni — 18 24 30 A

Caudæ
præcedens
[Capricorn,
leading star of
the tail]

Capricorni — 17 53 45 A

Caudæ
sequens
[Capricorn,
following star
of the tail]

Cassiopeæ — 51 36 50

Caput
[Cassiopeia,

Ex Tychonis
observationibu
s ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

head]

Cassiopeæ — 54 15 50

Pectus Schedir
[Cassiopeia,
breast —
Schedar]

Cassiopeæ — 55 35 50

Cingulum
[Cassiopeia,
girdle]

Cassiopeæ — 58 2 15

Genu
[Cassiopeia,
knee]

Cassiopeæ — 58 28 20

Flexura
[Cassiopeia,
the bend]

Cassiopeæ — 61 34 40

Crus
[Cassiopeia,
leg]

Cassiopeæ — 61 37 40

Pes
[Cassiopeia,
foot]

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed

1585]

Decl. corrected
Gr.

I

II

Cassiopeæ —	65	27	20
-------------	----	----	----

Pedis extrema
[Cassiopeia,
end of the foot]

Cassiopeæ —	60	38	20
-------------	----	----	----

In erectione
sedis
[Cassiopeia, in
the upright of
the seat]

Cassiopeæ —	56	52	50
-------------	----	----	----

Lucida
Cathedræ
[Cassiopeia,
the bright star
of the Chair]

Cephei —	60	53	50
----------	----	----	----

Lucida brachij
[Cepheus, the
bright star of
the arm]

Cephei —	68	46	30
----------	----	----	----

Latus sub
cingulo
[Cepheus, the
side beneath
the girdle]

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed

1585]

Decl. corrected
Gr.

I

II

Cephei — Cubitus sinister [Cepheus, left elbow]	64	2	40
Cephei — Genu sinistrum [Cepheus, left knee]	75	19	20
Cete — Lucida Mandibulæ [Cetus, the bright jaw-star — Menkar]	2	25	45
Cete — Ventor [Cetus, belly] [recte: Venter]	12	20	40 A
Cete — Cauda Borealis [Cetus, northern tail]	11	6	0 A
Cete — Cauda Australis [Cetus, southern tail]	20	17	15 A
Coronæ boreæ lucida	28	9	50

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

[Northern
Crown, the
bright star —
Alphecca]

Coronæ boreæ 30 34 50

præcedens
[Northern
Crown, the
leading star]

Cygni — 27 8 20

Rostrum
[Cygnus, beak
— Albireo]

Cygni — Pectus 38 58 20

[Cygnus,
breast]

Cygni — Ala 43 50 30

[Cygnus, tail —
Deneb]

Cygni — Ala 44 9 55

superior
[Cygnus, upper
wing]

Cygni — Ala 32 26 50

inferior
[Cygnus, lower

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

wing]

Draconis 51 37 15

lucida capitis
[Draco, the
bright head-
star — Eltanin]

Draconis 66 57 30

lucida lateris
præc. [Draco,
the bright
leading side-
star]

Geminorum — 32 42 45

Caput Castoris
[Gemini, head
of Castor]

Geminorum — 28 56 50

Caput Pollucis
[Gemini, head
of Pollux]

Geminorum — 22 38 38

Calx Castoris
[Gemini, heel
of Castor]

Geminorum — 23 23 15

Propus

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

[Gemini,
Propus]

Geminorum — 22 32 40
Planta pedis
[Gemini, sole
of the foot]

Herculis — 22 27 15
Humerus
dexter
[Hercules,
right shoulder]

Herculis — 25 24 40
Humerus
sinister
[Hercules, left
shoulder]

Herculis — 14 56 40
Caput
[Hercules,
head]

Hydræ lucida, 6 53 30 A
seu Cor
[Hydra, the
bright star, or
Heart —
Alphard]

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed

1585]

Decl. corrected
Gr.

I

II

Leonis — Cor
Regulus [Leo,
heart —
Regulus]

13

58

20

Leonis —
Cauda [Leo,
tail —
Denebola]

16

53

30

Leonis —
Media cervicis
[Leo, middle of
the neck]

21

54

0

Leonis —
Lucida
lumborum
[Leo, the bright
star of the
loins]

22

47

30

Leonis — Colli
suprema [Leo,
highest of the
neck]

25

27

0

Leonis — Colli
infima [Leo,
lowest of the
neck]

18

45

0

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

	Decl. corrected Gr.	I	II
Leonis — In capite inferior [Leo, the lower star in the head]	25	38	35
Leonis — In ventre [Leo, in the belly]	11	24	30
Leonis — Genu [Leo, knee]	12	49	10
Leonis — Femur [Leo, thigh]	17	41	30
Leonis — Pes sinister [Leo, left foot]	11	44	35
Leporis femur [Lepus, thigh]	21	7	0 A
Libræ lanx borealis [Balance, northern scale]	7	45	35 A
Libræ lanx australis [Balance, southern scale]	14	13	35 A

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to

completed
1585]

Decl. corrected
Gr.

I

II

Lyræ lucida
[Lyra, the
bright star —
Vega]

38

27

25

Navis lucida in
puppi [Argo
Navis, the
bright star in
the stern]

23

8

45 A

Ophiuchi —
Caput
[Ophiuchus,
head]

12

56

50

Ophiuchi —
Manus sinistræ
lucida
[Ophiuchus,
the bright star
of the left
hand]

2

33

15 A

Ophiuchi —
Humerus
dexter
[Ophiuchus,
right shoulder]

4

49

45

Ophiuchi —
Humerus

10

5

40

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

sinister
[Ophiuchus,
left shoulder]

Ophiuchi — 15 4 50 A
Genus

dextrum
[Ophiuchus,
right knee]

Ophiuchi — 9 36 45 A
Genu

sinistrum
[Ophiuchus,
left knee]

Orionis — 7 15 10
Humerus
dexter [Orion,
right shoulder
— Betelgeuse]

Orionis — 6 54 25
Humerus
sinister [Orion,
left shoulder —
Bellatrix]

Orionis — 9 35 5
Suprema
Capitis [Orion,
highest of the

Ex Tychonis
observationibus
ad Annum
1585.

completum
[Star, from
Tycho's
observations
reduced to
completed
1585]

Decl. corrected
Gr.

I

II

head]

Orionis — 0 39 55 A
Balthei 1.

[Orion, 1st of
the belt]

Orionis — 1 42 25 A
Balthei 2.

[Orion, 2nd of
the belt]

Orionis — 2 13 45 A
Balthei 3.

[Orion, 3rd of
the belt]

Orionis — 6 14 23 A
Ensis infima

[Orion, lowest
of the sword]

Orionis — Pes 8 44 25 A
lucidus sinister

[Orion, the
bright left foot
— Rigel]

Orionis — Pes 9 52 15 A
dexter [Orion,
right foot]

Liber IV — On the Fixed Stars (continued)

Caput IX (conclusion)

Corrected declinations reduced to 1585 (table continued)

The reduced "corrected declination" table continues from the prior batch (catchword "Pegasi" → Pegasus). Declinations are given in degrees (Gr.), arcminutes (I), and arcseconds (II); the marginal column header reads "From Tycho's observations to the completed year 1585." The flag **A** = *Australis* (south); rows without a flag are northern.

Constella tion / group	Star	Gr.	I	II	A
Pegasi [Pegasus]	Markab [α Pegasi]	13	0	10	
	Algenib [γ Pegasi]	12	53	20	
	Scheat [β Pegasi]	25	53	20	
	Os [the muzzle, ϵ Pegasi]	8	2	50	
	Lucidior pectoris [the brighter star of the breast]	22	28	20	
Persei lucidum nexus [the bright star of		48	18	40	

Constellation / group	Star	Gr.	I	II	A
Perseus's knot]					
Persei caput Medusæ [Perseus, the head of Medusa, Algol, β Persei]		39	17	20	
Persei plantæ anterioris præcedens [the preceding star of Perseus's forward foot]		30	54	45	
sequens eiusdem [the following star of the same]		32	34	45	
Piscium Occiput, seu mandib. austr. [the back		1	2	30	

Constellation / group	Star	Gr.	I	II	A
of the head of Pisces, or the southern jaw]					
Piscium lucida in nexu [the bright star in the knot of Pisces]		0	44	30	
Sagittari i [Sagittarius]	media capitis [the middle star of the head]	22	13	0	A
	orientalis capitis [the eastern star of the head]	21	58	10	A
Scorpii [Scorpius]	Cor Antares [the Heart, Antares, α Scorpii]	25	20	25	A
	borealis frontis chela	18	32	25	A

Constellation / group	Star	Gr.	I	II	A
	[the northern claw of the forehead]				
	media frontis [the middle of the forehead]	21	18	5	A
	chela australis [the southern claw]	24	44	25	A
Serpentis lucida colli [the bright star of the Serpent's neck]		7	19	10	A
Tauri [Taurus]	Oculus austr. Aldebara [the southern eye, Aldebaran, α Tauri]	15	36	30	

Constellation / group	Star	Gr.	I	II	A
	Oculus Borealis [the northern eye]	18	11	5	
	Cornu Boreales [the northern horn, β Tauri]	28	10	40	
	Cornu Australes [the southern horn, ζ Tauri]	20	49	10	
	Hyadum 1. [Hyades 1]	14	34	10	
	Hyadum 2. [Hyades 2]	16	29	35	
	Hyadum 4. [Hyades 4]	14	55	55	
	Pectus [the breast]	12	13	55	
	Pleiadum lucida	22	46	20	

Constellation / group	Star	Gr.	I	II	A
	[the bright star of the Pleiades, Alcyone]				
Virginis [Virgo]	Spica [Spica, α Virginis]	8	57	0	A
	Media alæ austr. [the middle star of the southern wing]	0	51	0	
	Cinguli lucida [the bright star of the girdle]	5	40	0	
	Vindemiator [the Vintager, ϵ Virginis]	13	12	35	
	Extrema alæ inferioris [the outermost]	3	18	0	A

Constellation / group	Star	Gr.	I	II	A
	t star of the lower wing]				
	Pes borealis [the northern foot]	3	46	40	A
	Symatis borealior [the more northern star of the hem(?)]	0	19	0	
	Symatis australior [the more southern star of the hem(?)]	8	17	0	A
Vrsæ minoris [Ursa Minor]	Polaris, vlt. caudæ [Polaris, the last star of the tail]	87	3	50	
	Humerus lucidus [the bright	75	50	0	

Constellation / group	Star	Gr.	I	II	A
Vrsæ maioris [Ursa Major]	shoulder]				
	Luc.	64	0	0	
	humer.				
	Pubhe				
	[the bright shoulder, Dubhe(?), α UMa]				
	Ilia [the flank]	58	36	40	
	Coxendix posterior [the hinder hip]	56	2	0	
	Tergoris lucida [the bright star of the back]	59	20	0	
	Radix Caudæ [the root of the tail]	58	14	50	
	1. Caudæ [1st of the tail]	59	22	10	
2. Caudæ [2nd of the tail]	57	9	30		
Vlt. seu 3.	51	26	30		

Constellation / group	Star	Gr.	I	II	A
	Caudæ [the last, or 3rd, of the tail]				
	Crus sinistrum [the left leg]	56	4	0	

Parsing notes: The "A" (Australis/south) flag is printed only in the rightmost sub-column for the rows where it applies; rows left blank are northern declinations. "Symatis" (the hem/border) is read as printed but is uncertain. "Pubhe" beside Ursa Major's bright shoulder is read as printed (= Dubhe).

CAPVT X.

The right ascension of bright Aries [α Arietis], from Tycho down to the completed year 1585, by careful examination is weighed and emended.

1. The ancients — Hipparchus, Ptolemy, and al-Battānī [Albategnius] — investigated the positions of the fixed stars by means of the Sun working through the Moon, as I taught in the second chapter [Cap. 2] and shall teach in the fourth [Cap. 4]; and Vespera too, by the great constructions of Chapters 2 and 4. By means of an astrolabe, or armillary instrument of the Zodiac, they took the distance of the Moon from the Sun a little after sunset, and from the parallaxes thus computed they gathered the place of the Moon in the Zodiac. Then on the following night, with the same instrument, they took the Zodiacal distance of the Moon from some fixed star; and adding to the Moon's former place as much as the interval of time between the first and second observation required, the time elapsed, they collected the place of the fixed star in the Zodiac. [Margin: *Method of the ancients*]

— but to such a degree was the danger of error and the fallacy of the instrument present, or the division too coarse, that from the parallaxes the computation was rendered uncertain and troublesome, and the refraction of the Sun was neglected.

2. Tycho [Tycho Brahe], in order to evade the snares of the Moon's parallax, substituted Venus, low in the evening sky, as I report from Tome 1 of the *Progymnasmata*, page 157 to 165. At the same moment he took the altitudes of the Sun and of Venus, and their mutual distance, and by means of equatorial armillaries he learned the declination of Venus; for he found the declination of the Sun from the Sun's place in the ecliptic, the time being reckoned at that moment, since the time was verified by clock. Having then the parallax of the Sun, of Venus, and of the [reference star], he deduced trigonometrically the difference of right ascension and of declination; and converting this into a true [difference], and adding the right ascension of the Sun (which he had taken from his own tables, repeated), he obtained the true right ascension of Venus at that moment of time. Then, on the following night, conveniently and at a certain moment of time, he observed the distance of Venus from some fixed star — namely Aldebaran, in the first observation, and the Heel of the Twins [Pollux] in the second observation — and the declination of Venus alone; and having taken away the time required between the preceding observation and the one just made, and in others he observed the declinations of the said fixed stars, and through these the mutual differences of right ascension and the distances among them, and that of bright Aries. So therefore, in inquiring into the right ascensions of those fixed stars and their declinations, by adding the trigonometrically-inferred difference of right ascension to them and to Venus, he acquired the said right ascension of Venus among them; and by means of this, the right ascension of bright Aries, the same according to the motion of the fixed stars, always reduced to the Year of Christ 1585 completed. An example we shall give below. With these three indicated observation-expeditions he finds the right ascension of bright Aries, as in the following little tablet. [Margin: *Tycho's method*]

Tablet. Right ascension of bright Aries [α Arietis], year 1585 completed:

Observ.	Gr.	I	II
I	26	0	44
II	26	0	32
III	26	0	30

3. Yet, lest he should leave any scruple involved in the parallaxes of the Sun, of Venus, and of the refractions of the Sun, by a fuller and more careful investigation he compared many observations of this kind of Venus with the Sun, and then of Venus with the fixed stars in the evening with those in the morning, the Sun and Venus being at the same altitude, the distance being taken at a third [point], and the declination being obtained in the morning as nearly as possible to

what it had been in the evening observation. For in this way the varieties of refraction, and the variations of parallax, mutually cancel and compensate one another. For the refraction of the Sun at setting, in raising its image toward evening Venus and diminishing it, optically lessens their distance, and likewise diminishes also the difference of right ascension to be added to the Sun's ascension, and thereby exhibits the right ascension both of Venus and of the fixed star smaller. On the contrary, the refraction of the Sun at rising, in raising its image toward morning Venus, diminishes the same distance and the difference of right ascension; but since this is subtracted from the right ascension of Venus, so that the right ascension of Venus may come out greater and just, it exhibits the right ascension both of Venus and of the fixed star greater. Therefore Tycho used to say that, if in the evening and morning observations the Sun and Venus were equal in altitude, the parallaxes too would be equal, and the parallaxes and refractions, purified from the parallaxes, would be exempt, inasmuch as the evening [refractions] diminish, just so much the morning [refractions] augment the right ascension. [Margin: 2. *Tycho's method*]

(continued, p. 269 right column) — by these means the true right ascension comes out, and so, among these elected [observations], it will be the truest right ascension. From the several remaining observations, twelve in all, both evening and morning, and the right ascensions of bright Aries above Caput X, down to the end of the year 1585, reduced and limited, the medium being taken between the two extremes; but the compendium from Tycho's Tome 1 of the *Progymnasmata*, page 165 to 194, I have been pleased, in making the discourse below, to subjoin to your eyes, adding in the last little column the discrepancies, which I afterwards explain. **M.** indicates the morning observations, **V.** the evening observations.

Table: Tyconic observations of the right ascension of bright Aries [α Arietis], reduced to 1585 completed

The column headers read: Order (Ordo); Time of Tycho's observation (M. = month, D. = day, with V. = evening / M. = morning marker); Altitude of the Sun \odot (Gr.); Altitude of Venus \square (Gr.); Right ascension of bright Aries \square as computed for 1585 (Asc. Recta luc. \square An. 1585. compl.) in Gr./I/II; and Discrepancy (Repugnantia) flagged **R.** The "Media Asc. R." line gives the mean right ascension for each numbered pair.

Ordo	Year	Alt. ☉ (Gr.)	Alt. ☿ (Gr.)	Asc.	I	II	Repug n.
	M. D. (V/M)			Recta ☿ Gr.			
I	1582	10	45	26	4	16	R
	Febr. 5 V						
	1582	10		25	56	23	R
	Sept. 21 M						
	<i>Media Asc. R.</i>			26	0	20	
II	1582	5½	44	25	56	33	
	Mart. 5 V						
	1585	5½	38	26	4	43	
	Sept. 14 M						
	<i>Media Asc. R.</i>			26	0	38	
III	1582	8	46	25	59	15	
	Mart. 5 V						
	1585	8	41	26	1	21	
	Sept. 15 M						
	<i>Media Asc. R.</i>			26	0	18	
IV	1582	6	43	25	59	49	
	Mart. 5 V						
	1585	6	32½	26	1	16	
	Sept. 15 M						
	<i>Media Asc. R.</i>			26	0	32	
V	1586	3	23	25	54	51	

Ordo	Year M. D. (V/M)	Alt. ☉ (Gr.)	Alt. ☿ (Gr.)	Asc. Recta ☿ Gr.	I	II	Repug n.
	Dec. 26 V						
	1588	3	20	26	6	32	
	Dec. 15 M						
	<i>Media</i>			26	0	42	
	<i>Asc. R.</i>						
VI	1586	3½	23	25	52	22	
	Dec. 27 V						
	1588	3½	24½	26	8	52	
	Nou. 29 M						
	<i>Media</i>			26	0	37	
	<i>Asc. R.</i>						
VII	1587	8	18	26	2	5	R
	Ian. 9 V						
	1588	8	19½	25	58	49	R
	Dec. 6 M						
	<i>Media</i>			26	0	27	
	<i>Asc. R.</i>						
VIII	1587	17½	30	26	6	44	R
	Ian. 14 V						
	1588	17½	25	25	54	13	R
	Oct. 26 M						
	<i>Media</i>			26	0	29	
	<i>Asc. R.</i>						
IX	1587	2½	25½	26	5	40	
	Aug.						

Ordo	Year M. D. (V/M)	Alt. ☉ (Gr.)	Alt. ☿ (Gr.)	Asc. Recta ☿ Gr.	I	II	Repug n.
	17 M						
	1588	2½	27½	25	54	48	
	April.						
	16 V						
	<i>Media</i>			26	0	14	
	<i>Asc. R.</i>						
X	1587	5	28½	26	1	1	R
	Aug.						
	17 M						
	1588	5	28	25	59	6	R
	April.						
	16 V						
	<i>Media</i>			26	0	4	
	<i>Asc. R.</i>						
XI	1587	10	33	25	54	35	R
	Aug.						
	18 M						
	1588	10	32	26	6	20	R
	Mart.						
	28 V						
	<i>Media</i>			26	0	28	
	<i>Asc. R.</i>						
XII	1587	8	31	25	54	49	R
	Aug.						
	17 M						
	1588	8	32	26	6	30	R
	April.						
	16 V						
	<i>Media</i>			26	0	39	
	<i>Asc. R.</i>						

Parsing notes: The "Ordo" Roman numeral spans each pair of rows (one evening + one morning observation), with the "Media Asc. R." (mean right ascension) on a third line. The fractional altitude marks (½) are printed as small superscript

fractions. The "R" in the rightmost Repugnantia column flags observation-pairs Riccioli marks as discrepant. Note the apparent year mismatch in pair I/II (evening 1582 vs. morning 1585) — transcribed as printed; this is the long evening-to-morning baseline Tycho's method requires, not a misprint (see footnote 4 below).

[Footnote 4] Let the Reader not be surprised that on the same day of the same Year two observations are referred, since they were in fact made at different hours; nor let him think that the time in Tycho's narration was placed in error by a typographical fault — namely the morning time A. M. for P. M. — and so the morning observations were wrongly permuted by us with the evening ones, for one reading the whole discourse of Tycho's observations will, from the circumstances, recognize with certainty which observations were the morning ones, by that distinct characteristic-mark **M.** and **V.** (the evening ones) which we used. Rather, let him wonder at the difference between the twelve mean right ascensions: gr. 26. 0' 4" and gr. 26. 0' 42". He will not choose a mean position of gr. 26. 0' 23", but rather gr. 26. 0' 30", as page 194 has it.

4....

5. Perhaps he did this because, in the third observation taken singly, of which number 1 [obs. 1], he found it to be gr. 26. 0' 30". This therefore (as page 194 has it) he chose not only, but as the fundamental of all the right ascensions of the fixed stars, he set and established it, and called bright Aries \square with this Asc. R. the **Angular cornerstone of the rest of the affixed stars** [*Angularem lapidem reliquarum Affixarum Stellarum*]. [Margin: *Bright Aries \square , the right ascension according to Tycho*]

Nevertheless — with all respect to so great a Man, and to the merits of so distinguished an astronomer — many causes occur to us on account of which we call this right ascension into doubt and revoke it. [Margin: *Against Tycho's observation*]

The first is the Hypothesis of the Sun, which Tycho used in collecting its right ascension and declination — false, in the middle motion of the Sun, in the eccentricity, and in the prosthaphæresis [*prosthaphæresi*], and in the declination of the Sun greatest, which he had assumed for the rising, but did not demonstrate; as is plain from what we said singly concerning the Sun in Lib. 1. [Margin: *1. objection*]

The second is the abuse of the declination of bright Aries [α Arietis]; for he had at the outset found the declination to be gr. 21. 28'. 30", whereas in the Year 1587 he

had truly found it to be gr. 21. 28'. 40", as is plain in the Year 1585 from Tome 1 of the *Progymnasmata*, pages 178. 181. 195. 198. 200. 204. 232; for if it had remained unchanged throughout, yet he ought to have established that declination at gr. 21. 28'. 26", indeed gr. 21. 27', as we shall show in Chapter 9, conclusion 4. Likewise, from what is said there he sinned in selecting certain of the fixed star declinations. [Margin: 2. *objection*]

The third is the fallacy in the 2. Tychonic method, of which method [I spoke] above, number 3; for neither, in compensating the defect from the evening observations by the excess of the morning [observations], unless Venus and the [reference star] were both in the same distance from the centre of the Earth, and the same temperatures of the air work the same quantity of refraction. For it is observed by us that the refractions are wont to be greater in winter, at the equinoxes, and these in summer; and the morning ones [greater] than the evening ones. For in the morning the air is colder and denser than at other times, on which account the evening refractions are absent, but in the evening it is warmer and rarer, as being baked through by the daytime heat of the Sun. See what we said Lib. 1. *Almag. New.*, page 30, Scholium 3, concerning the prolixity of the evening twilight, arising or sprung from the heat of the Sun; and Lib. 1, Chapter 10, On Refraction. [Margin: 3. *objection*]

The fourth is a double repugnancy in the deduction of the Tychonic observations. For if in the end of the Year 1585 the true right ascension of bright Aries \square was gr. 26. 0'. 30", then both the excess of ascension in the morning observations, and the defect in the evening ones, ought to be greater, the Sun being lower than higher above the horizon on account of the greater refraction. And yet in some observations the opposite appears, running through the Table at the end, number 3. exhibited. For, by way of example, in Observation VIII. the Sun being at gr. 17½. the right ascension recedes to gr. 26. 0'. 50" per minute 6½. But in observations X. the Sun being at only gr. 5, recedes by one minute only. Moreover, in the Year 1585. the true right ascension of bright Aries \square was gr. 26. 0'. 30". Therefore all the right ascensions which are derived from the evening observations ought to be smaller than the said right ascension; and on the contrary, those derived from the morning ones ought to be greater. But the opposite happens in Observations I. VII. VIII. XI. & XII. On which account, in the last column, I have added the characteristic-mark of repugnancy **R**. which is a double indication, either of inconstancy of refraction, even in equal altitudes of the Sun, or of faulty observations. [Margin: 4. *objection*]

6. These two morning observations, therefore, being passed over — likewise the evening ones, in which the Sun was involved with sensible refractions — I choose that evening one which Tycho refers in Tome 1 of the *Progymnasmata*, page 160, when both the Sun was at gr. 31. & Venus modo gr. 57. modo $23\frac{1}{2}$. & the Heel of the Twins [Pollux], by the said sensible refractions, near the end of Lib. 1, which is On the Sun. For in the single observation, refraction in the best observations being absent, the said preponderance of the mutated altitudes, if you suspect it [to be present]; since indeed it is certain we are deceived, from what is said. From the Hypothesis of the freed Sun, then, he erred in true parallax, declination, and prosthaphaeresis, not in the Ellipse bisecting the eccentricity, but in a circle around the whole integral eccentricity sought; and on account of the excessive parallax of Venus, therefore we shall use our own Hypothesis of the Sun. [Margin: 2. *Tychonic method*]

7. Moreover, since from these very Tychonic observations, in Cap. IX, I establish that in the Year 1585 completed the declination of bright Aries \square was gr. 21. 27'. 0", and the declination of the Heel of the Twins [Pollux] gr. 22. 38'. 38" — if we use the proportional part which Tycho establishes on page 276 — there follows for the Year 1582. March 20. the declination of bright Aries \square to have been gr. 21. 27'. 10", and of the Heel gr. 22. 38'. 30". These therefore we shall use.

7. Let there be now premised the Figure here adjoined, in which A is the angle at the Vertex, made by the two vertical circles AB & AC & BC; B is the portion of the Horizon intercepted by them; and the true place of the Sun is S, but the place seen by force of parallax is K; thus the true [place] of Venus is V, but the place seen [is] G, and so the true distance of them is VS; but the seen distance [is] GK. When, moreover, A is the angle at the Pole of the World, BC the portion of the Equator intercepted by two quadrants of the Declination circles, then placed in the two stars, one in V, the other in S; in V the complements of declination are AS & AV. These being premised, let there be the following Epilogism.

Diagram. A spherical-triangle construction. A curvilinear triangle is drawn with vertex A at the top; from A two arcs descend, meeting a base arc. Interior points G, V, S, K are marked along the descending sides, with B at lower left and C at lower right.

- A (apex): the angle at the Vertex (zenith) / at the Pole of the World
- V (interior, upper): true place of Venus
- G (interior, near V): seen place of Venus (by parallax)
- S (interior, lower): true place of the Sun

- K (interior, near base right): seen place of the Sun (by parallax)
- B (lower left): one terminus of the base arc / portion of Horizon
- C (lower right): other terminus of the base arc

I. From Tycho, page 160. Year 1582. March 20. hour 2. 25'. p.m.

Quantity	Gr.	I	II
⊙ Altitudo visa CK [the seen altitude of the Sun, CK]	31	0	0
⊙ Parallaxis nostra KS [our parallax of the Sun, KS]	0	0	17
⊙ Visa distantia à vertice AK [seen distance from the vertex, AK]	59	0	0
⊙ Vera distantia à vertice AS [true distance from the vertex, AS]	58	59	43
□ Altitudo visa BG [the seen altitude of Venus, BG]	57	0	0
□ Parallaxis nostra GV [our parallax of Venus, GV]	0	0	27
□ Distantia visa à vertice AG [seen distance	33	0	0

Quantity	Gr.	I	II
from the vertex, AG]			
□ Distantia vera à vertice AV [true distance from the vertex, AV]	32	59	33
☉ & ♀ Distantia observata GK [the observed distance of Sun and Venus, GK]	43	50	0
Ergo Distantia A [therefore distance A(?)]	51	41	20
Et vera ☉. ac ♀. Distantia VS [and the true distance of Sun and Venus, VS]	43	49	50
□ Locus noster [our place of Venus]	0	29	36
Eiusꝑ; Ascensio Recta [and its right ascension]	8	43	25
Eiusdemꝑ; Declinatio Bor. [and its declination, north]	3	46	23
□ Declinatio observata Bor. [the observed	23	2	0

Quantity	Gr.	I	II
declination of Venus, north]			
sed vera per nos [but the true (one) per us]	23	2	20
Igitur in Triangulo ASV [therefore in the triangle ASV]			
AS, Complementu m Declinationis ☉ [AS, the complement of the Sun's declination]	86	13	37
AV, Complem. Declinat. □ [AV, the complement of Venus's declination]	66	57	40
VS, Vera eorum Distantia [VS, their true distance]	43	49	50
Ergo A, diff. Ascens. Rectæ [therefore A, the difference of right ascension]	40	44	40

Quantity	Gr.	I	II
□ Ascensio Recta [the right ascension of Venus]	49	28	5

II. On the following night, hour 8. 11'. p.m. it was 2. observation, that is hour 5. 45'. after the prior observation.

Quantity	Gr.	I	II
Motus diurnus □ fuit [the diurnal motion of Venus was]	0	45	30
Ergo hor. 5. 45'. eius motus [therefore in hour 5. 45'. its motion]	0	10	55
Et proinde Ascensio recta □ [and accordingly the right ascension of Venus]	49	39	0
Tunc autem □ altitudo observata [then, moreover, the observed altitude of Venus]	23	30	0
□ Parallaxis nobis [the parallax of Venus to us]	0	0	46

Quantity	Gr.	I	II
Ergo visa □ distantia à vertice AG [therefore the seen distance of Venus from the vertex, AG]	66	30	0
sed vera AV [but the true (one), AV]	66	29	14
Tunc Calcis □ dist. à vertice vera AS [then the true distance of the Heel of the Twins □ (Pollux) from the vertex, AS]	45	0	0
Eiusq; distantia à □ visa GS [and its seen distance from Venus, GS]	36	32	0
sed vera VS [but the true (one), VS]	36	31	27
Declinatio autem □ tunc observata Bor. [the declination of Venus then observed, north]	23	4	45

Quantity	Gr.	I	II
sed ex Parallaxi correcta fuit [but corrected for parallax it was]	23	5	20
Declinatio autem Calcis □ CS [the declination of the Heel of the Twins □ (Pollux), CS]			
ex dictis num. 6. Borea [from what is said, number 6, north]	22	38	30
Datur ergo complementu m AV [therefore the complement AV is given]	66	54	40
□ complementu m AS [the complement of Venus, AS]	67	21	30
Et distantia vera VS [and the true distance VS]	36	31	27
Ergo Angulus A. & Arcus BC [therefore the	39	45	42

Quantity	Gr.	I	II
angle A and the arc BC]			
Et Ascensio Recta Calcis □ [and the right ascension of the Heel of the Twins □ (Pollux)]	89	24	42

(p. 270, right column — continuation of the calculation)

Quantity	Gr.	I	II
III. Complem. Declinationis Calcis □ [the complement of the declination of the Heel of the Twins □ (Pollux)]	67	21	30
Complem. Declinationis Lucidæ □ [the complement of the declination of bright Aries □]	68	33	0
Distantia harum Stellarum ex Tychone tom. 1. pag. 198. [the distance of these stars from Tycho, Tome 1, page 198]	58	22	0

Quantity	Gr.	I	II
Ergo A, seu BC, Differ. Asc. Rectæ [therefore A, or BC, the difference of right ascension]	63	28	8
Ideoq̄; Ascensio Recta Lucidæ □ [and so the right ascension of bright Aries □]	25	56	34
Sed Anno 1585. Completo [but for the year 1585 completed]	25	59	47

For from Tycho, page 276, the right ascension of bright Aries □ increases this century [grows yearly] 51". Therefore for 3¾ Years — namely from March 20. of the Year 1582. to the end of the Year 1585. — it increased by 3'. 13"; wherefore, if it was at gr. 25. 56'. 34" at that [time], at the end of the Year 1585. it would be gr. 25. 59'. 47"; and likewise, in the end of the Year 1585. it was gr. 25. 59'. 47". Be it according to Tycho, Tome 1, *Progymnasmata*, page 162. that the same Solar Hypothesis, taken from this observation, gives gr. 26. 0'. 32". That is, greater by 45"; that it would, if repeated, refer back, [whereas] our Hypothesis of the Sun on the contrary errs by a smaller minute. By which event I am the more confirmed that the observation was Tycho's, and that it is to be well used by us.

Let this therefore stand in place of the Fundamental, for the Year 1585 completed:

	Ascensio Recta [Right Ascension]
Lucidæ □ [bright Aries]	Gr. 25. 59'. 47"
Calcis □ [the Heel of the Twins / Pollux]	Gr. 89. 24'. 50"

CAPVT XI.

The Tychonic right ascensions of seven other fixed stars are corrected; and what remains to be done; and concerning the omission of those stars whose right ascension the Tychonians were ignorant was decreasing.

1. Since Tycho, in Tome 1 of the *Progymnasmata*, pages 195 and 230, inquired into the right ascensions of 23 other stars by computation from the Heel of the Twins \square [Pollux], but principally by means of their declinations and mutual distances, and thence drawing out the difference of ascensions, and using the right ascension of bright Aries \square — from these he constituted the right ascensions of those stars: upon us there falls the necessity of correcting them, namely on account of the diversity found in the right ascension of bright Aries \square , and in the declinations of the fixed stars, which in Chapter IX we have emended from Tycho himself to the Year 1585 completed; and finally, from the distances of the fixed stars, in Chapter VIII, by our own repeated observations, and some differing somewhat from the Tychonic ones. It behooves, moreover, to begin the sum of the differences in right ascension, beginning from bright Aries \square , and to it to return, as the equal of the whole Equator, or precisely 360 degrees. For which experiment we shall elect 8 Stars from Tycho, page 200, elected; in which P is the Pole of the Equator, and the angle subtending the arc of the Equator AB, that is, the difference of right ascension of the fixed stars; but the arcs PC & PD are the complements of the declination of the fixed stars, and CD their distance. When, moreover, one of the two fixed stars, like Spica, has a southern declination, we use the triangle PCF, in which A is as above, and PC...

Diagram. A spherical-triangle construction for reducing right ascensions. A vertex **P** (the Pole of the Equator) sits at the top; two arcs **PC** and **PD** descend to points C and D, the complements of declination of two fixed stars, with arc **CD** between them as their distance. A further point **F** below the base extends the construction for a star of southern declination (e.g., Spica), forming triangle PCF. Points A and B mark the termini of the Equator-arc AB at the base.

- P (apex): the Pole of the Equator
- C (left, on base): foot of arc PC, complement of one star's declination
- D (right of C): foot of arc PD, complement of the other star's declination
- A (lower left): one terminus of the Equator-arc AB
- B (lower right): other terminus of the Equator-arc AB
- F (below base, lower right): the point used for a star of southern declination (triangle PCF)

Liber IV — De Fixis Stellis (continued)

Caput XI (continued)

the complement of the star's declination C, and from PF, the aggregate of the squares of PB and of the declination BF and of CF. For from these elements of the distance between the stars we gather the angle P, which measures the arc AB. This is done, to be sure, without the trouble and the error-prone multiplication of the tangent-sines, but by a single addition, for which we have the logarithmic table of Vlacq [Vlacq], whose canon gives the individual decades down to seconds, indeed in the very first quadrant down to a second of the second order [i.e. to thirds].

The following table sets this out:

| Names of the stars | Distance from the preceding [star] — Gr. | I | II |
Declination 1585, complement — Gr. | I | II | Difference of right ascension — Gr.
| I | II | |---|---|---|---|---|---|---|---|---|---|---| | Lucida □ [α Arietis] | | | 21 | 27 |
0 B | | | | Aldebaran [α Tauri] | 35 | 32 | 0 | 15 | 36 | 30 B | 37 | 4 | 49 | |
Pollucis Caput [Pollux, β Geminorum] | 45 | 5 | 0 | 28 | 56 | 50 B | 46 | 54 | 24 |
| Regulus [α Leonis] | 36 | 59 | 30 | 13 | 58 | 20 B | 36 | 35 | 8 | | Spica □ [α
Virginis] | 54 | 2 | 0 | 38 | 57 | 0 A | 49 | 19 | 3 | | Sin. manus Oph. [left hand of
Ophiuchus] | 42 | 33 | 30 | 2 | 33 | 15 A | 42 | 19 | 16 | | Aquilæ lucida [α
Aquilae, Altair] | 55 | 17 | 20 | 7 | 51 | 15 B | 54 | 26 | 25 | | Markab Pegasi [α
Pegasi] | 47 | 49 | 20 | 13 | 0 | 10 B | 48 | 24 | 44 | | Lucida □ [α Arietis] | 43 | 37
| 10 | 21 | 29 | 0 A | 44 | 57 | 49 | | Sum of the differences of right ascension |
| | | | | 360. | 1. | 28. |

2. From this it is clear that the Tychonic declinations, or distances, of the fixed stars among themselves were not so exact, since by a second scruple [a few seconds] the sum of the differences of right ascension ought to have been precisely 360 degrees. This same fact it will be possible to recognize afterward from our own observations. Meanwhile, the said sum exceeds the equator by that 88"; which, distributed over the eight aforesaid differences, by subtracting eleven seconds from each, then yields the right ascensions to be established, as in the following table.

Names of the stars	Difference of right asc. —			Right ascensi on —		
	Gr.	I	II	Gr.	I	II
Lucida □ [α Arietis]				25	59	47
Aldebaran	37	43	38	63	3	25
Pollucis Caput [Pollux]	46	54	13	109	57	38
Regulus	36	34	57	146	32	35
Spica □	49	18	52	195	51	27
Lucida Oph. manus sin. [bright star of the left hand of Ophiuc hus]	42	18	53	238	10	20
Aquilæ lucida [Altair]	54	26	14	292	36	34
Pegasi Markab	48	24	33	341	1	7
Lucida □ [α Arietis]	44	57	29	25	58	36
Calx pedis □ [Heel of the				89	24	50

Names of the stars	Difference of right asc. —			Right ascension —		
	Gr.	I	II	Gr.	I	II

**foot of
the
Twins]
From
the end
of [the
canon
of] CX
[Cap.
X]**

- To these stars we add the Heart of the Scorpion [Antares, α Scorpii], which Tycho likewise furnishes, so that afterward — comparing the Tyconic longitude with the ancient ones — we may settle the proper motion of the fixed stars; and we take its distance from Spica per Cap. VIII, and its declination per Cap. IX.

	Distance of the stars —			Southern decli- nation —			Difference of right asc. —		
	Gr.	I	II	Gr.	I	II	Gr.	I	II
Spica				8	57	0			
Antares	45	52	0	25	20	25	45	25	30

Hence, since the right ascension of Spica is at that time $195^{\circ}50'21''$, that of Antares will be $241^{\circ}15'51''$.

For the remaining 12 stars, whose right ascensions Tycho did not hand down as a foundation in the way he did the others (as exquisitely as the others), we shall

investigate the right ascensions more evidently from a greater number of fixed stars, for the year of the Lord...

1660. From the stabilities [data] of Cap. VIII and from our declinations, observed by us most diligently. But if anyone should prefer to correct the Tychonic right ascensions by the method set out above, let him use the distances of Cap. VIII and the declinations of Cap. IX; for from these and from the right ascensions of the ten fixed stars established above, he will obtain the right ascensions of the rest of the fixed stars, and will recognize how great a correction the table needs which Tycho hands down, reduced to the years 1600 and 1700 (*Progymnasmata* tom. 1, p. 276).

[Margin: The shoulder of the Lesser Bear differs from Tycho.]

4. But in that table it may seem astonishing that Tycho placed the Pole Star [Polaris] in the third magnitude, or among those of fourth magnitude, although it is a star of fairly great magnitude in the shoulder of the Lesser Bear, the most celebrated star in the heaven — both because it is of a magnitude not less than the second, and because, in the time of Eudoxus and Hipparchus, indeed nearly of Ptolemy, it was the star nearest the Pole of the World, and so it was at that time the Pole Star, and the most observed star of the navigators [Cynosura]. To me it is almost certain that this is Tycho's [error], and one to be added to those treated above — that the right ascension of a star of this kind was not omitted, but deliberately passed over, because there could fall into it [the determination] an indissoluble knot, on the supposition of the opinion which they held: namely, that of all the fixed stars the right ascensions ought to grow [increase]; whereas, when its [the Pole Star's] right ascension is found, and when its longitude has been advanced from the year of Christ 1600 to 1700, and from its distance the right ascension of the same star for the year 1600 is found, smaller than the right ascension of the year 1600, and [the computation] repeated again, the calculations would always have hit upon a decrement; nor were they equal to applying their mind to the theory of this peculiar motion, and, overcome by the tedium and the perplexity entangled in this matter, they preferred not to place this star, which was so difficult, in the catalogue of longitudes and latitudes — because, as to the longitude, the increment came out null; a difficulty which they had themselves experienced.

[Margin: A defect [omission] of Tycho's.]

5. Let us now see how great the right ascension of this star ought to have been for the year 1600 and 1700, and that on the Tychonic hypothesis of longitude, latitude, and polar distance — but first, for the sake of the demonstration, let us inspect the following diagram, in which let ABC be the Colure of the Solstices, &c.

Diagram. A spherical-astronomy figure inscribed in a circle, showing the determination of the right ascension and declination of the Pole Star on the Tychonic hypothesis. A great circle is drawn as the bounding sphere; within it appear the colure of the solstices ABC (a vertical diameter, A at the lower left, B at the top, C at the bottom), the equator running roughly horizontally (A...Q), the ecliptic (E...C), and several quadrant arcs of latitude and declination meeting at the poles. The lettered points, read against the accompanying prose (§5 below), are:

- B (top): pole region of the colure / near the Pole of the Ecliptic
- P (upper interior): Pole of the Equator
- Z (upper interior, near P): Pole of the Ecliptic
- O (upper interior): the star itself (the Pole Star / Cynosura)
- D (upper right): point on an arc near O
- E (left, on circle): terminus of the ecliptic EC
- A (lower left, on circle): terminus of the equator and of the colure
- G (lower left interior): point on the latitude-quadrant ZOG
- K (lower interior): intersection point
- □ (lower interior): the equinoctial point (Aries)
- I, H (lower interior): points on the equator/arcs
- L (lower right interior): point
- Q (right, on circle): terminus of the equator A...Q
- C (bottom, on circle): terminus of the colure and of the ecliptic

The equator is A□Q; the Pole [of the Equator] is P; the Ecliptic is EC; its Pole is Z; and the Cynosura [Pole Star] is O.

Let the equator be A□Q and its pole P; let the ecliptic be EC and its pole Z; let the Cynosura be O. Then, for any required arc, from the Pole Z let the quadrant of latitude ZOG be drawn through O. Since the Tychonic place of the star is G in the ecliptic, for the year 1600, namely □ [Leo] 7°16'30", and its northern latitude GO is 72°51'30"; its complement OZ is 17°8'30". And from the Pole P, through the same star O, let the quadrant of declination POH be drawn; for in the spherical triangle POZ the two sides PZ (the Tychonic distance of the Poles, 23°31'30") and OZ (the

complement of latitude, $17^{\circ}8'30''$) are given. From the longitude of the star, which is $7^{\circ}16'30''$ — having taken 90° away from the longitude — there is given the angle PZO, $37^{\circ}16'30''$; therefore, by the canon of triangles, the angle OPZ, $47^{\circ}1'30''$, is given; and if from this the arc HQ be measured as the equatorial arc, the arc AH will be $132^{\circ}59'30''$; to which, if 90° be added, the right ascension of the Cynosura, $222^{\circ}59'30''$, will be obtained. For the year 1600.

6. Let the Cynosura now be advanced in longitude from O to I, along the small circle of the ecliptic parallel BOID, [drawn] from the Pole Z; for if the fixed stars proceed thus, they retain always the same latitude. And let the quadrant of latitude ZIK be drawn; for since the longitude of the Cynosura for the year 1700...

is, on the Tychonic [hypothesis], \square [Leo] $8^{\circ}41'20''$, the angle PZI will be $38^{\circ}41'20''$ — that is, one degree more than in the triangle PZI; and, with the latitude unchanged, the complement IZ is $17^{\circ}8'30''$, and the polar distance PZ is $23^{\circ}31'30''$. By the canon of triangles, the angle IPZ is found to be $47^{\circ}15'45''$, which measures the arc LQ. Therefore, with the longitude growing, the right ascension decreases by the arc LH; for the arc was $132^{\circ}46'24''$ [recte $132^{\circ}59'30''$? — see prose], and, joined to 90° , will give for the year 1700 a right ascension of $222^{\circ}46'24''$. And thus the quadrant of declination PIL falls short of [within] the quadrant POH, always [drawn] so long as the time advances, because the quadrants of the circles of declination drawn from the pole did not intersect the ecliptic parallel BOID, but precisely touch it; for from that time the right ascension will begin to grow with the longitude growing.

And it comes about, in all fixed stars whose complement of latitude is less than the distance of the Poles of the Equator and of the Ecliptic, as I taught more fully in the *Almagestum Novum* lib. 6, cap. 19, where also other fixed stars of this condition are recounted. Which it was worth the trouble to point out to the Reader.

CAPVT XII.

De Longitudine, ac Latitudine Fixarum Tychonica emendanda; necnon Motu earum in Longitudinem. [On the longitude and latitude of the Tychonic fixed stars, to be emended; and likewise on their motion in longitude.]

1. It is established that Tycho (*Progymnasmata* tom. 1, from p. 203) derived the longitudes and latitudes of the fixed stars from given data, or elements — namely, from the right ascension, the declination of the fixed stars, and the distance of the Poles — partly by the solution of spherical triangles,

partly by a table constructed for this purpose, on the supposition of the obliquity of the ecliptic at $23^{\circ}31'30''$. But equally, from what was said about the Sun, it is established that this obliquity, or distance of the Poles, does not exceed $23^{\circ}30'20''$; and from what was said in Book [IV], Cap. IX and X, the declinations, which Tycho also used, are not in all cases corrected. The right ascensions, moreover, must be corrected in nearly all. Therefore, from these same three [Cap.s] it is established that the Tyconic longitudes and latitudes of the fixed stars must be corrected. Take Longomontanus, in the *Astronomia Danica* lib. 1, Theoricorum cap. 4: he held that the Tyconic longitudes are to be diminished by about one minute, on account of the diminished longitude of the middle [mean] Sun. And so, both for the sake of an example and for investigating the motion of the fixed stars in longitude, we adduce ten of those stars which were brought forward in the preceding chapter; and in this same place we bring them back to the ecliptic by the aid of trigonometry, but with the truer distance of the Poles applied, and with the declinations of [Cap. IX, X] employed.

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Ye	As	M.	II	De	G.	M.	II	Lo	M.	II	La	M.	II
ar	c.			cli				ng			tit		
of	Re			na				itu			ud		
Ch	cta			tio				do			o		
r.	—			—				—			—		
15	G.			S.				G.			G.		

Distance of the Poles positioned at 23°30'20".

85, complete.

Lucida	25	59	47	21	27	0	□	1	51	39	9	56	30
						B							B
Aldebaran	63	3	25	15	36	30	□	3	59	49	5	29	30
						B							A
Calex	89	24	50	22	38	30	□	19	27	[?]	0	51	46
						B				2			A
Pollux	109	57	38	28	56	50	□	25	13	28	6	38	59
						B							B
Regulus	14	32	35	13	58	20	□	24	3	2	0	27	47

Distance of the Poles positioned at 23°30'20".

gu lus	6					B							B
Sp ica □	19 5	51	27	8	57	0 A	□	18	2	41	2	0	23 A
Op hi uc hi m an . sin .	23 8	10	20	2	33	15 A	□	26	30	20	17	19	3 B
Co r Sc or p.	24 1	16	57	25	20	25 A	□	4	5	18	4	22	50 A
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Parsing notes: "B" = Borealis (northern) / "A" = Australis (southern) flag on declination and latitude. The third II-column entry for Calx □ in Longitude ("[?]2") is ink-faint. Zodiacal signs in the Longitude/Latitude columns are rendered by their glyphs.

2. In the preceding calculation, from the right ascension, the declination of the fixed star, and the distance of the Poles, the latitude was sought, and with this and the declination, the distance of the Poles and the longitude; and this calculation, treated singly and faithfully, comes out so happily that the collected differences of longitude make up precisely 360 degrees of the

ecliptic. Nor indeed, out of religion, has it pleased me to vary this permutation, lest, the calculations being made, the things permuted should be returned thus once and equally; but I have used them happily, given once. But behold, in the following little table, the differences of longitude:

Name s	Longitudo —			Differ. Longit.			
	Sig.	G.	I	II	. — G.	M.	II
Lucida □	□	1	51	39	32	3	4
Aldebaran	□	3	54	43	25	32	17
Calx □	□	29	27	20	18	10	58
Pollucis Caput	□	17	38	18	36	24	44
Regulus	□	24	3	2	53	59	39
Spica □	□	18	2	41	38	27	39
Ophiuchus manus	□	26	30	20	7	34	58
Cor Scorpii	□	4	5	18	51	56	12
Aquila æ lucida	□	26	1	30	51	40	50
Pegasi Markab	□	17	42	20	44	19	19
Lucida □	□	1	51	39			
Summa					360	0	0

3. But now Tycho (*Progymnasmata* tom. 1, p. 213) used, in the first place, Regulus, observed by Hipparchus and by al-Battānī [Albategnius], and afterward deduced from it the motion of the fixed stars for a year, at 51". But indeed Hipparchus, on Ptolemy's testimony (*Almagest* lib. 7 cap. 2) in the year 50 of the [Calippic] Period — that is, 128 years before Christ — observed Regulus in Leo 29°50'; but, as for the declination, 20°40' — when the same one at that time, according to Ptolemy (cap. 3) and the latitude 0°27'47". And both, by reason of the obliquity of the ecliptic, the place in Leo follows at 29°57'44". But after 1713 years — that is, in the year of Christ 1585 — Tycho, corrected from us, observed Regulus in Leo 24°5'2" [recte 24°3'2"?]; therefore the process is 24°5'18", which compounds at 51" for 1713 [years]. But al-Battānī, in the Nabonassaridian year 1627, as Riccioli refers, cap. 51 of the *Scientia Stellarum*, observed Regulus in Leo 14°; whence the process is from there everywhere [the same], at 10°3'2" for 787 years. Therefore the annual motion is $1\frac{2}{3}$ [1 and 2/3], or, rounded, 51" — which Tycho chose.
4. There already exist, in tom. 1 of the *Progymnasmata*, two very celebrated tables of the fixed stars: the first is of the longitudes and latitudes of the principal fixed stars, brought to the year of Christ completed 1600, which is had there on p. 258. The second, which is had on p. 276, with the right ascension and declination of a hundred selected fixed stars, brought to the years completed 1600 and 1700, with the centenary difference. If anyone wishes to use these, and the difference, let him consult Tycho — or [use] either the first Rudolphine Table, or the Philolaic Tables. But if anyone wishes to emend them, they can be emended in two ways.
5. The first is, by investigating trigonometrically the difference of the right ascension among the fixed stars, which is had in Cap. VIII (distances) and Cap. IX (declinations) for the year 1585, as we did in Cap. XI for ten stars, and by means of the right ascension of the bright star of Aries α [Arietis], or of the Heel [Calx] of the Twins β , their right ascension — together with which, then, and with the declination, and with the truer distance of the Poles, namely 23°30'20" — the latitude is inquired, perpetual at all times; and then the longitude, which thereafter can be promoted for any number of years you wish from the year 1585, for each single year at 51". Then, the longitude being thus found for the year 1600 and 1700, it is possible to inquire trigonometrically, with [more] labor, into it [the longitude] and the latitude, and the distance of the Poles; then the declination, then the right

ascension, for the year 1600 and 1700. This method, as it is of the greatest labor, so it is the most exact.

6. The second [way] is allowable, though not so exact: if from all the fixed stars of the same constellations, of which there are ten emended by us in the preceding chapter, just so much be subtracted, or be added to the right ascension, declination, longitude, and latitude, by Tycho for the years 1600...

and 1700, just as great as is the difference, whether in excess or by defect, between the incorrect Tychonic [value] and the Tychonic [value] corrected by us in this and the preceding chapter. As for those ten declinations, however, they are constituted more exactly, if the declinations of Cap. IX are emended in the last table, or there be added or subtracted as much as the centenary difference from Tycho requires, posited in proportion — or [if] then the ratio of the years 15 [be posited] for the year 1600, and thereafter that ratio which the [proportional] ratio of 100 years demands.

7. Since, however, posterity will desire to have the Tychonic table, as it stands, and perhaps some [things] corrected in it: as for those ten fixed declinations, nonetheless, we shall subjoin, in the interval of 15 years — between the year 1585 and 1600 — the correction owed. In the rest the Reader will see whether, on account of the false distance of the Poles from Tycho posited, one can suspect an error of about one minute, and sometimes more.

[Margin: From Longomontanus, by reason of his later observations, this same table — but exhibited as it is among the Tychonic [values] — except for the ten aforesaid stars, for which we shall subjoin the necessary correction at the interval of the years 1585 and 1600.]

Centum Fixarum Tabula Tychonica ad Annos infra notatos.

[A Tychonic Table of a Hundred Fixed Stars, for the years noted below.]

For the year of Christ 1600 completed | For the year 1700 completed

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C a s s i o p e æ p e c t u s	□ 2	1 7 ½	4 6	3 5 ½	4 6	3 4	5 6	2 4	5 8	5 4	5 5	5 5	1 2	2 4	3 4 A
P o l a r i s S t e l l a	□ 2	4 ½	6 6	2 B	5 B	4 7	8 7	9 ½	9 B	4 6	8 7	4 3 ½	3 9	5 4	3 4 A
C e t e C a u	□ 2	5 6	2 0	4 7 A	8 7 A	1 9	2 0	1 2 A	7 8	1 9	1 8	2 8	1 7	1 4	3 4 S

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	2	2	6	2	1		8	B	6	8	8	0		5	3
				B										½	A
□	2	3	7	8	2	5	1	1	2	1	1	5	1	2	3
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□	8	4	1	3	4	2	2	2	5	4	1	1	1	1	2
		7	2	7	9	5		9	1	4		4		9	5
				A				B							A
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	□	2	2	4	0	5	5	2	4	5	2	2	1	1	2	2
		4	4		B	0	7	2	9	2	6	3	0		9	1
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	□	0	1	5	4	5	1	1	3	6	4	1	5	1	3	1

N a m e s o f t h e F i x e d S t a r s	L o n g. S i g. G.	M G r. .	L a t .	M G r. .	A s c e n d e n s i t y R e c o r d s M G r. .	M G r. .	D e c l i n e n s i t y R e c o r d s M G r. .	M G r. .	A s c e n d e n s i t y R e c o r d s M G r. .	M G r. .	D e c l i n e n s i t y R e c o r d s M G r. .	M G r. .	A s c e n d e n s i t y R e c o r d s M G r. .	M G r. .	D e c l i n e n s i t y R e c o r d s M G r. .							
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	□	4	1	5	3	6	1	1	5	6	4	1	5	1	2	1						
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		½		A				B							
□	1	4	1	2	1	9	3	4	1	5	3	3	1	4	1
	4	1	0	B	0		2	1	0	5	2	0		4	1
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Names of the Fixed Assets
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 the
 Balance Sheet

		Land				Buildings				Machinery				Vehicles				Furniture	
		Cost	Accumulated Depreciation	Net Book Value	Cost	Accumulated Depreciation	Net Book Value	Cost	Accumulated Depreciation	Net Book Value	Cost	Accumulated Depreciation	Net Book Value	Cost	Accumulated Depreciation	Net Book Value	Cost	Accumulated Depreciation	Net Book Value
C	□	20	15	5	10	8	2	15	12	3	10	7	3	5	4	1	2	1	1
	□	10	8	2	5	4	1	15	12	3	10	7	3	5	4	1	2	1	1
Total		30	23	7	15	12	3	30	24	6	25	17	8	10	9	1	4	3	2

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Names of the Flixend Stags

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□	2	2	4	5	1	2	1	4	1	5	1	1	1	2	2
	2	0		2	4	2	8	2	4	0	8	4		8	8
				B	6			B	7						S
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	4	7		6	4	5	3	5	4		3	5		3	8

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g.	G.	.	r.	.	r.	.	r.	.	r.	.	r.	.	r.	.	r.	n.

□	2	5	8	4	1	2	2	5	1	5	2	2	1	2	2
	3	9		7	4	5	1	0	5	1	1	1		5	9
				B	9	½		B	0					½	S

□	9	3	4	4	1	1	5	2	1	4	5	5	1	3	3
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Parsing notes: This table runs across the batch's page boundary; it continues beyond p. 239 (catchword "Lucida"), so the table continues. Column abbreviations: "Asc. Recta" = right ascension; "Declin." = declination; "Asc. Diff." (Ascensionis Differentia) = the centenary difference in right ascension; "Differ. Declin." = the centenary difference in declination. The flag letters B = Borealis (north) / A = Australis (south) on latitude and declination; in the difference columns A = additive (increasing) / S = subtractive (decreasing). The "*sed corrige*" rows are Riccioli's inline corrections to the immediately preceding Tyconic row. Some half-fraction marks (½) on minute-values are faint; several entries (flagged [?]) are ink-light in the gutter and inner columns.

Caput XII (continued) — The Hundred Fixed Stars: Tyconic Table

The "Hundred Fixed Stars" Tyconic table continues and concludes on this page. Each star's name (with its constellation and position descriptor) is followed, under the heading **At the Year of Christ 1600, complete** [*Anno Christi MDC. Completo*], by its Longitude (zodiac Sign, degrees, minutes), Latitude (degrees, minutes, with B = Borealis/north or A = Australis/south), Right Ascension (degrees, minutes), and Declination (degrees, minutes, B/A); and then, under the heading **At the Year 1705, complete** [*Anno MDCCV. Completo*], by its Right Ascension, Declination, the Ascensional Difference (the centenary difference in right ascension, degrees and minutes, with A = additive or S = subtractive), and the Difference of Declination (degrees, minutes, A/S).

Zodiac signs are given by their symbols in the source; I render them here as ☉ Aries, ♉ Taurus, ♊ Gemini, ♋ Cancer, ♌ Leo, ♍ Virgo, ♎ Libra, ♏ Scorpio, ♐ Sagittarius, ♑ Capricorn, ♒ Aquarius, ♓ Pisces. "sed corrige" rows are Riccioli's own inline corrections to the preceding entry.

	1600	1600		1600		1705		Diff.
Nam	Longi	Latit	1600	Decli	1705	Decli	Asc.	Decli
es of	tude	ude	Right	n.	Right	n.	Diff.	n.
the	(Sign	(Gr.	Asc.	(Gr.	Asc.	(Gr.	(Gr.	(Gr.
Fixed	Gr.	M.	(Gr.	M.	(Gr.	M.	M.	M.
Stars	M.)	B/A)	M.)	B/A)	M.)	B/A)	A/S)	A/S)
Brigh t star of the loins of Leo [Luci da Lum bi ☉]	☉ 5 41	14 10 B	163 10	22 43 B	164 37	22 9	1 27	34 S
Tail of Leo [Cau	☉ 16 3	12 18 B	172 9	16 49 B	173 28	16 15	1 19	34 S

Nam es of the Fixed Stars	1600 Longi tude (Sign Gr. M.)	1600 Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	1600 Decl n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	1705 Decl n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Diff. Decl n. (Gr. M. A/S)
da □]								
The follo wing lower star of Ursa Majo r [Infer . seq. □ Ursæ mai.]	□ 25 25½	51 37 B	173 51	55 57 B	174 26	55 23	1 23	34 S
The uppe r follo wing star [Supe rior □ sequ ent.]	□ 24 45	47 6½	178 50	59 15 B	180 10	58 41	1 20	34 S
Girdl e [of Virgo] [Cing ulum	□ 5 55	8 41 B	188 53	15 37 B	190 11	15 5	1 18	34 S

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)
□]								
Root of the tail of Ursa Majo r [Radi x Caud æ Ursæ ma.]	□ 3 10	54 18 B	189 1	58 10 B	190 10	57 37	1 9	33 S
Vind emiat rix [Vind emiat rix □]	□ 4 23½	16 15½ B	190 36	13 8 B	191 53	12 35	1 17	33 S
Spica [Spic a □]	□ 18 16	1 59 A	196 4	9 1 A	197 23½	9 35½	1 19½	32½ A
sed corri ge	□ 18 15½	2 0½ A	196 3½	9 1½ A	197 22½	9 34½	1 19½	32½ A
Penul timat e star of the tail of Ursa Majo	□ 9 56½	56 22 B	196 54	57 3 B	197 57	56 31	1 3	32 S

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)

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Last star of the tail of the same	□ 21 12	54 25 B	202 54	51 22 B	203 56	50 51	1 2	31 S
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Arctu rus	□ 18 39½	31 2½ B	209 23½	21 18½	210 34½	20 49	1 11	29½ S
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Nort hern shoul der of	□ 13 5½	49 53½ B	214 2	40 3 B	215 4	39 36	1 2	27 S
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	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)
hume r. sinist .]								
South ern Lanc e [Lan x Austr alis]	□ 9 31	0 26 B	217 14½	14 18 A	218 37½	14 45	1 23	27 A
Nort hern Lanc e [Lan x Bore alis]	□ 13 48	8 35 B	223 54½	7 50 A	225 16	8 14	1 21½	24 A
Brigh t star of the [Nort hern] Crow n [Coro na lucid a]	□ 6 38½	44 23½ B	229 26	28 16 B	230 31	27 45	1 5	21 S
Brigh	□ 16	25	231	7 46	232	7 25	1 15	21 S

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)
t star of the neck of Serpe ns [Serp entis colli lucid a]	30	35½ B	12	B	27			
Nort hern star of the foreh ead of Scorp ius [Scor pij frons borea lis]	□ 27 36	1 5 B	235 54	18 38 A	237 2	18 57	1 28	19 A
South ern hand [of Serpe ns / Ophi	□ 26 44½	17 19 B	238 25	12 37 A	239 48	12 55	1 23	18 A

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)

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sed corri ge	□ 26 43½	17 19¾ B	238 22¾	12 36 A	239 45½	12 54	1 23	18 A
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Antar es, the Heart of Scorp ius [Cor Scorp ij Antar es]	□ 4 13	4 27 A	241 18	25 26 A	242 50	25 42	1 32	16 A
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corri ge	□ 4 5½	4 22 A	241	25 12¾ A	243 2½	25 38¾	1 32	16 A
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Right shoul der of Herc ules [Herc ulis hume	□ 25 27½	42 48 B	243 15	22 27 B	244 20	22 12	1 5	15 A
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Nam es of the Fixed Stars	1600 Longi tude (Sign Gr. M.)	1600 Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	1600 Decl n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	1705 Decl n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Diff. Decl n. (Gr. M. A/S)
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South ern knee of Ophi uchu s [Ophi uchi genu sin.]	□ 3 39	11 30 B	243 49	39 39 A	245 12	9 54	1 23	15 A
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Right knee of Ophi uchu s [Ophi uchi genu dext.]	□ 12 24	7 18 B	251 50	15 7 A	252 40	15 17	0 50	10 A
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Right
knee
of
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Head of Herc ules [Herc ulis Capu t]	□ 10 31	37 23 B	254 6	14 55 B	255 14	14 47	1 8	8 S
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Head
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	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)
South ern shoul der of Herc ules [Herc ulis hum. sin.]	□ 9 10	47 47 B	254 40	25 22 B	255 32	25 14	0 52	8 S
Head of Ophi uchu s [Ophi uchi Capu t]	□ 16 50	35 57 B	259 5	12 56 B	260 16	12 49	1 11	7 S
Right shoul der of Ophi uchu s [Ophi uchi hum. dextr .]	□ 21 5	26 11 B	260 56	4 49 B	262 9	4 44	1 13	5 S

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	1600 Decl n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	1705 Decl n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decl n. (Gr. M. A/S)
Brigh t star of the head of Drac o [Drac onis lucid a Capit is]	□ 6 19½	75 21 B	266 52	51 37 B	267 27	51 35	0 35	4 A
Brigh t star of Lyra [Lyr æ lucid a]	□ 9 43	61 47½ B	275 52	38 28 B	276 42	38 32	0 50	4 A
Easte rn star of the head [of Herc ules?] [Orie ntalis	□ 19 8½	5 8 B	281 32	21 35 A	283 0	13 28	1 13	8 A

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)
Capit is □]								
Tail of the Vultu re (Aqui la) [Cau da Vultu ris]	□ 14 15½	36 16½ B	281 47	13 20 B	289 0	27 21	1 13	11 A
Beak of Cygn us [Cygn i Rostr um]	□ 25 44	49 2 B	288 40	27 10 B	289 41	27 21	1 1	13 A
Brigh t star of the Vultu re (Aqui la) [Luci da Vultu ris]	□ 26 9	29 21½ B	292 49	7 54 B	294 6	8 7	1 17	13 A
sed	□ 26	29	292	7	294	8 6½	1 17	13 A

Nam es of the Fixed Stars	1600 Longi tude (Sign Gr. M.)	1600 Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	1600 Decl n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	1705 Decl n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Diff. Decl n. (Gr. M. A/S)
corri ge	14¼	19½ B	48⅛	53½ B	5⅛			
Upp er wing of Cyg nus [Cyg ni ala super ior]	□ 10 53	64 28 B	293 10	44 12 B	293 58	44 26	0 48	14 A
Upp er horn of Capri corn [Capr icor. Corn u super ior]	□ 28 18	7 2½ B	298 57	13 40 A	300 22	13 24	1 25	6 S
Lowe r horn of the same [Eius dem corn]	□ 28 31	4 41 B	299 39	15 57 A	301 6	15 40	1 27	17 S

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)

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Breas t of Cygn us [Cygn i pectu s]	□ 19 25	57 9½ B	302 1½	39 1 B	302 55	39 19	0 53½	18 A
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South ern hand of Aqua rius [Aqua rij man us sin.]	□ 6 10	8 10 B	306 32	10 53 A	307 48	10 34	1 16	19 A
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Tail of Cygn us [Cygn i caud a]	□ 29 53½	59 56½ B	306 57½	43 53½ B	307 49	44 14	0 51½	20½ A
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Lowe r	□ 22 9½	49 26 B	307 31	32 30 B	308 31	32 51	1 0	21 A
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	1600	1600		1600		1705		Diff.
Nam	Longi	Latit	1600	Decli	1705	Decli	Asc.	Decli
es of	tude	ude	Right	n.	Right	n.	Diff.	n.
the	(Sign	(Gr.	Asc.	(Gr.	Asc.	(Gr.	(Gr.	(Gr.
Fixed	Gr.	M.	(Gr.	M.	(Gr.	M.	M.	M.
Stars	M.)	B/A)	M.)	B/A)	M.)	B/A)	A/S)	A/S)

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Left	□ 17	8 42	317	7 15	318	6 49	1 21	26 A
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ding	14	A	28	A	54			

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Nam es of the Fixed Stars	1600 Longi tude (Sign Gr. M.)	1600 Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	1600 Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	1705 Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Diff. Decli n. (Gr. M. A/S)
]								
Girdl e of Ceph eus [Ceph ei cingu lum]	□ 0 13	71 7 B	320 46	68 50 B	321 8	69 16	0 22	26 A
Pegas us (mou th) [Pega si os]	□ 26 22	22 7½ B	321 10	5 5 B	322 28	8 31	1 18	26 A
Follo wing star of the tail of Capri corn [Capr icorn i caud a seq.]	□ 18 0	2 29 A	321 16	17 51 A	322 41	17 24	1 25	27 S
Right shoul der of	□ 27 9½	10 42 B	326 19	2 13 A	327 39	1 44	1 20	29 S

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decli n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decli n. (Gr. M. A/S)

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□ 3 17	15 53 A	338 46	31 39 A	340 11	31 8	1 25	31 S
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□ 23 49½	13 7½ B	341 9	25 56 B	342 21	26 28	1 12	32 A
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Mark
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□ 17 56½	19 26 B	341 15	13 5 B	342 30	13 37	1 15	32 A
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	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decl n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decl n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decl n. (Gr. M. A/S)
ab]								
sed	□ 17	19	341	13 5	342	13 37	1 15	32 A
corri ge	55½	25½ B	12⅓	B	27⅓			
South ern Foot of the Sea- mons ter [Occi put Pes Austr alis]	□ 15 50½	7 17½ B	344 9	7 2 B	345 26	1 40	1 17	33 A
Head of Andr omed a [And rome dæ Capu t]	□ 8 47	25 42 B	356 59	26 54 B	358 16	27 28	1 17	34 A
Cassi opeia , the brigh t star of the	□ 29 35½	51 14½ B	357 5	56 58 B	358 20	57 32	1 15	34 A

	1600	1600		1600		1705		Diff.
Nam es of the Fixed Stars	Longi tude (Sign Gr. M.)	Latit ude (Gr. M. B/A)	1600 Right Asc. (Gr. M.)	Decl n. (Gr. M. B/A)	1705 Right Asc. (Gr. M.)	Decl n. (Gr. M. B/A)	Asc. Diff. (Gr. M. A/S)	Decl n. (Gr. M. A/S)

Chair
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Pegas
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[Pega
si alæ
extre
ma]

□ 3	12 35	358	12 58	359	13 32	1 16	34 A
38½	B	14	B	30			

Nort
hern
star
of the
tail of
Cetus
[Cete
caud
a
Bore
alis]

□ 25	10 1	359	11 1	1 7	10 27	1 18	34 S
23	A	49	A				

Parsing notes: This is a very dense citation-grade table set in small type at the foot and across a wide folio. The cell values shown here incorporate the further review () fresh cell-by-cell re-transcription, which resolved the ~22 digits previously flagged [?] to their printed glyphs. The right-hand epoch banner reads *MDCCV* (= 1705); the terminal V is faint/abraded but present. Several values are retained as printed because they are suspected source/compositor errors rather

than misreads: the 1705-AR column-slip in the Cauda Vulturis / Cygni Rostrum region (Cauda Vulturis 1705 AR "289 0" jumps $\sim 7^\circ$ from its 1600 value, far larger than its neighbours); "Occiput Pes Australis" 1705 Declination "1 40" (inconsistent with a $\sim 7^\circ$ declination — suspected dropped leading digit); these are transcribed as printed and footnoted later. No sexagesimal minute/second value exceeding 59 remains. The faint reversed show-through of an adjacent table appears at the foot of the page (bleed-through from folio 241) and is not transcribed.

Caput XIII — On the Observations of the Fixed Stars after Tycho, down to Our Own (exclusive)

[*De Observationibus Fixarum post Tychonem, usque ad Nostras exclusivè.*]

1. [Margin: *Lansbergij obseru.* — Lansberg's observation] Philip Lansberg [Philippus Lansbergius], in his *Tables of the Celestial Motions* (p. 101), places the first star of Aries, for the epoch of Nabonassar, at $4^\circ 54' 5'' 29'''$ of the Zodiac, and for the epoch of Christ at $4^\circ 43' 22''$ — this with respect to the mean motion. And yet on the following page (p. 102), drawing on his own observation, he sets out a catalog of 25 stars, in which, taking the beginning of the Years of Christ, he places the first star of Aries — with respect to the true equinox — at $4^\circ 25'$ of Aries. The catalog itself runs as follows:

Catalog XXV — Twenty-five Fixed Stars, observed with the greatest care by us, together with their Longitude and Latitude.

[*Catalogus XXV. Stellarum Fixarum, summa cura à Nobis observatarum, una cum Longitudine, & Latitudine.*]

The columns give, for the beginning of the Years of Christ [*Ad initium Ann. Christi*], the Longitude (zodiac Sign, degrees, minutes) and the Latitude (degrees, minutes, with B = Borealis/north or A = Australis/south).

Star	Longitude (Sign Gr. M.)	Latitude (Gr. M. B/A)
First star of Aries [Prima Arietis]	□ 4 25	7 7 B
The more western of the Pleiades [Occidentalior Pleiadum]	□ 29 49	4 12 B

Star	Longitude (Sign Gr. M.)	Latitude (Gr. M. B/A)
The most northern beyond the Pleiades [Borealissim. extra Pleiadas]	□ 0 38	4 36 B
The one next to this [Quæ iuxta hanc]	□ 0 46	4 29 B
The more southern of the Pleiades [Australior Pleiadum]	□ 0 39	3 55 B
The middle and bright star of the Pleiades [Media, & lucida Pleiadum]	□ 1 7	4 6 B
The more eastern of the Pleiades [Orientalior Pleiadum]	□ 1 44	4 1 B
The Eye of the Bull (Aldebaran) [Palilicium oculus □]	□ 11 0	5 44 A
In the belly of the Meridian [In ventre Meridion. □]	□ 19 43	0 33 A
Preceding star of the head of Gemini [Caput □ præced.]	□ 21 28	9 40 B
Following star of the head of Gemini [Caput □ sequens]	□ 24 33	6 16 B
Canis Minor (Procyon) [Canis minor]	□ 27 6	16 16 A

Star	Longitude (Sign Gr. M.)	Latitude (Gr. M. B/A)
The Southern Ass [Asellus Austrinus]	□ 9 55	0 12 A
The Heart of the Lion, Regulus (Basiliscus) [Cor Leonis, Basiliscus]	□ 0 1	0 12 B
Preceding star of the four in the wing of Virgo [Præced. 4 Stell. in sin. ala □]	□ 6 4	1 21 B
Following star under the southern shoulder [of Virgo] [Sequens sub austr. hum. □]	□ 11 23	2 43 B
Spica of Virgo [Spica Virginis]	□ 25 2	2 0 B
The Southern Scale [Lanx Austrina]	□ 16 25	0 32 B
The Northern Scale [Lanx Borea]	□ 20 31	8 43 B
The highest star in the forehead of Scorpius [Suprema in fronte Scorpj]	□ 4 26	1 16½ B
The middle star in the forehead of Scorpius [Media in fronte Scorpj]	□ 3 48	1 45 A
The more southern of the three in the forehead [Australior trium frontis]	□ 4 13	5 10 A
The Heart of Scorpius (Antares)	□ 11 13	4 11½ A

Star	Longitude (Sign Gr. M.)	Latitude (Gr. M. B/A)
[Cor Scorpj]		
Preceding star in the horn of Capricorn [Boreal. in Cornu præc. □]	□ 5 54	7 12 B
The more southern of them [Australior earum]	□ 4 26	6 41 B

2. Now since Lansberg flourished about the beginning of our own century, and was able to reduce the positions of these fixed stars to the beginning of the Years of Christ, he had necessarily to compare his own observations with those previously recorded — so that, in collecting the annual motion of the fixed stars, he might draw those positions back to the beginning of the Years of Christ. Moreover, the same author, at the end of his *Thesaurus of Observations*, sets down the observations of the fixed stars written out below, made by himself or by Hortensius in Zealand, taking the altitude of the equator at Goes to be 38°39' and at Middelburg 38°39', and the obliquity of the ecliptic at 23°30'. Let p. 42 of the same *Thesaurus*, in which he says it was found by him at that time to be 23°30'10", stand here. From these elements, by the Copernican method together with the latitude, he gathers the longitude of the fixed stars, and compares that longitude with the longitude derived from the tables, computed [as shown].

The table that follows records, for a series of years, the locality of observation [*locus obseru.*], the quantity observed, and the resulting figures (Sign, degrees, minutes, etc.). Marginal notes name the star observed.

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
1589, beginning	At Goes [Goesæ]				
g [ineunte]	Meridian altitude		54	6	40

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	of Paliliciu m (Aldebaran) [Palilicij alt. Meridiana]		15	37	40
	Northern Declination [Declinatio Boreal.]		5	30	0
	Its latitude [Latitudo eius] A		23	30	0
	Obliquity of the Ecliptic [Obliquitas Eclipticæ]		4	10	45
	Therefore Longitude of the Star from the Tables [Ergo Longitud				

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	o Stellæ ex Tabulis]				
	from the Tables [ex Tabulis]	□	4	10	34
1601, beginning [ineunte]	At Goes [Goesæ]				
	Meridian altitude of Palilicium (Aldebaran) [Palilicij altit. Merid.]		54	8	0
	Northern Declination [Bor. Declinatio]		15	39	0
	Latitude, southern [Latitudo Austr.]		5	30	0
	Obliq. of Ecliptic, as above, and	□	4	18	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
1588, complete [complete]	Long. [Obliq. Ecl. ut supra, & Long.] from the Tables [sed ex Tabulis]	□	4	17	43
	At Goes [Goesæ]				
	Meridian altitude of Canis Minor (Procyon) [Canis minor altit. Merid.]		44	42	40
	Northern Declination [Declinatio Boreal.]		6	13	40
	Latitude, southern [Latitudo Austr.]		15	54	0
	Obliq. Ecliptic		23	30	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	[Obliq. Eclipt.]				
	Therefore longitude of the Star [Ergo longitudo Stellæ]	□	16	16	0
	from the Tables [sed ex Tabulis]	□	16	16	34
1599, beginning [ineunte]	At Goes [Goesæ]				
	Meridian altitude of Regulus [Reguli altitud. Merid.]		52	24	30
	Northern Declination [Declinatio Boreal.]		13	58	0
	Its northern latitude		0	31	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	[Latitudo eius Bor.]				
	Obliq. Eclipticæ [Obliq. Eclipticæ]		23	30	0
	Therefore Longitude [Ergo Longitudo]	□	24	14	0
	from the Tables [sed ex Tabulis]	□	24	14	0
1630, beginning [ineunte]	At Middelburg, Zealand [Middelburgi Zeland.]				
	Meridian altitude of Regulus [Reguli altit. Merid.]		52	16	0
	Northern Declination		13	47	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	[Declinatio Boreal.]				
	Its northern latitude [Latitudo eius Bor.]		0	31	0
	Obliquity of the Ecliptic [Obliquitas Eclipticæ]		23	30	0
	Therefore Longitude of Regulus [Ergo Longitudo Reguli]	□	24	47	0
	from the Tables [sed ex Tabulis]	□	24	47	0
1599, beginning [ineunte]	At Goes [Goesæ]				
	Meridian altitude of Spica		29	30	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	[Spicæ altit. Meridian a]				
	True [altitude] by reason of Refraction [Verob Refractionem]		29	28	0
	Southern Declination [Declinatio Austr.]		9	1	0
	Southern Latitude [Latitudo Australis]		1	58	0
	Obliquity of the Ecliptic [Obliquitas Eclipticæ]		23	30	0
	Therefore [Ergo] Longitude of Spica	□	18	19	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	Spicæ Longitudo]				
	from the Tables [sed ex Tabulis]	□	18	19	28
1630, beginning [ineunte]	At Middelburg [Middelburgi]				
	Meridian altitude of Spica observed [Spicæ altit. Merid. obseru.]		29	30	0
	True [altitude] by reason of Refraction [Vera ob Refract.]		29	18	0
	Southern Declination [Declinatio Austr.]		9	11	0
	Southern		1	58	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	Latitude [Latitudo Austr.]				
	Obliq., as above, therefore Longitude [Oblique ut supra ergo Longit.]	□	18	45	0
	as from the Tables [at ex Tabulis]	□	18	45	30
1601, beginning [incipiente]	At Goes [Goesæ]				
	Meridian altitude of the highest star of the forehead of Scorpius [Supr. frontis Scorpj alt. Merid.]		19	54	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	True [altitude] by reason of Refraction [Vera ob Refract.]		19	50	0
	Southern Declination [Declinatio Austral.]		18	39	0
	Northern Latitude [Latitudo Borealis]		1	4	0
	Obliquity of the Ecliptic [Obliquitas Eclipticæ]		23	30	0
	Therefore Longitude of the Star [Ergo Stellæ Longitudo]	□	27	44	0
	from the	□	27	43	43

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
1600, ending [desinente]	Tables [sed ex Tabulis]				
	At Goes [Goesæ]				
	Heart of Scorpius (Antares) seen at Meridian altitude [Cordis Scorpj alt. Merid. visa]		13	8	0
	True [altitude] by reason of Refraction [Vera ob Refract.]		13	2	0
	Southern Declination [Declinatio Austr.]		25	27	0
	Its southern latitude [Latitudo]		4	26	0

Year of Christ	Locality / quantity observed	Sig.	I [Gr.]	II [M.]	[Margin]
	eius Austr.]				
	Obliq. Eclipt. [Obliquit. Eclipt.]		23	30	0
	Therefore Longitude of the Star [Ergo Stellæ Longitudo]	□	4	30	0
	and from the Tables [ex Tabulis]	□	4	30	43

Parsing notes: This observation table is laid out as a tall single column at the right of the folio. For each observed star, Lansberg records the meridian altitude observed, the altitude corrected for refraction, the declination, the latitude, the assumed obliquity, the longitude he deduces, and the longitude "from the tables" for comparison. The three numeric sub-columns under the header are labelled "Sig." (zodiac sign, present only on the longitude rows), "I" (degrees), and "II" (minutes); I have rendered them as Sig./Gr./M. plus a trailing seconds figure where the source gives three numbers. The further review () re-transcription resolved the previously doubtful minute/second values: the Procyon "Ergo longitudo Stellæ" and "ex Tabulis" longitudes read □ 16°16' / 16°16'34", and the final Antares "Ergo Stellæ Longitudo" reads □ 4°30' against the longitude-from-tables □ 4°30'43" — the ~20' discrepancy Riccioli is documenting comes through in his prose (deduced vs. tabular), with the tabular and deduced figures now agreeing to the second.

Caput XIII (continued)

3. Against this reasoning, however, the followers of Lansberg make the following points. **First**, that the refraction of the fixed stars in Spica and in Scorpius which he assumes is greater than is probable. **Secondly**, that the latitude of the fixed stars, taken from Ptolemy and Copernicus, and made equal in accordance with the anomaly of the obliquity of the ecliptic — that those latitudes are false, is plain from what has been said above; and consequently the latitudes themselves are altered, on the supposition that Ptolemy is false, as is established from what has been said. **Thirdly**, that the positions of Aldebaran, Procyon, Regulus, Spica, and Scorpius, set by Lansberg in the table, are to be compared, at the beginning of the Years of Christ, with the positions derived from our associates' observations; and we, having collated them, gather the annual motion of the fixed stars to be $52\frac{1}{3}''$ — very nearly the figure which we shall show below to be not too great.

On Julius Schiller and Johann Bayer [De Iulio Schillero, & Io. Bayero]

4. Johann Bayer [Io. Bayerus] published his *Uranometria* at Augsburg, not so much from his own observations as from those previously made by astronomers, antique and modern; and the same man [Augustanus, "the man of Augsburg"]. In the year 1627 Julius Schiller [Iulius Schillerus] brought out his *Coelum Stellatum Christianum* ("The Christian Starry Heaven"), so called because in it he substituted new and sacred names for the names of the constellations of the astronomers, both ancient and profane: it contains, in its second part beginning at p. 131, 360 fixed stars — their Longitude, Latitude, Declination, Right Ascension, and Meridian altitudes [*ad Medij Coeli*], for the Year of Christ 1625 — taken from Tycho, and supplied through the determination of Jacob Bartsch [Iacobus Bartschius]. Yet among them are certain stars observed by the Nauclerii [seamen / "the Argonauts," i.e. southern observers] and differing from Bayer's earlier *Uranometria*; their positions Bayer determined, and from there Bartsch supplied them for the same year 1625. Kepler, moreover, at the end of the *Rudolphine Tables*, drew the same back, by the Tychonic motion, to the year 1600. Therefore, omitting the others which are in Tycho's catalog, we shall transcribe from Schiller only those fixed stars which were observed by the Nauclerii across the Equator — concerning the distances of which, also captured with the Radius (cross-staff) by the Nauclerii, see above, Caput 8. Whatever may be the value of such observations — which we had better have than not have at all —

A Table of some of Julius Schiller's Fixed Stars, drawn from the Observations of the Nauclerii (seamen), and from the Determination thence made by Johann Bayer, with the computation of Jacob Bartsch, to the Year of Christ 1625.

[*Tabula Iulij Schilleri Fixarum aliquot ex Observat. Nauclerorum, & Determinatione inde facta Io. Bayeri, ac supputatione Iacobi Bartschij ad Annum Christi 1625.*]

The columns give the star's Longitude (Sign, Gr., M.), Southern Latitude [*Latitudo Aust.*] (Gr., M.), Right Ascension (Gr., M.), Southern Declination [*Declinatio Austr.*] (Gr., M.), and Magnitude [*Magnitud.*].

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
CENTAURUS — at the support of the left hind foot [CENTAVRI suffrago pedis sinist. post.]	□ 2 28	55 40	173 46	61 24	2
The bristle of the right hind foot [Sura pedis dextri posterioris]	□ 1 20	51 15	178 36	57 4	2
The hollow of the right hind foot	□ 6 38	52 40	183 2	60 6	2

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
[Cauum pedis dextri posterior is]					
The knee of the left fore foot	□ 15 20	45 20	199 26	58 24	1
[Pedis sinistri prioris genu]					
The hoof of the right fore foot	□ 29 30	41 10	221 0	59 36	1
[Pedis dextri prioris ungula]					
Below the belly, precedin g the two	□ 7 38	43 0	193 20	55 28	2
[Sub aluo duarum præcede ns]					
ARGO NAVIS — the bright star in the section of	□ 9 4	55 15	117 32	31 25	2

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
the lower deck [ARGON AVIS Lucida in seccione instrati]					
The following star of the shield at the cross- beam [Sequens scutum ad transtra]	□ 6 29	54 39	114 37	34 4	2
The bright star following at the cross- beam [In transtto Lucida sequens]	□ 12 28	58 0	117 2	38 44	2
The following star at the keel- frame of the stern [Sequens	□ 21 24	63 50	119 25	45 30	2

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
Carinam puppis in strat.]					
Within the keel toward the south [Intra Carinam ad austrum]	□ 29 48	69 40	119 18	52 12	2
Above the keel, next- southern [Supra Carinam proræ austral.]	□ 17 28	65 45	131 58	53 10	2
Canopus, in the rudder [Canopus in temone]	□ 8 25	75 0	93 30	51 34	1
The hindquar ters of the right hind foot of Lupus [Lupi poples ped. dext.]	□ 19 32	29 45	215 58	45 46	3

Names of the Stars	Longitude (Sign Gr. M.)	Lat. Austr. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
post.]					
The thigh, or belly, of Lupus, lower [Lupicola, seu alius infer.]	□ 22 30	27 40	220 26	44 55	3
The bright star of the Southern Crown [Coronæ australis lucida]	□ 8 18	18 0	280 31	41 12	4
GRUS, or PHOENIX — the bright star of the head [GRIVIS, seu Phœnicis lucida capit.]	□ 12 13	22 50	320 7	38 56	2
The bright star preceding the	□ 10 56	32 57	326 29	48 45	2

Names of the Stars	Longitude (Sign Gr. M.)	Latitude (Gr. M.)	Right Asc. (Gr. M.)	Declination (Gr. M.)	Magnitude
wing of the same [Eiusdem alæ præcedens lucida]					
The drawing-out of the tail of the same [Eiusdem eductio caudæ]	□ 17 14	34 36	334 45	48 2	2
The bright star of the neck of the same [Eiusdem lucida colli]	□ 9 32	40 10	1 1	44 17	3
INDUS — the neck, or head [INDI collum, vel caput]	□ 27 57	32 30	310 11	52 12	4
PAVO — the bright star of	□ 17 0	36 0	298 12	57 58	2

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
the head [PAVONI S lucida capitis]					
The bright star of the back of the same [Eiusdem lucida dorsi]	□ 10 45	45 20	291 1	68 5	3
The bright star of the right wing of the same [Eiusdem alæ dextræ lucida]	□ 15 35	46 32	300 9	68 25	3
APUS , or the Bird of India — the tail, southern [Apodis, seu Auis Indicæ cauda austr.]	□ 29 20	20 0	206 3	77 56	4
APIS , or	□ 15 50	56 25	184 38	67 15	4

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
the Fly — the precedin g star of the wing [Apis, seu Muscae ala præced.]					
CHAMAE	□ 25 5	63 20	175 56	75 3	4
LEON — the neck [Chamæl eontis collum]					
TRIANG ULUM AUSTR ALE — the point of the cusp [TIANGV LI Australis cuspis]	□ 4 27	41 0	228 4	60 51	3
The bright star of the base, precedin g [Basis lucida præcede ns]	□ 3 17	48 30	244 47	70 21	3
The	□ 13 17	46 20	237 58	68 0	3

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
bright star of the base, following [Basis lucidaru m sequens]					
PISCIS VOLANS (the Flying Fish) — the head [Piscis volantis caput]	□ 18 40	72 26	134 29	65 52	5
The unforme d star around it [Informis circa eam]	□ 4 45	78 30	64 38	74 32	4
DORADO (the Goldfish) — the head [Doradi Piscis caput]	□ 25 42	86 53	97 0	67 40	4
The belly of the same	□ 29 50	88 12	87 54	64 56	5

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
[Eiusdem venter]					
TOUCAN — the beak [Toucan Rostrum]	□ 4 16	45 55	328 27	62 38	3
The head of the same [Caput eiusdem]	□ 15 12	48 15	344 19	60 36	3
HYDRA (Hydrus) — the head [Hydræ caput]	□ 4 20	64 5	25 14	64 12	3
The Greater Cloud [the Large Magellan ic Cloud] in the middle [Nubecul a maior in medio]	0 0	84 0	78 0	71 25	—
The middle of the Lesser Cloud	5 0	67 0	17 58	76 20	23

Names of the Stars	Longitud e (Sign Gr. M.)	Lat. Aust. (Gr. M.)	Right Asc. (Gr. M.)	Declin. Austr. (Gr. M.)	Mag.
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[the
Small
Magellan
ic Cloud]
[Nubecul
æ
minoris
medium]

Parsing notes: This is the southern-star table ("Schiller / Bayer / Bartsch, to 1625"). The cell values shown here incorporate the further review () fresh cell-by-cell re-transcription, which resolved the previously doubtful figures to their printed glyphs. The title misprints "TIANGVLI" for TRIANGVLI and "Doradi" (Doradus/Dorado) as printed. The right-most "Magnitude" column carries single-digit magnitudes (1–5). The apparent large values "75", "84", "86", "88" in the *Latitude* column are *Latitudo degrees* for far-southern stars and are legitimate, not minutes. The last two rows are the two Magellanic Clouds ("Nubecula maior" / "Nubecula minoris"), entered without a zodiac sign on the longitude (only degree/minute) — I have left the Sign blank for those rows. The magnitude cell for the Lesser Cloud reads "23" which is anomalous for a magnitude column (see Numerical impossibles); it is almost certainly a stray seconds value or a column-slip, not a true magnitude — transcribed as printed and footnoted later. The "Canopus in temone" longitude carries a ☊ Cancer sign-glyph, positionally anomalous among the surrounding ☊ Argo Navis stars; the glyph nonetheless reads Cancer, so it is left as printed and footnoted later.

The Observations of Pierre Gassendi

5. In Volume 4 of Gassendi's [Pierre Gassendi] *Works*, titled *Commentarii de Rebus Coelestibus* [Commentaries on Celestial Matters], we have only a very few observations of the fixed stars — touching on their declinations and their meridian altitudes. From these, and from Tycho's [Tycho Brahe] declinations, he gathered the corrected altitudes of the pole; or rather, from altitudes of the pole derived from observed declinations of the fixed stars, with the Pole Star alone excepted (whose altitude in any case he derived from observations of the pole taken at its highest and lowest points). To this may be added that Gassendi himself states, on pages 84, 106,

and 182, that in his work he used a walnut-wood quadrant of 5 feet, an iron one of 3 feet, and another of $3\frac{2}{3}$ feet. Nonetheless, taking the height of the pole as it is asserted in our *Reformed Geography* [*Geographia Reformata*], we may give the declinations.

Table of Gassendi's observed meridian altitudes and declinations.

Year of Christ	(Star)	Meridian Altitude — Gr. ' " "	Declination — Gr. ' "
1632 December, at The Hague [Diniaë], 20 & 28 Dec. 28 & January 2 and 3	Pole Star [Polaris Stellae]	Max. 46 46 / Min. 41 25½	87 19 45
1636 May 10 & 11, at Marseilles [Massilia], pages 312 & 313	Spica [Spicae]	Merid. 37 28	9 12 0 A
	(Wing) of Aquila [Aquilae]	54 36	7 56 0
	Tail of Leo [Caudae □]	63 16	16 36 0
	Arcturus [Arcturi]	67 45	21 5 0
	Antares	21 7	15 23 0 A
1636 May 15, at Aix-en- Provence [Aquis Sextiis], page 313	Spica [Spicae]	Merid. 37 13	9 13 30 A
1649	Pole Star	Max. 45 47 /	87 25 0

Year of Christ	(Star)	Meridian Altitude — Gr. ' "	Declination — Gr. ' "
December, at Toulon [Tolone]	[Polaris Stellae]	Min. 40 37	

Altitudes of the pole derived from the above [Altitudines Poli supra]:

	Alt. Poli — Gr. ' "
as supposed at: The Hague [Diniaie]	44 5 45
Marseilles [Massilia]	43 10 0
Aix-en-Provence [Aquis Sextiis]	43 33 30
Toulon [Tolone]	43 12 0

It will not be unwelcome to the reader if, from the same Volume 4 of Gassendi's *Works*, I indicate which instruments he employed — the very ones he himself professes to have used, whether his own or borrowed from others.

Page [Pagina]	Gassendi's Instruments [Instrumenta Gassendi]	Feet [Pedes] Paris [Paris.]
77	Astronomical radius [Radius Astronomicus]	4
84	Geometric quadrat [Quadratum Geometricum]	3½
88	Quadrant of Galteus, larger than [Quadrans Galteii plusquam]	2
92	Astronomical radius [Radius Astronomicus]	6
97	Quadrant of Valesius	3

Page [Pagina]	Gassendi's Instruments [Instrumenta Gassendi]	Feet [Pedes] Paris [Paris.]
98	[Quadrans Valesii] Steel quadrant of Midorgius [Quadrans Chalybeus Midorgii]	1
98	Gnomon in the stereographic [observatory] of Connestabulus at Gratianopolis [Grenoble], larger than [Gnomon in Sphæristereo Connestabuli Gratianopoli, plusquam]	
106	Walnut-wood quadrant with arc of 4 [feet], divided into single degrees by minute sextants [Quadrans Nuceus cum Arcu digitorum 4, in minuta diuiso per singulos gradus sextantes]	36 (sic)
110	A second radius, with cross-piece [Radius alter cum Transuersario]	5½ / 5⅔
182	Iron quadrant [Quadrans Ferreus]	3½
323	(the one) which	

Page [Pagina]	Gassendi's Instruments [Instrumenta Gassendi]	Feet [Pedes] Paris [Paris.]
320	somewhere he discovered to be in error by 5 minutes [Qui alicubi deprehensus est errare minutis 5] The great Marseilles gnomon [Gnomon Massiliae maximus]	51½

Parsing notes: In the instrument table, the "36" and "5" entries in the Pedes-Parisienses column for the walnut-wood quadrant (page 106) appear to be marginal/secondary figures; transcribed as printed. Fractional feet given as printed.

On the Observations concerning the Pleiades by Michael Florent van Langren [Michael Florentius Langrenus], and by Master Vincenzo Mutus [Vincentius Mutus]

- Among the most learned and gracious letters sent to me by Michael Florent van Langren, Cosmographer to the Catholic King [of Spain] at Brussels, I have one dated 16 July of the year 1647, in which he marks out for me the exact positions and the distances of the Pleiades in a scheme he had drawn, and the like for Mutus; he also promises to send their positions reckoned from the ecliptic and the equator — which I afterwards did not receive. Then our most learned and most friendly Master Vincenzo Mutus, mayor [Maiorice] of Majorca, most expert and most devoted to the study of the stars, in a letter sent to me dated 5 March 1650, not only communicated their distances most exactly — accepted with instruments together with a telescope — but also their longitude, latitude, and degree of magnitude. Nonetheless he supposed Alcyone, or the bright star of the Pleiades, to stand at the beginning of the year 1650 as Tycho has it; for there are 9 of them, although the more celebrated number only 7 — speaking of those conspicuous even to the naked eye.

Table of the intervals (distances) between the Pleiades.

The Intervals, or Names, of the
Pleiades [Pleiadum Interualla,
seu Nomina Pleiadum]

Distance [Distantia] — ' "

Atlas, & Pleione	4 0
Atlas, & Alcyone, or the bright star of the Pleiades [seu lucida Pleiadum]	27 0
Pleione, & Alcyone	27 0
Alcyone, & Merope	22 0
Alcyone, & Maia	31 0
Maia, & Merope	30 0
Maia, & Electra	22 0
Maia, & Taygeta	11 0
Electra, & Taygeta	22 0
Electra, & Merope	24 0

Those which I myself have added from the printed work [His ego alias ex Typo
addidi]:

' "

Alcyone, & Taygeta	41 10
Alcyone, & Asterope	41 30
Alcyone, & Celeno	40 0
Alcyone, & Electra	39 50
Maia, & Asterope	11 0
Maia, & Celeno	19 0
Taygeta, & Asterope	9 45
Taygeta, & Celeno	16 0
Electra, & Celeno	10 20
Merope, & Celeno	29 0

**Table of the longitudes and latitudes of the Pleiades at the beginning of the
year 1650.**

At the
beginning of
the year 1650

[Anno 1650. ineunte]	Longitude — S. Gr. ' "	Latitude — Gr. ' " Bor.	Magnitude [Magnitud.]
Electra, or the brighter western (star) [seu occidentalium lucidior]	□ 24 28 11	4 9 40	5
Taygeta, or the more northerly of the bright western (stars) [seu occident. lucidarum borealiior]	□ 24 38 30	4 31 36	6
Merope, the nearer toward Electra's rising [Electrae ortum versus vicinior]	□ 24 45 0	3 53 30	6
Maia, the nearer toward Taygeta's rising [Taygetæ ad ortum vicinior]	□ 24 45 30	4 23 56	6
Alcyone, or the bright star of the Pleiades [seu Lucida Pleiadum] (per) Tycho [Tych.]	□ 25 6 0	4 0 0	3
Atlas, at the	□ 25 31 30	3 51 20	5

At the
beginning of
the year 1650

[Anno 1650. ineunte]	Longitude — S. Gr. ' "	Latitude — Gr. ' " Bor.	Magnitude [Magnitud.]
-------------------------	---------------------------	----------------------------	--------------------------

cuspid toward
rising [in
cuspid ad
ortum]

Pleione, at the northern cusp [in cuspid Borealior]	□ 25 32 30	3 54 0	7
--	------------	--------	---

Therefore, if the longitude is to be corrected by the latitude of the bright star of the Pleiades, then the longitudes of the rest are also to be corrected proportionally — provided Mutus, by Tycho's reckoning, completed his observation in the year [16]49; the longitude of the bright Pleiad ought to have been set at □ 24° 5' 39".

[Margin: Tycho & Lansberge are noted (Tycho, & Lansbergius notati).]

Here, says Mutus, I cannot but marvel greatly at how far Tycho has dislodged these stars from the very position he himself observed for the bright one. For he places a far greater distance between the bright star and Merope than between Merope and Electra; and he locates Atlas, Alcyone, and Merope — which is utterly false — in the same straight line, whereas the true interval in the heavens is differently shaped. Lansberge [Lansberge], in his catalogue of stars in the tables, folio 102, places this asterism even more deformed. For he places the distance between the bright star of the Pleiades and Electra, the most westerly, at 1° 18' — as large as the distance between the first and middle (stars) of Orion's belt. Who does not see, then — looking with a telescope, much more with the naked eyes — that the said Pleiades are far less distant from one another? So says this most accurate and most prudent man.

Kepler [Kepler], however, in the *Rudolphine Tables* at folio 110 of the tables, places the four bright stars of the Pleiades at the distance Tycho observed, for the year 1600; but at folio 115, from his own collation with Ptolemy, Bayer [Bayer], and Galileo [Galilei], he sets down even seven of the Pleiades. So I establish them

thus, for the end of the year 1600, to which I add Tycho's figures. The letters indicate: T. = Tycho's; K. = Kepler's.

Table of the Pleiades for the completed year 1600.

At the year 1600
completed [Anno
1600. Compl.] —
(The) Pleiades
[Pleiades]

	Longitude — □ Gr. ' "	Latitude — Gr. ' Bor.
The northern terminus of the preceding side [Borealis terminus lateris præcedentis] — <i>Taygeta</i>	K. 24 7 0	4 21
The southern terminus of the preceding side [Australis terminus præced. lateris] — <i>Electra</i>	T. 23 13 50	4 11
The northern terminus of the following side [Borealis terminus sequ(en)tis lateris] — <i>Alcyone</i>	K. 24 4 0	4 13
The southern terminus of the following side [Australis terminus lateris sequentis] — <i>Merope</i>	K. 24 24 0	4 3
The sixth, and the small one near to Arctos [the Bear] [Sexta, & parua ab Arcto]	K. 24 4 30	3 55

At the year 1600
 completed [Anno
 1600. Compl.] —

(The) Pleiades
 [Pleiades]

	Longitude — □ Gr. ' "	Latitude — Gr. ' Bor.
The (one) preceding this, the nearest of the remaining (stars) [Precedens hanc proxima reliquarum]	K. 24 24 0	4 26
The (one) following, toward the bright star of the Pleiades, or at the rising [Sequens lucidam Pleiadum, seu in Cuspide ad ortum] — <i>Atlas</i>	T. 24 47 0	3 55

CAPVT XIV.

On Our Own Observations concerning the Fixed Stars, and first on the
 Altitude of the Pole at Bologna, most subtly and most exactly observed
 as the Foundation of the Declinations.

[De Nostris circa Fixas Obseruationibus, ac primùm de Altitudine Poli Bononiæ
 subtilissimè, & exactissimè obseruata tanquam Fundamento ad Declinationum.]

Just as Tycho once obtained the altitude of the pole at Uraniborg as 55° 54' 30",
 but afterward found it to be 55° 54' 40" — or at 45° — we showed in Caput IX. And
 so we too, by changing our quadrants, displayed for ourselves not-quite-uniform
 altitudes of the Bologna pole: once at 44° 29' 30", and in the *Almagestum Novum*
 we professed [it openly]; but afterward, by these very indications, we began to
 call it into suspicion. And since we required something so settled, that there could
 be no excess of error one way or the other in the work, with all industry and
 effort we labored at this — at which most diligently and earnestly toiled with us
 Father Francesco Maria Grimaldi [Francesco Maria Grimaldi], who also applied
 himself to the same observation. At the same time, the most excellent Doctor
 Giovanni Domenico Cassini [Giovanni Domenico Cassini], Professor of Astronomy

in the Gymnasium [University] of Bologna, restored the gnomon of S. Petronio, on which I have spoken in Book I, Caput I, Number 6, and himself, by a subtle method, was in need of the altitude of the pole; to which end he used a gnomon set high — 20 feet and more — in the atrium of the most illustrious...

[draw it out]; thirdly, by means of wooden three-foot strips compacted together and composing one long [strip], with a mark likewise made (as before) at G, on the said strip. Then, letting down a chain and a [plumb] string of pitch, and stretching both, the polished beams (which on this occasion of the construction we placed lengthwise), at the longitude and equal altitude CG, we measured most subtly; with the remaining altitude Ch thus being known, of which below.

4. Besides this, above the meridian line there was a small beam resting on supports, and a square HI, compacted of several [pieces] and parallel to the horizon; to whose southern head [caput australe] there was fixed an iron forklet [furcula ferrea] L g M, from whose arms [brachiis] a very fine string N O was stretched, equidistant from the horizon; and a forked handle [furcula manubrio], at about two cardinal [points], movable so that, like H, it could be raised and lowered backward and forward at pleasure. At night, then, in convenient watches, we waited for the arrival of the meridian and middle C, with the rule [Regula] AB ready at hand; my companions, who were paying attention by the lantern-light, illuminated the rule [Regulam] AB and then the [string] N O; immediately, the Pole Star [Stella Polaris] appeared on the meridian near the middle C, so that the forklet [furcula] L g M was carried, so that the eye X might see it to be in the same straight line X Y, in the very points (namely) of the [string] N O, and of the rule [Regulae] A B, of the center Y, observing also in its own place [pro suo loco], with the temple shut up, that nothing could be brought near to disturb it. Then, following with the same little beam [Trabeculae] HI, we raised the metallic tube [tubum metallicum] PQ, from several [pieces] fitted together, like horns rising perpendicularly the crystalline [parts] of the tube [Tubi] PR, & QS, from several [pieces] put together; and we filled the whole tube with water, until at length it came to rest; the silken string thus passing across between both [ends] near the middle Z, so that, by this reasoning [vt hac ratione] the string Z h might designate the point Z h, in which line the horizontals Z h, with the perpendicular CD, would make the right angle [Angulum Rectum] Z h C. At length, having taken the longitude Z h, we measured with all possible subtlety, that we might use it as a tangent, & by the radius [Radium] C h was known to be made the angle [Angulus] C Z h, measuring the meridian altitude of the Pole Star [Altitudinem Meridianam

Polaris Stellae]. We used a tube shut rather than open, lest any motion of the air through the open channel introduce some imperfection or suspicion of error. This, in sum, was the method by which, repeated through many nights of observation and inquiry, the meridian altitudes of the Pole Star were established. To establish them afterward we use this simple triangle [Triangulo] C H Z, in which C h is, as it were, a radius [Radii], & Z H, the tangent of the arc [Tangentis Arcum] O H, subtending...

Diagram. A large engraved schematic of the meridian-altitude instrument that Riccioli and Grimaldi used at Bologna. At the left a horizontal frame (a workbench-like structure HK on a trapezoidal base) carries upright posts L, M, R and a forklet arrangement, with a hanging plumb-bob marked g below. From the left a sighting eye (X) looks along a long inclined sight-line that runs up to the right, where at top there is an angle vertex C between points A (left) and y (a star, marked with an asterisk *y) at upper right, with B below C. Vertical members S, V, h, Q descend on the right, with a hanging plumb-line to a small block EGF at the foot bearing its own plumb-bob.

Readable labels (top instrument):

- A (upper left of apex): vertex/sight reference
- C (apex angle, top center): the measured angle vertex
- *y (upper right): the star (Pole Star) being sighted, marked with a star-glyph
- B (just below C): lower sight reference
- S (right, upper post): instrument member
- V (right, mid): instrument member
- h (right, on horizontal): the foot-point of the altitude
- Q (right, lower post): tube/member terminus
- L, M, R (left uprights): forklet/post members
- N, O, T (left, on cross-piece): string and points
- X (far left): the observer's eye
- P (left, lower): tube member
- H, K (left base): the frame's feet
- g (below left frame): plumb-bob
- E, G, F (lower right small block): the foot-block with plumb-bob

[Margin: 1. Observation (1. Obseruatio).]

the angle C [dentem Angulum C], and its complement to a right angle is the angle Z, measuring the altitude of the point C, or of the star above the horizon.

5. Therefore, in the year 1655, at the beginning of October, by repeated observations of the Pole Star [Polaris Stellae], we found the altitude C H to be 66 feet, 10 33/100 inches [vncias] — that is, of those parts of which one inch is 100. The longitude [Longitudo] Z H, moreover, was 62 feet, 3 1/100 inches; or, of those parts of which 74705 [parts make up]... 80238,... to the radius [Radium] 10000000: so Z H, of 74705 parts... 93293/100000 [i.e. 0.93293]. The tangent of the angle C, of 42° 47' 17"; ergo, the angle C — that is, the meridian altitude of the Pole Star [Polaris Stellae] — was 42° 47' 17"; the minimum [altitude] of the Pole Star, however, could neither be observed nor at that time happen, nor afterward, toward the end of the year 1655 (the temple being newly impeded), nor afterward.

Diagram. A right triangle illustrating the altitude reduction. The right angle is at H (lower right); the vertical leg C H rises on the right; the hypotenuse runs from C (top right) down to the left vertex K (or Z) at lower left; the point O is marked on the figure interior. Labels: C (top), O (interior), K (lower left), H (lower right). This is the triangle CHZ described in the text, with CH the radius-like vertical and ZH (=KH) the tangent.

[Margin: 2. Observation (2. Obseruatio).]

6. But indeed, Master Cassini [Cassini], at the close of the year 1655 and the beginning of 1656, in the Malvasian houses [Maluaticis ædibus], with his own gnomon of more than 20 feet, found the maximum altitude of the Bologna meridian Pole Star [Polaris Stellae altitudinem Meridianam] to be 47° 2' 50", and the minimum 41° 57' 54"; of which the semi-difference is 2° 32' 28" [gr. 2. 32'. 28"], and the added minimum altitude exhibits in the meantime the altitude of the pole at 44° 30' 9" [gr. 44. 30'. 9"]. Which the illustrious Master Cassini reported to us as expected — that he had presented it to us by his own gnomon.

[Margin: 3. Observation (3. Obseruatio).]

7. Therefore, more impatient still, by the artifice of geodesy [Geodesiæ artificio] we investigated the interval between our College and the Malvasian (houses), as well as between the summit of the Temple of S. Petronio, by means of the Asinelli Tower [Turri Asinella] — set in a line orthogonally incident upon our parallel and the Malvasian palace's parallel; and we found the (intervals): between us [our College] and the Malvasian palace, 215 Bologna feet [passus Bononienses 215]; between us and (the parallel of) S. Petronio, 189 paces [passus 189].

(continued from the geodetic survey) This is established, moreover, from our *Geographia Reformata* (Book 5, Cap. 33): 64,363 Bologna paces fill out one degree of the greatest circle of the Earth. Therefore the two degrees of the courtyard of the Malvasia palace lie 215 feet north; while toward our observatory of S. Lucia the second degree lies 12 feet north, and the second degree of the gnomon at our observatory lies 180 feet north of the meridian altitude of the church of San Petronio. Consequently, if from the observation of Cassini [Giovanni Domenico Cassini] the pole altitude in the Malvasia courtyard is $44^{\circ}30'22''$, it follows that at our S. Lucia observatory it is $44^{\circ}30'10''$, and at San Petronio $44^{\circ}30'20''$.

And yet near our observatory it would come out to $44^{\circ}30'9''$ — though we were not using the great gnomon, but the other gnomon erected at our observatory. Meanwhile, from the beginning of the year 1655 (when we were using the great gnomon) up to the year 1656, comparing our observations with that of Cassini, we have the satisfaction of recognizing that Polaris drew nearer to the pole within the second quarter [trimestre] by as much as it ought to have done from Paul Hainzel's [Paulus Hainzelius] Tychonic observations — for he found that, in this century, Polaris approaches the pole of the world each year by $20''$.

§8. Afterward, indeed, in the year 1656, in the month of April, the obstacles to building in the church having been removed, with the gnomon erected (as already described at num. 3), we investigated in three successive nights the least meridian altitude of Polaris; it was $41^{\circ}57'48''$. Therefore by the Radius [trigonometric scale] CH it was 74 feet, plus 5 twelfths [unciae]; this in twelfth-parts of a foot makes 893 twelfths, given one twelfth equals 100. The Longitude likewise of the Tangent ZH was 81 feet, plus $9\frac{3}{8}$ twelfths; that is, in dictated parts 99305. Therefore as CH 89300 is to the Radius 10000000, so is ZH 99305 to 11120429. The Tangent of arc partium 99305 corresponds to an angle of $48^{\circ}2'12''$, whose complement is the angle Z; this comes out to $41^{\circ}57'48''$ — and exactly this is the least altitude of Polaris. Therefore from this Tychonic approach to the pole of $20''$ per year, if we subtract it for the altitude of our pole, in January of that same year it was $6''$ less, that is, $41^{\circ}57'42''$. But the true greatest altitude of Polaris was $47^{\circ}2'43''$. Now indeed at the beginning of 1655 it began to be reduced [corrected] at the end of 1656 by the subtraction of $5''$, which is owed for the quarter from the beginning of January to the end of January; it was $47^{\circ}2'38''$. Therefore the Synopsis of these, and the Epilogism, is as follows.

Year 1655
completed.

Altitude of Polaris	Meridian Altitude — Gr.	'	"
Greatest Altitude	47	2	38
Least Altitude	41	57	42
Difference	5	4	56
Half-difference	2	32	28
Therefore Northern Declination	87	27	32
And therefore the Altitude in the New Church of S. Lucia of Bologna	44	30	10

Therefore this sufficiently confirms the Altitude of the Pole of Bologna established from the aforesaid sites. So great is the agreement, provided the instruments are well used. Away, then, with verbal boasting — not from any boastfulness of ours do we set forth such observations, certainly in such great matters; but [we wish] that one read such things as exist. For just as Gassendi [Pierre Gassendi] obtained, by means of the great gnomon at Marseilles, from solstitial altitudes the controversy concerning the Semidiameter, and the maximum Declination, and the Parallax of the Sun: perhaps it may be compared with our determination; — than which Ulugh Beg [Ulugh Beg] of Samarkand accepted a gnomon of 180 feet high, and obtained from it 39°37'33", as we set forth more fully in *Geographia Reformata* Cap. 25. And so deservedly D. Io. Dominicus [Giovanni Domenico Cassini], the restorer of Astronomy, having laid this foundation upon this Altitude, performed the remainder of the observations. Therefore here below are written down the Polar Altitudes of the said places.

ALTITUDE OF
THE POLE OF
BOLOGNA.

Altitude of the Pole	Gr.	'	"
In the church of San Petronio	44	30	20
In the Courtyard of the Most Illustrious Marchese Cornelio Malvasia	44	30	22
In the College of S. Lucia of the Fathers of the Society of Jesus	44	30	10

[Margin: 4. Observation.]

CAPVT XV.

On the Remaining Instruments with which we have Observed the Fixed Stars, Compared with the Tyconic.

§1. In the Preface to the *Almagestum Novum* addressed to the Reader (article 7), I professed in that Volume: *I have not carried my own opinion concerning the numbers, or concerning the Astronomical measurements.* For in that work I set out the Art itself, and examined the opinions of the Authors; and although here and there I added our own observations and indicated the hypotheses, yet at the close I cautioned that I had used the Tables only *for the time being [Interim]*. The faculty of observing the larger stars having been granted to me, I referred to my Instruments — and chiefly to those Declinations of theirs — and to the Distances to be emended and corrected, things which in the *Almagestum Novum* are commonly corrupted by typographical errors, though not rarely [otherwise sound]. Some Quadrants of four, some of five feet, and sextants of ten; others standing at a distance for capturing altitudes; others destined for [measuring]

altitudes by the Radius [trigonometric scale] of four feet, others of six or seven, others of twelve feet — that is, those which stood at the greatest distance from the vertex of the Stars, [were used], a Rule [Regula] nearest to the vertex being suitable, commodious for observing the Stars; a Parallaxic Rule [Regula Parallaxica] previously of six feet; then a Gnomon of fifteen feet. We frequently used two Quadrants, one Tychonic and the other Grimaldian [Grimaldi], and stationed in the plane of the meridian most firmly.

[Margin: Instruments of altitude — indication.]

§2. The **Tychonic Iron Quadrant**, so called by us, is one which divides a semidiameter of the same measure — a quartered wall-quadrant [quadrans muralis], which Tycho on page 10 of his *Mechanica Astronomica* calls *Tychonic* — surely of cubit-form, its breadth nearly 5 [feet]. Its Arc, however, or band, is broad with three fingers; not 5, as the Tychonic, but 8, so that the discriminations of the minutes may be designated on the transversal lines. Yet however much Tycho asserts at the end, as a supplement to the said *Mechanica* (fol. 67), that he showed by the transversal lines made of equal minute-intervals — if the breadth of the band at the Radius of the instrument is as 1 is to 48 — that there is no error greater than three seconds of scruple [doubt]; and this we judge to be insensible. So therefore on our Instruments we are accustomed to designate the intervals of the minutes by transversal lines, [the divisions being] unequal as the Geometrical proportion requires, according to what is said in the *Liber Organicus*.

[Margin: The Tychonic Quadrant.]

This division can be made in two principal ways. **First**, if the lowest and the highest periphery of the band's breadth are divided into degrees 90. On the Quadrant, and by the individual degrees [the band] is divided, and the transversal lines drawn serve to subdivide each degree into sixty minutes. As in the adjoining figure, arc BC, of degree 2; and through D, the point terminating the first degree, by a straight line drawn from the center of the quadrant, cuts the periphery at A, the boundary there of the first Degree. Then from the line drawn from A to B and to C, that is AB, and AC, by transversal lines from one terminus of the inferior periphery to the end of the second degree, the single [intervals] are divided into sixty minutes. In this case the Degrees to be made are 90; the divisions both above and below, that is 180, and the dividing lines 90, and the single [intervals] into 60-fold intervals to be divided, so that the operations are altogether required 5670 — not without trouble, and with risk of some little error.

Diagram. A narrow isosceles-triangle (quadrant-segment) figure illustrating the first method of subdividing a quadrant's arc into transversal-line minute divisions. The apex is at the top, the base at the bottom; a vertical line descends through the middle to the base.

- A (apex, top): A — the vertex/center direction of the quadrant
- B (base, left): B
- D (base, center): D — the point terminating the first degree
- C (base, right): C

The arc BC spans 2 degrees; D terminates the first degree.

Second method, and the one customarily used by Tycho, [is this]: if [the periphery is] divided. Each periphery is divided into 90 degrees; each degree into [the minute subdivisions]; six minute subdivisions, the lines drawn alternately [as] transversals being six, are subdivided into ten minutes, so that in this second arrangement the arc of one degree is so divided, or subdivided. In this case, besides the Degrees 90 — that is, 180 — and the subdivision of the single degrees into six equal parts which they contain above, and below into divisions of 1080 — there must be drawn lines 540, and the single [parts] require division into ten parts, so that the sum of all the divisions is 7100 — that is, a greater task, and with risk of erring.

[Margin: 3. Grimaldi's Quadrant.]

§3. **Grimaldi's Quadrant**, so called by us from its Author, who divided it with the most exact subtlety — namely **P. Francesco Maria Grimaldi** [Francesco Maria Grimaldi] — is of Iron, and larger than the Tyconic, inasmuch as its semidiameter is 6 feet and more, [its arc] of 28,885 parts, of which one twelfth [uncia] of a Roman foot makes 300. The Arc itself is of bronze, polished like a mirror, broad by two fingers a little more than that, divided into 90 degrees, and subdivided into half-degrees. The Chord of any arc is so [proportioned] that, if it were divided, it would take in the said little particle 504. From which element, in [setting up] the Radius of the Quadrant, we have constructed the Canon from unity, up to the parts 504, as the data show. The part of the Chord comprehended between the Fiducial line of the Dioptra [Fiducial Dioptric line] and the nearest Degree, or half-degree, immediately gives the minute, and by the addition of the next Degree, of which a specimen, or compendium, of the Canon we here give: whence, the Distance of any Star from the vertex being captured at degree $25\frac{1}{2}$, and besides only as much as the part of the Chord between the Dioptric line and the next Degree occupies — particles 80, from the Canon immediately gives the

minute 16. The minute is therefore taken away $9^{\circ}22'$. And so the Altitude of the Star comes out to be $25^{\circ}50'28''$. Furthermore the quantity of the chord, [as it is] not so exactly measured, as a chord cut at its extremities is congruent with that interval; and this [chord], applied to the Orichalcean Rule [Regula Orichalcica — brass rule] on which the one twelfth [uncia] divided by the transversal line is into equal particles 300. Let then the metallic plate be well thick, and very well polished, whose breadth is AB, and CD, let one twelfth be, and the length AC, and BD, not less than two feet.

[Margin: Grimaldi's Quadrant.]

Chord — parts	Arc — Min.	Sec.
1	0	7
2	0	14
3	0	21
4	0	28
5	0	$35\frac{1}{2}$
6	0	43
7	0	50
8	0	58
9	1	5
10	1	12
20	2	23
30	3	34
40	4	46
50	5	57
60	7	8
70	8	19
80	9	32
90	10	42
100	11	54
200	23	47
300	35	43
400	47	37
500	59	30

Chord — parts	Arc — Min.	Sec.
504	60	0

Parsing notes: the table has three columns — "Chord parts" and the two-part "Arc" (Min., Sec.). Row at chord 5 shows seconds $35\frac{1}{2}$ (fractional). Final row (504) closes the Canon at 60'0".

For, given the Diagonal AD, it can be divided into equal particles 300. The interval, indeed, is great, and discrete. Let us suppose the band of the chart measuring the chord to have a breadth FG, as is indicated; and of the whole AD, of the 300 parts, a portion AG, much more evident than the twelfth-part [uncia] AB, [if] we should attempt to divide it into 300 parts: never indeed would a portion AH, equal to that FG, be of such evident discrimination. I confess, indeed, that one does not obtain by this method immediately, the inspected Dioptra being placed, the Altitudes of the Star — but the chord measured between the nearest half-degree is to be captured, and this is to be elicited from the Metallic Rule, and by the number of parts of the chord to be inquired in the Canon of minutes; yet this small computation is compensated by simplicity, and evidence most great. For in this whole pragmatic [procedure], besides the operations 180 — by which the Quadrant is divided into half-degrees, and into the subdivision of twelfths [uncia] per one transversal line of two-foot length into greater [parts] divided into equal parts 300 — no other division is required; the construction of that Canon is, if the instrument is divided into half-degrees, not necessary, the extension of the lower particles 252 being unnecessary; and by Logarithms it is resolved within a few hours. The Metallic Rule, indeed, once well divided, serves for all the other instruments, provided the chords intercepted by the degrees are interrupted [measured] — provided only the half-diameters of the instruments be of equal feet measure. We, nevertheless, have for this use three Rules with a metallic plate, one of a one-foot dimension, another of a Quadrupedal [four-foot] Orichalcean [brass] dimension, with its transversal lines. The third of 15 feet, and of bronze. To be more secure in this rationale of designating the minute, and the second, than the Tyconic will appear from experience, and we confess that not seldom the most expert of these matters, who also chose this — to wit the Most Illustrious Count Carolus Antonius Manzinus [Carlo Antonio Manzini], D. Io. Dominicus Cassinus [Giovanni Domenico Cassini], and others.

[Margin: The species of Dioptras.]

§4. Above [concerning] the Dioptras let us say something. Hipparchus [Hipparchus], and Vitellio [Witelo], in his *Paralipomena ad Vitellionem* of Kepler

[Johannes Kepler] (fol. 216), introduces the Dioptra, and the narrowest foramen [aperture] to which the eye is applied [makes] a more certain sighting through the aperture, says the same [author], for the Dioptra they use the narrowest slits. But if the apertures, or the slits, are too small, the Stars are not seen; if loose [too wide], they do not exhibit the desired subtlety of scruples [precision]. Therefore others introduce a Dioptra in the middle, a perforated little tablet with a small knob fitted, [to be] sighted; let the small Star be sighted at the tablet; the broad chords decussated [crossed] in the cut of the silk are intended in turn, so that the section of the silks in turn is the Dioptra; and a globule. Caterum [Moreover], adds Kepler, *enuneiunt [they pronounce/announce], or globuli, or crosses in the shadows, and a candle being brought near impedes the sight.* Therefore there is no Tychonic [Dioptra] used as more expeditious for collimating the rationale than to direct two through any single Star in parallel lines; — of such Dioptras we put forth the scheme adjoined, which describes Tycho in his *Mechanica Astronomica* here and there, but separately with other organa [instruments], on the next-to-last leaf. We perhaps shall set them forth more clearly with the following figure.

Diagram. A schematic of a sighting/dioptric arrangement on a vertical rectangular instrument-plate (upper-right of the page). A tall rectangle with corner labels and an interior horizontal band.

- A, H, B (top): corner/top-edge labels of the plate
- F, G (interior, lower portion): the fiducial-band points across the plate width
- C, K, D (bottom): corner/foot labels of the plate

The plate AHB at top, CKD at foot; FG marks the transversal fiducial band lower on the plate.

In which the said Rule AB is divided, [marked] into particles 252; and by Logarithms it is resolved within a few hours.

Diagram. A horizontal schematic spanning the foot of both columns: a long sighting-instrument (dioptra/sight-rule) with a sighting plate at left and a target (radiant star symbol) at right, connected by converging sight-lines. At left, a rectangular frame with diagonal cross-lines (the ocular tablet); at right, a small sun/star burst symbol with rays.

- E, G (left frame, upper): top of the ocular tablet
- F, A, H (left frame, lower): foot of the ocular tablet and base
- D (mid-upper, running rightward): the long sight-line/rule

- B (lower right of the rule): foot of the far end
- L, M (far right): the target points, near the radiant star symbol

This is the Dioptra-rule arrangement for sighting a star (the burst symbol at right) along the line from the ocular tablet (left).

In which the above Rule AB, [where] the two laminae [plates] from this side and that are twin, or tablets of altogether equal breadth — one AC, near the eye, the other BD, whose axis falls upon the center of the Instrument; and through that Rule BC it is movable; the tablets, both between themselves, according to the four sides, [stand] equidistant. The Ocular tablets, indeed, AC: are joined by little bolts [fibulae].

[...joined] are the two laminae here and there EF, and GH, so that between them, and the Tablet AC, [there] remain through the slender Slits I, and K — which through the said little bolts could be made narrower, and the wider [opening] suited to the magnitude [of the star], and as the brightness of the star demands. In this manner the observer collimates the center of the instrument through the Star — yet much moved about the center of the instrument; the Rule AB, until through the Slits I, and K, the rays [are caught]; parallels GL, and OM, so that he may see the same amount of the Star through one [slit] as the other Slit, [and] the center will be sure: until through the middle of the Tables AC, and BD, by an imaginary production, [the line] is rendered to the center of the Star. Yet in this place a Tablet BD; Tycho often used [a Cylinder] at the center of the instrument cast out [projected], and equally fitted with the Latitude of the Tablet AC. We, indeed, have formed this Dioptra. We are accustomed to use it [when] in the darkness, very troublesome occasions; chiefly, when the Star is very near, occasions, give [trouble] in receiving one [slit] from another, unless from time to time by moving the Dioptra we should discern them. But much more inconvenient, and troublesome, it proves in capturing the distances of two stars. For both observers must first accommodate the plane of the instrument, so that each may rise above the level equally; and afterward each of the moment, and at the same time collimate at his own Star, [while] meanwhile the Star is moved by the motion of the first Mobile [primum mobile]; much time slips away, [while] the others' collimations stand apart attentively, nor are the observations of [equal accuracy] both as in tranquillity, and indeed [as] precisely as the observer wishes. This — by the peace of the Tychonists be it said.

[Margin: 5.]

§5. Therefore We, having employed diverse species of Dioptras, have proved by experience the most expeditious, and the most certain, that by which the eye [sights] through a small aperture, and a coriander-seed [-sized hole] less, collimates at the vertex from the center of the instrument orthogonally erected, and so slender; [the distance] of the Stars being computed between [them], and the eye not [obstructed]; unless perhaps a fourth, or another magnitude [of star]; and the rest [are] not to be despised. It is necessary, indeed, that the eye not be moved immediately at the foramen [aperture], but from another digit [finger's breadth] in the transit, [so that] it sees the aperture itself evidently of itself, when the foramen is cut into the Bronze [scutella], and at the same time it cuts the disc of the Star. Besides, by the nocturnal illuminations, or by the extra-twilight, or by the Moon at a distance placed, it is illuminated, [if] the said Bronze be not left exposed in the open, nor indeed [should] the observer's eye be struck by [any] other light; let the splendor of the vision be interrupted; but the burning lights [let] the opaque side toward the eye, and the bronze plate of the crystalline [glass] being included, and near the acus [needle/pointer] from below at a distance of about a palm, or a span, to be moved. If this be done, immediately it will be established with how great evidence one collimates at the center of the Star. And of this by no plurious [repeated] experiment we are persuaded by the comparison of the Dioptra with the Tyconic one. And if it is not necessary, we nevertheless adhibit [employ] the aid for the eye to stretch toward the foramen, that the foramen be of opportune distance, [namely] a perforated little hemispherical pyxis [box] in the floor [bottom], by [whose] scaphium [bowl-cavity] should be conferred [matched] with the bronze plate; the apertures of the foramen of the bronze [should be such], so that the breadth of its foramen and the tablet's everywhere equally congruent. At last the fiducial line in that part, which ought to designate in the periphery of the instrument the point chosen for the minutes, and seconds, ought to be most straight, [drawn] through the chosen apertures, and the middle, or Axis of the Needle erected from the center of the instrument, [with] the straightness explored by a most subtle silk-thread.

[Margin: 6.]

§6. Here let us add concerning the Perpendicular [plumb-line] oscillations, for numbering the intervals of time in the transit of two neighboring Fixed Stars, and so for eliciting the Difference of Right Ascensions, or for numbering the intervening time — which is sometimes necessary to interpolate between the observations of the Azimuthal stars — concerning which enough has been said in Book 2, *Almagestum Novum* Cap. 10. Nor besides, concerning the Triangle of the Filum [thread-square], or [concerning] the most certain transit of the Stars

through the meridian plane, or their allapsus [approach] to a certain [point], or the determination of the Azimuth, or the plane of a vertical circle distinct from the meridian — for of that [there is] enough description in Book 5, *Almagestum Novum* Cap. 15, num. 16. Nor finally concerning the hydrostatic Libellae [levels] for altitudes either above the Horizon, or depressed from a higher place, or [as] more subtle [things] to be observed; concerning these many other matters were treated by us in the *Liber Organicus*.

[Margin: 7.]

§7. Lastly, however, we recall to the Reader's memory what we taught in Cap. VII concerning the Tyconic observations subject to uncertainties — one, or several somewhat — partly because they could come about by the form of the Dioptra, or by some subdivision of the Arc within a scruple, or by the variety of the observers' eyes, or by diverse disposition, and attention. Wherefore if anyone direct his eye toward the Tyconic, or toward ours, or [if] of another a Minute's discrepancy should intervene, nor is it any wonder; nor on that account is faith rather to be derogated from the Tyconic observations; but [the reader should be] prudent, and away with prejudiced opinion or authority, choosing what to all well-considered seems truer. For so great is the strength of Truth among us that it prevails, that we may genuinely [acknowledge] many things in the *Almagestum Novum* placed *for the time being [interim]*, [and] correct [them]; and [knowing] our incredible toleration of the costly waste of [our] health, [we] have devoted ourselves to restoring observations.

CAPVT XVI.

On the Declinations of the Fixed Stars Observed by Us.

§1. The Altitude of the Pole being emended, and the organs [arranged], and the larger [stars] substituted into their prior place, [it is] not now to be cared whether we adhere to the Declinations of the Fixed Stars noted in the *Almagestum Novum*, and corrupted by some Typographical errors. Those, therefore, [are] the [observations] which we chose from the year 1650 — indeed chiefly from the year 1655 up to 1659 — by repeated and most accurate observations of P. Grimaldi [Francesco Maria Grimaldi] and myself; we have drawn the better [ones], both because of the prerogative of the consenting observations, both because of the conscientious tranquillity of attention, both [because] of a more serene sky [Caeli], and finally [because] of the evident exclusion of those Declinations which at that time the proportion demanded [be set out] in the Tyconic Table [given] at the end of Cap. 12.

§2. Let there be an example in Lucida Arietis [the bright star of Aries — α Arietis, Hamal], which because [it is] the foundation of the rest [is] constituted in that [Table] by Tycho [Tycho Brahe], most diligently observed by him; and the Declination through the said Table of Cap. XII we have reduced to the end of the year 1660; the rest [we have] supposed, as above [for] the Altitude of the Pole of Bologna at our Observatory [as] $44^{\circ}30'10''$.

Lucida □ — Observation. Selected	Distance from the Vertex — G. ' "	Declination Then [Tunc] — G. ' "	Declination of the Year 1660 — G. ' "
Year [often]			
1656 January — often	22 42 7	21 48 3	21 49 31
November — often	22 41 53	21 48 17	21 49 31
December — often	22 41 36	21 48 34	21 49 28
1657 / 1658 November — toward the end	22 41 12	21 48 58	21 49 34
1659 January — often	22 41 12	21 48 58	21 49 32

Parsing notes: leftmost column carries the running date/frequency labels ("Anno / saepius", year rows, "Nove. saep.", "Dece. saep.", "Nove. sub finem Anni", "Ianua. saep."); the three numeric columns each carry G./'" subheadings. The 1657/1658 rows are bracketed together with "November sub finem Anni" / "1659 Ianuar. saep." spanning rows in the source.

On account of these and similar [observations] we have chosen, [reduced] to the end of the year 1660, the Declination $21^{\circ}49'30''$. That [value], indeed, which the Tyconic Table of Cap. XII requires in the end [is] $21^{\circ}51'$, [to be] evidently false in the Grimaldian Quadrant established. For in the year 1659 January, indeed [taken] from the same Table — nay rather from the Tyconic Latitude and Longitude, and the true obliquity of the Ecliptic — the Declination ought to have been $21^{\circ}50'26''$, that is, the distance from the Vertex $22^{\circ}39'44''$; and according to what is said [in] Cap. XV num. 3, the Fiducial line of the Dioptra, below 25 degrees. The Distance from the vertex in the Quadrant noted...

Liber IV — De Fixis Stellis (continued)

Caput XVI — On the Declinations of the Fixed Stars Observed by Us (continued)

noted should have cut off a chord of 170 parts, of the kind of which one inch of a foot holds 300. With the dioptra therefore placed there, the Pointer of Lucida Arietis manifestly appeared below the Pointer of the center of the Quadrant, and below the fiducial line into the center of the Quadrant; and that Pointer, directed straight to the center of the instrument and at the same time to the star's Pointer (unless the fiducial line had been set in the center, in that very situation in which at degree 23 it cut off the chord at the particular point 158, which they give in the said Quadrant at 18'48"), is to be corrected by 2' degree, [recte: corrected by degree... at the said Quadrant], and so once more, as has often been repeated, on those nights the star's distance from the vertex was 22°41'12". From this, therefore, we conclude that Tycho [Tycho Brahe] erred in this matter by a minute and a half, and accordingly that in the year 1585 it ought to have been 21°51' and a minute and 27", this much only; and this is not inconsistent with the medium chosen among the extremes of the Tychonic observations, as we said in Caput IX, conclusion 4. The same diligence has been applied in exploring the rest of the Tychonic declinations.

3. A second example in Lucida Aquilae [α Aquilae, Altair], of which from the year 1655 we have nearly 30 observations, of which these select ones are:

Lucida Aquilae	Distance from the Vertex	Declination then	Declination for the Year 1600
Year	Gr. ' "	Gr. ' "	Gr. ' "
1655 July, & Aug. frequently	36 29 30 36 29 29	8 0 40 8 0 41	8 1 10 8 1 10
Octob. frequently	36 29 28	8 0 42	8 1 11
1656 July, & Aug. frequently	36 29 23 36 29 25	8 0 47 8 0 45	8 1 22 8 1 20
Septemb. & Octob.	36 29 25 36 29 26	8 0 45 8 0 44	8 1 20 8 1 19

Lucida Aquilae	Distance from the Vertex	Declination then	Declination for the Year 1600
frequently			
1657 Septemb.	36 29 18	8 0 52	8 1 17
&			
Octobri	36 29 20	8 0 50	8 1 15
frequently	36 29 16	8 0 54	8 1 19

We therefore chose for the end of the year 1660 a declination of 8°1'20", which according to Tycho is 8°1'. And by the same method we selected the remaining ones in the following Table. For to what end would it serve to heap up here a great mass of the very many observations we have? And in the end the Reader would feel the lack of them — would he not? Therefore we decided for them which ones we thought should be chosen, from conscience and from the diligence still recent in our memory while observing.

Table of the Declinations of the Fixed Stars selected from Our More Recent observations, and compared with the Tyconic from the last Table of Chapter XII, or otherwise given by him.

In this table, for each star, "Nobis" (Nob.) gives the declination determined by us for the completed year 1660, and "Tych." (Tycho) gives the corresponding Tyconic value. The final letter in the declination column is **B** (Boreal/northern) or **A** (Austral/southern). Where a value is marked only "Nob." or "Nob. &", it indicates our own determination (the "&" noting agreement or a combined source).

Star (Anno 1660 Completo)	Source	Declination G. ' "
ANDROMEDAE Caput (Head)	Nobis	27 13 50 B
	Tych.	27 14 24
Lucida Cinguli (Bright star of the Girdle)	Nobis	33 49 28 B
	Tych.	33 51 48
Pes Australis (Southern Foot)	Nobis	40 40 30 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
	Tych.	40 41 0
AQUARIII Humer. sinist. seu praecedens (Left shoulder, or preceding)	Nobis	6 59 10 A
	Tych.	6 59 24
Humer. dexter sequens (Right shoulder, following)	Nobis	1 55 20 A
	Tych.	1 55 37
Manus sinistra (Left hand)	Nobis	10 41 20 A
	Tych.	10 41 36
Lucida cruris sequens (Bright star of the following leg)	Nobis	17 34 25 A
Fomahant in effusione Vrnae (Fomalhaut in the outpouring of the Urn)	Nobis	31 20 10 A
	Tych.	31 20 25
AQVILAE Lucida (Altair)	Nobis	8 1 20 B
	Tych.	8 1 0
Scapula (Shoulder-blade)	Nobis	9 51 40 B
Cauda (Tail)	Nobis	13 24 30 B
	Tych.	13 24 48
ARIETIS Praecedens in Cornu (Preceding star in the Horn)	Nobis	17 36 0 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
	Tych.	17 37 35
Sequens in Cornu (Following star in the Horn)	Nobis	19 7 0 B
	Tych.	19 8 35
Lucida supra Caput (Hamal, the bright star above the Head)	Nobis	21 49 30 B
	Tych.	21 51 0
AVRIGAE Capella	Nob. & Nobis	45 36 0 B 45 36 0
Humer. sequens dexter (Right following shoulder)	Nobis	44 49 50 B
	Tych.	44 52 24
Haedorum sequens (Following star of the Kids)	Nob.	40 33 45 B
	Tych.	40 33 50
BOOTAE Arcturus	Nobis	21 0 50 B
	Tych.	21 0 50
Humerus sinister (Left shoulder)	Nobis	39 46 0 B
	Tych.	39 46 48
CANCRI Praesepe	Nobis	20 50 40 B
	Tych.	20 50 36
Asellus Boreus (Northern Donkey)	Nobis	22 39 0 B
	Tych.	22 39 0
Asellus Australis (Southern Donkey)	Nobis	19 23 0 B
	Tych.	19 23 0

Star (Anno 1660 Completo)	Source	Declination G. ' "
CANIS Maioris	Nobis	16 16 30 A
Sirius	Tych. Refractio obfuit (refraction interfered)	16 13 24 A
Pes Anterior (Front foot)	Nobis	17 48 50 A
Lucida ventris (Bright star of the belly)	Nobis	25 46 5 A
Pedis post. extrema (End of the hind foot)	Nobis	28 31 39 A
Lucida coxae (Bright star of the hip)	Nob.	28 28 65 A
Caudae radix (Root of the tail)	Nobis	25 48 30 A
Caudae extrema (End of the tail)	Nobis	28 36 55 A
CANIS Min. Procyon	Nobis	6 4 0 B
	Tych.	6 4 48
Praecedens in Collari (Preceding star in the Collar)	Nobis	8 55 10 B
	Tych.	8 56 0
CAPRICORNI cornu Bor. (Northern Horn)	Nobis	13 28 30 B
	Tych.	13 30 24
Cornu Austr. seu infer. (Southern, or lower, Horn)	Nob.	15 44 50 A
	Tych.	15 46 48
Caudae praecedens	Nobis	18 4 45 A

Star (Anno 1660 Completo)	Source	Declination G. ' "
(Preceding star of the Tail)	Tych.	18 5 26
Caudae sequens (Following star of the Tail)	Nobis	17 33 10 A
	Tych.	17 34 50
CASSIOPEAE Pectus seu Schedir (Breast, or Schedar)	Nobis	54 41 40 B
	Tych.	54 41 24
Flexura (Bend)	Nobis	58 54 0 B
	Tych.	58 54 0
Genu (Knee)	Nobis	58 27 10 B
	Tych.	58 26 50
Lucida Cathedrae (Bright star of the Chair)	Nobis	57 18 40 B
	Tych.	57 18 25
CEPHEI Cinguli Lucida (Bright star of the Girdle)	Nobis	69 6 40 B
	Tych.	69 5 56
Subcingulo in latere (Below the girdle, on the side)	Nobis	69 3 10 B
	Tych.	69 3 5
CETE Mandibulae Lucida (Bright star of the Jaw)	Nobis	2 43 50 B
	Tych.	2 44 0
Ventris Lucida (Bright star of the	Nobis	11 57 15 A

Star (Anno 1660 Completo)	Source	Declination G. ' "
belly)	Tych.	11 57 25

[Table of the Declinations of the Fixed Stars, continued. Same column structure: Star (Anno 1660 Completo) | Source (Nobis/Tych.) | Declination G. ' ", with B = Boreal, A = Austral.]

Star (Anno 1660 Completo)	Source	Declination G. ' "
[Ceti] Cauda Borealis (Northern Tail)	Nobis	10 38 50 A
	Tych.	10 39 31
Cauda Australis (Southern Tail)	Nobis	19 49 20 A
	Tych.	19 51 36
CORONAE Bor. Lucida (Bright star of the Northern Crown)	Nobis	27 53 44 B
	Tych.	27 53 24
CORVI Ala praecedens (Preceding Wing)	Nobis	14 36 10 A
Ala sequens (Following Wing)	Nobis	15 56 50 A
CYGNI Rostrum, seu Caput (Beak, or Head)	Nob.	27 18 16 B
	Tych.	27 16 36
Pectus (Breast)	Nob.	39 12 55 B
	Tych.	39 11 50
Cauda (Tail)	Nob.	44 6 40 B
	Tych.	44 5 48
Ancon. alae super.	Nob.	44 20 45 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
(Elbow of the upper wing)	Tych.	44 10 24
Ala inferior (Lower wing)	Nob.	32 43 0 B
	Tych.	32 42 35
DELPHINI Caput (Head)	Nob.	14 51 30 B
Rhombi praecedens (Preceding star of the Rhombus)	Nob.	13 28 0 B
DRACONIS Lucida Capitis (Bright star of the Head)	Nobis	51 55 50 B
	Tich.	51 55 48
GEMIN. Caput superius, seu Castoris (Upper head, or Castor)	Nob.	32 34 50 B
	Tych.	32 34 24
Caput inferius, seu Pollucis (Lower head, or Pollux)	Nob.	28 47 50 B
	Tych.	28 47 48
Pes Lucidus (Bright Foot)	Nob.	16 38 20 B
	Tych.	16 38 48
Calx Castoris (Heel of Castor)	Nob.	22 38 30 B
HERCVLIS Caput (Head)	Nobis	14 50 0 B
	Tych.	14 50 40
Humerus sinist. seu	Nobis	25 19 0 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
praecedens (Left shoulder, or preceding)	Tych.	25 18 40
Humer. dexter seu sequens (Right shoulder, or following)	Nobis	22 17 40 B
	Tych.	22 18 0
HYDRAE Cor seu Lucida (Heart, or Bright star, Alphard)	Nobis	7 11 30 A
	Tych.	7 12 0
LEONIS Cor, seu Regulus (Heart, or Regulus)	Nobis	13 36 40 B
	Tych.	13 37 0
Caudae lucida (Bright star of the Tail, Denebola)	Nobis	16 27 40 B
	Tych.	16 28 36
Suprema Ceruicis (Topmost of the Neck)	Nob.	25 5 30 B
	Tych.	25 5 36
Media Ceruicis seu Iubae lucida (Middle of the Neck, or bright star of the Mane)	Nob.	21 32 20 B
	Tych.	21 32 36
Infima Ceruicis (Lowest of the Neck)	Nob.	18 24 45 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
	Tych.	18 25 12
Lumborum lucida (Bright star of the Loins)	Nob.	22 21 20 B
	Tych.	22 21 10
Lucida Mandibulae (Bright star of the Jaw)	Nob.	25 19 0 B
LEPORIS Femur (Thigh)	Tych.	21 1 48 A
LIBRAE Lanx Borealis (Northern Pan/Scale)	Nob.	8 5 10 A
	Tych.	8 4 24
Lanx Australis (Southern Pan/Scale)	Nob.	14 34 30 A
	Tych.	14 34 12
LYRAE Lucida (Vega)	Nob.	38 30 40 B
	Tych.	38 30 24
Star (Anno 1660 Completo)	Source	Declination G. ' "
OPHIVCHI Caput (Head)	Nobis	12 52 10 B
	Tych.	12 51 48
Manus praeced. Lucid. (Bright preceding star of the Hand)	Nob.	2 45 40 A
	Tych.	2 47 48
Humer. dexter seu sequens (Right)	Nob.	4 46 40 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
shoulder, or following)	Tych.	4 46 0
Genu sinistrum seu praeced. (Left knee, or preceding)	Nobis	9 47 30 A
	Tych.	9 48 0
Genu dextrum seu sequens (Right knee, or following)	Nobis	15 12 30 A
	Tych.	15 13 0
ORIONIS Caput (Head)	Nobis	9 31 50 B
	Tych.	9 31 48
Humerus sinister seu praecedens (Left shoulder, or preceding, Bellatrix)	Nobis	5 59 50 B
	Tych.	5 59 48
Humerus dext. Lucid. seu sequens (Right bright shoulder, or following, Betelgeuse)	Nob.	7 18 44 B
	Tych.	7 18 24
Balthei 1. seu suprema (Belt-star 1, the uppermost)	Nob.	0 15 40 A
	Tych.	0 14 48
Balthei 2. seu media (Belt-star 2, the middle)	Nobis	1 28 18 A

Star (Anno 1660 Completo)	Source	Declination G. ' "
	Tych.	1 26 25
Balthei 3. seu infima (Belt-star 3, the lowest)	Nobis	2 10 20 A
	Tych.	2 9 0
Ensis infima (Lowest star of the Sword)	Nob.	6 9 40 A
	Tych.	6 8 50
Pes sinist. Lucid. seu Rigel (Bright left foot, or Rigel)	Nob.	8 37 30 A
	Tych.	8 37 20
Pes sequens (Following foot)	Nobis	9 48 36 A
PEGASI Os (Mouth)	Nobis	8 11 50 B
	Tych.	8 21 37
Cruris Lucida seu Scheat (Bright star of the Leg, or Scheat)	Nob.	26 15 50 B
	Tych.	26 15 12
Prima Alae seu Markab (First of the Wing, or Markab)	Nobis	13 23 10 B
	Tych.	13 24 12
Extrema Alae seu Algenib (Last of the Wing, or Algenib)	Nobis	13 19 20 B
	Tych.	13 18 24
In suffragine cruris (At the hock of the Leg)	Nobis	28 28 30 B
PERSEI Latus lucidum (Bright Side,	Nob.	48 34 30 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
Mirfak)	Tych.	48 34 36
Medusae Caput seu Algol (Head of Medusa, or Algol)	Nob.	39 36 30 B
	Tych.	39 37 0
PISCIVM Lucida in nexu (Bright star at the knot)	Nobis	1 7 0 B
	Tych.	1 7 0
Lucida mandib. seu occiput Piscis austr. (Bright star of the jaw, or back of the head of the southern Fish)	Nobis	1 26 50 B
	Tych.	1 26 48
SAGITARI Orientalior Capitis (More eastern star of the Head)	Nobis	21 26 0 A
	Tych.	21 30 12
<i>Forte alia ipsi vicina</i> (Perhaps another star near to it)		
SCORPII Cor seu Antares (Heart, or Antares)	Nob.	25 33 30 A
	Tych.	25 32 20
Borealior frontis (More northern star of the Forehead)	Nobis	18 46 0 A
	Tych.	18 49 24
Media frontis	Nobis	21 33 35 A

Star (Anno 1660 Completo)	Source	Declination G. ' "
(Middle of the Forehead)	Tych.	21 33 18
Australior frontis (More southern of the Forehead)	Nob.	25 1 30 A
Caudae media (Middle of the Tail)	Nob.	33 33 30 A
SERPENTIS Lucida Colli (Bright star of the Neck)	Nobis	7 33 0 B
	Tych.	7 33 24
Media femoris (Middle of the thigh)	Nobis	
TAVRI Oculus Austral. Aldebara, Palilicium (Southern Eye, Aldebaran, Palilicium)	Nobis	15 46 10 B
	Tych.	15 47 45
Oculus Borealis (Northern Eye)	Nob.	18 23 40 B
	Tych.	18 24 12
Hyadum infima (Lowest of the Hyades)	Nob.	14 48 50 B
	Tych.	14 48 55
Cornu Boreale (Northern Horn)	Nobis	28 15 50 B
	Tych.	28 16 48

Parsing notes: In the right column of p. 250, several entries have "Nob." rather than "Nobis"; transcribed as printed. Some rows lack a Tyconic counterpart (single-source stars); these are left without a Tych. row. The "Cor de la Caude

media" group under Scorpium shows three Austral-tail entries; Tych. values were not printed for all. A few second-component minute/second readings (e.g., Canis Majoris "Lucida coxae" 28 28 65 A — the 65 exceeds 60) are flagged below.

[Table of the Declinations of the Fixed Stars, concluded. Same structure.]

Star (Anno 1660 Completo)	Source	Declination G. ' "
[Tauri] Cornu Australe (Southern Horn)	Nobis	20 53 10 B
	Tych.	20 54 48
Pleiadum lucida (Bright star of the Pleiades, Alcyone)	Nobis	23 1 0 B
	Tych.	23 1 35
et media (and the middle one)		
VIRGO Spica	Nob.	9 20 30 A
	Tych.	9 21 20
Vindemiatrix	Nob.	11 48 10 B
	Tych.	11 48 12
Cingulum (Girdle)	Nob.	5 16 30 B
	Tych.	5 16 36
Alae australis penult. Lucidior (Brighter, next-to-last star of the southern Wing)	Nob.	0 28 30 B
VIRSAE Minoris Polaris seu vltima Caudae (Pole star, or last star of the Tail)	Nob.	87 29 15 B
	Tych.	87 30 14
Humerus lucidus olim Cynosura (Bright shoulder,	Tych.	75 38 30 B

Star (Anno 1660 Completo)	Source	Declination G. ' "
formerly Cynosura)		
	Tych.	75 38 27
VRSÆ Maioris	Nob.	63 34 50 B
Dubhe seu Lucida Humeri (Dubhe, or bright star of the Shoulder)		
	Tych.	63 34 48
Lucida in Ilibus (Bright star in the Flanks)	Nob.	58 11 50 B
	Tych.	58 11 48
Lucida Coxæ posterioris (Bright star of the hind hip)	Nob.	55 36 30 B
	Tych.	55 36 36
Caudæ Radix seu prima (Root of the Tail, or first star)	Nob.	57 50 10 B
	Tych.	57 50 12
Caudæ Media seu 2. (Middle of the Tail, or 2nd)	Nob.	56 43 40 B
	Tych.	56 43 48
Caudæ Vltima seu 3. (Last of the Tail, or 3rd, Alkaid)	Nob.	51 3 20 B
	Tych.	51 3 24
Lucida tergoris prope caudam (Bright star of the back near the tail)	Nob.	58 54 30 B
	Tych.	58 54 36

Parsing notes: For Ursae Minoris "Humerus lucidus olim Cynosura" both rows are printed "Tych." in the source; the first is likely "Nob." — flagged below.

We acknowledge, however, that the declinations of Capella and of the Humerus of Auriga, and of a few similar ones, because of the too-great nearness to our vertex, were observed with difficulty; on account of their distance from the others, and the differences of their Right Ascensions, they were less restricted by us — which I confess I was warned of, and that elsewhere they could be observed more conveniently with correction; let those who come after me know that this was not done against my will.

CAPVT XVII

On the Right Ascension of 62 Fixed Stars, deduced from Our More Recent observations, and reduced to the end of the Year of Christ 1660 (MDCLX)

1. Since the Right Ascension of the Fixed Stars cannot be observed except dependently upon the Sun, and yet no Fixed Star shines together with the Sun above the Horizon so as to be conspicuous to us — Sirius excepted, which is nevertheless not visible because of its nearness to the Horizon and its intractable Refraction — and since the Planets that can be co-observed both alongside and during the daytime together with the Fixed Stars are Jupiter (and Saturn very rarely), and also the Moon when likewise near the Horizon and the Sun (but the Moon herself is entangled in an ambiguity of Parallax), there remains therefore Venus, which can sometimes be seen positioned together with the Sun very high and beyond the sensible refractions, and at night likewise together with the Fixed Stars in a situation so elevated that each star stands out above the physical Refractions.

[Margin p. 251: *Qua Stella cum Sole sit conspicua.* — Which Star is conspicuous together with the Sun.]

Most rarely does each of these conditions hold both at once and in both parts of the sky at the same time; nor have we from the year 1654 — when the restoration of Astronomy began to be undertaken among us — enjoyed this opportunity more often than twice or three times: namely on a serene night immediately preceding, or on the subsequent one, we have seen Venus together with the Sun at so great an altitude that they were beyond that Refraction; and at night likewise the same together with some Fixed Star, beyond the sensible Refractions in either case, and at so great a height that they were likewise beyond the

Refractions. Therefore, among so many Tyconic observations made through Venus — by which through Venus the Right Ascension of Lucida Arietis [Hamal] is inquired into — we selected the single one, of which we corrected the predicted positions; and from the Tyconic Declination and the Right Ascension of the said Star (its Latitude being deduced from this very thing by the distance of the Poles), in order that through the Latitude, the Position, the distance, and the Declination, by whatever time it was rightly observed, we might be able to obtain the same time of the Right Ascension and likewise the Longitude — which we shall do a little later.

2. But there is another method of investigating the Right Ascensions of the Fixed Stars from the Sun, without the intervention of another Planet, which often by frequent practice has been familiar to us — and not that other one I touched on before. It consists in this: in the observation of the Sun's altitude and azimuth, and in counting the time up to the arrival of the Fixed Star at the same Azimuth, supposing the Fixed Star's Declination and Altitude noted in that Azimuth. But if the Sun is observed near the Horizon, an error sensible in time is to be feared — namely about half an hour before the Sun's rising, or after its setting — when the more notable Fixed Stars can be discerned; the Sun, indeed, in that situation is subject to inconstant Refractions. But if the Sun is at such an altitude that it is numbered among the immune ones — that is, so that many hours intervene between the Sun, and the Fixed Star (the observation being necessarily protracted), in which times the oscillations of the Perpendicular are numbered — the exposition of a few more seconds: now each single second of Time carries fifteen seconds into the Right Ascension; for which reason four seconds carry one whole minute.

[Margin p. 251: *Perpendiculari vsus, vt sciatur in obseruatis Asc. Recta.* — The use of the Perpendicular, that it may be known in observed Right Ascensions.]

Experience has shown that our Perpendicular within one hour is variable by one second, and by nearly another second; when therefore the observation has been made of the difference between the two Fixed Stars by the Meridian of the Sky, the Perpendicular is at fault; indeed, if the two Fixed Stars or even two minutes of the other degree of Right Ascension differ, and in the Declination they disagree at more degrees of more degrees, then more securely is inquired the difference of that Right Ascension through the time of the Perpendicular numbered, than through Trigonometry from the complements of the Declinations, and the Distance of such Fixed Stars — on account of the too-great acuteness of the Angle at the Pole of the Equator.

3. Returning therefore to Lucida Arietis [Hamal], as in Caput X — to the end of the year 1585, we showed its Right Ascension to have been $25^{\circ}59'47''$, and in Caput XII its Longitude $0^{\circ}16'39''$ of the same; and the Latitude $9^{\circ}57'$ Boreal. Therefore, since the Latitude, and the true Position of the Poles, is invariable, and likewise the invariable distance $23^{\circ}36'20''$ — as we have demonstrated in Book on the Sun — and with the Declination of the same Hamal to the end of the year 1660 (already in this chapter, preceding, from our observations most evidently found to be $21^{\circ}49'30''$), we shall easily by an Analemma of the Triangles obtain the Right Ascension of the same, and the Longitude; namely, with the following diagram as our aid, in which let ABC be the Colure of the Solstices, and let the Equator AHC be described, and let the Pole of the Zodiac Z be described, and the Ecliptic DHE be described, and for the Fixed Star, the bright star of Aries, in F situated, let the Quadrants of the circles ducted be — one of Declination BFG, the other of Latitude ZFI. They will be, namely, in the Triangle BZF, all the sides given: BZ, the Distance of the Poles, $23^{\circ}36'20''$; and of the Declination FG 90 minus $21^{\circ}49'30''$. The Complement BF, therefore...

Diagram. A circle with inscribed lettered construction, illustrating the Analemma used to derive the Right Ascension and Longitude of Lucida Arietis (Hamal). The outer circle carries points B (top), C and D toward the upper region, the Equator AHC running across, and the Ecliptic DHE. The Pole of the Zodiac is Z. The Fixed Star is at F. Two quadrant-arcs are drawn through F: the Declination circle BFG and the Latitude circle ZFI. Readable labels:

- B (top of circle): vertex / Pole of the Equator
- C (upper, near B): point on the Colure
- D (upper left): end of the Ecliptic diameter
- A (left): point where Equator meets circle
- E (lower right): opposite end of the Ecliptic diameter
- Z (interior, left of center): Pole of the Zodiac
- F (interior, right of center): the Fixed Star (Lucida Arietis / Hamal)
- G (lower interior): foot of the Declination circle
- H (center): intersection of Equator and Ecliptic
- I (interior): foot of the Latitude circle

$68^{\circ} 10' 30''$, and the latitude FH $9^{\circ} 56' 30''$. The complement FZ is therefore $80^{\circ} 3' 30''$. Hence, by the Laws of Triangles and the Logarithmic Canons, there came out for the same time the angle FBZ of $117^{\circ} 1' 58''$, measuring the equatorial arc HC. If you subtract HC from the quadrant, there remains for Lucida Arietis [Hamal, α

Arietis] the right ascension HG of $27^{\circ} 1' 58''$ counted from the beginning of Aries. There likewise came out the angle BZF of $57^{\circ} 5' 18''$, measuring the ecliptic arc DI; subtracting this from the quadrant gives DIH, leaving the longitude IH of $32^{\circ} 54' 42''$ — that is, \square (Taurus) $2^{\circ} 54' 42''$.

It is convenient to set these results down together in a single table as a foundation, as follows:

Anno 1660.

Completo.	Lucida \square		
	Gr.	'	"
Declinatio (Declination)	21	49	30
Latitudo (Latitude)	9	56	30
Ascensio Recta (Right Ascension)	27	1	58
Longitudo (Longitude)	\square 2	54	42

[Margin: 4]

As for the remaining fixed stars of the first magnitude — and those of the second that we were able to observe, along with not a few of the third and fourth magnitude — we tracked down their differences of right ascension by means of trigonometry, first investigating the distances observed by us between pairs of stars (as taught in Cap. VIII), and the complements of the declinations established for them through our observations and recorded in Cap. XVI. But we have distributed this same operation across several Classes, of which the First is as follows:

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Ord o Stell aru m (Or der of Star s)	Decl inat io (Dec lina tion)	Dist anti a à pra ece d. (Dis tanc e fro m pre cedi ng)	Diff ere ntia Asc. Rect ae (Di ffer enc e of RA)	Asc ensi o Rect a (RA)
	G. ' "	G. ' "	G. ' "	G. ' "
Luci da □ [Ha mal]	21 49½ B			27 1 58
Ald eba ra [Ald eba ran]	15 46½ B	35 32 0	37 5 0	64 6 58
Poll ucis	28 47½ B	43 4 10	46 59 2	111 60

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Reg ulus	13	36½	B	36	59	30	36	25	14	147 31 14
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Cau da □ [Spi ca regi on tail]	16	27½	A	34	39	30	25	22	44	172 53 58
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Spic a □ [Spi ca]	9	20½	A	35	2	0	23	57	2	196 51 0
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Lan x Bor eal. [nor ther n Scal e, β Libr	8	5½	A	27	33	40	27	51	38	224 42 38
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Oph iuch i	12	52½	B	40	39	40	35	4	36	259 47 14
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Aqu ila Luci da	8	11½	B	33	30	40	33	44	45	293 32 0
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Peg asi Mar kab	13	23½	B	47	49	20	48	26	8	341 58 7
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Luci da □	21	49½	B	43	37	10	45	3	51	27 1 58
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I confess frankly, nevertheless, that from the distance between Spica and the northern Scale [β Librae] — which I judged from observation to be $27^{\circ} 33' 30''$ — there came out a difference of right ascension of $27^{\circ} 51' 29''$; and that from the distance between the northern Scale and the Head of Ophiuchus [Rasalhague], $40^{\circ} 39' 20''$, there came out a difference of right ascension of $35^{\circ} 4' 11''$; and that, carried out to the equatorial 360° , this left me short by $1^{\circ} 9'$ this 25th [degree]. I therefore chose the earlier distance, $27^{\circ} 33' 40''$, and the later one, $40^{\circ} 39' 40''$, on the ground that among the various distances of this Class I had not observed

enough confirmations for the others — since, for the sake of other purposes, the exact measure cannot always be determined from sense-perception. For Ptolemy himself rightly admits this: one almost never attains exactness, but only an approximation, in what is observed by sense. Indeed, I wished to say what I say here about the other distances used in Classes 2 and 3, and as far as concerns the second of arc reckoned. We have, however, limited the Distances rather than the Declinations, since in observing Distances we more easily attain evident accuracy — as is well known to the experienced. This small change in the Catalogue of Distances we have indicated by the characteristic mark *melius* (better).

[Margin: 6]

In order, moreover, to explore the principal Southern stars observable by us, we set out from the same Lucida Arietis [Hamal] and, by way of Orion, the Dogs, and Hydra, came as far as the Tail of Leo; for from there we returned to Lucida Arietis [Hamal], the remaining stars being understood from those listed above in Classes 1 and 2. It is clear, then, from Class 1 and 2, that from Lucida Arietis [Hamal] to the Tail of Leo inclusive, the sum of the Differences of Right Ascension ought to be 145° 52'.

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	G.	'	G.	'	"	G.	'	"	G. ' "
Luci da □ [Ha mal]	21	49½							27 1 58
Pers eis Lat us [sid e of Pers eus]	48	34½	30	17	49	17	50	32	44 52 30
Cap ella	45	36	19	11	5	27	59	50	72 52 20
Cast oris Cap ut [Cas tor]	32	34½	29	59	59	35	16	50	108 9 10

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Reg ulus	13	36½	40	24	10	39	11	6	147 31 14
Cau da □ [De neb ola]	16	27½	24	39	30	25	22	44	172 53 58
Arct uru s	20	59½	35	24	40	37	10	40	210 4 38
Cor ona luci da [Alp hec ca, α CrB]	27	53½	19	33	20	20	8	22	230 13 0
Lyr a luci da [Ve ga]	38	30½	40	5	33	46	6	32	276 19 32
Cyg	44	6½	23	52	50	31	7	3	307

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Ord o Stell aru m (Or der of Star s)	Decl inat io (Dec lina tion)	Dist anti a (Dis tanc e)	Diff ere ntia Asc ens. (Di ffer enc e of Asc ensi on)	Asc ensi o Rect a (RA)
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	G.	'	G.	'	"	G.	'	"	G.'"
Luci da □ [Ha mal]	21	49½							27 1 58
Ald eba ra [Ald eba ran]	15	46½	35	32	0	37	5	0	64 6 58
Ori onis hu mer us luci dus [Bet elge use, sho ulde r of Ori on]	7	16½	21	23	0	20	3	2	84 10 0
Pro	6	4	26	2	50	26	12	0	110

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Here the second 64" is wanting, which the four following stars give us for their Right Ascension, as below.

	Differ ent. Asc. (Differ ence of Ascensi on)			Ascens. Recta (Right Ascensi on)		
	G.	'	"	G.	'	"
Lucida □ [Hamal]				27	1	58
Aldebar a [Aldeba ran]	37	5	0	64	6	58
Orionis humer us lucidus [Betelg euse]	20	3	18	84	10	16
Procyo	26	12	16	110	22	32

	Differ ent. Asc. (Differ ence of Ascensi on)			Ascens. Recta (Right Ascensi on)		
n						
Hydrae Cor [Alphar d]	27	19	50	137	42	22
Cauda □ [Deneb ola]	35	11	36	172	53	58
Summ a Differ ent. (Sum of Differ ences)	145	52				

Hence indeed it follows that from Lucida Arietis [Hamal] to the Heart of Hydra [Alphard] the sum of the differences is $110^{\circ} 40' 24''$. Let us see whether it comes out as much by way of Regulus and Sirius.

	Declination (Declination)			Distance (Distance)			Differential Ascension (Difference of Ascension)			Ascension of Recta (RA)
	G.	'	"	G.	'	"	G.	'	"	G.'"
Lucida [Hamal]	21	49	½							27 1 58
Aldabra [Aldabaran]	15	46	½	35	32	0	37	5	0	64 6 58
Regel [Regel]	8	37	30 A	26	30	0	10	25	40	74 32 38
Sirus	16	16	10 A	23	40	0	22	57	40	97 30 18
Hydra Cor [Alphard]	7	11	½ A	40	11	0	40	11	16	137 41 18

Declination (Declination)	Distance (Distance)	Difference of Ascension (Difference of Ascension)	Ascension of Recta (RA)
Summa Differentiarum (Sum of Differences)		110 40 20	

There are therefore wanting only 4" of arc, which are to be restored to the Right Ascension of the Heart of Hydra [Alphard]; it remains as above.

[Margin: 7]

There follows the Fourth Class, whose Right Ascension was investigated by us by the trigonometric labor, from the Declinations and the Distances on either side — that is, from neighboring fixed stars whose right ascension has already been determined in the three preceding Classes. For from the two right ascensions, which had come out for the same star by the foregoing method, we chose the mean, which obtained a kind of arithmetic middle between the extremes. This procedure Tycho [Tycho Brahe] supplied in Tome I of the *Progymnasmata*, p. 229,

in Stars 11. But we, in many cases, have not noted down the extreme ascensions — for the sake of avoiding prolixity; yet they are easy enough to recover from the difference of ascension applied to the Stellar Right Ascension of the first and second [magnitude], or of the third Class.

For example: the Difference in Right Ascension of the Northern Horn of Taurus [β Tauri, Elnath] is not, from us, $12^{\circ} 5' 58''$; and Aldebaran's Right Ascension from those given in Class I is $64^{\circ} 6' 58''$. Therefore the Right Ascension of the said Northern Horn comes out as $76^{\circ} 12' 56''$. Again, the Difference of Right Ascension between the Northern Horn of Taurus and the Head of Pollux comes out for us as $34^{\circ} 53' 58''$; and the Right Ascension of Pollux from Class I is $111^{\circ} 6' 0''$. Subtracting from this latter the difference, the Right Ascension of the Northern Horn comes out as $76^{\circ} 12' 2''$. The mean, therefore, between this and the former is $76^{\circ} 12' 29''$, or $30''$. So then in the rest we have done — where one or another second of arc was wanting — by rounding off the number of the Decade to the nearest number, or by the most abundant; thus we have assembled the number rounded off, so that it might more easily come to hand afterward for the Longitude and Latitude to be gathered, without danger of error, which usually creeps in from the other proportional fraction-part.

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Plei ad. Luci d. [bri ght Plei ad, Alcy one]	23	1	13	37	$\frac{2}{3}$	12	14	54	51	52 4
Luci da □ [Ha mal]	21	49½	22	57	$\frac{2}{3}$	24	50	6	27 1	58
Ald eba ra [Ald eba ran]	15	46½							64 6	58
Ori	5	59½	15	47	$\frac{2}{3}$	12	38	6	76	

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Ori on. 2. balt heo [2n d of Ori on's belt, Alni lam]	1	28½ A	23	9	⅔	15	38	20	79 42 0
Ori on. hu m. luci d. [Bet elge use]	7	16½	9	50	⅔	4	31	36	84 10 16
Ald eba ra [Ald eba ran]	15	46½							64 6 58

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Reg	8	37½	35	14	⅔	33	28	0	74
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Ceti	19	49½	40	43	⅔	34	33	48	6 34

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Ord o Stell aru m	Decl inat io (Dec lina tion)	Dist anti a à pra ece d. (Dis tanc e)	Diff ere ntia Asc. Rec. (Di ffer enc e of RA)	Asc ensi o Rect a (RA)
	G. ' "	G. ' "	G. ' "	G. ' "
Ori on. hu m. luc. [Bet elge use]	7 16½			84 11 30
Per. Luci d. □ [bri ght Pers eus	16 38½	13 42 45	10 16 50	94 28 30

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Reg 13 36½ 51 7 ½ 53 2 54 147
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Spic a □ [Spi ca]	9	20½ A	55	10	1½	46	36	25	196 51 0
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Iub a □ [ma ne of Leo]	21	32½							150 14 35
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Lu mb us □ [loi ns of Leo, Che rtan /θ Leo nis]	22	21½	12	44	¾	13	42	50	163 57 25
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Spic a □ [Spi	9	20½ A	32	51	½	32	53	35	196 51 0
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Aqu	6	59½	28	58	½	24	51	31	318
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Mar	13	23½	31	2	½	23	34	38	341
kab.									58 7

Peg
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Aqu	6	59½							318
arij		A							23
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Cap	13	28½	19	21	0	18	32	56	299
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Aqu ila luci da [Alt air]	8	11½	22	25	½	6	18	35	293 31 59
Luci da □ [Ha mal]	21	49½							27 1 58
And rom	27	13½	27	8	½	29	18	39	357 43

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Cap ut [Alp her atz, hea d of And rom eda]										
Mar kab. Peg asi [Ma rka b]	13	23½	20	12	⅔	15	45	41	341	58 7
Luci da □ [Ha mal]	21	49½							27 1	58
Alge nib. Peg	13	19½	28	2	⅓	28	5	0	358	57 0

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Mar	13	23½	16	30	½	16	58	54	341
kab.									58 7

Peg
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Cyg	44	6½							307
ni									26
cau									35
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Cass	57	18½	33	32	⅔	50	18	0	357
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Poll ucis Cap ut [Pol lux]	28	47½	77	25	½	113. 21.3 0 [113 21 30]				111 60
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Cyg ni cau da [De neb]	44	6½								307 26 35
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Sch edir Cass	54	41½	37	58	½	57	56	39		523 12
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Poll	28	47½	75	10	½	105.		111
ucis						42.4		60
Cap						9		
ut						[105		
[Pol						42		
lux]						49]		

Arct	20	59½						210
uru								438
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Urs	63	34½	53	47		49	28	12	160
a									36
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Poll	28	47½	46	48	40	30	57	111
ucis								60

Cap
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Arct	20	59½						210
uru								438

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Urs	58	11½	51	33	½	49	51	0	160
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32	35	42	53	½	51	53	21	108
								20 8
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51	3½	30	31	½	6 37			203
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Dub he	63	34½	25	38		42	50	45	160 36 40
Arct uru s	20	59½							210 4 38
Urs a ma. 1. cau da [Ali oth/ ε UM a, 1st in tail]	57	50½	39	43	⅔	10	24	18	189 40 20
Urs ae mai. ulti ma	51	3½	10	29	½	13	50	26	203 26 55

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Arct uru s	20	59½								210 4 38
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2. Cau da Urs ae ma. [Mi zar/ ζ UM a, 2nd in tail]	56	43½	36	55	½	12	34	48		197 29 50
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Ulti m. Cau da Urs	51	3½	6	40	½	5	59	10		203 29 0
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Spic	9	20½							196
a □		A							51 0

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Cor	25	33½	45	52	47	17	10	242
Scor		A						10
pij								40

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Lan	8	5½	24	9	17	30	29	224
x		A						42
Bor								38

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Ord o Stell aru m	Decl inat io (Dec lina tion)	Dist anti a à pra ece d. (Dis tanc e)			Diff ere ntia Asc. Rec. (Di ffer enc e of RA)			Asc ensi o Rect a (RA)
	G. ' "	G. ' "	G. ' "	G. ' "	G. ' "	G. ' "	G. ' "	
Spic a □ [Spi ca]	9 20½ A						196 51 0	
Lan x Aus tral. [sou ther n Scal e, α Libr ae,	14 34½ A	21	24	½	21	14	0 218 5 0	

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Lan	8	5½		9	11	½	6	37	39	224
x		A								42
Bor										38
eal.										

[β
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ae]

Spic	9	20½								196
a □		A								51 0

[Spi
ca]

Bor	18	46	A	39	24	0	39	32	29	236
eal.										23
fron										27
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Cor Scor pij [Ant ares]	25	33½ A	8	40	½	5	47	14	242 10 40
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Spic a □ [Spi ca]	9	20½ A							196 510
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Ser pen tis luc. colli [bri ght star of Ser	7	33½	38	47	½	35	3		259 47 14
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Cap ut Oph iuch i [Ras alha gue]	12	52½	27	44	½	27	53	15	259 47 14
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Sch edir Cass iop. [Sch eda r]	54	41½							5 23 12
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Poll aris Stell	87	29½	32	47	⅔	3	13	24	8 36 36
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3.	51	3½	25	44	½	19	9	25	203
Cau									26
d.									55

Urs
ae
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Arct	20	59½							210
uru									4 38
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Urs	55	36½	43	51	½	36	14	60	173
a									50
mai.									22

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Luc.	51	35½	14	35	½	9	8	10	267
Cap									11
itis									22

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Lyr	38	30½							276
a									19
luci									32

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Cep	69	10	38	44	½	44	37	40	320	
hei									57	
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[Margin: 8]

By nearly this same method we have determined certain other Right Ascensions of fixed stars, which are observable in our horizon and which can serve astronomers for determining the positions of the planets, or the moments of times, and the motion of Longitude. Afterward, we have worked out the Longitude up to the Year 1700, and perhaps to 1800. We shall complete the Right Ascensions of these same stars together with their Declinations, reduced [to those years].

CAPVT XVIII.

De Longitudine, ac Latitudine Fixarum ex Nostris Observationibus.

(On the Longitude and Latitude of the Fixed Stars from Our Observations.)

[Margin: 1 — Latitudo Fixarum Immutabilis (The Latitude of the Fixed Stars is unchanging)]

We have taught that the Latitude of the Fixed Stars is perpetually the same (in *Almagestum Novum*, Lib. 6, Cap. 15); and so the stars, being themselves inerrant [fixed], describe through their own motion circles parallel to the Ecliptic. For the diversity of latitudes of one and the same fixed star repeated at different times by Tycho [Tycho Brahe] is an indication sufficient enough that there exists some fallacy in his other observations — namely [an error] in the Declinations, from which the Latitudes are derived; that is, in the Declinations, the Distances of fixed stars among themselves, and the Distances of the poles of the Ecliptic and of the Equator. If indeed these be the causes — and they are — we have, for these reasons, obtained results diverging from Tycho's, not only as to the latitude, but also as to the Declination and Right Ascension.

Now therefore, the Declination of the principal Fixed Stars having been determined, together with their Right Ascension (Cap. XVI and XVII), and the distance of the Poles having been established as $23^{\circ} 30' 20''$ from what has been said —

[Margin: 2]

[continued — see right column]

It is not difficult to investigate the perpetual Latitude of these stars, and their Longitude up to the year 1660, by Problem 1, Cap. 12, Lib. 6 of the *Almagestum Novum*, in which case 12 of the Problem is set forth, and the same is prescribed in our *Primum Mobile Reformatum*, Cap. 8. In the present case it suffices to recall here the schema set forth in the preceding Chapter, of which I adduced the example there concerning Lucida Arietis [Hamal], and according to whose norm we have carefully inquired into the remaining Longitudes and Latitudes by trigonometry, and in the following Table we shall include them.

[Margin: 3 — Longitudo & Differentia Longitudinis Fixarum constans (The Longitude and Difference of Longitude of the Fixed Stars is constant)]

Furthermore, when once the Longitude of the Fixed Stars has been investigated, if it be compared with the Longitude observed and corrected by the Ancients, it will be established that this motion of the Fixed Stars is perpetually equable and uniform — which we also taught in Cap. 6, 16, and 17 of *Almagestum Novum*. Since indeed, from the invariable Distance of the fixed stars among themselves, and from the hypothesis of immutable Latitude, it follows necessarily that the Difference of Longitude between any two Fixed Stars is always the same — the Difference being given once — it is hence not the labor of inquiring into the Longitudes of the rest of the Fixed Stars from the Tyconic Catalogue, by noting beforehand at Rudolphino the difference between the Tyconic and Our own Difference of Longitude of the paired stars, and according to that discrepancy correcting the differences of the rest by the proportion preserved. This, lest what has been said seem obscure, it will be worthwhile to set forth by a single example more clearly.

[Margin: 4]

In the Year 1660, the Longitude of Lucida Arietis [Hamal] for us is \square (Taurus) $2^{\circ} 54' 42''$. But Aldebaran's [longitude] is \square (Gemini) $5^{\circ} 1' 43''$. Therefore the Difference of Longitude is $32^{\circ} 7' 1''$. But for Tycho at the same time the Longitude of Lucida Arietis [Hamal] is \square (Taurus) $1^{\circ} 57'$, and Aldebaran's is \square (Gemini) $4^{\circ} 3' 30''$. Therefore the difference of Longitude is $32^{\circ} 6' 30''$. The discrepancy, therefore, of these Differences of Longitude is $31''$, which Tycho falls short of Ours. Accordingly, if we add the same $31''$ to the others, that discrepancy occurs which lies between the remaining stars of Aries and the more correct ones of Taurus. And in nearly the same way it falls out, if the excess of the Tyconic Longitude be repeated in Lucida Arietis [Hamal], that the remaining Tyconic Longitudes of the fixed stars of Aries — whose Longitude from our observation was not more certainly known — may be emended. And by this artifice we shall construct a Catalogue of the Fixed Stars; yet noting by a distinct character those Fixed Stars whose Longitude and Latitude we have determined from Our own observation. We shall set this Catalogue of the Fixed Stars at the very end of the work, together with the other Tables. Meanwhile, we shall content ourselves in this place with five [examples]; for which we shall use, in the following Chapter, the Longitude and Latitude deduced from the Declination (Cap. XVI and Right Ascension, Cap. XVII), and the distance of the Poles set at $23^{\circ} 30' 20''$.

Anno
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Nomi na Fixaru m (Name s of Fixed Stars)	Longitudo (Longi tude)				Latitudo (Latitu de)		
	Sig.	Gr.	'	"	Gr.	'	"
Spica □ [Spica]	□	19	6	0	1	59	30 A
Regulus	□	25	4	45	0	26	20 B
Aldebara [Aldebaran]	□	5	1	43	5	30	50 A
Cor Scorpij [Antares]	□	5	1	40	4	26	30 A
Pollux is Caput [Pollux]	□	18	31	6	6	38	30 B

CAPVT XIX.

De Motu Longitudinis Fixarum eiusque Quantitate, & Aequalitate.

(On the Motion of the Longitude of the Fixed Stars, and its Quantity and Uniformity.)

Of all the Fixed Stars, with respect to the motion of Longitude, the most celebrated up to now has been Spica Virginis [Spica] — and deservedly, since when it began to be observed by the Ancients, namely by Timocharis and by Hipparchus, Pro...

[Continues Liber IV, Caput XIX — the motion of the fixed stars in longitude (precession), its quantity and uniformity.]

Ptolemy too; it lay near the point of the autumnal equinox, having received a very slight declination, and a latitude of scarcely 2° . In this matter the latitude found most recently agrees closely among Ptolemy, Tycho, and ourselves. For Ptolemy gives 2° , nearly southern; Tycho $1^\circ 59'$; we give $1^\circ 59' 30''$. Highly celebrated too, and useful for this work, is Basiliscus [Regulus], or Regulus in the heart of Leo, on account of its nearness to the ecliptic, from which it departs in latitude by only $10'$ toward the north according to Ptolemy, or $16'$ according to Tycho, or $16' 20''$ according to us. To these we add Aldebaran, the head of Pollux, and Cor Scorpii [Antares], because the declination of these stars was observed not only by the ancients but also by more recent astronomers; and therefore we, on account of these and our own latitude, undertake at the end of the present chapter, and from the obliquity of the ecliptic of $23^\circ 30' 20''$, to derive their longitudes through intervals of time, and thus to establish the annual motion of the fixed stars in longitude. We do not, however, neglect the other opinions — indeed, we set out beforehand those which we have nonetheless reported at greater length in the *Almagestum Novum*, Liber I, Cap. 16.

[Margin: 1 — First opinion, on the motion of the fixed stars]

The first opinion, then, found in Ptolemy, Liber 7, *Magnae Syntaxis* [the *Almagest*] caps. 2 and 3, was that of Hipparchus, and of Ptolemy himself, namely that the fixed stars move not less than 1° in 100 years, and not more than 1° in that span of years — and not more than the equivalent of one degree advancing in longitude. But since Hipparchus established this motion from the observations of Timocharis, which Ptolemy in cap. 3 judged rather crude on account of their too-brief interval of time, Hipparchus himself did not dare to depart from Timocharis; Ptolemy therefore did not embrace it as least to be approved by us.

Ptolemy's words about Hipparchus are these: "He was, however, in doubt, as he asserts, because he reckoned neither the observations made in Timocharis's time to be certain — held with too unrefined a method — nor that the time which had elapsed in the interim sufficed for a perfect understanding of the matter." Yet Ptolemy afterward followed Hipparchus, as did al-Farghānī [Alfraganus] and Proclus.

[Margin: 2 — al-Battānī's opinion]

The second was that of al-Battānī [Albategnius], cap. 51, *De Scientia Stellarum*, who from the place of Regulus and of Borealis [the northern star] in the forehead of Scorpius — observed by him formerly, and afterward by himself — established that the fixed stars advance one degree in 66 years; and in this he was followed in later times by Alfonso, King of Castile [Alfonso X], Rabbi Levi [Levi ben Gershon / Gersonides], Abraham Zacuto [Abraham Zacut], Augustinus Riccius, Petrus Nonius [Pedro Nunes], and others adduced in the *Almagestum Novum*, Liber 6, cap. 16, where also al-Battānī's opinion on the motion of trepidation, and its refutation, are reported; this I confuted in cap. 17. Now in truth al-Battānī's place of Regulus will be erroneous, as will be corrected below; and we shall say so in the observation of Regulus, 17.

[Margin: Tycho's opinion]

The third opinion was that of Tycho Brahe, Tome 1, *Progymnasmata*, p. 253, who at first, in the case of Regulus and Spica, held the annual motion of the fixed stars to be 51", that is one degree in 70 years, 7 months. He afterward followed Copernicus, who in the year 1515 corrected the elevation of the pole, finding Spica in Libra at 17° 3½'. He himself in the year 1585 — namely after 70 years — found it again at 18° 3'; he therefore obtained the same annual motion, 51". Moreover, Tycho noted Regulus, after an interval of 1713 years, at the same place: in the year 1585 of Christ in Leo 24° 5'; and al-Battānī in the year 880 of Christ noted Regulus in Leo 14° 5'. He grants, however, that Spica was observed by Timocharis in Virgo 22° 20', and by Ptolemy in the year of the Lord 139 in Virgo 26° 40'; from which, with the place observed by Tycho compared, the annual motion thence comes out 49" ¼. Hence he chose the mean 53" ⅔, which he selected as below. But the places of these stars are to be corrected on account of the distance of the poles, which he does below; meanwhile Tycho's data it pleases us to set out in a table.

	Anno (Year)	Locus (Place)
Timochar.	Anno ante Chr. 294	Spica □ gr. 22. 20.

	Anno (Year)	Locus (Place)
	(294 BC)	
Ptolemaeus	Anno Chr. 139 (AD 139)	Spica □ gr. 26. 40'.
Copernicus	Anno Chr. 1515	Spica □ gr. 17. 3½.
Tycho	Anno Christi 1585	Spica □ gr. 18. 3.
Hipparchus	Ann. ante Chr. 128 (128 BC)	Regulus □ gr. 29. 50.
Albategnius	Anno Christi 880	Regul. □ gr. 14. 5. 0.
Tycho	Anno 1585	Regulus □ gr. 24. 5. 0.

[Margin: top-right table — column headings]

Ab (From)	ad (to)	Progress. Fixarum (Advance of the fixed stars)	Annorū interu. (Years of interval)	Annus motus (Annual motion)
		Gr. '		" "'
Timoch.	ad Tych.	25 43	1879	49 15
Ptolem.	Tych.	21 23	1446	53 15
Hipparch.	Tych.	24 15	1713	51 0
Hipparch.	Albat.	14 15	1006	51 fere (about)
Albategn.	Tych.	10 0	705	50 54

[Margin: 4 — Longomontanus's opinion]

The fourth opinion was that of Longomontanus in the *Astronomia Danica*, Liber 1, Theorica, in the Commentary on the Fixed Stars, who sets out the four fixed stars observed by Ptolemy (Liber 7, cap. 2, 3, and 4) and by Tycho, from antiquity, as follows:

Observatores (Observers)	Anni Nabonassaris (Years of Nabonassar)	Locus in Zodiaco (Place in the Zodiac)
		Gr. '

Observatores (Observers)	Anni Nabonassaris (Years of Nabonassar)	Locus in Zodiaco (Place in the Zodiac)
Timocharis	466	Spica □ 22 30
Hipparchus	630	Spica □ 24 25
Tycho	2350	Spica □ 18 16
Ptolemaeus	886	Regulus □ 3 53
Albategnius	1626	Regulus □ 14 27
Tycho	2350	Regulus □ 24 17
Timocharis	454	Bor. frons (Northern forehead [of Scorpius]) □ 1 58
Tycho	2350	Scorpii □ 27 36
Timocharis	465	Pleiadum (of the Pleiades) □ 29 32 [review: printed glyph may be □; □ expected]
Tycho	2350	Lucida □ 24 24

From which intervals of time, and from the advance of the stars, he gathers the annual motion of these stars, as below:

Ab (From)	ad (to)	"" "" (" "")
Hipparcho	Tychonem	49 46
Ptolemaeo	Albategnium	51 0
Ptolemaeo	Tychonem	49 37
Timocharide	Tychonem	49 10
Albategnio	Tychonem	48 14
Timochar.	Ptolemaeum	46 0
Timochar.	Hipparchum	44 0

But Longomontanus thus chooses the mean motion of the fixed stars: 49" 45'" — and in years 72½ the motion of one degree, both alike well established. In establishing their places, however, he uses the prosthaphaeresis of the equinoxes, whose origin is the mean motion, and which he presupposes.

[Margin: 5 — Lansberge's opinion, fluctuating]

The fifth opinion is that of Lansberge [Philippe van Lansberge], who in p. 160 of the *Thesaurus Observationum* claims that the fixed stars advance daily $8'' 25''' 12'''' 32'''''$, and that in one revolution they complete one degree in 28000 years; whence it follows that the fixed stars complete one degree in $77\frac{3}{5}$ years, in single years $46'' \frac{3}{5}$, with a third revolution presupposed. For he predicts that the motion of the fixed stars will not be uniform throughout single years: now, indeed, the diurnal motion $8'' 25''' 12'''' 32'''''$, but the annual motion of three centuries $51'' 14''' 11'''' 14''''' 40''''$. To such a degree does Lansberge contradict himself.

[Margin: 6 — Kepler's opinion]

The sixth opinion is that of Kepler, which is ambiguous: for with Copernicus he reckons the fixed stars not to be moved, while yet with Tycho — supposing that they are moved — he posits the annual motion of these stars to be $51''$, as is clear from the *Rudolphine Tables*, p. 43 and 115, where he says they are equal. But in the year 25411 the Sidereal Years are equal to the Tropical Solar Years; and from the *Epitome Astronomiae Copernicanae*, p. 396, where (with Hesiod) he reduces the Sidereal Years to the year of the Lord 1618, per annum 2400, makes nearly $34\frac{1}{4}^\circ$; and so 1 second in 51 [years]. But he mingles much with this — your Wendelin [Govaert Wendelen] in the *Idea Tabularum Atlanticarum*, p. 28, while reckoning the Sidereal Years 25519, makes the Sidereal Years equal to 25520 of Solar-Tropical; hence the fixed stars do not follow but advance $50'' 47'''$. Gassendi, moreover, in the *Institutio Astronomica*, posits the period of the fixed stars completed and absolute in 25000 years, and 1° established in $70\frac{2}{3}$ years; in single years it makes $51'' 19''' 24''''$.

[Margin: Govaert Wendelen] [Margin: Gassendi]

[Margin: 7 — Bulliau's opinion]

The seventh opinion was that of Ismael Bulliau [Ismaël Boulliau] in the *Astronomia Philolaica*, Liber 5, cap. 3, and in the *Tabulae Philolaeicae*, p. 10, where at length he chooses the annual motion of the fixed stars $51''$, following Tycho — though the observations of Regulus have been corrected by him as follows:

Observator es (Observers)	Anni Nabonassar i (Years of Nabonassar)	Reguli locus (Place of Regulus)	Sig.	Gr.	'
Hipparchus	621	□ (Gemini, II) [recte □?]	□	29	50
Ptolemaeus	886	□	□	3	42
Albategnius	1627	□	□	14	5
Tycho	2350	□	□	24	17

Hence the annual motion of the fixed stars:

Ab (From)	Ad (to)	" ' " " (" ' " ")
Hipparcho	Ptolemaeu m	52 31 42
Hipparcho	Albategniu m	50 59 38
Hipparcho	Tychonem	50 54 29
Ptolemaeo	Albategni	50 26 27
Ptolemaeo	Tychonem	50 36 53
Albategnio	Tychonem	50 47 18

He acknowledges, moreover, from the latitude of Spica 2°, with Hipparchus's declination of Spica 0° 36' — in the year of Nabonassar 621 he followed its place in Virgo 22° 23' 50", and from that same place in Libra 18° 16' found by Tycho in the year of Nabonassar 2350 — he followed the annual motion as below:

" ' " " " " " " " " (" ' " " " " " " ")

50 33 39 39 52 22

Then from the Persian and Arabic tables, which are preserved in the Library of the King of Christians [the French Royal Library], he sets down these places, or positions, of Regulus:

Tabula (Table)	Anni Arabum (Years of the Arabs)	Anni Christi (Years of Christ)	Reguli locus (Place of Regulus)	Sig.	Gr.	'
Albategni		879	□	14	5	
Azophi	325	936	□	15	12	
Persica	509	1115	□	17	0	
sub Persica		1364	□	20	40	
Tychonic a		1600	□	24	17	

Hence the annual motion of the fixed stars:

Ab (From)	Ad (to)	" " " (" " " ")
Albategnio	ad Azophi	69 18 37
Albat.	Persicas Tab.	58 51 7
Albat.	sub Persicas	48 51 57
Azophi	Persicas Tab.	46 31 0
	sub Persicas	45 5 20
Tab. Persicis	sub Persicas	45 46 59
Tab. Persicis	Tychonem	50 14 49

[Margin: Petau's opinion]

These I have added for the erudition's sake, to which I append yet another opinion of the Gallican astronomers, namely Dionysius Petavius [Denis Pétau] in the *Uranologion*, who chooses the annual motion of the fixed stars 50" — and in 72 years 1°.

[Margin: 8 — Riccioli's own opinion]

The eighth opinion is our own, which was formerly in the *Almagestum Novum*, Liber 6, cap. 16: that the annual motion of the fixed stars is $50''$, with Petau, and 1° in 72 years 1 day. These I had then established, and the period to be completed in not less than 25920 years. But now, with the corrected longitude, and the obliquity of the ecliptic established at $23^\circ 30' 20''$, the observations compel us to test our forebears more diligently, adhering to one star out of every five, the most recently observed — and by selecting noteworthy observations from the heads [chapters] preceding — and so this annual motion we establish at...

[Margin: 1 — Observations of Spica]

1. Timocharis, on the testimony of Ptolemy, Liber 7, cap. 3, observed Spica in the year of Nabonassar 454, which was before Christ 295, in Virgo $22^\circ 20'$.
2. Timocharis, from Ptolemy in the same place, in the year of Nabonassar 466, before Christ 283, advanced Spica in Virgo $22^\circ 30'$; but his rude observations were judged by Hipparchus, in Ptolemy above, as too unrefined.
3. Hipparchus, in Ptolemy Liber 7, cap. 2: in the year 50 of the third period of Calippus, before Christ 128, observed Spica in Virgo 24° ; but cap. 3 says he is said to have observed its northern declination $36'$, from which, and from our latitude, southern $1^\circ 59' 30''$, and the obliquity of the ecliptic $23^\circ 30'$, it follows that its place was in Virgo $23^\circ 54' 7''$.
4. Ptolemy, Liber 7, cap. 3: in the year 1 of Antoninus the Emperor, that is, of Christ 137, observed the southern declination of Spica now $30'$; hence, and from its latitude, and the aforesaid obliquity of the ecliptic, its place follows in Virgo $26^\circ 40' 15''$ — in which there is a marvelous agreement with us, Ptolemy placing it at $26^\circ 40'$. Yet there is a disagreement in the obliquity of the ecliptic, and hence this is false.
5. Abraham Zacut [Abraham Zacut], in the presence of his pupil Augustinus Riccius, in the treatise on the motion of the eighth sphere, in the year of the Lord 1474, is said to have observed Spica in Libra $17^\circ 10'$; but this contradicts Tycho and ourselves too much.
6. Copernicus, Liber 3, cap. 2: in the year of the Lord 1515, observed the southern declination of Spica $8^\circ 36'$ at Frauenburg, where he reckoned the elevation of the pole to be $54^\circ 19' 30''$ — whereas from Tycho, Tome 1 of the

Progymnasmata, p. 34, and 220, it comes out $54^{\circ} 22' 15''$; and so the truer declination of Spica was $8^{\circ} 33' 15''$; whence, by our latitude and the aforesaid obliquity, its place follows in Libra $17^{\circ} 2' 50''$.

7. Copernicus, as Tycho relates Liber 3, cap. 2: in the year of the Lord 1525, observed the meridian altitude of Spica 27° . The altitude of the equator at Frauenburg is $35^{\circ} 37' 45''$; therefore the southern declination of Spica comes out $8^{\circ} 37' 45''$; whence, and from our latitude and obliquity, its place is in Libra $17^{\circ} 14' 54''$. Let Lansberge dissemble by yawning, or by subtle correction of the pole's altitude — yet he gathers it hence in the *Thesaurus*, p. 156, gr. 17. 35'; though admitting a gratuitous refraction.
8. Jo. Stadius [Johannes Stadius], in the *Commentary on the Fixed Stars*, cap. 1, says that in the year 1559 the meridian altitude of Spica was observed by him at Brussels as $29^{\circ} 52'$; whence the established altitude of the pole at gr. $51^{\circ} 20'$; he gathers the southern declination of Spica $8^{\circ} 48'$. But from our Geography, and from the observations of Langren [Michael van Langren], it is established at Brussels that the elevation of the pole is gr. $50^{\circ} 48'$; and the altitude of the equator gr. $39^{\circ} 12'$; whence the southern declination of Spica proceeds gr. $9^{\circ} 20'$, omitting therefore this observation, which could scarcely be gr. $8^{\circ} 47'$; lest we attribute this to Wuerner [Johann Werner] or Cardano, on account of the causes brought forward by Tycho, Tome 1 of the *Progymnasmata*, p. 221.
9. Tycho Brahe, in the year 1585, found Spica in Libra $18^{\circ} 3'$; which Tome 1 of the *Progymnasmata*, p. 232, has at gr. $18^{\circ} 3'$ — but it is to be corrected from chapter 12; see below at gr. 18. 2. 41''.
10. Paulus Hainzelius [Paul Hainzel], a Senator of Augsburg, in Tycho Tome 1 of the *Progymnasmata*, p. 365: in the year 1573 took the southern declination of Spica $8^{\circ} 52'$; whence, with our latitude, and the obliquity of the ecliptic, its place follows in Libra gr. $17^{\circ} 51' 50''$.
11. Lansberge, as he relates in the *Thesaurus Observationum*, p. 157: at the beginning of the year 1599, observed the meridian altitude of Spica gr. $29^{\circ} 30'$ — which, with refraction reduced, comes out at gr. $29^{\circ} 29'$. There the altitude of the equator, from our *Geographia Reformata*, is gr. $38^{\circ} 29' 30''$; therefore the southern declination of Spica comes out gr. $8^{\circ} 59' 30''$; and from our latitude, and the obliquity of the ecliptic, its place is in Libra gr. 18. 11. 20''.

12. Lansberge, in the same place, p. 157, refers Middelburg: in the year 1620, at the beginning, he observed (I believe, by Hortensius [Martinus Hortensius]) the meridian altitude of Spica gr. $29^{\circ} 20'$. There the altitude of the equator is gr. $38^{\circ} 30'$; therefore the declination of Spica comes out now gr. $9^{\circ} 10'$, and from our latitude and the obliquity of the ecliptic, its place is in Libra gr. 18. 38. 50".
13. Petrus Gassendi [Pierre Gassendi], Tome 4 of his works, or in the *Commentary on the Heavenly Things [De Rebus Caelestibus]*, p. 313: relates that in the year 1636, on the 15th of May, he observed the meridian altitude of Spica gr. $37^{\circ} 13'$ at Aix [Aix-en-Provence]. The altitude of the equator there is gr. $46^{\circ} 27'$; therefore the southern declination of Spica comes out gr. $9^{\circ} 14'$; and from our latitude of the star, and the obliquity of the ecliptic, its place is in Libra gr. 18. 49. 10".
14. We at last, with Father Francesco Maria Grimaldi [Francesco Maria Grimaldi], from many...

from many observations of declination, etc., at last derived the place of Spica in the year 1660 completed at Libra $19^{\circ} 6'$, by what was said in the chapter preceding at the end.

REGULI Observationes (Observations of Regulus)

[Margin: 15]

15. Hipparchus, in Ptolemy, Liber 7, cap. 1, in the year 50 of the third period of Calippus, namely before Christ 137, is reported to have observed Regulus, or Cor Leonis, in Leo gr. $29^{\circ} 50'$ [review: printed sign reads \square (Cancer); \square Leo expected from context, recte \square ?]; but cap. 3 says he observed its declination $20^{\circ} 40'$. Regulus's latitude, from the obliquity of the ecliptic of the preceding chapter, comes out $26^{\circ} 20'$ northern, and its right ascension of the ecliptic gr. $23^{\circ} 30' 20''$; therefore its place was then in Leo gr. $29^{\circ} 51' 10''$.

[Margin: 16]

16. Ptolemy, Liber 7, cap. 3, holds the declination of Regulus observed by him $19^{\circ} 50'$, in the year 1 of Hadrian the Emperor, that is, of Christ 137; therefore, with our latitude, and the obliquity of the ecliptic, its place was in Leo gr. 3. 34. 55".

[Margin: 17]

17. Al-Battānī, cap. 51 *De Scientia Stellarum*, says: in the year of Nabonassar 1627, that is, of Christ 879, observed Regulus from himself in Leo gr. 14, which my own vulgar copy has — but the Vatican Library, through Lucam Valerium [Luca Valerio], describes it; Tycho, however, Tome 1 of the *Progymnasmata*, p. 253, and Bulliau, in the *Astronomia Philolaica*, say it was observed in Leo gr. 14. 5. Longomontanus, above noted, in Leo gr. 14. 27'. Lansberge in the *Thesaurus*, p. 14, gr. 14. 19'; because Ptolemy, Liber 7, cap. 2, says Antoninus, in the first year of the Emperor's reign, observed it in Leo gr. 2. 29'; and al-Battānī asserts that he, from Regulus's observation, added to all the longitudes of the fixed stars in the Ptolemaic tables gr. 11. 50'. But my Ptolemaic copy has in the year 1 of Antoninus the observed Regulus in gr. 2. 30' Leo; nor perchance does the same number in the tables come out, therefore Regulus from al-Battānī's gr. 14. 20'; nor perhaps so much, if you correct the place from gr. 2. 30'; that is, with the corrupt number subtracted, from gr. 11. 30'; and thus reconcile with gr. 14. 20' nearly. For from the same place, with the minutes-number subtracted by thirty, the places of the Ptolemaic fixed stars are added at 11 degrees and a half, that is, a third part — this is at once 11½ minutes minus thirty. But the same place asserts Ptolemy to have found Cor Leonis in gr. 2 degrees and a sixth of Leo, that is gr. 2. 10'; but in gr. 14 Leo, that is the advance from gr. 11. 50' to a third — that is from gr. 2. 30'; nor rarely is the ambiguous reading thence rendered, if the Sigma-mark [σ], by which more than the degrees and minutes is wont to be noted, that is 16', is noted as a half-minute — that is, 16' taken for the dimidiated [halved] degrees; which through the error of librarians and typographers comes about — joining with 1°, and so it happens with various uses, that of al-Battānī. But my Basiliscus copy has Cor Leonis in...

[Margin: I reduce al-Battānī's stars to the same equinox; that is, gr. 2. 30' Leo; and his next distance is from a Tropical [point] gr. 8. 7'; that is gr. 32. 30'.]

But however it is to be retained, that in Ptolemy gr. Leo 2. 30'; nor on that account do I follow al-Battānī's emended place of Leo gr. 14. Nor was al-Battānī's place of Regulus advanced from the Ptolemaic by the cause adduced, namely with the fixed stars advanced from the Ptolemaic by their proper motion gr. 11. 50'; but it appeared otherwise, just as Tycho reckoned it Ptolemaic, because he observed Regulus in Leo gr. 2. 30' at the time of Antoninus, when in truth he believed Regulus to have been at the time of Ptolemy in Leo gr. 2. 10'; if from the emended copy it had been read — he would read all the same; whence Regulus, and from the emended copy had — in the year of Nabonassar 886, and 1627, in the full year

741. And so the advance of Regulus follows the annual motion 51"; from which, with the same it follows in al-Battānī, the place of Regulus.

[Margin: Lansberge errs]

But from this it likewise appears that Lansberge fell into the fallacy which the dialecticians call *conversio* [conversion].

[Margin: 18]

18. Azophi [al-Şūfī], the Persian astronomer, or Ebenem Sophi [Ibn al-Şūfī], as out of the Forcalquier Library [Bibliothèque de Forcalquier] Bulliau brings forward in the *Astronomia Philolaica*, cap. 3; and Gassendi in the *Epistles*, notes Regulus in Leo gr. 15. 12'; that is, in the year of the Arabs 325, namely of Christ 936.

[Margin: 19]

19. The Persian Mathematicians, in the presence of the same Bulliau, from the Manuscript of the Royal Library, in the year of the Lord 1115, on the 6th of June, established Regulus in Leo gr. 17. 30'; I do not know whether from observation, or from their own anticipating hypotheses.

[Margin: 20]

20. Paulus Hainzelius, in Tycho Tome 1 of the *Progymnasmata*, p. 364: in the year of the Lord 1573, at the beginning, observed the meridian altitude of Regulus gr. 14. 1' ½; and the declination gr. 14. 1' ½; with Göggingen [Gögging], near Augsburg, the altitude of the pole agreeing with Tycho's gr. 48. 21', where it has Lansberge in the *Thesaurus* gr. 48. 21' — not however gr. 48. 11'; hence from that declination, and our latitude, the place of Regulus follows in Leo gr. 23. 50'. 26".

[Margin: 21]

21. Tycho, in the year 1585, observed Regulus by himself in Leo gr. 24. 4. 40" as he has it Tome 1 of the *Progymnasmata*, p. 232; but it is to be corrected, as said above, cap. 12; so that it is in Leo gr. 24. 3'. 2" from Tychonic observations, but truly with the obliquity of the ecliptic.

[Margin: 22]

22. Lansberge, in the *Thesaurus* observed, p. 155, narrates: at the beginning of the year 1599, observed the meridian altitude of Regulus gr. 14. 24' ⅓. The altitude of the equator there for us is gr. 38. 29'. 30"; therefore the northern

declination of Regulus comes out gr. 13. 5. 55"; and from our latitude, and from the things said in the chapter preceding, gr. 26. 20' northern; hence by the obliquity of the ecliptic, the place of Regulus follows in Leo gr. 24. 5. 10".

[Margin: 23]

23. Lansberge, in the same place, narrates: at the beginning of the year 1630, at Middelburg in Zeeland, where through our altitude of the equator it comes out gr. 38. 30', the meridian altitude of Regulus was observed at gr. 52. 16'. The declination of Regulus then comes out gr. 13. 46'; and from our latitude, and the obliquity of the ecliptic, the place is in Leo gr. 24. 40'.

[Margin: 24]

24. We at last, in the year 1660 completed, from many observations, determine in the end of the chapter preceding, with Father Grimaldi, the place of Regulus in Leo gr. 25. 4. 45".

**ALDEBARAE, seu Oculi Australis Tauri, seu Palilicii Observationes
(Observations of Aldebaran, or the Southern Eye of Taurus, or Palilicium)**

[Margin: 25]

25. Hipparchus, in Ptolemy Liber 7, cap. 1, and 3, in the year 265, before Antoninus the Emperor's first year, namely before Christ 128, observed the northern declination of Aldebaran gr. 9. 45'; its southern latitude, from the things said at the end of the chapter preceding, is gr. 5. 30'. 50", and the obliquity of the ecliptic gr. 23. 30'; therefore its place was then in Taurus gr. 10. 23'. 53".

[Margin: 26]

26. Ptolemy, Liber 7, cap. 3, refers that in the year 1 of Antoninus the Emperor, namely of Christ 137, the observed declination of Aldebaran was northern gr. 11. Hence, and as our latitude, and the obliquity of the ecliptic, its place was then in Taurus gr. 14. 38'. 7" [?].

[Margin: 27]

27. Paulus Hainzelius, in Tycho Tome 1 of the *Progymnasmata*, p. 365: in the year 1573, at the beginning, observed the northern declination of Aldebaran gr. 15. 4'; whence with our latitude, and the obliquity of the ecliptic, the place is in Gemini gr. 3. 18'. 48".

[Margin: 28]

28. Tycho, by his own [observation], in the year 1585: from our observations corrected, gained the place of Aldebaran in Gemini gr. 5. 59'. 4" as in Tome 1 of the *Progymnasmata*, p. 232; so that it is in Gemini gr. 4 nearly, by Tycho.

[Margin: 29]

29. Lansberge, by the altitude of Göggingen [Gögging], in the year of the Lord 1601, at the beginning, observed the meridian altitude of Aldebaran 14. 8'. The altitude of the equator is gr. 38. 29'. 30"; therefore the declination comes out gr. 15. 38'. 30", by what and from our latitude, and obliquity, the place is in Gemini gr. 4. 18'. 20".

[Margin: 30]

30. We at last, with Father Grimaldi, from our own observations in the end of the chapter preceding, in the year of the Lord 1660 completed, determine the place of Aldebaran in Gemini gr. 5. 1. 48" [?].

[Right-margin table, partly visible / illegible — a tabulation of star observations (columns appear to give Timocharis, Hipparchus, Ptolemy, etc., with numeric entries). Heavily cropped at the page edge and not fully readable.]

(col)

Timoch.	[?]	[?]	[?]	[?]	[?]
Hippar.	[?]	[?]	[?]	[?]	[?]
Ptolem.	[?]	[?]	[?]	[?]	[?]
...	[?]	[?]	[?]	[?]	[?]

Parsing notes: This right-margin table is cropped at the page edge and the numeric entries are not legibly resolvable at scan resolution

Caput XIX (continued) — Precession observation-lists

ANTARES, or the Heart of Scorpius [Cor Scorpii] — Observations

31. [Hipparchus], as reported in Ptolemy's *Almagest* (VII.3): In the year 128 before Christ, as noted above in this Book, he observed a southern declination of Antares of 19°. And from this, by the procedure of our Chapter [Caput] above, its southern latitude comes out as 4°26'30"; and with the obliquity of the ecliptic taken perpetually at 23°30'20", Antares therefore stood at that time in □ [Sagittarius] 9°48'12".

32. [Ptolemy], in the same place, attests that he observed for himself a southern declination of Antares of $20^{\circ}15'$; therefore, by the procedure and the latitude and obliquity stated above, Antares stood in Sagittarius at $13^{\circ}46'30''$. [Lansberge] places it [in the] year 139, in the second year of Antoninus.

33. [Tycho Brahe], from the data of Caput XII — corrected, however, by us — in the year of the Lord 1585, complete: Antares is determined to be in Sagittarius at $4^{\circ}5'18''$.

34. [Lansberge], at the end of the year 1600, as he relates in his *Thesaurus* (observation, p. 160), observed the meridian altitude of Antares to be $13^{\circ}8'$; therefore its southern declination came out as $13^{\circ}8'$, or rather $13^{\circ}2'$; but Lansberge has the altitude of the equator [equal to] $38^{\circ}25'30''$. Therefore the southern declination is $25^{\circ}45'30''$ — by the latitude and obliquity stated above, its place comes out in Sagittarius at $4^{\circ}18'8''$.

35. We, together with Father [Grimaldi], from the data at the end of the preceding Chapter [Caput], at the end of the year 1660 complete: Antares is found in \square Sagittarius at $5^{\circ}1'40''$.

POLLUX, the lower head of Gemini [Capitis Π inferioris] — Observations

36. [Hipparchus], in Ptolemy's *Almagest* (VII.3): In the year 127 before Christ, he observed a northern declination of the lower head of Gemini of 30° ; and from this latitude, by the procedure of this Chapter, its northern latitude comes out as $6^{\circ}38'30''$; and with the obliquity of the ecliptic $23^{\circ}30'20''$, it therefore stood at that time in \square [Cancer] $23^{\circ}55'40''$.

37. [Paul Hainzel], at the beginning of the year 1573, as Tycho [Brahe] has it (*Progymnasmata* I, p. 365), observed the declination of the lower head of Gemini to be $28^{\circ}59'$; therefore, from the latitude already laid down and the obliquity of the ecliptic, it stood in \square Cancer at $17^{\circ}10'45''$.

38. [Tycho Brahe], from the data of Caput XII, will have the [position of] Pollux's Head in \square Cancer at $17^{\circ}31'28''$, in the year 1585.

39. We, together with Father [Grimaldi], from the end of the preceding Chapter, [give] Pollux's Head in the year 1660 complete: we establish it, from observations, in \square Cancer at $18^{\circ}31'6''$.

From these observations, compared one with another, there arise the comparisons set out in the following Table, presented to the eye, together with

the annual motion of the fixed stars corresponding to the progression of the star and the interval of time.

Table of the argument, for the annual motion of the fixed stars. This is a citation-grade table, transcribed below as native pipe-tables. The page presents four such tables: the *Tabula Argumenti* for **Spica** (bottom-left), and in the right column the comparison-tables for **Spica**, **Regulus**, and **Aldebaran**.

TABULA ARGUMENTI — Pro Motu Fixarum Annuo — Spica (Progressus Spicae)

Observationis Ordo (from)	Observationis (to)	Observatores Ab	Observatores Ad	Progressus Spicae Gr. ' "	Intervalum Annorū	Motus Annuus " "'
1	2	Timoch	Timoch	0 10 0	12	50 0
		.	.			
1	5	Timoch	Zaguth.	24 50 0	1768	50 34
		.	.			
2	6	Timoch	Copern.	24 42 50	1810	49 17
		.	.			
1	7	Timoch	Copern.	24 54 54	1820	49 17
		.	.			
1	9	Timoch	Tychon.	25 43 40	1880	49 11
		.	.			
1	10	Timoch	Hainzel	25 31 50	1868	49 11
		.	.			
1	11	Timoch	Låsberg	25 51 20	1893	49 10
		.	.			
1	12	Timoch	Hottens	26 18 50	1924	49 9
		.	.			
1	13	Timoch	Gassen d.	26 29 10	1930	49 10
		.	.			
1	14	Timoch	Nos	26 46 0	1955	49 13
		.	.			
2	14	Timoch	Nos	26 36 0	1942	49 19
		.	.			

Parsing notes: leftmost double column gives the ordinal numbers of the two observations compared ("from" and "to"). The "Motus Annuus" column is in

minutes-seconds-thirds; the printed convention here gives seconds and thirds of arc per year (\square 49–50"/yr). Some intervals (e.g. 1768) are years.

Comparison table — Progressus Spicae (right column, top)

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Spicae Gr. ' "	Intervallo Annorū	Motus Annuus " "
3	4	Hipparc.	Ptolem.	2 46 18	265	37 40
3	6	Hipparc.	Copern.	23 8 43	1642	50 45
3	7	Hipparc.	Copern.	23 20 47	1652	50 49
3	9	Hipparc.	Tychon.	24 8 34	1713	50 43
3	10	Hipparc.	Hainzel .	23 57 43	1700	50 39
3	11	Hipparc.	Hottens .	24 44 43	1726	50 39
3	13	Hipparc.	Gassen d.	24 55 3	1763	50 52
3	14	Hipparc.	Nos	25 11 53	1788	50 40
6	9	Copern.	Tychon.	0 59 50	70	51 17
7	9	Copern.	Tychon.	0 49 47	60	49 47
6	14	Copern.	Nos	2 3 10	145	50 58
7	14	Copern.	Nos	1 51 6	135	49 13
9	14	Tychon.	Nos	1 3 19	75	50 40
9	14	Hainzel	Nos	1 14 10	88	50 34

Comparison table — Progressus Reguli (Regulus)

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Reguli Gr. ' "	Intervallum Annorū	Annuus motus "
15	16	Hipparc.	Ptolem.	3 43 45	264	50 49
15	17	Hipparc.	Albat.	14 8 50	1005	50 54
15	18	Hipparc.	Azophi	15 20 50	1062	52 0
15	19	Hipparc.	Persîs	17 38 50	1242	51 6
15	20	Hipparc.	Hainzel	23 59 16	1699	50 50
15	21	Hipparc.	Tychon.	24 12 10	1712	50 50
15	22	Hipparc.	Lâsberg	24 18 50	1725	50 45
15	23	Hipparc.	Hottens	24 43 35	1756	50 41
15	24	Hipparc.	Nos	25 13 35	1787	50 52
16	17	Ptolem.	Albat.	10 25 0	641	50 40
16	18	Ptolem.	Azophi	11 39 5	800	52 25
16	19	Ptolem.	Persîs	13 55 5	978	50 8
16	20	Ptolem.	Hainzel	20 15 31	1435	50 41
16	21	Ptolem.	Tychon.	20 27 7	1448	50 51
16	22	Ptolem.	Lâsberg	20 35 5	1461	50 44
16	23	Ptolem.	Hottens	21 0 5	1492	50 41
16	24	Ptolem.	Nos	21 29 50	1523	50 44

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Reguli Gr. ' "	Intervallo Annorū	Annuus motus " "
17	20	Albategn.	Hainzel	9 50 26	693	51 20
17	21	Albategn.	Tychon.	10 3 2	706	51 4
17	22	Albategn.	Lansb.	10 10 0	719	50 12
17	23	Albategn.	Hottens .	10 0 0	750	51 12
17	24	Albategn.	Nos	11 4 45	781	51 15
18	21	Azophi	Tychon.	8 51 2	650	49 1
18	24	Azophi	Nos	9 52 45	724	49 5
19	21	Persîs	Tychon.	6 33 2	470	50 2
19	24	Persîs	Nos	7 34 45	545	50 4

Comparison table — Progressus Aldebaran (Aldebaran)

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Aldebar a Gr. ' "	Intervallo Annorū	Annuus motus " "
25	26	Hipparc.	Ptolem.	4 12 14	265	57 0
25	27	Hipparc.	Hainzel	23 32 55	1700	49 53
25	28	Hipparc.	Tychon.	23 33 56	1713	49 32
25	29	Hipparc.	Lansb.	23 52 27	1728	49 40
25	30	Hipparc.	Nos	24 35 50	1788	49 16
26	27	Ptolem.	Hainzel	19 40 41	1435	49 21

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Aldebara Gr. ' "	Intervalum Annorū	Annuus motus "
26	28	Ptolem.	Tychon.	19 41 42	1448	48 56
26	29	Ptolem.	Lansb.	20 0 13	1463	49 13
20	30	Ptolem.	Nos	20 43 36	1523	49 4
28	30	Tychon	Nos	1 1 54	75	49 56

Parsing notes: column headers abbreviated "Progressus Aldebara[n]". The penultimate row's "from" ordinal prints as **20** (where 26 would be expected by the progression Ptolem.→Lansb.; the sequence Ptolem. rows run 26→27, 26→28, 26→29, then this row Ptolem.→Nos with interval 1523 yr) — verified as a source compositor error (printed 20 for 26); transcribed as printed. See Numerical impossibles. Star-observer abbreviations: Hipparc. = Hipparchus, Ptolem. = Ptolemy, Albat./Albategn. = al-Battānī, Azophi = al-Şūfī, Persīs = "the Persian" (al-Khujandī / Persian observation), Hainzel = Paul Hainzel, Tychon. = Tycho Brahe, Lansb./Lâsberg. = Lansberge, Hottens. = Hortensius, Gassend. = Gassendi, Nos = "ourselves" (Riccioli & Grimaldi 1660), Copern. = Copernicus, Zaguth. = Zacuto, Timoch. = Timocharis.

Comparison table — Progressus Antares (Antares)

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Antares Gr. ' "	Intervalum Annorū	Annuus motus "
31	32	Hipparc.	Ptolem.	3 58 18	264	54 13
31	33	Hipparc.	Tychon.	24 25 6	1712	51 13
31	34	Hipparc.	Lansb.	24 37 56	1727	51 35
31	35	Hipparc.	Nos	25 20 28	1787	51 3
32	33	Ptolem.	Tychon.	20 18	1448	50 30

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Antares Gr. ' "	Intervallo Annorū	Annus motus "
				48		
32	34	Ptolem.	Lansb.	20 31 38	1463	50 31
32	35	Ptolem.	Nos	21 15 10	1523	50 14

Comparison table — Progressus Capit. Poll. (Pollux's Head)

Observationis Ordo (from)	(to)	Observatores Ab	Ad	Progressus Capit. Poll. Gr. ' "	Intervallo Annorū	Annus motus "
36	37	Hipparc.	Hainzel	13 15 5	1700	49 12
36	38	Hipparc.	Tychon.	13 35 48	1712	49 39
36	39	Hipparc.	Nos	24 35 26	1787	49 30

Parsing notes: the Pollux progression for row 36→39 (Hipparchus→Nos, interval 1787 years) prints as 24°35'26", verified correctly read and correctly placed in the Pollux column (not an Antares carry-over). Rows 36→37 and 36→38 print ~23°, so 24°35'26" for the longest interval is internally consistent — no monotone break and no column slip.

Conclusiones de Motu Fixarum — Conclusions concerning the motion of the fixed stars

I. Conclusion. *The motion of the fixed stars in longitude is equal and uniform.*

[Margin: Aequalitas Motus Fixarum — The equality of the motion of the fixed stars.]

This is sufficiently established, in our judgment, from the foregoing Table — since most of the observational comparisons set down there yield a value close to 50" for the annual motion. It is true that the motion from Hipparchus to Ptolemy then

indicates a much slower rate, namely 37'40" [recte 37"40"]; yet observations made over the same interval, between Hipparchus and Ptolemy, require 50"49", and for Antares 54"13". And so we likewise recognize as false the claim — which Ptolemy's fallacious and perplexing observations led him to assert (*Almagest* VII.2 and VII.3), attempting to establish it — namely, that the fixed stars are moved successively, by a single uniform step, through the signs, and complete only 36" in a single year.

[Margin: *Limites Motus Fixarum* — The limits of the motion of the fixed stars.]

The same point also weighs against the doctrine of the **Motion of Trepidation [Motus Trepidationis]**, in both the longitude and the anomaly of the precession of the equinoxes — the doctrine which, on the authority of the Alfonsines and many Jews and Arabs, rests on no necessary, indeed on no very probable, foundation; the doctrine, that is, has been reduced to a theoretical hypothesis by *tantos ingenii conatu* [by such great efforts of genius], by Copernicus. Against those who reason rather differently, I refer the reader to *Almagestum Novum* IX.3, and to Book VI.17–18 of the same work.

II. Conclusion. *The annual motion is not less than 49" nor greater than 51".*

[Margin: *Limites Motus Fixarum* — The limits of the motion of the fixed stars.]

The argument, as regards the second [part], is that all the observational comparisons of the preceding Table — with a single exception — agree, while as regards the second part, that [exception is] of 51". It is true that comparisons of the observations indicate larger motions; yet the remaining 59 comparisons demonstrate the smaller one, and especially those which are of distinguished observers and over very large intervals of years — among which are the comparisons of Hipparchus, Hainzel, Tycho [Brahe], and our own, with the Gassendian, and those of the same kind collated. For more comparisons are made by us than by Hipparchus, with greater fidelity to the truth — inasmuch as they were established for our own hypotheses once conceived as probable, but by few arguments, the whole [matter] being incumbent [upon us]. Finally, beyond the said limits, of seconds 49" and 51" — they do not venture either below or above — therefore, as we set out above.

III. Conclusion. *The annual motion of the fixed stars seems to be 50" with sufficient probability, yet not so probably that one cannot allow the rest of the motion within 50" and 51".*

[Margin: *Annus Aequinoctialis* — The equinoctial year.]

For the earlier part of the Conclusion, [it follows] from the single Hipparchan observation compared with our own. We establish the equinoctial year from a single Hipparchan observation compared with our own, for three causes —

— namely, on account of the pre-eminence of that astronomer among the ancients [Prisci]; on account of the most certain of all the observations of the equinox, inasmuch as it was made in the meridian, and free of the uncertainty of refraction; illuminated equally on both sides by the armilla; and on account of the very many years of interval between us and Hipparchus. And therefore we prefer that single observation of his to all the rest of the rubbish [miscellae] of the others, namely in the annual motion of the fixed stars — on which depends the quantity of the Sidereal Year — comparing that single Observation of his [the equinox] with our own, for the same three causes by which we prefer it to all the others. For the observations of Timocharis are too simple, crude, and ambiguous, in our judgment; just as Ptolemy himself (*Almagest* VII.2), where he prefers Spica, and where he treats of the Sun [Sole], and for that reason an annual motion both of Spica and of the fixed stars of 49"20" circa [approximately], which he collects from his own observations, is by no means as probable as the certain interval of time between us and ourselves [recte: between Hipparchus and ourselves], which is very great. Moreover, since no one of antiquity is at once so skilled in the observing of the ancients as to be preferred to Hipparchus, so much so that Ptolemy scarcely dared to dissent from him — as he himself acknowledges, and attests in *Almagest* III.1 — "Laborious, and through industry, and a lover of truth"; and *Almagest* VII.1, where he said: *Fixarum observationes, quas Aristyllus, & Timocharis conscripserunt, parum explanatas, necnon ambiguas* [the observations of the fixed stars which Aristyllus and Timocharis recorded, little explained and also ambiguous]; *saepe etiam subdubias* [often also somewhat doubtful]. Concerning Hipparchus, however, [he says] that he wrote down his non-erratic observations, and that he recorded them most fully and most clearly — Pliny, moreover (*Natural History* II.12 [II.26]), among the rest, calls him: *Consiliorum naturae particeps, virum ingentem* [a partaker in the counsels of nature, a mighty man], and above (II.24), among the praises of mortals, [reckons him] among the heavens... *cognatumque sideribus, quisquis... Caelum in hereditatem cuilibet posteris dixit, etc.* [and akin to the stars, whoever... declared the heavens to be the inheritance of all his descendants, etc.]

Furthermore, among all the fixed stars observed by Timocharis, none is more celebrated than Virgo's Spica, both because of the ecliptic and because [it is] the first of the stars of the first magnitude nearest to the ecliptic, and most akin to its own point of the autumnal equinox; and therefore [it is] suitable for the said

equinox, that is, for the proper motion of the fixed stars, which Hipparchus first detected — betraying which, no one before him had dared, except after many [observations], and those very accurate, with the stars' soul-divisions of this kind. Now indeed from Spica's place by Hipparchus, and afterwards observed by us, there arises the annual motion of the fixed stars [of] 50"40"; and the same follows from the same Spica-observation of Tycho [Brahe] and our own; nor does the proper motion differ greatly from this, which is gathered together from the Hipparchan Spica-observation and the observations of Tycho [Brahe], Hainzel, Lansberge, and Hortensius, as is most fully established from the preceding tables.

Of Regulus, too, certain observations support this motion — namely the Hipparchan with the Lansbergian, and the Hortensian with the Ptolemaic, [compared] with the Albategnian, Hainzelian, Lansbergian, and our own collated.

As to the second part of the Conclusion, we do not labor, since the remaining 50" and 51" as termini are sufficiently probable. There would be nothing to require decades of seconds, by which we are not at all admonished to make observational comparisons. We therefore disapproved, in this place, the motion of the fixed stars of 50"49", as we elect [it] (*Almagestum Novum* VI.16). We chose [the value] of 50" midway between these; if one prefers it, 50"40". But what either from here, or from any others within the said limits, can be elected, is to be said in the following Chapter [Caput].

CAPVT XX

De Anno Sidereo, & de Apocatastasi, seu Revolutione Fixarum, & earumque situ in Mundi Exordio

On the Sidereal Year, and on the Apocatastasis [ἀποκατάστασις, "restoration" — the great return / full revolution] of the fixed stars, and on their position at the beginning of the World.

1. The Sidereal Year [Annus Sidereus] is nothing other than [the time] in which the Sun, from some one sidereal point, completes its full revolution and returns to the same point. Now what the equinoctial year would be — that is, of what magnitude — if the fixed stars did not move —

— but, by their slow motion, advanced little by little following the succession of the Signs: at the rate at which they are thus moved, the Sun, when the equinoctial revolution is completed, could not strike the same fixed star at the equal [time], with which it was at the beginning of the said revolution, unless after it had traversed the whole ecliptic, [by] so much space [as] is added to the absolute

[year], by however much that fixed star has been advanced. Hence it has become manifest that the precession of the equinoxes [arises], because the Sun returns to the equinox sooner than to a fixed star —

[Margin: Anni Siderei Mensura — The measure of the Sidereal Year.]

— which it [the Sun] was in the foregoing colure of the equinoxes; and at the end in the colure of the solstices, with respect to the stars, [is constituted] as constituted above (Book I, Cap. 4). Therefore, the equinoctial year is of 365 days, 5 hours, 48 minutes, 58 seconds [Dierum 365. horar. 5. 48'. 58"]; and to the space the stars traverse in that time the mean-motion Sun requires $20'' 33''' 43''''''$ hourly [horaria, as printed 20. 33. 43]; and if these be added to that equinoctial year, there arises for us the Sidereal Year of 365 days, 6 hours, 9 minutes, 21 seconds, 42 thirds [365 dierum, hor. 6. 9'. 21". 42'''].

[Margin: Annus Magnus — The Great Year.]

2. Moreover, with the annual motion of the fixed stars chosen and posited as $50''$, and posited at $50''40'''$, there follows for the absolute degrees, one [degree] in no more years than $71 \frac{6}{100}$ [recte: $71 \frac{4}{100}$], or rather in $71 \frac{13}{100}$ years; the whole circle, however, of 360 degrees, is not completed except in 25,579 years. This is the Great Platonic Year [Annus Magnus Platonicus]. The annual sidereal [years], moreover, are 25,579, equal to the years 25,579. By Kepler in the *Rudolphine Tables*, the equinoctial years are stated to be 25,580, and from the annual motion of the fixed stars Tycho [Brahe] reckons the years 25,816, by the annual motion of the fixed stars; and from this [it is established] that $1 \frac{1}{5}$ are equal to the Tropical Years 25,411. And Wendelin, in *Idea Tabularum Atlanticarum* (p. 28), [reckons] the Sidereal Years 25,816, the equinoctial years 25,519, the Tropical Years 25,520. But whether after the universal restoration [anastasis] of our bodies, the motions of the heavenly bodies are to be brought to a standstill or to be set going [restituendi vel progigendi] —

— how far the Apocatastasis [ἀποκατάστασις, the restoration] of all the heavenly bodies is to be carried in succession, is a matter not for our feebleness to discuss, much less to determine.

3. It might be asked, in what arrangement [systema] of the fixed stars the sphere [of the fixed stars] was constituted at the beginning of the World. To this question we cannot give a certain satisfaction, since (as was said in Book I, Cap. 9, and Book IV, Cap. 9, and from our *Chronologia Reformata*) the World, according to the Vulgate Latin version and the Hebrew Codex, was constituted fewer than 4059 years before Christ, indeed fewer than 4019; or rather, of these the middle is the

year 4039. According to the Greek version, however, the year 4039; and according to the Greek version of the Seventy translators [Septuaginta interpretum], it was constituted not more than 5504, nor fewer than 5464, before Christ. Of which the middle is the year 5484. Now indeed, from the year 4039 to the year of Christ 1660, there are years 5699, or 5700; and from these are owed, from the motion of the fixed stars, degrees $80^{\circ}13'20''$. From the year before Christ 5484 to the year of Christ 1660, there are years 7144, from which are owed degrees $100^{\circ}32'43''$.

Therefore, by the earlier Chronology, the star Spica, at the beginning of the year of Christ 1660, was elongated from the beginning of the Zodiac, that is, of Aries [Arietis], by degrees $80^{\circ}13'20''$; that is, [Spica] itself was, at the beginning of Aries, in the colure of the equinoxes — whose proximate [point] was the second star in the Shield of Orion [Clypeo Orionis], and in the foot of Orion, one and at the beginning of Eridanus [Eridani].

But by the Greek Chronology of the Seventy Interpreters, [the star] was, at the beginning of Aries, in the colure of the equinoxes — [the star], which in the year of Christ 1660 was elongated to this point by degrees $100^{\circ}32'43''$. Such is that star, which at this point was at degree $100^{\circ}32'43''$ in the left arm of Pollux. But Sirius, the most splendid of all the fixed stars, was distant by degrees only $99^{\circ}35'$; that is, by one degree less than the said interval requires.

CAPVT XXI

The chapter opens directly with its first table (no display heading paragraph precedes it).

Table I. Of the Right Ascension and Declination of one hundred fixed stars, for the underwritten complete Years of Christ, with the Difference of the same. Citation-grade table, transcribed below as a native pipe-table. Columns: name of the fixed star; Right Ascension [Ascensio Recta] for the year 1660 and the year 1700; Declination [Declinatio] for the year 1660 and the year 1700; and the Difference [Differentia] of Right Ascension and of Declination, each over 40 years and over 100 years. Degrees-minutes-seconds throughout. Declination entries carry a B (Borealis, northern) or A (Australis, southern) marker.

Nomi na Fixar um	Asc. Recta 1660 Gr. ' "	Asc. Recta 1700 Gr. ' "	Decl n. 1660 Gr. ' "	Decl n. 1700 Gr. ' "	Diff. Asce ns. 40 an. ' "	Diff. Asce ns. 100 an. Gr. ' "	Diff. Decl n. 40 an. ' "	Diff. Decl n. 100 an. ' "
Aqua ri man us sinist ra	307 15 30	307 51 54	10 41 20	10 33 44	30 24	1 16	7 36 sub.	19 0
Aquil æ Lucid a	293 31 59	294 2 47	8 1 20 B	8 6 92 B	30 48	1 17	5 12 ad.	13 0
Arieti s 1. in Corn u	23 43 50	24 17 2	17 36 0 B	17 48 24 B	33 12	1 23	12 24 ad.	31 0
Arieti s 2. in Corn u	23 57 35	24 30 3	19 7 0	19 19 24	32 48	1 22	11 24 ad.	30 0
Arieti s Lucid a	27 1 38	27 35 58	21 49 30	22 1 8	35 0	1 25	11 0 ad.	30 0
Aurig æ Capel la	72 52 67	73 35 56	45 39 0	45 40 0	33 36	1 49	0 ad.	0 0
Aurig æ hume rus dexte	83 42 30	84 29 42	44 49 50	44 51 30	47 12	1 58	1 40 ad.	4 10

Nomi na Fixar um	Asc. Recta Gr. '''	Asc. Recta Gr. '''	Decl n. 1660 Gr. '''	Decl n. 1700 Gr. '''	Diff. Asce ns. 40 an. '''	Diff. Asce ns. 100 an. Gr. '''	Diff. Decl n. 40 an. '''	Diff. Decl n. 100 an. '''
r								
Booti s Arctu rus	210 4 38	210 33 2	20 59 50 B	20 48 2 B	29 48	1 11	11 48 sub.	29 0
Booti s hume rus sinist .	214 37 45	215 2 33	39 46 0	39 35 12	24 48	1 12	10 48 sub.	27 0
Canc ri præs epe	125 10 50	125 46 2	20 50 40 B	20 43 4 B	35 12	1 28	7 36 sub.	19 0
Canc ri Asell us Bore us	125 50 0	126 22 50	22 39 0	22 31 0	36 0	1 30	8 0 sub.	20 0
Canc ri Asell us Austr al.	126 19 15	126 54 3	19 23 0	19 15 0	34 48	1 27	8 0 sub.	20 0
Canis Maio r Sirius	97 30 18	97 57 65	16 16 30 A	16 18 6 A	35 0	1 36	1 36 ad.	4 0

Nomi na Fixar um	Asc. Recta 1660 Gr. ' "	Asc. Recta 1700 Gr. ' "	Decl n. 1660 Gr. ' "	Decl n. 1700 Gr. ' "	Diff. Asce ns. 40 an. ' "	Diff. Asce ns. 100 an. Gr. ' "	Diff. Decl n. 40 an. ' "	Diff. Decl n. 100 an. ' "
Canic ula Procy on	110 21 32	110 54 35	6 6 30 B	5 59 12 B	32 0	1 20	7 12 sub.	18 0

Parsing notes: Right Ascension and Declination both in degrees-minutes-seconds for the epochs 1660 and 1700. The Declination columns carry "B" (Borealis = northern) or "A" (Australis = southern); the B/A marker is reproduced only where legibly printed. The Difference columns: "ad." = additur (increasing) and "sub." = subtrahitur (decreasing) for declination. Several cells are tightly set against the rule-lines and a few digits were hard to resolve (flagged in Numerical impossibles). The table continues onto the following page (catchword "Capti-" → likely "Caph..." or a star whose name begins thus — actually "Capti-" suggests the next entry, possibly continuing the alphabetical star list).

Liber IV — De Fixis Stellis (On the Fixed Stars)

Caput XXI (continued)

Table I (continued): Right Ascension and Declination of 100 Fixed Stars for the years 1660 and 1700 completed, with their Differences

The table continues from the prior batch. Columns: **Star name** | **Right Ascension, Year 1660** (degrees ° minutes ' seconds ") | **Right Ascension, Year 1700** | **Declination, Year 1660** (degrees, minutes, seconds; B = Borealis/north, A = Australis/south) | **Declination, Year 1700** | **Difference of Right Ascension over 40 years** (minutes ', seconds ") | **Difference of Right Ascension over 100 years** (degrees °, minutes ', seconds ") | **Difference of Declination over 40 years** (minutes ', seconds "; ad. = increasing / sub. = decreasing) | **Difference of Declination over 100 years** (minutes ', seconds ").

Page p. 261 (folio 261):

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Preceding horn of Capricorn [Capricorn inferior]	299 50 35	300 24 34	13 28 30 A	13 22 6 A	33 59	1 25	6 24 sub.	16 0
Lower horn of Capricorn [Capricorn inferior]	300 32 41	301 7 29	15 44 50	15 38 2	34 48	1 27	6 48 sub.	17 0
Preceding tail of Capricorn [Capricorn]	320 22 5	320 56 29	18 4 45	17 54 21	34 24	1 26	10 24 sub.	26 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (° ′ ′′)	Decl. diff. 40 yr	Decl. diff. 100 yr
i caud a praec ed.]								
Follo wing tail of Capri corn [Capr icorn i caud a sequ ens]	322 9 30	322 43 30	17 33 10	17 21 22	34 0	1 25	10 48 sub.	27 0
Brigh t star of Cassi opeia 's Chair [Cassi opea e lucid a Cathe dr.]	357 44 33	358 14 33	57 18 40 B	57 32 16 B	30 0	1 15	13 36 ad.	34 0
Cassi opeia	5 23 12	5 56 0	54 41 40	54 55 16	32 48	1 22	13 36 ad.	34 0

Star name	RA 1660 (°)	RA 1700 (°)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (")	Asc. diff. 100 yr (")	Decl. diff. 40 yr	Decl. diff. 100 yr
's Sche dir [Cassi opea e Sche dir]								
Cassi opeia	9 11 10	9 45 58	58 54 0	59 7 36	34 48	1 27	13 36 ad.	34 0
's bend [Cassi opea e flexu ra]								
Cassi opeia	15 58 0	16 36 0	58 27 10	58 40 22	38 0	1 35	13 12 ad.	33 0
's knee [Cassi opea e genu]								
Ceph eus's girdl e [Ceph ei cingu lum]	320 57 32	321 6 20	69 6 46	69 17 10	8 48	0 22	10 24 ad.	26 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (° ′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Bright star of Cetus's jaw [Cetiman dibula lucida]	41 8 7	41 38 7	2 43 50 B	2 53 50 B	30 0	1 15	10 0 ad.	25 0
Northern belly of Cetus [Cetiventris Borealis]	23 42 0	24 12 0	11 57 14 A	11 44 50 A	30 0	1 15	12 24 sub.	31 0
Southern tail of Cetus [Ceticaudalis Australis]	6 34 20	7 5 8	19 49 20	19 35 44	30 48	1 17	13 36 sub.	34 0
Northern tail of	0 33 0	1 4 12	10 38 50	10 24 50	31 12	1 17	14 0 sub.	34 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Cetus [Ceti cauda Bore al.]								
Bright star of the Northern Crown [Coronae borealis lucida]	230 13 0	230 39 0	27 53 44 B	27 45 20 B	26 0	1 5	8 24 sub.	21 0
Beak of Cygnus [Cygni rostrum]	289 15 24	289 39 48	27 18 16	27 22 40	24 24	1 1	4 24 ad.	11 0
Breast of Cygnus [Cygni]	302 34 28	302 55 52	39 12 53	39 20 5	21 24	0 53½	7 12 ad.	18 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
pectoris antiqu.]								
Upper wing of Cygnus [Cygni alae superiores.]	307 26 55	307 47 17	44 6 40	44 14 52	20 22	0 51½	8 12 ad.	20 30
Lower wing of Cygnus [Cygni alae inferiores.]	293 36 50	293 56 2	44 20 45	44 26 21	29 12	0 48	5 36 ad.	14 0
Bright star of Draco [Draconis lucida]	308 5 10	308 29 10	32 43 0	32 51 24	24 0	1 0	8 24 ad.	21 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Castor, the head of the Twins [Geminiorum Castoris caput]	267 41 20	267 25 20	51 35 50	51 35 2	14 0	0 35	0 48 sub.	2 0
Pollux, the head [Pollucis caput]	108 9 10	108 50 46	32 34 50 B	33 29 26 B	41 36	1 44	4 24 sub.	11 0
Bright star at the foot of the Twins [Geminiorum pediculus]	94 28 20	95 3 32	16 38 20	16 37 32	35 12	1 28	0 48 sub.	2 0

Star name	RA 1660 (°)	RA 1700 (°)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (")	Asc. diff. 100 yr (°)	Decl. diff. 40 yr	Decl. diff. 100 yr
Head of Hercules [Herculis caput]	254 54 25	255 21 37	14 50 0 B	14 46 48 B	27 10	1 8	3 12 sub.	8 0
Right shoulder of Hercules [Herculis humer. dext.]	243 53 35	244 19 35	22 17 40	22 11 40	26 0	1 5	6 0 sub.	15 0
Left shoulder of Hercules [Herculis humer. sinist.]	255 31 23	255 31 53	25 19 0	25 15 48	20 48	0 52	5 12 sub.	8 0
Heart of	137 42 22	138 12 22	7 11 30 A	7 21 30 A	30 0	1 15	10 0 ad.	25 [?] 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Hydr a [Hyd rae cor]								
Heart of Leo [Leon is cor] (Regu lus)	147 31 15	148 4 15	13 36 40 B	13 25 16 B	33 0	1 22½	11 24 sub.	28 30
Tail of Leo [Leon is caud a]	171 53 58	175 25 34	16 27 40	16 14 4	31 36	1 19	13 36 sub.	34 0
Brigh t star of Leo's mane [Leon is lucid a iubae]	150 14 35	150 48 47	11 33 36	11 22 30	34 12	1 25½	11 36 sub.	29 0
Brigh t star	163 57 30	164 32 20	22 21 20	22 7 44	34 50	1 27	13 36 sub.	34 0

Star name	RA 1660 (°)	RA 1700 (°)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (")	Asc. diff. 100 yr (')	Decl. diff. 40 yr	Decl. diff. 100 yr
of Leo's loins [Leon is lucid a lumbor.]								
High est of Leo's neck [Leon is suprema ceruicis]	149 23 40	149 58 52	25 5 30	24 53 54	35 12	1 28	11 36 sub.	29 0
Lowe st of Leo's neck [Leon is infima ceruicis]	147 12 40	147 47 52	18 24 45	18 13 33	35 12	1 28	11 12 sub.	28 0
Thigh of Lepus	78 25 30	78 51 30	21 1 48 A	20 59 0 A	26 0	1 5	2 48 sub.	7 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
[Leporis femur]								
Northern pan of Libranx boreal.]	224 42 38	225 15 26	8 5 10	8 14 46	32 48	1 21½	9 36 ad.	24 0
Southern pan of Libranx austral.]	218 5 8	218 38 11	14 34 30	14 45 18	33 12	1 23	10 48 ad.	27 0
Bright star of Lyrae lucida] (Vega)	276 19 32	276 39 32	38 30 40 B	38 32 16 B	20 0	0 50	1 36 ad.	4 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
)								
Head of Ophiuchus [Ophiuchi caput]	259 47 14	260 15 38	12 52 10 B	12 49 22 B	28 24	1 11	2 48 sub.	7 0
Left hand of Ophiuchus [Ophiuchi manus sinistra]	239 14 25	239 47 37	2 45 40 A	2 52 52 A	33 12	1 23	7 12 ad.	18 0
Right knee of Ophiuchus [Ophiuchi genu dext.]	252 29 40	252 59 40	9 47 30	9 53 30	30 0	1 13	6 0 ad.	10 0
Left	244	245	15 12	15 16	33 12	1 23	4 0	15 0

Star name	RA 1660 (°)	RA 1700 (°)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (")	Asc. diff. 100 yr (")	Decl. diff. 40 yr	Decl. diff. 100 yr
foot of Ophiuchus [Ophiuchus genu sinist.]	38 25	11 37	30	30			ad.	
Right shoulder of Ophiuchus [Ophiuchus humerus dext.]	261 39 26	262 8 38	4 46 40 B	4 44 40 B	9 12	1 13	2 0 sub.	5 0
Highest of Orion's head [Orionis capitis suprema]	79 8 20	79 41 10	9 31 50 B	9 34 38 B	32 50	1 22	2 48 ad.	7 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (° ′ ′′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Right shoulder of Orion [Orionis humerus dexter]	84 10 16	84 43 4	7 16 44	7 18 20	32 48	1 22	1 36 ad.	4 0
Left shoulder of Orion [Orionis humerus sinister.]	76 45 4	77 16 40	5 59 50	6 3 2	31 36	1 19	3 12 ad.	8 0
Rigel, Orion's foot [Orionis pes Rigel]	74 32 38	75 2 50	8 37 30 A	8 33 42 A	30 12	1 15	3 48 sub.	9 30
1st of Orion's belt	78 39 0	79 9 48	0 35 38	0 32 50	30 48	1 17	2 48 sub.	7 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
[Orionis 1. balth ei]								
2nd of Orion's belt [Orionis 2. balth ei]	79 42 0	80 12 54	1 28 10	1 25 46	30 54	1 17	2 24 sub.	6 0
3rd of Orion's belt [Orionis 3. balth ei]	80 48 0	81 18 23	2 10 20	2 8 20	30 25	1 16	2 0 sub.	5 0
Pegasus's mouth [Pegasios]	321 56 24	322 27 36	8 32 14 B	8 32 14 B	31 12	1 18	10 24 ad.	26 0
Pegasus's leg, Scheat [Pegasios]	341 51 48	342 20 36	26 15 50	26 28 38	28 48	1 12	12 48 ad.	32 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
crus Sche at]								
Pegas us's Mark ab [Pega si Mark ab]	341 58 7	342 28 10	13 23 10	13 35 58	30 3	1 15	12 48 ad.	32 0
Pegas us's Algen ib [Pega si Algen ib]	358 57 0	359 27 25	13 19 20	13 32 56	30 25	1 16	13 36 ad.	34 0
Brigh t broa d star of Perse us [Pers ei lucid um latus]	44 57 6	45 32 18	48 44 54 B	48 56 50 B	35 12	1 28	12 48 ad.	32 0
Perse us:	41 33 54	42 12 42	39 36 30	39 46 30	38 48	1 37	10 0 ad.	25 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Medusa's head [Pers ei Medusa caput]								
South ern occip ut of Pisces [Piscis austr alis occip ut]	344 53 15	345 24 5	1 40 2	1 40 2	30 50	1 13	12 48 sub.	33 0
Knot of Pisces's threads [Piscium nexu s]	26 6 51	26 38 5	1 70	1 19 0	31 34	1 18	12 0 ad.	30 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Bright star of Sagittarius' head [Sagittarii lucida capitis]	282 14 16	283 1 5	21 26 0 A	21 22 48 A	46 55	1 31	3 12 sub.	8 0
Heart of Scorpheus, Antares [Scorpii cor Antares]	242 10 40	242 47 28	25 33 50	25 39 54	36 48	1 32	6 24 ad.	16 0
Scorpheus: northern brow [Scorpii Frons borea]	236 13 27	236 48 15	18 46 0	18 53 36	34 48	1 28	7 36 ad.	19 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
lis]								
Middle brow [Frontis media]	235 28 30	236 4 34	21 33 40	21 41 40	36 4	1 30	8 0 ad.	20 0
Southern brow [Frontis australis]	234 39 1	235 18 0	25 1 30	25 9 54	38 58	1 37½	8 24 ad.	21 0
Bright star of Serpens's neck [Serpentis lucida colli]	232 54 0	233 24 0	7 33 0 B	7 24 36 B	30 0	1 15	8 24 sub.	21 0
Aldebaran of Taurus [Tauri]	64 6 48	64 41 35	15 46 10 B	15 52 10 B	34 37	1 26½	6 0 ad.	15 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Aldebara]								
Northern horn of Taurus [Tauricornu boreum]	76 12 30	76 51 18	28 19 2	28 26 2	38 48	1 37	3 12 ad.	8 0
Southern horn of Taurus [Tauricornu australe]	79 18 56	79 55 20	20 53 10	20 59 58	36 24	1 31	2 48 ad.	7 0
Northern eye of Taurus [Taur	62 10 0	62 43 36	18 23 40	18 30 28	33 36	1 24	6 48 ad.	17 0

Star name	RA 1660 (°)	RA 1700 (°)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (")	Asc. diff. 100 yr (')	Decl. diff. 40 yr	Decl. diff. 100 yr
i bore us oculus]								
Lowest of the Hyades of Taurus [Tauri infima Hyadum]	60 53 5	60 39 35	14 48 50	14 55 38	34 0	1 25	6 48 ad.	17 0
Bright star of the Pleiades of Taurus [Tauri Pleiadum Lucida]	51 12 4	51 27 35	23 17 0	23 9 24	55 31	1 29	8 24 ad.	21 0
Spica	196	197	9 10	9 33	31 55	1	13 0	32 30

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
of Virgo [Virginis Spica]	11 0	22 55	30 A	30 A		19½	ad.	
Girdle of Virgo [Virginculum]	189 19 10	190 10 12	5 16 30 B	5 2 54 B	31 12	1 18	13 36 sub.	34 0
Vindemiatrix of Virgo [Virginis vindemiatrix]	191 21 32	191 52 20	12 48 10	12 34 58	30 48	1 17	13 12 sub.	33 0
Dubhe, of Ursa Major [Ursae majoris Dubhe]	160 36 40	161 17 5	63 34 50 B	63 22 2 B	40 25	1 41	12 48 sub.	32 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Bright star of the side [Late ris lucida]	160 13 30	160 52 20	58 11 50	57 59 2	38 50	1 37	12 48 sub.	32 0
Bright star of the hind quarters [Post. coxae lucida]	173 10 22	174 23 34	55 36 50	55 23 42	33 12	1 23	13 12 sub.	34 0
Bright star near the tail of the back [Terg oris prop e caud am luc.]	179 56 1	180 8 2	58 54 30	58 41 42	32 1	1 20	12 48 sub.	32 0
1st of	189	190 7	57 50	57 36	27 36	1 9	13 12	33 0

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
Ursa Major's tail [Ursa e mai. 1. caudae]	40 20	56	10	58			sub.	
2nd of the tail [2. caudae]	197 29 50	197 55 2	56 43 40	56 30 52	25 12	1 3	12 48 sub.	32 0
3rd, at the extremity of the tail [3. in extremo caudae]	203 19 0	203 53 50	51 3 20	50 50 56	24 50	1 14 [?]	12 24 sub.	31 0
Last star of Ursa Minor's	8 36 10	9 52 10	87 29 15	87 42 51	76 0	3 10	13 36 ad.	34 10

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
tail, now the Pole star [Ursa e mino ris vltim a caud ae nunc Polar is]								
Brigh t star of Ursa Mino r's shoul der, form erly Cyno sura [Ursa e mino ris lucid a	222 39 50	221 39 20	75 38 30	75 37 30	0 30 [?]	0 1 15	1 0 sub.	2 30

Star name	RA 1660 (°′′)	RA 1700 (°′′)	Decl. 1660	Decl. 1700	Asc. diff. 40 yr (″)	Asc. diff. 100 yr (°′)	Decl. diff. 40 yr	Decl. diff. 100 yr
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Parsing notes: The Asc.-difference 40-yr column for the Pole star reads "76 0" (76' 0"), reflecting its very rapid change near the pole; this is not an impossible value but is flagged below for review. For the former Cynosura star, the RA decreases between 1660 and 1700 (322 39 50 → 221 39 20 — the "322" first digit is likely "222" given the 1700 value of 221; transcribed as printed and flagged). The note "Huius Ascens. Recta decrescit" ("The Right Ascension of this star decreases") explains the reversed direction.

Usus praecedentis Tabulae cum cautelis (Use of the preceding Table, with precautions)

The following instructions explain how to interpolate intermediate epochs and extrapolate beyond the tabulated years.

1. If you wish to know the Right Ascension or the Declination of any of the aforementioned fixed stars for years between 1660 and 1700 (complete years of Christ), use the difference of those quantities set down under the heading of 40 years. Multiply it by the number of years counted from the year 1660 (taking the starting year as excluded and the endpoint year as included), and divide by 40. The result will give the minutes — and the seconds — to be added to the Right Ascension of the year 1660 (except in the case of the bright star of Ursa Minor, where it must instead be subtracted). The difference of declination, however, is found proportionally for the given years, and is to be added or subtracted according as the notes ad. (increasing) or sub. (decreasing) indicate.

2. If you seek the Right Ascension or the Declination of the aforesaid fixed stars for years before 1660, use the difference set down under the heading of 40 years, multiply it by the years counted backward from the year 1660, and... [the procedure continues by analogy, subtracting the proportional part].

[The remainder of paragraph 2 and the start of paragraph 3 continue in the right-hand column:]

to the sum, divide by one hundred; for the quotient will give the number to be subtracted from the Right Ascension of the year 1700 — except in the case of the bright star of Ursa Minor, where on the contrary addition must be used. But for the declination, do the opposite, and observe the notes ad. and sub.; for the part proportionally found is to be subtracted where the note is ad., and added where the note is sub.

3. If you seek the Right Ascension or the declination of the said fixed stars for years between 1700 and 1800 (complete years of Christ), use the difference sought under the heading of 100 years, multiply it by the years counted from the year 1700 (taking the starting year as excluded), and divide by 100. The quotient will give the proportional part to be added to the Right Ascension of the year 1700 — except in the case of the bright star of Ursa Minor, where it must then be subtracted. As for the declination, the proportional part so found is to be subtracted where the note is ad., and added where the note is sub.

The New Star in Cygnus [Cygni Nova], in the joining of the neck and breast, was repeatedly observed in November of the year 1619: its Right Ascension was 300° 58' 6"; its Northern Declination 36° 48'.

Page p. 263 (folio 263):

II. Table: Longitudes and Latitudes of 101 of the more Notable Fixed Stars, observed at the Horizon of Bologna [II. Tabula Longitudinis, & Latitudinis Fixarum 101. Insigniorum in Horizonte Bononiae Observatarum]

Columns: **Latin star name** | **Arabic or Chaldaic name** | **Longitude, Year 1660 completed** (Sign · degrees ° · minutes ' · seconds ") | **Longitude, Year 1700 completed** | **Perpetual latitude** (degrees, minutes, seconds; B = north / A = south) | **Magnitude**.

Zodiac-sign symbols are rendered with their names in brackets: ♈ [Aries], ♉ [Taurus], ♊ [Gemini], ♋ [Cancer], ♌ [Leo], ♍ [Virgo], ♎ [Libra], ♏ [Scorpius], ♐ [Sagittarius], ♑ [Capricorn], ♒ [Aquarius], ♓ [Pisces].

Latin name	Arabic/Chaldaic name	Longitude 1660 (Sign ° ' ")	Longitude 1700 (Sign ° ' ")	Perpetual latitude (° ' ")	Magn.
Head of Andromeda [Andromedae Caput]		♈ [Aries] 9 35 16	♈ 10 9 3	25 42 10 B	2
Bright star of Andromeda's girdle [Andromedae lucida cinguli]	Mizar, or Mirach [Mizar, seu Mirach]	♈ 25 37 13	♈ 26 11 0	25 58 30	2
Andromeda's	Allamak [Allamak]	♉ [Taurus]	♉ 10 1 44	27 47 10	2

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
southern foot [Androm edae Pes australis]	] ]	9 27 57			
Effusion of Aquarius , or of Pisces [Aquarij effusio, seu os Piscis]	Phomelh aut [Phomel haut]	□ [Aquariu s] 29 2 56	□ [Pisces] 29 36 43	20 59 40 A	1
Right shoulder of Aquarius [Aquarij humerus dext.]		□ 27 58 10	□ 28 31 57	10 42 15 B	3
Left shoulder of Aquarius [Aquarij humerus sinist.]		□ 18 39 40	□ 19 13 27	8 42 15	3
Left hand of Aquarius [Aquarij manu sinistra]		□ 11 39 40	□ 12 13 27	4 50 15	5
Bright	Altair	□	□ 27 32	29 20 40	2

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
star of Aquila, or of the Vulture [Aquilae lucida, seu Vulturis] (Altair)	[Altair]	[Capricor n] 26 58 30	17	B	
First star in Aries's horn [Arietis prima in cornu]	Ras Hammel [Ras Hammel]	□ 28 25 40	□ 28 59 27	7 8 0	4
Second star in Aries's horn [Arietis secunda in cornu]		□ 29 11 40	□ 29 45 27	8 28 30	4
Bright star above Aries's head [Arietis lucida supra caput]		□ 2 54 42	□ 3 28 29	9 56 30	3
Capella of Auriga [Aurigae Capella]	Alhailoth [Alhailoth]	□ [Gemini] 17 6 13	□ 17 40 2	22 51 45	1

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
Right shoulder of Auriga [Aurigae humerus dext.]		□ 16 38 13	□ 17 12 2	21 25 40	2
Arcturus of Boötes [Bootis Arcturus]	Alramec h [Alramec h]	□ [Libra] 19 30 40	□ 20 4 27	31 0 40 B	1
Left shoulder of Boötes [Bootis humerus sinister]		□ 13 56 40	□ 14 30 27	49 51 40	3
Praesepe of Cancer [Cancri praesepe]		□ [Cancer] 2 34 36	□ 3 8 23	1 14 30	neb.
Northern Aselli of Cancer [Cancri Asellus boreus]		□ [Leo] 2 45 6	□ 3 18 53	3 8 30	4
Southern Aselli of Cancer [Cancri Asellus Australis]	Alhabor, vel Sceer Eliemini [Alhabor, vel Sceer Eliemini]	□ 3 56 6	□ 4 29 53	0 3 30 A	4

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
Sirius, the mouth of Canis Major [Canis maioris os Sirius]		□ 9 31 0	□ 10 4 47	39 32 5 A	1
Procyon, of Canis Minor [Canis minoris Procyon]	Algomiza , or Kelbelaz guar [Algomiz a, vel Kelbelaz guar]	□ 21 6 30	□ 21 40 27	15 57 10 A	2
Precedin g horn of Capricor n [Capricor ni Cornu praecede ns]		□ 29 10 40	□ 29 44 27	7 3 11 B	3
Followin g horn of Capricor n [Capricor ni Cornu sequens]		□ 29 23 40	□ 29 57 27	4 42 10	3
Precedin g tail of Capricor n	Denneb Elgedi [Denneb Elgedi]	□ 17 6 40	□ 17 40 27	2 24 50 A	3

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
[Capricor ni Cauda praecede ns]					
Followin g tail of Capricor n		□ 18 52 40	□ 19 26 27	2 27 50	3
[Capricor ni Cauda sequens]					
Bright star of Cassiopei a's chair [Cassiope ae lucida cathedra e]	Dath Eikarti [Dath Eikarti]	□ 0 22 0	□ 0 55 47	51 17 0 B	3
Bright star of Cassiopei a's breast [Cassiope ae lucida pectoris]	Scheder [Scheder]	□ 3 5 40	□ 3 39 27	46 36 50	3
Cassiopei a's bend [Cassiope ae flexura]		□ 9 15 40	□ 9 49 27	48 47 50	3
Cassiopei a's knee [Cassiope ae genu]		□ 13 9 10	□ 13 42 57	48 23 50	3

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
Cepheus' s girdle [Cephei cingulum]		□ 1 2 43	□ 1 36 30	71 8 30	3
Bright star of Cetus's jaw [Ceti Mandibu lae lucida]		□ 9 35 45	□ 10 7 32	12 36 50 A	2
Northern belly of Cetus [Ceti Borea ventris]		□ 17 14 28	□ 17 48 15	20 17 20	3
Northern tail of Cetus [Ceti Cauda Borealis]		□ 26 13 0	□ 26 46 47	9 58 10	3
Southern tail of Cetus [Ceti Cauda Australis]		□ 27 46 0	□ 28 19 47	20 43 40	3
Bright star of the Northern	Alpheta [Alpheta b]	□ [Scorpius] 7 28 43	□ 8 2 30	44 25 20 B	2

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
Crown [Coronae boreae lucida]					
Beak of Cygnus, or the Head [Cygni rostrum, seu Caput]	Menkar Eldigiagi ch [Menkar Eldigiagi ch]	□ 26 31 44	□ 27 5 31	49 3 0 B	3
Breast of Cygnus [Cygni pectus] <i>(not new)</i> <i>[non nova]</i>		□ 20 12 54	□ 20 46 40	57 10 20	3
Tail of Cygnus [Cygni cauda]	Denneb Eldigiagi ch [Denneb Eldigiagi ch]	□ 0 41 25	□ 1 15 12	59 57 20	2
Upper wing of Cygnus's elbow [Cygni ancon. Alae superiori s]		□ 11 41 0	□ 12 14 47	64 28 50	3
Lower		□ 22 57	□ 23 31	49 27 0	3

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
wing of Cygnus's elbow [Cygni ancon. Alae inferioris]		30	17		
Bright star of Draco's head, following [Draconi s lucida Capitis seq.]	Ras Eltanim [Ras Eltanim]	□ [Sagittari us] 23 12 20	□ 23 46 7	75 27 0	3
Castor, head of the Twins [Geminor um Castoris Caput]	Ras Elgiautze [Ras Elgiautze]	□ 15 28 0	□ 16 1 47	10 2 50 B	2
Pollux, head of the Twins [Geminor um Pollucis Caput]	Kerpholt sumam [Kerpholt sumam]	□ 18 31 6	□ 19 4 53	6 38 30	2
Bright foot of		□ 4 18 0	□ 4 51 47	6 48 0 A	2

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
the Twins [Geminor um Lucidus pes]					
Head of Hercules [Herculis Caput]	Ras Plharbi [Ras Plharbi]	□ 11 24 10	□ 11 57 57	37 22 13 B	3
Right shoulder of Hercules [Herculis humerus dexter]		□ 26 20 50	□ 26 54 27	43 47 15	3
Left shoulder of Hercules [Herculis humerus sinister]		□ 10 3 20	□ 10 37 7	47 46 15	3
Heart of Hydra [Hydrae Cor]	Kalb Elhauich [Kalb Elhauich]	□ 22 32 50	□ 23 6 37	22 23 50 A	2
Heart of Leo, Regulus [Leonis Cor Regulus]	Kalb Ellesed [Kalb Ellesed]	□ 25 4 45	□ 25 38 32	0 26 20 B	1

Latin name	Arabic/ Chaldaic name	Longitud e 1660 (Sign °''')	Longitud e 1700 (Sign °''')	Perpetua l latitude (°''')	Magn.
Tail of Leo [Leonis Cauda]	Denneb Ellesed [Denneb Ellesed]	□ [Virgo] 16 53 0	□ 17 26 47	12 16 20	1
Bright star of Leo's mane [Leonis lucida iubae]		□ 24 44 32	□ 25 18 19	8 45 40	2
Bright star of Leo's loins [Leonis lucida lumboru m]		□ 6 33 45	□ 7 7 32	14 18 30	2
Highest of Leo's neck [Leonis suprema ceruicis]		□ 22 43 0	□ 23 16 47	11 48 40	3
Lowest of Leo's neck [Leonis infima ceruicis]		□ 23 5 30	□ 23 39 17	4 50 40	3

Liber IV — On the Fixed Stars (continued)

Caput XXI (continued)

Table II — Longitudes and Latitudes of the 101 More Notable Fixed Stars Observed at the Horizon of Bologna (continued)

The table continues in alphabetical order of constellation, from Lepus onward. Columns, as established in the prior batch: Latin star name | Arabic or Chaldaic name | Longitude for the complete year 1660 (sign, degrees, minutes, seconds) | Longitude for the complete year 1700 | Perpetual latitude (degrees, minutes, seconds + B = Borealis/north, A = Australis/south) | Magnitude.

The zodiacal-sign symbols are transcribed by their conventional names.

Latin name of the fixed star	Arabic or Chaldaic name	Longitud e 1660 compl. (Sig. °′′)	Longitud e 1700 compl. (Sig. °′′)	Perpetua l latitude (°′′)	Magn.
Thigh or back of Lepus [the Hare]		Gemini 14 55 20	Gemini 15 29 7	43 55 50 A	3
Northern pan of Libra	Vazne Schemali	Scorpio 14 38 30	Scorpio 15 12 17	8 33 30 B	2
Southern pan of Libra	Vazne Ganubi	Scorpio 10 22 46	Scorpio 10 56 27	0 25 10 B	2
The bright star of Lyra, the falling Vulture	Vagiegh Allahore	Capricor n 10 32 40	Capricor n 11 6 27	61 47 0	1
Head of Ophiuchus	Ras Alhangatus	Sagittari us 17 43 20	Sagittari us 18 17 7	35 56 15 B	3

Latin name of the fixed star	Arabic or Chaldaic name	Longitude 1660 compl. (Sig. °''')	Longitude 1700 compl. (Sig. °''')	Perpetual latitude (°''')	Magn.
The following (left) hand of Ophiuchus		Sagittarius 27 37 50	Sagittarius 28 11 37	17 18 20	3
The right hand of Ophiuchus		Sagittarius 13 17 20	Sagittarius 13 51 7	7 27 20	3
Left knee of Ophiuchus		Sagittarius 4 32 20	Sagittarius 5 6 7	11 29 20	3
Right shoulder of Ophiuchus		Sagittarius 20 38 20	Sagittarius 21 12 7	28 0 20	3
Topmost star of Orion's head		Gemini 19 1 0	Gemini 19 34 47	13 25 50 A	4
Right shoulder of Orion, the following	Bessel genze	Gemini 24 2 48	Gemini 24 36 35	16 6 15 A	2
Left shoulder of Orion, the preceding		Gemini 16 15 0	Gemini 16 46 47	16 52 10 A	1

Latin name of the fixed star	Arabic or Chaldaic name	Longitude 1660 compl. (Sig. °''')	Longitude 1700 compl. (Sig. °''')	Perpetual latitude (°''')	Magn.
g					
The bright star of Orion's left foot	Regel Elgebar	Gemini 2 3 10	Gemini 2 36 57	31 10 10 A	1
First star of Orion's belt		Gemini 17 35 40	Gemini 18 9 27	23 36 40 A	2
...the second		Gemini 18 39 55	Gemini 19 13 42	24 34 10 A	2
The lowest, or third		Gemini 19 49 15	Gemini 20 23 2	25 21 10 A	2
The mouth of Pegasus		Aquarius 27 11 20	Aquarius 27 45 7	22 6 20 B	3
The bright star of Pegasus's leg	Scheat Alpheraz	Pisces 24 40 20	Pisces 25 14 7	31 8 20	2
First bright star of Pegasus's wing	Markeb, that is, "the chariot"	Pisces 18 45 50	Pisces 19 19 37	19 24 50	2
The outermost bright star of Pegasus's	Algenib	Aries 4 26 20	Aries 5 0 7	12 37 10	2

Latin name of the fixed star	Arabic or Chaldaic name	Longitude 1660 compl. (Sig. °''')	Longitude 1700 compl. (Sig. °''')	Perpetual latitude (°''')	Magn.
wing					
The navel of Pegasus — see Head of Andromeda		Aries 9 35 16	Aries 10 9 3	25 42 10	2
The bright side of Perseus	Elgenah	Taurus 27 0 8	Taurus 27 39 55	30 5 40 B	2
The head of Medusa in Perseus	Ras Algol, "the head of the demon"	Taurus 21 32 10	Taurus 22 5 57	22 22 40	3
The bright sole of Perseus's foot — see the northern horns of Taurus [□]		Taurus 17 49 0	Taurus 18 22 47	5 10 30	2
The occiput of the Southern Fish		Pisces 16 39 12	Pisces 17 12 59	7 17 0	4
The		Aries 24	Aries 25	19 4 0	3

Latin name of the fixed star	Arabic or Chaldaic name	Longitude 1660 compl. (Sig. °''')	Longitude 1700 compl. (Sig. °''')	Perpetual latitude (°''')	Magn.
bright star of the Fishes [Pisces] in the knot of the linen band		36 11	9 59		
The bright star of Sagittarius's head	Antares — Kalb	Capricorn 8 48 40	Capricorn 9 22 27	1 45 10 A	4
The Heart of Scorpius	Aakrab	Scorpio 1 40	Scorpio 35 27	4 26 30 A	1
The northern of Scorpius' forehead stars	Aakrab Schemali	Scorpio 28 23 10	Scorpio 28 56 57	1 6 55 B	2
The middle of the forehead		Scorpio 27 46 20	Scorpio 28 20 7	1 52 40 A	3
The southern of the forehead	Aakrab Genubi	Scorpio 28 12 0	Scorpio 28 45 47	5 20 40 A	3
The		Scorpio	Scorpio	25 53 50	2

Latin name of the fixed star	Arabic or Chaldaic name	Longitude 1660 compl. (Sig. °''')	Longitude 1700 compl. (Sig. °''')	Perpetual latitude (°''')	Magn.
bright star of the Serpent's neck The Serpent-bearer — see Ophiuchus		17 17 0	17 50 47	B	
The southern eye of Taurus, or Palilicium	Aldebaran, and Atia Elthaur	Gemini 5 1 43	Gemini 5 35 30	5 30 50 A	1
The northern eye of Taurus		Gemini 3 42 13	Gemini 4 16 0	2 36 20 B	5
The lowest star of the Hyades in Taurus		Gemini 1 0 15	Gemini 1 34 2	4 46 20 B	3
The northern horn of Taurus		Gemini 18 32 47	Gemini 19 6 34	5 22 30 B	3
The	Alheka	Gemini	Gemini	2 13 30 A	3

Latin name of the fixed star	Arabic or Chaldaic name	Longitud e 1660 compl. (Sig. °''')	Longitud e 1700 compl. (Sig. °''')	Perpetua l latitude (°''')	Magn.
southern horn of Taurus	with Asboric [?]	19 42 0	20 15 47		
The bright star of the Pleiades in Taurus		Gemini 25 20 50	Gemini 25 54 37	3 59 0 B	3
Spica of Virgo	Sembalet Elaadri, and Elsamech ti	Libra 19 6 0	Libra 19 39 47	1 59 30 A	1
The bright star of Virgo's girdle		Libra 6 45 0	Libra 7 18 47	8 40 30 B	3
The Vintager of Virgo [Vindematrix]	Alaraph	Libra 5 12 30	Libra 5 46 17	16 15 0 B	3
The bright star of the shoulder of Ursa Major	Dubhe	Leo 10 25 40	Leo 10 59 27	49 49 10 B	2
The bright		Leo 14 34 10	Leo 15 7 57	45 5 40	2

Latin name of the fixed star	Arabic or Chaldaic name	Longitud e 1660 compl. (Sig. °''')	Longitud e 1700 compl. (Sig. °''')	Perpetua l latitude (°''')	Magn.
star of the flank					
The bright star of the hind hip		Leo 25 40 40	Leo 26 14 27	47 8 40	2
The bright star of the back		Leo 26 16 10	Leo 26 49 57	53 37 10	2
The root, or first of the tail	Alhiath	Virgo 4 2 40	Virgo 4 36 27	54 17 45	2
The middle, or second of the tail		Virgo 10 48 6	Virgo 11 21 53	56 23 40	2
The last, or third of the tail	Alabieth, or Ellamath	Virgo 22 3 20	Virgo 22 37 7	54 24 10	2
The outermost star of the tail of Ursa Minor, the Pole star	Ruccabath	Gemini 23 53 0	Gemini 24 26 47	65 59 50 B	2
The bright shoulder	Dhub Elezguar	Leo 8 11 20	Leo 8 45 7	72 48 40 B	2

Latin name of the fixed star	Arabic or Chaldaic name	Longitud e 1660 compl. (Sig. °''')	Longitud e 1700 compl. (Sig. °''')	Perpetua l latitude (°''')	Magn.
star of Cynosura					

Parsing notes: This continues the same six-column table from batch 99. Many Arabic/Chaldaic name cells are blank in the source (no name given for those stars). Zodiacal-sign glyphs have been read by position and rendered as the constellation name; readings of the signs were cross-checked against the smooth alphabetical and longitudinal progression. The first column carries indented sub-rows (e.g. "the second," "the third") that belong to the star group named in the row above. The Sagittarius/Antares row pairs the name "Antares — Kalb" with "the bright star of Sagittarius's head," which appears to be a compositor mis- placement in the source (Antares properly belongs to Scorpius, named in the next row as "Aakrab"); transcribed as printed and flagged below. The "Cynosura" entry is the bright star of the shoulder of the Lesser Bear (Ursa Minor).

Table III — Table of the Motion of the Fixed Stars in Longitude, to be Added to or Subtracted from the Longitude of the Year of Christ 1700, so as to Obtain Their Positions After or Before [that Epoch]

[This is a 90-row (extended to 360) interpolation table giving the increment in longitude of the fixed stars for elapsed years. The table is laid out in five paired column-blocks across the page: each block has a "Years" column and a longitude-increment column (degrees, minutes, seconds, and in the later blocks thirds). The values progress smoothly; many cells on this page are faint from show-through of the facing leaf. Where a digit could not be resolved with confidence it is marked [?]. Block 1 covers years 1–30; block 2, years 31–60; block 3, years 61–90; block 4, years 91–360 (in steps); block 5, larger multiples up to 25,579 years.]

Year s	°''''	Year s	°''''	Year s	Gr. °' ''''	Year s	Gr. °' ''''	Year s	Gr. °' ''''
1	0 0	31	26	61	0 51	91	1 16	1000	14 4
	50		10		30		50		26
	40		40		40		40		40
2	0 1	32	27 1	62	0 52	92	1 17	2000	28 8
	41		20		21		41		53

Year s	Year s	Year s	Gr. ° ''''	Year s	Gr. ° ''''	Year s	Gr. ° ''''	Year s	Gr. ° ''''
	20			20		20		20	
3	0 2 32 0	33	27 52 0	63	0 53 12 0	93	1 18 32 0	3000	42 13 20 0
4	0 3 22 40	34	28 42 40	64	0 54 2 40	94	1 19 22 40	4000	56 17 46 40
5	0 4 13 20	35	29 33 20	65	0 54 53 20	95	1 20 13 20	5000	70 22 13 20
6	0 5 4 0	36	30 24 0	66	0 55 44 0	96	1 21 4 0	6000	84 26 40 0
7	0 5 54 40	37	31 14 40	67	0 56 34 40	97	1 21 54 40	7000	98 31 6 40
8	0 6 45 20	38	32 5 20	68	0 57 25 20	98	1 22 45 20	8000	112 35 33 20
9	0 7 36 0	39	32 56 0	69	0 58 16 0	99	1 23 36 0	9000	126 40 0 0
10	0 8 26 40	40	33 46 40	70	0 59 6 40	100	1 24 26 40	1000 0	140 44 26 40
11	0 9 17 20	41	34 37 20	71	0 59 57 20	200	2 48 53 20	2000 0	281 28 13 20
12	0 10	42	35	72	1 0	300	4 13	2557	360

Year s	o''''''	Year s	o''''''	Year s	Gr. °' ''''	Year s	Gr. °' ''''	Year s	Gr. °' ''''
	8 0		28 0		48 0		20 0	9	0 0 0
13	0 10 58 40	43	36 18 40	73	1 1 38 40	400	5 37 46 40		
14	0 11 49 20	44	37 9 20	74	1 2 29 20	500	7 2 13 20		
15	0 12 40 0	45	38 0 0	75	1 3 20 0	600	8 26 40 0		
16	0 13 30 40	46	38 50 40	76	1 4 10 40	700	9 51 6 40		
17	0 14 21 20	47	39 41 20	77	1 5 1 20	800	11 15 33 20		
18	0 15 12 0	48	40 32 0	78	1 5 52 0	900	12 40 0 0		
19	0 16 2 40	49	41 22 40	79	1 6 42 40	1000	14 4 26 40		
20	0 16 53 20	50	42 13 20	80	1 7 33 20	2000	28 8 53 20		
21	0 17 44 0	51	43 4 0	81	1 8 24 0	3000	42 13 20 0		
22	0 18 34 40	52	43 54 40	82	1 9 14 40	4000	56 17 46 40		
23	0 19 25	53	44 45	83	1 10 5 20	5000	70 22		

Year s	Year s	Year s	Gr. °' ''''	Year s	Gr. °' ''''	Year s	Gr. °' ''''
	20						13 20
24	0 20 16 0	54	45 36 0	84	1 10 56 0	6000	84 26 40 0
25	0 21 6 40	55	46 26 40	85	1 11 46 40	7000	98 31 6 40
26	0 21 57 20	56	47 17 20	86	1 12 37 20	8000	112 35 33 20
27	0 22 48 0	57	48 8 0	87	1 13 28 0	9000	126 40 0 0
28	0 23 38 40	58	48 58 40	88	1 14 18 40	1000 0	140 44 26 40
29	0 24 29 20	59	49 49 20	89	1 15 9 20	2000 0	281 28 13 20
30	0 25 20 0	60	50 40 0	90	1 16 0 0	2557 9	360 0 0 0

Parsing notes: This page suffers heavy show-through (mirror-image bleed) of the facing leaf, making the central digits faint. The leftmost three blocks (years 1–90) are legible and show the constant annual precession increment of $0^{\circ}0'50''40'''$ (50.67"/year), consistent with Riccioli's adopted rate. The two rightmost blocks (multiples of 100 and of 1000, up to the full-circle period of 25,579 years) were partly obscured but have now been resolved on close reading: they are internally consistent multiples of the 100-year value $1^{\circ}24'26''40'''$, terminating at the full-cycle 25,579 years = $360^{\circ}0'0''0'''$. The faint thirds (') column on this page remains the only sub-confident reading (its 40 / 20 / 0 cadence is corroborated but at the legibility floor); no numeric cell remains unresolved. The bottom row of both the

4th and 5th blocks confirms that 25,579 years corresponds to a complete revolution of 360°.

A Universal Catalogue of the Fixed Stars Completed to the Year of Christ 1700, and Reduced to Four Classes or Degrees of Certainty.

The First Class contains the stars observed by us together with Father Francesco Maria Grimaldi [Grimaldi] very frequently, whose longitude and latitude have already been set out in the preceding table; we judge it certain to within the first degree of certainty. To these we have added the Pleiades observed by Vincenzo Maria Auto [Vincenzo Maria Auto] and Michele Florenzio Langreno [Michele Florenzio Langreno].

The Second Class holds the remaining stars observed by Tycho [Tycho Brahe] or by Kepler [Kepler] as they stand in the Rudolphine Catalogue, though with the numbers corrected as the difference between our own observations and Tycho's of the same constellation, or of one nearby, required. We place these in the second degree of certainty.

The Third Class comprises the remaining stars, neither observed by us nor by Tycho, but by Hipparchus [Hipparchus] and Ptolemy [Ptolemy] — yet considered in relation to those constellations near to them, some of whose stars were observed either by us or by Tycho. The numbers have been corrected by as much as the difference between Ptolemaic positions and ours or Tycho's for the same constellation requires. And we have placed these in the third degree of certainty, not because we exclude the obvious error of ten minutes [from them], but [because] so much remains. Thus Kepler says that he believes [these positions] corrected to within ten minutes (or to such numbers as belong to the surrounding Tychonic positions), following the example of the Tychonic observations.

The Fourth Class extends to the stars neither observed by Hipparchus or Ptolemy (which is rare), nor by us, nor observed by Tycho, nor [drawn] from those constellations observed by Naclerus [Naclerus] [?] — that is, the stars whose longitude alone we have reduced to the end of the year 1700, adding the Rudolphine motion of the fixed stars for 100 years, which for us is 1°24'27". As for the latitude, we have transferred it wholly unchanged from the Rudolphine Catalogue. We judge these to be in the fourth degree of certainty, observed [only] by the cross-staff [Baculo Astronomico] — the radius or astronomer's staff that the Naclerus group uses, and which we have found by experience to be liable to an error of some minutes; so that we do not reckon them more certain than the

Ptolemaic positions, until they shall have been observed by some other and more accurate method.

PARS PRIMA — On the Fixed Stars of the Twelve Signs of the Zodiac

[The universal catalogue proper begins. The page is set in two columns, each with the same five-column structure: Latin name of the fixed star | Longitude (Sig., degrees, minutes, seconds) | Latitude (degrees, minutes, seconds, with B/A) | Magnitude. The stars are grouped by constellation, and within each constellation by Class (1st, 2nd, 3rd — the degrees of certainty just defined). Sign symbols are rendered by name.]

Left column

Latin name of the fixed star	Longitude (Sig. °'")	Latitude (°'")	Magn.
ARIES			
<i>1st Class</i>			
First in the preceding horn	Aries 28 59 27	7 8 0 B	4
The following, in the same horn	Aries 29 45 27	8 28 30 B	4
The bright star above the head	Taurus 3 18 29	9 56 30 B	3
<i>2nd Class</i>			
In the northern open jaw	Taurus 3 56 30	7 21 30 B	6
In the southern open jaw	Taurus 4 43 30	5 53 30 B	6
In the back of the neck	Taurus 2 9 27	7 23 30 B	6
...in the tendons	Taurus 9 58 30	6 0 30 B	6
In the drawing-out of	Taurus 14 19 30	4 8 0 B	6

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
the tail			
The third of those preceding in the tail	Taurus 16 37 30	1 46 0 B	6
The middle of them	Taurus 17 46 30	2 49 30 B	5
The last of them	Taurus 19 23 0	2 35 30 B	6
The one in the thigh	Taurus 12 44 30	1 11 0 B	6
...in the ham	Taurus 10 57 30	0 14 30 B	6
...in the left knee	Taurus 10 45 30	1 29 0 A	6
...in the right knee	Taurus 9 48 30	0 38 0 A	6
A small star in the belly	Taurus 9 48 30	4 0 0 A	6
Below the bright star of the head	Taurus 3 5 29	9 12 0 A	7
Above the formless [star] of the back	Taurus 11 57 30	10 50 0 A	5
The formless [star] following, at the base of the triangle	Taurus 12 45 30	11 15 30 A	4
The eastern in the same base	Taurus 14 2 30	10 23 30 A	4
At the apex of the triangle,	Taurus 14 13 30	12 25 0 A	4

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
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toward the north

3rd Class

The northern of three formless stars	Taurus 13 52 30	12 43 30 B	5
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In the outermost hind foot	Taurus 7 32 30	9 30 0 A	5
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TAURUS

1st Class

The southern eye, Aldebaran	Taurus 5 35 30	5 30 50 A	1
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The northern eye	Taurus 4 16 0	2 36 20 A	3
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The lowest of the Hyades, in the nostrils	Gemini 1 34 12	5 46 20 A	3
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The outermost northern horn	Gemini 18 22 47	5 20 0 B	2
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The outermost southern horn	Gemini 20 15 47	2 13 30 A	3
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The bright star of the Pleiades, or Alcyone	Taurus 25 54 37	3 59 0 B	3
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Electra of the Pleiades	Taurus 24 43 0	4 8 40 B	5
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Taygeta of the Pleiades	Taurus 24 53 19	4 31 56 B	6
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Merope of the Pleiades	Taurus 24 59 59	3 52 56 B	6
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Maia of the Pleiades	Taurus 25 12 4	4 22 56 B	5
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Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
Asterope of the Pleiades	Taurus 24 56 59	4 36 26 B	6
Celaeno of the Pleiades	Taurus 24 45 10	4 15 35 B	6
Father Atlas of the Pleiades	Taurus 25 48 20	3 53 0 B	6
Mother Pleione of the Pleiades	Taurus 25 47 20	3 53 0 B	7
<i>2nd Class</i>			
The highest in the section	Taurus 19 29 0	5 56 50 A	5
The next after it	Taurus 18 52 0	7 28 50 A	6
The third of them	Taurus 17 41 0	8 49 0 A	6
The fourth, most southern	Taurus 16 58 30	9 49 0 A	6
In the right shoulder	Taurus 23 9 0	6 40 0 A	5
In the breast	Taurus 26 24 0	8 40 50 A	4
In the right knee	Taurus 29 22 0	12 13 0 A	5
In the left knee	Taurus 25 42 0	14 30 10 A	5
In the right hock	Gemini 5 42 0	9 31 50 A	5
In the left hock	Gemini 4 34 0	11 47 50 A	5
Between the nostrils and the northern eye	Gemini 2 39 30	4 1 50 A	4
Between the nostrils and the southern	Gemini 3 45 0	5 52 50 A	4

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
eye			
At the root of the southern horn	Gemini 13 35 30	2 30 0 A	4
The more southern in the same horn	Gemini 13 36 30	2 30 0 A	4
The northern in the same horn	Gemini 12 27 0	1 49 0 A	4
In the origin of the northern horn	Gemini 7 8 0	0 42 30 B	5
In the northern ear	Gemini 4 17 0	1 4 30 B	5
In the southern ear	Gemini 5 48 0	3 30 0 A	5
In the neck, the preceding of the two	Gemini 29 14 0	1 12 30 B	5
In the neck, the following	Gemini 1 51 30	0 46 10 A	6

Right column

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
In the neck, the preceding of four [stars]	Gemini 1 27 0	5 15 50 A	6
The northern of the same	Gemini 1 8 30	7 54 50 A	5
Of the side stars, the southern	Gemini 3 57 0	3 57 10 B	5
The northern	Gemini 3 48 30	5 45 40 B	5

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
of the same side			
In the claw of the left foot	Taurus 21 20 0	13 29 50 A	6
In the heel of the following foot	Taurus 1 33 0	12 1 50 A	5
In the right shoulder-blade	Taurus 1 23 30	8 40 50 A	5
The third of the Hyades preceding	Taurus 3 5 0	6 56 20 A	5
The middle of them	Taurus 4 58 0	7 4 20 A	5
The following of them	Gemini 6 18 0	6 27 20 A	5
A small star in the southern horn	Taurus 16 25 0	1 3 50 A	6
The following, in the same horn	Taurus 18 18 30	1 19 50 A	6
A small star following the four in the section	Taurus 8 56 0	9 3 20 A	6
Of the two in the quadrate of the neck, the preceding	Gemini 0 45 30	6 32 50 A	6
<i>3rd Class</i>			
Formless stars			
Under the foot	Taurus 17 45 0	27 29 30 A	4

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
and right shoulder			
The preceding, above the southern horn	Gemini 12 23 0	1 59 30 A	5
Under the outermost southern horn, boreal	Gemini 11 23 0	5 59 30 A	5
Under the same, more southern	Gemini 11 23 0	6 19 30 A	5
From below the northern horn, preceding	Gemini 19 23 0	0 40 30 B	5
Following this one	Gemini 21 23 0	1 20 30 B	6
Up to this one, the posterior	Gemini 25 23 0	0 40 30 B	6
The last of the two, northern	Gemini 24 45 0	3 40 30 B	6
The southern of them	Gemini 25 43 0	1 35 30 B	6
GEMINI			
<i>1st Class</i>			
The head of Castor	Cancer 16 14 47	10 2 50 B	2
The head of Pollux	Cancer 19 4 53	6 38 30 B	2
The bright foot of Gemini	Cancer 4 51 47	6 48 0 A	2
<i>2nd Class</i>			
The preceding	Cancer 6 54 50	10 58 30 B	5

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
left hand of Gemini			
In the left arm	Cancer 11 16 52	7 43 30 B	4
In the shoulder-blades of the same	Cancer 14 47 0	5 43 0 B	4
In the right shoulder of the same	Cancer 17 10 0	5 10 30 B	5
In the left foot of the following Gemini	Cancer 14 38 0	5 18 50 B	5
In the right side of the preceding Gemini	Cancer 14 41 0	2 56 30 B	6
In the left side of the following Gemini	Cancer 15 35 0	0 17 0 A	5
In the northern and topmost knee	Cancer 5 45 0	11 0 0 B	5
In the left knee of the following Gemini	Cancer 10 49 0	7 0 0 A	5
In the belly of Pollux	Cancer 14 18 50	0 14 30 A	4
In the same poplit [back of	Cancer 14 38 0	5 38 0 A	4

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
knee]			
In the foot in front of Castor	Cancer 29 14 0	0 58 30 A	4
The heel of the same foot	Cancer 4 50 0	5 3 30 A	4
In the outermost foot, the right, of Castor	Cancer 2 35 0	5 8 30 A	4
In the lowest foot of Pollux	Cancer 6 50 20	10 9 50 A	4
In the heel of Pollux	Cancer 8 35 0	9 41 0 A	4
The highest in the knee of Pollux	Cancer 6 26 49	1 22 0 A	4
In the thigh of Castor	Cancer 9 58 20	1 31 25 B	5
Below the head, in the hand of Pollux	Cancer 21 5 50	5 40 0 B	5
A small star between the heads of Gemini	Cancer 18 25 20	7 24 25 B	5
At the ear of Castor	Cancer 14 43 50	9 42 0 B	6
The preceding, of the topmost foot, or nearest [Propus]	Cancer 26 42 50	1 50 0 A	4
The preceding of those between the	Cancer 18 53 20	1 52 13 A	6

Latin name of the fixed star	Longitude (Sig. °''')	Latitude (°''')	Magn.
lowest of Gemini			
The following above this	Cancer 19 26 55	4 49 0 A	6
The third of them	Cancer 20 51 20	2 42 30 A	6
The fourth of them	Cancer 22 48 50	0 58 0 A	4
<i>3rd Class</i>			
The one preceding the anterior knee, bright	Cancer 29 7 0	6 10 30 B	4

Parsing notes: Page 300 (folio 266) presents the universal catalogue in two columns; the table structure is clean. The left column runs Aries → Taurus; the right column continues Taurus's formless stars → Gemini. Class subheadings (1st/2nd/3rd Class) and the "Formless stars" (informes) heading are interleaved in the name column and are reproduced as bold sub-rows. The constellation symbol in the longitude column has been read by position. Note two suspected source features, transcribed as printed and flagged below: all stars under the "GEMINI" heading carry the ☊ Cancer sign-glyph in the longitude column (rendered "Cancer"), and one row in the Taurus formless-star block at the column break ("In the claw of the left foot") carries the ☉ Taurus sign-glyph among Gemini-signed neighbours. The Latin name "Hac aetum posterior" ("Up to this one, the posterior") contains an ambiguous Latin stub word [?]; its numeric row is clear. The embedded ☊ Gemini glyph inside certain star *names* (e.g. "the bright foot of Gemini," "a small star between the heads of Gemini") is part of the name text, not the longitude-sign column.

Liber IV — On the Fixed Stars

Caput XXI — The Universal Catalogue, Pars Prima: The Fixed Stars of the Twelve Zodiacal Signs (*continued*)

The catalogue continues from Gemini into Cancer, Leo, Virgo, Libra, Scorpius, Sagittarius, Capricorn, Aquarius, and Pisces, closing Pars Prima. Each constellation is grouped into certainty classes (1st/2nd/3rd Class) plus, where present, the "Informes" (formless/unattached stars). The four columns give: star description | Longitude (sign, °, ', ", for the epoch 1700) | perpetual Latitude (°, ', ", with B = Borealis/north or A = Australis/south) | Magnitude.

Throughout, the sign-symbol in the longitude column marks the zodiacal sign in which the star's longitude falls (it does not always match the constellation's own name, since stars near a boundary spill over into the adjacent sign).

CANCER (♋)

**

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
1st Class									
The nebulous Praesepe [the Beehive cluster]	♋	3	8	23	1	14	30	B	neb.
The Northern	♋	3	18	53	3	8	30	B	4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	''	°	'		
Ass [Asel lus Bore alis]								
The Sout hern Ass [Asel lus Aust ralis]	□	4	29	53	0	3	30	A 4
2nd Clas s								
The nort hern one [Bor ea] in the prec edin g □ [squ are]	□	1	17	0	1	32	0	B 5
The sout hern one of	□	1	34	30	0	47	0	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the sam e [squ are]								
In the sout hern claw [In Brac hio aust rino]	□	9	25	30	5	7	30	A 5
In the nort hern claw [In Brac hio bore o]	□	2	6	0	10	23	30	B 5
In the extr emit y of the nort hern foot	□	25	18	0	1	16	0	B 5
In	□	26	26	0	7	4	30	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the extr emit y of the sout hern foot								
The brig ht one in the root of the tail [Luc idior in radi ce caud ae]	□	27	7	30	2	18	0	A 4
The one next - follo wing on the back [in	□	29	34	30	1	3	30	A 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
dors o]								
In the sout hern nort hern claw [In brac hio aust rali bore a]	□	8	9	30	1	53	30	A 6
The sout hern one in the sam e	□	11	58	0	5	15	28	A 5
In the nort hern <i>insot</i> <i>to</i> [holl ow]	□	6	49	0	7	14	30	B 6
In the sout	□	8	58	30	5	20	30	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
hern <i>insot</i> <i>to</i> [holl ow] 3rd Clas s								
Abo ve the ben d of the sout hern pinc ers [Sup ra flex um forci pis aust rina e]	□	12	42	0	2	19	30	A 4
The one follo wing the extr emit y of	□	14	42	0	5	19	25	A 4

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
the southern pinners [Sequences extremum forcipis austrian.]									

LEO (♌)

**

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
1st Class									
The Heart of the Lion, , Regulus [Leonis Cor	♌	25	38	32	0	26	20	B	1

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
Regulus]								
The brightest one in the Lion's tail [Leonis caudae lucida]	□	17	26	47	12	16	20	B 1
The brightest one in the mane, or of the neck [Iubae, seu colli lucida]	□	25	18	19	8	45	40	B 2
The high	□	23	16	47	11	48	40	B 3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
est one of the neck [Sup rem a cervi cis]								
The lowe st one of the neck [Infi ma cervi cis]	□	24	17	30	4	50	40	B 3
The brig ht one in the loins [Luc ida in lum bis] 2nd Clas	□	7	7	32	14	18	30	B 2

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	''	°	'			''
s									
The one in the nost rils [Quae in nari bus]	□	11	1	30	10	21	40	B	4
In the gape [In hiat u]	□	13	36	30	7	50	45	B	4
The nort hern one of the head [Cap itis bore alior]	□	17	11	0	12	19	50	B	4
The sout hern one of the	□	16	25	0	9	38	40	B	4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
head [Cap itis aust ralio r]								
In the sout hern brea st [In pect ore aust ralio ri]	□	26	12	30	1	25	40	A 5
The one next - prec edin g Regu lus [Ant eced ens Regu lum prox ime]	□	23	5	30	0	0	25	B 4
Here	□	19	16	30	0	15	50	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
it precedes in the right knee [Hic prae ced. in genu dext r.]								
In the right knee [In drac e dext ra]	□	17	29	0	3	10	10	A 4
The one follo wing in the othe r foot [Seq uens in	□	10	2	0	3	47	10	A 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
alter o pede]								
In the left knee [In drac e sinis tra]	□	25	8	0	3	55	10	A 4
In the left arm pit [In sinis tra Axill a]	□	2	10	0	0	7	50	B 4
In the belly , the one prec edin g thre e [In vent re	□	23	46	0	2	9	52	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
trium ante ced.]								
The north hern one of thes e [Ear um bore alior]	□	3	8	0	5	55	0	B 6
The sout hern one of thes e [Ear um aust ralio r]	□	5	17	10	2	49	20	B 6
The one prec edin g two in	□	4	36	0	12	52	50	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the loins [Pra eced ens duar um in lum bis]								
In the butt ock, the nort hern one prec edin g [In Clun e prae cede ns bore a]	□	9	12	0	9	41	20	B 3
The sout hern one follo wing [Seq	□	10	30	0	7	50	25	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
uens aust rina]								
In the thigh h [In fem ore]	□	13	20	30	6	6	50	B 5
In the hind er knee [In genu post erior i]	□	14	30	30	1	39	52	B 4
In the mid dle of the foot [Me dia in pede]	□	17	19	0	0	53	10	A 4
The lowe st one	□	20	50	0	3	2	40	A 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
in the foot [Infi ma in pede]								
In the nail of the left foot [In ung ula pedi s sinis tr.]	□	17	55	0	4	49	30	A 6
In the nail of the right foot, prec edin g [In ung. pedi s	□	17	24	20	5	44	30	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
prae ced. dext r.]								
In the mid dle of the body [In med io corp ore]	□	1	37	30	10	15	30	B 6
A little one on the head [Par vula in capit e]	□	11	10	0	10	46	10	B 6
The one prec edin g two in the	□	17	15	0	7	40	30	A 4

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
left hind foot [Pra eced ens duar um in sinis tro pede post erior i] [Tyc ho's othe r man uscri pt: Tych onis alter code x] Of the form less ones abov e the back									
	□	10	12	0	5	42	30	A	5
	□	27	45	30	17	38	40	B	5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
, the one prec edin g [Info rmiu m supr a dors um prae ced.]								
The one follo wing the m [Seq uens earu m]	□	1	20	0	16	28	50	B 5
The high est one of the brig ht back , abov	□	6	16	30	16	45	40	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
e the tail [Sup rem a lucid ae dors i supr a caud am]								
The one of the thre e nort hern ones und er the belly [Bor ealis triu m sub vent re]	□	14	45	0	17	17	50	B 4
The mid	□	9	52	15	0	10	50	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
dle one of the m [Me dia earu m]								
The sout hern one of the sam e [Aus trali s earu mde m]	□	10	42	0	2	30	0	A 5
**								

VIRGO (♍)

**

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
1st Clas s								
Spic	□	19	39	47	1	59	30	A 1

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
a [the Ear of grain]								
The bright one of the girdle [Lucida cinguli]	□	7	18	47	8	40	30	B 3
The Vintager [Vindemiatrix]	□	5	46	17	16	15	0	B 3
2nd Classes								
Of the preceding ones in	□	19	7	50	6	6	0	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the head , the nort hern one [Pra eced enti um in capit is bore alis]								
The sout hern one of the sam e [Ear um aust ralio r]	□	19	56	47	4	36	30	B 5
The one follo wing in the nort	□	23	30	48	8	33	0	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
hern face [Sequentium in vultu aurea]								
The southern one of the same [Eardemaurina]	□	23	41	50	9	30	0	B 5
In the extremity of the southern and left wing [In	□	22	55	47	0	42	28	B 3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
extr ema alae aust ralis, & sinis trae]								
The one prec edin g of the four in the wing [Pra eced ens de quat uor in ala bore a]	□	0	39	49	1	24	29	B 4
The othe r one follo wing in	□	5	59	17	2	49	30	B 3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the shou lder [Alte ra sequ ens in hum ero]								
The next -to- last of the m [Pen ulti ma earu m]	□	10	51	18	2	23	0	B 6
The last of the m [Vlti ma earu m]	□	14	0	50	1	44	28	B 4
On the right , and	□	1	16	47	13	36	0	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the nort hern one of the wing , of thre e prec edin g [In dext ra, & bor. ala triu m prae ced.]								
Of the rem aini ng two on the sout h [Reli quar um duar um	□	3	15	50	11	36	28	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
aust rina]								
Und er the girdl e on the hip [Sub peri zom ate in clun e]	□	16	46	18	8	9	30	B 3
On the left of the nort hern hip [Sini strae coxa e bore alis]	□	22	12	19	3	10	27	B 6
The one follo wing two	□	22	33	18	1	45	0	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
nort hern ones [Seq uent ium duar ii bore al.]								
The sout hern one of the m [Ear um aust ralio r]	□	21	7	50	0	20	0	A 6
In the left knee [In genu sinis tro]	□	16	7	48	2	24	0	B 6
The nort hern one of	□	29	12	50	11	2	0	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the high est fring e [Bor ealio r supr ema e fimb riae]								
The mid dle of the thre e in the fring e [Me dia triu m in fimb ria]	□	0	22	47	18	0	0	B 4
The lowe st, and sout hern	□	0	14	50	2	57	0	B 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
of the fringe e [Infi ma, & aust r. fimb riae]								
The sout hern one of two of the high er fring e [Aus trali or duar ii supe riori s fimb riae]	□	1	15	17	11	47	29	B 4
In the	□	2	45	50	0	31	0	B 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
southern foot [In pede australi]								
In the right, or northern foot [In pedextro, seu boreo]	□	5	53	48	9	48	27	B 4
Between the Vintager and the girdle [Inter Vindem.]	□	2	44	50	25	30	0	B 6

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
& cing ulu m]									
The one follo wing this in the right hip [Seq uens hanc in clun e dext r.]	□	23	1	18	9	40	0	B	6
The one in the neck [Qua e in cervi ce]	□	29	9	17	4	59	0	B	6
The little one follo wing	□	9	48	50	16	13	30	B	6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the Vint ager [Par va sequ ens Vind emia trice m]								
The one prec edin g thre e in a strai ght line with the nort hern wing [Pra eced ens triu m in rect a linea Alae	□	11	34	47	12	40	0	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	''	°	'		
bore alis]								
The mid dle of the sam e [Me dia earu mde m]	□	16	9	50	12	34	0	B 6
The one follo wing this [Seq uens hanc]	□	23	34	48	13	7	0	B 5
The one betw een the four th and the fifth [Qua e	□	24	30	17	5	22	0	B 6

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
The one following three under Spica [Sequentium sub Spica]	□	18	36	47	7	51	30	A	5
The middle one to the south [Media austrum]	□	20	58	50	9	16	28	A	5
The one following	□	21	59	17	6	16	30	A	5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
on the east [Seq uens orie ntali s] 3rd Clas s								
In the thig h, the one prec edin g sout hern [In fem ore prae ced.- aust r.]	□	19	23	50	9	30	0	B 6
In the extr eme hip [In	□	20	23	48	8	29	28	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
coxa e extr emo]								

LIBRA (♎)

**

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
1st Clas s								
The Nort hern Scal e- pan [Lan x Bore alis]	♎	15	12	17	8	33	10	B 2
The Sout hern Scal e- pan [Lan x Aust ralis]	♎	10	56	27	0	25	10	B 2

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
]								
2nd Clas s								
The one above the southern pan [Quae supra lancem austral.]	□	10	7	27	1	54	10	B 5
The one above the southern pan [Quae supra lancem boreal.]	□	11	4	30	5	17	0	B 4
The	□	13	51	0	1	13	10	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
first from the southern scale , towards its rising [Prima à lanc e aust ral. ad ortu m]								
The second from the same [Sec und a ab eade m]	□	17	44	30	2	57	40	B 6
The third	□	20	58	28	4	27	10	B 3

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
towards the rising g [Tert ia ad ortu m]									
Below this towards the rising g [Infr a hanc ad ortu m]	□	23	13	57	4	13	10	B	4
Below the same towards the setting g [Infr a	□	20	52	30	2	10	10	B	4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	''	°	'		
eand em ad occa sum]								
Belo w the nort hern scale towa rds the risin g [Infr a lanc em bore alem ad ortu m]	□	17	10	0	8	30	0	B 4
Of the form less ones , the one prec edin g	□	23	33	27	0	2	0	B 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
two towa rds the Sout hern Claw [Info rmis duar um infra lace m Aust rina m]								
The lowe r of the sam e [Ear und em infer ior]	□	28	28	57	0	6	10	B 4

**

LIBRA (□) (continued)

**

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
The one prece din g thre e follo wing [Pra eced es triu m sequ enti um]	□	25	41	30	3	32	12	B	4
The mid dle one [Me dia]	□	26	13	26	9	15	B	A	4
The east ern uppe r one [Sup erior Orie ntali s]	□	27	6	50	9	19	50	A	4
The	□	28	44	30	10	57	50	A	5

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
s Belo w the nort hern Claw [Infr a Chel am aust r.- bore al.]	□	24	27	30	8	42	50	A	4
Belo w the sam e sout hern [Infr a eand em aust ralis]	□	24	59	50	10	20	48	A	4

SCORPIUS (♏)

**

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
1st Clas s									
The Heart of the Scor pion , Anta res [Sco rpii Cor Anta res]	♏	5	35	27	4	26	30	A	1
The nort hern one in the bro w [Bor ealis in fron te]	♏	28	56	57	1	6	35	B	2
The mid dle of the	♏	28	20	0	1	52	40	A	3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
bro w [Me dia fron tis]								
The sout hern one in the bro w [Aus trali s in fron te]	□	28	45	47	5	20	40	A 3
2nd Clas s								
In the foot towa rds the sout h, und er the sout hern	□	29	4	30	8	26	0	A 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
bro w [In pede ad aust rū sub aust rali fron tis]								
The most - nort hern of the bro w [Bor ealis sima fron tis]	□	0	14	30	1	44	0	B 4
The little one in the trian gle with the	□	29	28	0	0	16	0	B 5

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
brigit ht bro w, or bette r [Par va in △ cū lucid a frōti s vel meli us]	□	29	23	0	0	16	0	B	5
The one prec edin g to the hear t, towa rds the nort h [Pra eced ens cord i ad	□	3	32	0	3	53	0	A	4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
er, concerning the new Star [Ex Keplero denov a Stella]								
Under the sole of the foot of Serpent- bearer [Sub volapedi s Serpentarii]	□	4	18	0	1	48	0	A 4
The	□	5	33	0	3	30	0	A 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
one above the Scor pion' s hear t [Qua e supr a cor Scor pii]								
Abo ve the one prec edin g the Hear t [Sup ra prae cede nte m Cor]	□	3	22	0	2	48	0	A 4
Belo wit in the hind	□	3	42	0	6	58	0	A 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	''	°	'		
er body [Infr a ea in corp ore post er.]								
In the first vert ebra [In prim o spon dylo]	□	5	25	0	10	58	0	A 3
In the seco nd vert ebra [In secu ndo spon dylo]	□	11	5	0	14	50	0	A 3
In the sting	□	19	50	0	15	32	0	A 3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
of the tail [In acul eo caud ae] 3rd Clas s								
In the third vert ebra , from Clavi us [In 3. spon dylo ex Clavi o]	□	12	41	0	18	20	0	A 3
The one follo wing in the four th	□	15	41	0	19	49	0	A 3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
vert ebra [Seq uens in 4. spon dylo]								
The one after it in the fifth vert ebra [Post eam in 5. spon dylo]	□	20	31	0	19	9	0	A 3
The furt her one in the sixth vert ebra [Vlte rior in 6. spon	□	22	51	0	16	59	0	A 3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
dylo]								
The one in the seventh vertebra [Quae in 7. spondylo]	□	21	21	0	15	29	0	A 4
The one preceding the sting [Praecedens aculeum]	□	14	41	0	14	44	0	A 3
The formless one following the	□	23	31	0	13	39	0	A neb.

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
sting [Info rmis sequ ens acul eum]									
The one prec edin g of the two abov e the sting [Dua rum supr a acul eum prae ced.] The one follo wing the m [Seq uens earu	□	17	51	0	1	29	0	A	4

Star	Sign	Long			Lat.			B/A	Mag.
		°	'	"	°	'	"		
m]									
Othe rwis e [Alit er]	☐	21	51	0	4	29	0	A	5

SAGITTARIUS (♐)

**

Star	Sign	Long			Lat.			B/A	Mag.
		°	'	"	°	'	"		
1st Clas s									
The brig ht one of the Hea d [Luc ida Capi tis]	☐	9	22	17	1	45	10	B	4
2nd Clas s									
In the poin t of	☐	26	56	0	6	54	40	A	4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the arro w [In cusp ide sagit tae]								
or [vel] Kepl er	□	26	56	0	6	54	0	A 4
or [vel] Ptole my	□	27	16	0	6	50	40	A 4
In the left han dle of the han d [In man ubri o sinis tr. man us]	□	0	17	0	6	50	50	A 4
or [vel] Ptole		0	16	0	6	50	30	A 4

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
my In the nort hern part of the sout hern arc [In part e bore a arcu s aust ralio r]	□	2	13	30	2	59	20	A	4
In the sam e, the nort hern one [In eode m bore alio]	□	29	7	30	8	28	10	B	4
In	□	1	49	0	1	30	10	A	4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the left shou lder [In hum ero sinis tro]								
The one prec edin g this in the dart [Ant eced ens hanc in iacul o]	□	6	0	0	3	9	49	A 5
The mid dle one in the head [Me dia in	□	10	14	0	0	59	40	B 4

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
capit e]									
The last of thre e in the head [Vlti ma triu m in capit e]	□	12	9	0	1	31	38	B	4
The first in cont act [Pri ma in cont actu]	□	14	10	0	3	7	30	B	4
The mid dle in the nort hern cont act	□	14	30	30	4	17	40	B	4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
[In bore o cont actu med ia]								
The one follo wing , and uppe r [Seq uens , & supe rior]	□	15	37	0	14	50	30	B 5
This one to the east [Hae c orie ntali or]	□	20	34	30	5	8	48	B 6
The last east ern one in	□	24	28	30	5	22	39	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
contact [Orientalis ultima in contactu]								
The dim one in the lower contact [Obscure in contactu inferiori]	□	20	50	0	1	25	38	B 6
The dim one in the right elbow	□	27	51	0	3	7	10	A 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		

[Obscura in dextro cubito]

SAGITTARIUS (♐) (continued — 3rd Class and remainder)

**

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		

3rd Class

In the southern part of the arc [In australi parte arcus]	♐	0	36	0	11	10	0	A	3
---	---	---	----	---	----	----	---	---	---

In the eye,	♐	7	46	0	0	25	0	B	neb.
-------------	---	---	----	---	---	----	---	---	------

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
a dou ble neb ula [In ocul o neb ulos a dupl ex]								
In the right shou lder [In hum ero dext ro]	□	15	6	0	2	10	0	A 5
On the shou lder- blad es [In scap ulis]	□	12	36	0	2	50	0	A 5
In the third	□	10	56	0	4	40	0	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
trap eziu m of the shou lder [In arm o terti a trap ezii]								
Und er the four th Axill a of the trap eziu m [Sub Axill a quar ta trap ezii]	□	9	26	0	6	40	0	A 5
In the left hock	□	10	16	0	23	20	0	A 2

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
, to the prio r [In suffr agin e sinis tra prio ri]								
In the knee of the sam e [In genu eius dem]	□	9	36	0	18	20	0	A 2
In the prio r right hock [In prio ri dext ra suffr agin	□	29	16	0	13	30	0	A 3

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
e] In the left shou lder- blad e [In scap ula sinis tra]	□	19	56	0	13	50	0	A	3
In the hind er right knee [In post erior i dext ro genu]	□	19	16	0	20	30	0	A	3
In the first dra wing -out of the tail	□	20	26	0	5	10	0	A	5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
[In educatione caudae primaria]								
The one following it on the Terebellum [Sequens eam in Terebello]	□	21	11	0	6	10	0	A 5
In the same place, the one preceding-	□	21	11	0	6	10	0	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
southern in the [□] [Ibid em prae ced.- aust rini la teris]	□	22	6	0	6	50	0	A 5
In the same place, the one following [Ibid em sequens]								

CAPRICORNUS (♑)

**

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
1st Class									
The horn , the one prec edin g, or the perp etual [Cor nu prae cede ns, seu fu perp etuu s]	□	29	44	27	7	3	11	B	3
The horn , the one follo wing infer ior [Cor nu sequ ens	□	29	57	27	4	42	10	B	3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
infer ius]								
The brig ht one prec edin g the tail [Cau dae prae cede ns lucid a]	□	17	40	27	2	24	50	A 3
The one follo wing the tail [Cau dae sequ ens lucid a]	□	19	26	27	2	27	50	A 3
2nd Clas s								
The mid dle	□	0	17	0	7	3	10	B 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
of thre e in the horn , prec edin g [Me diu m triu m in corn u prae ced.]								
The sout hern of the m [Aus trali s earu nde m]	□	29	57	0	6	34	9	B 4
The neb ula abov e the	□	28	34	0	7	17	10	B neb.

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
prec edin g horn [Neb ulos a supr a corn u prae cede nte m]								
The West ern neb ula at the base of the trian gle in the bro w [Neb ulos a Occi dent	□	0	23	0	0	49	40	B neb.

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
alis basis trian guli in fron te]								
The East ern neb ula [Neb ulos a orie ntali s]	□	1	7	0	0	29	10	B neb.
The high est of the sam e trian gle [Sup rem a eius dem triāg uli]	□	1	3	0	1	21	8	B 6
The	□	28	39	0	0	25	10	B neb.

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
neb ula in the bro w prec edin g [Neb ulos a in fron te prae c.]									
In the neck of the two nort hern ones [In cervi ce duar um bore al.]	□	4	15	0	3	26	10	B	5
The sout hern	□	3	32	0	0	16	7	B	6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
one of the m [Ibid em aust ralis]								
The one prec edin g in the left knee , dim [Pra eced . in genu sinis tro obsc.]	□	3	13	0	6	58	0	A 6
The one follo wing in the left knee [Seq	□	3	54	0	9	7	0	A 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
uens in genu sinis tro]								
In the left forel eg [In sinis tro arm o]	□	7	39	0	8	1	0	A 6
The lowe st one in the belly [Infi ma in vent re]	□	12	50	30	6	55	0	A 4
The one follo wing on the nort h,	□	13	26	0	6	28	0	A 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
with the next - follo wing und er the sam e wing [Seq uens bore al. conti gua rum sub alia]								
The one of thre e in the east ern belly [Triu m in vent re orie ntali	□	20	49	0	4	24	0	A 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
or]								
The lowest of the m [Infimaeurum]	□	18	57	0	4	22	0	A 6
The northern one of the three [Septentrionalis trium]	□	18	44	0	3	13	0	A 5
Of the two on the front of the back [Duum]	□	19	47	0	0	28	0	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
in dors anteriori]								
The one following on the back [Sequens in dors o]	□	12	33	0	1	15	30	A 5
The one preceding two towards the flanks [Antecedens duar ii ad Ilia]	□	15	51	0	4	47	0	A 6

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
The one follo wing the sam e [Seq uens earu nde m]	□	17	32	0	4	48	0	A	6
The one prec edin g in the uppe r tail [Ant eced . in caud a supe r.]	□	19	40	0	2	23	10	A	5
In the sout hern sout hern tail [In	□	21	53	0	0	13	30	A	5

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
superioricaudala austral.]									
The one preceding this towards the north [Precedens hanc ad boream]	□	21	42	0	0	0	30	A	6
The northern one in the eastern tail [Borealis in	□	21	20	0	4	18	10	B	6

Star	Sign	Long			Lat.			B/A	Mag.
		°	'	"	°	'	"		

orientalica]

AQUARIUS (♒)

**

Star	Sign	Long			Lat.			B/A	Mag.
		°	'	"	°	'	"		

1st Class

The bright one of the right shoulder [Humeri dexteri lucida]	♒	28	31	57	10	42	15	B	3
--	---	----	----	----	----	----	----	---	---

The bright one of the	♒	19	13	27	8	42	15	B	3
-----------------------	---	----	----	----	---	----	----	---	---

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
left shou lder [Hu meri sinis tri lucid a]								
The infer ior one of the left han d [Ma nus sinis trae infer ior]	□	12	25	47	4	30	15	B 5
In the effus ion [of wate r], Fom alha ut [In	□	29	36	43	20	59	40	A 1

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
effusion Fomaha ant]								
2nd Classes								
In the head [In capite]	□	23	49	0	15	25	15	B 5
In the right shoulder, the southern one of the said sign [In humero dextro austro ral. de	□	27	58	30	9	11	45	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
hoc vide infin e sig.]								
On the back , und er the arm pit [In dors o sub axill a]	□	20	0	0	29	6	0	B 44
The mid dle one in the left han d [Me dia in man u sinis	□	8	51	0	8	19	16	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
tra]								
The one preceding the brightest one of the hand [Antecedēs lucidior manus]	□	7	54	30	11	51	0	B 4
In the right elbow [Incubito dextro]	□	2	32	28	8	17	45	B 5
In the right hand,	□	4	27	0	10	37	30	B 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the nort hern one [In dext ra man u bore alior]								
The one prec edin g of the rem aini ng two, sout hern [Reli quar um duar um aust r. prae ced.]	□	4	45	30	8	52	46	B 4

**

AQUARIUS (♒) (continued)

**

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
The one follo wing the m [Seq uens earu m]	♒	6	15	29	8	10	15	B	4
The one prec edin g in the right Coty la [vess el] [Pra eced es in Coty la dext ra]	♒	2	46	14	6	49	0	B	4
The one follo wing	♒	29	53	30	2	29	45	B	6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
in the sam e [Seq uens in eade m]								
In the right thig h [In fem ore dext ro]	□	1	15	29	1	9	46	A 5
The one towa rds the Butt ocks [Qua e ad Clun es]	□	24	35	0	1	59	45	A 4
Sche at, in the right shin [Sch	□	4	44	28	8	9	45	A 3

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
eat in dext ra tibia]								
The nort hern shin, towa rds the knee [Bor ea tibia e ad genu]	□	4	27	30	5	36	40	A 5
In the left hip [In coxa sinis tra]	□	1	2	29	5	39	44	A 6
In the left sout hern knee ,	□	28	18	0	10	48	15	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
more-southern [In sinistrogular- australior]								
In the same, northern [In eodem borealior]	□	1	12	30	9	57	15	A 6
The first from the hand in the effusion of	□	5	14	29	4	8	45	B 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
water r [Pri ma à man u in effus ione aqua e]								
The next - follo wing sout hern one [Suc cede ns aust ralis]	□	7	26	30	0	19	15	A 4
The one follo wing in the first ben d of the wate	□	10	22	28	1	23	46	A 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
r [Seq uè in prim o flex u aqua e]								
The one acco mpa nyin g it [Qua e illa m comi tatur]	□	13	0	30	0	59	45	A 5
In the othe r sout hern ben d [In alter o flex u	□	12	13	29	2	48	46	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
aust rali]								
The one prec edin g the nort hern one follo wing [Pra eced ēs bore alior sequ enti um]	□	12	5	30	3	58	15	A 5
The sout hern one follo wing [Seq uens aust ralio r]	□	12	33	29	4	10	14	A 5
The one near this,	□	12	37	0	4	43	45	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
declining towards the south [Prope hanc declinans austr.]								
After this, the curving ones preceding [Post hanc cōtiguous praece.]	□	15	29	30	10	58	46	A 5
The one following	□	16	0	29	11	32	45	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the sam e [Ear und em sequ ens]								
In the third ben d of the wate r, the one prec edin g thre e [In 3. flex u aqua e bore a triū]	□	14	25	30	14	28	47	A 5
The mid dle one	□	15	8	28	15	16	15	A 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
of the m [Me dia earu m]								
The one follo wing the m, sout hern [Seq uens earu m aust ralis]	□	16	6	30	16	22	45	A 6
The one of thre e follo wing , nort hern [Triu m sequ	□	9	17	0	14	44	46	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
enti um bore alis]								
The mid dle one of the m [Me dia earu m]	□	9	43	0	15	29	45	A 5
The sout hern one of the sam e [Aus trali s earu nde m]	□	11	12	30	16	30	40	A 5
In the last ben d, of the	□	5	47	29	14	15	15	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the upper [In vlti mo flex u, triu m supe rior]								
The mid dle one of the m [Me dia earu m]	□	5	24	30	15	39	47	A 5
The lowe st of the m, near Fom alha ut [Infi ma earū	□	4	39	28	15	52	45	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
prae ced. post aqua e flex um]								
The nort hern one of thos e follo wing [Seq uent ium bore alis]	□	23	37	30	14	39	46	A 4
The sout hern one of the m [Aus trali s earu m]	□	21	42	30	18	39	41	A 4

[Margin / note block, foot of the Aquarius column, folio 269:] **[Margin:** Note Kepler and Longomontanus, who placed the right shoulder at a longitude of 27° 49²/₃, or

27° 48'. In the year 1600, Tycho put it at 27° 9²/₃ — whence they exceeded by an error of 40 minutes. (*Aduerte Keplerum, & Lōgomontanū posuisse humeri dextri longitudinē in gr. 27. 49²/₃. vel gr. 27. 48'. Anno 1600. cum Tycho posuerit gr. 27. 9²/₃. quare excesserūt errore 40. minutum.*)

PISCES (♓)

**

Star	Sign	Long			Lat.			B/A	Mag.
		°	'	"	°	'	"		
1st									
Clas									
s									
The back of the head of the Southern Fish [Piscis australis occiput]	♓	17	12	59	7	17	0	B	4
The bright one in the knot of the	♓	25	9	59	9	4	0	B	3

Star line	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
[Lucida in nexu lini] 2nd Class								
The southern one in the mouth of the Fish [In ore Piscis austri]	□	24	24	30	9	4	30	B 4
The northern one in the back of the	□	18	53	0	8	55	0	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
head [Borealis in occipite]								
The one preceding two in the back [Praecedens duarū in dors o]	□	21	4	30	9	3	30	B 5
The one following in the back [Sequens in dors o]	□	25	19	0	7	14	0	B 5
The	□	18	43	29	4	27	30	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
one preceding in the belly [Precedens in aluo]								
The one following in the belly [Sequens in aluo]	□	22	22	30	3	25	28	B 5
In the tail [In cauda]	□	28	24	29	6	24	0	B 5
Above this towards	□	29	49	28	7	27	30	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the risin g [Sup ra hanc ad ortu m]								
The one follo wing [Seq uens]	□	3	51	30	5	28	30	B 4
In the sout hern line n, of the thre e prec edin g brig ht ones [In lino aust rali	□	9	58	29	2	11	30	B 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
lucid oru m triu m prae cede ns]								
The mid dle of the sam e [Ear und em med ia]	□	13	30	28	1	6	0	B 4
The one follo wing [Seq uens]	□	15	43	30	0	58	0	B 4
In the ben d [In flex u] — the nort	□	13	47	28	1	30	30	A 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
hern line n [Lini bore a]								
The one follo wing sout hern in the sam e plac e [Ibid em sequ ens aust ralis]	□	15	8	30	4	19	0	A 4
The one prec edin g thre e after the ben	□	18	55	28	1	2	30	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
d [Post flex um triu m prae cede ns]								
The mid dle of the m [Me dia earu m]	□	21	18	0	4	40	0	A 4
The last one follo wing [Seq uens vlti ma]	□	23	20	0	7	55	30	A 5

PISCES (□) (continued)

**

Star	Long				Lat.			B/A	Mag.
	Sign	°	'	"	°	'	"		
In the northern line, at the knot, preceding [Inlinoboreànexupraecedens]	□	23	34	29	1	38	0	B	5
After this, the southern one of three [Posthanc trium australis]	□	22	38	30	1	52	0	B	5

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
] The middle one in the knot , northern [Media in nexu bore a]	□	22	38	30	5	21	30	B	4
The northern and last of the line n [Borea & vlti ma lini]	□	22	59	0	9	24	28	B	5
The northern one	□	24	37	30	22	0	30	B	6

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
in the back of the Nort hern Fish [Bor ea in ote Pisci s bore i]									
The sout hern one in the sam e plac e [Aus trali s ibid em]	□	24	12	0	20	43	28	B	5
The nort hern one of	□	20	45	0	22	55	30	B	6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the head of the trian gle [Bor ea trian guli capit is]								
The sout hern one of the said trian gle [Aus trali s trian guli dicti]	□	19	29	0	19	24	30	B 6
The mid dle, and the prec edin	□	18	26	0	20	24	29	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
g of the trian gle [Me dia, & ante cede ns trian guli]								
In the sout hern spin e, near the elbo w of And rom eda [In spin a aust rali prop e cubi tum sinis t.	□	19	19	0	13	21	30	B 6

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
Andromeda] The middle one after it [Mediapostillam]	□	19	25	0	12	22	0	B	6
The lowest of them [Infimillarum]	□	19	51	30	11	22	0	B	6
The northern one of two in the belly [Boreaduar]	□	24	40	29	17	26	29	B	6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
um in aluo]								
The one mor e towa rds the sout h [Qua e magi s ad aust rum]	□	22	21	0	15	30	28	B 5
The one follo wing the mid dle of thre e in the sout hern spin e	□	22	23	30	12	28	0	B 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
[Sequens media trium in spina australi]								
The one following the northern in the belly , towards the Boreas [north] [Sequens boream in aluoad Bore	□	25	33	28	18	31	30	B 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
am]								
In the back of the head of the northern fish [In occipitalis borei]	□	23	3	30	23	9	29	B 6
3rd Class								
Of the formless ones in the [□] under the northern	□	19	32	30	15	39	30	A 4

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
edin g side [Aus trali s later is prae cede ns]								
The one follo wing [Seq uens]	□	24	51	28	5	29	30	A 4
The one prio r to the follo wing [□] [Prio r sequ enti um hoc □]	□	2	37	30	4	33	29	A 5
The post	□	7	33	29	4	23	30	A 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
erior [Post erior]								

PARS SECUNDA — The Northern Stars outside the Zodiac (*Astra Borealia extra Zodiacum*)

[Folio 269, right column. Heading: "PARS SECUNDA — Astra Borealia extra Zodiacum." This opens the second part of the Universal Catalogue: the non-zodiacal northern constellations. Note that in this part the latitude column is headed "Latitudo B." — the formless-star latitudes here are reckoned with the same B/A (north/south) convention.]

URSA MINOR (The Lesser Bear)

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
1st Class s									
The extr emit y of the tail, now Pola ris [Extr ema caud ae nun	♏	24	26	47	65	59	50	—	2

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
root of the tail [Quae in radice caudae]								
The upper one of the two in the following [□] [Superior duarum in □ sequentium]	□	22	59	0	74	56	0	— 4
The lower one of	□	26	22	0	77	34	30	— 5

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
the m [Infe rior earu m]								
The one prec edin g the m in the [□] [Infe rior prae cede ntiū in □]	□	16	11	0	75	19	30	— 3
Of the form less ones towa rds the head , the mor e- sout	□	7	24	0	71	20	0	— 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
hern [Info rmis ad capu t Vrsa e aust ralio r]								
The one abov e this [Qua e supe r hanc]	□	28	50	0	70	15	0	— 6
The first of the form less ones in a strai ght line with the	□	18	47	0	35	47	0	— 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
Pole [Pri ma infor miu m in linea rect a cum Polo]								
The seco nd [Sec und a]	□	18	58	0	37	17	0	— 6
The third , dim [Tert ia obsc ura]	□	19	17	0	40	10	0	— 6
The four th [Qua rta]	□	19	33	0	43	53	10	— 6
The first of the form	□	23	8	0	57	52	0	— 6

Star	Long			Lat.			B/A	Mag.
	Sign	°	'	"	°	'		
less ones near the Pole [Pri ma infor mis circa Pola rem]								
The seco nd [Sec und a]	□	23	25	0	70	39	0	— 6
The third [Tert ia]	□	26	11	0	69	0	0	— 6
The four th [Qua rta]	□	26	37	0	68	1	0	— 6
The fifth [Qui nta]	□	8	53	0	67	40	0	— 6
The sixth [Sext a]	□	11	27	0	67	19	0	— 6

Star	Long			Lat.			B/A	Mag.	
	Sign	°	'	"	°	'			"
The near est one to the Pole [Vici nissi ma Polo]	♈	28	0	0	63	52	0	—	6

**

Parsing notes (whole batch): These are tightly-set citation-grade star tables in a two-column folio layout. Longitude sign-symbols (♈–♏ and ♐♑ etc.) are read from the engraved zodiac glyphs in the first sub-column; where a star's longitude crosses into the adjacent sign, the printed glyph differs from the constellation's own name (this is correct, not an error). The seconds (") sub-columns are frequently blank or "0" and are very tightly set against the minutes column; several values flagged [?] below are where minutes/seconds digits could not be cleanly resolved. In Pars Secunda (Ursa Minor) the latitude is a near-polar distance (60–77°), so no B/A polarity is printed for the northern circumpolar stars — recorded as "—". The "♈" symbol in several star-descriptions denotes the small quadrilateral/lozenge figure the star belongs to (a printer's geometric glyph), transcribed as "[♈]".

Liber IV — On the Fixed Stars (continued)

Caput XXI — The Universal Catalogue, Pars Secunda (Northern constellations outside the Zodiac), continued

The tables below continue the catalogue of boreal (northern) constellations. Column order throughout: **star description (Latin original given where it carries technical placement) | Longitude (zodiac Sign, degrees, minutes, seconds — for the year 1700) | Latitude (degrees, minutes, seconds) with B = Borealis (north) / A = Australis (south) | Magnitude.** Stars are grouped by

certainty class (1st, 2nd, 3rd Classis) and by "Informes" (formless stars). Zodiac-sign glyphs are rendered by their standard names.

Convention for these tables: in the longitude column the three sub-columns are Sign, degrees, and minutes/seconds as printed; in the latitude column the three sub-columns are degrees, minutes, seconds. Where the source prints "B." in the latitude header it marks northern latitude unless an "A" appears in the row.

URSA MAIOR (Ursa Major / the Great Bear)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The bright star of the shoulder, Dubhe [Lucida humeri Dubhe]	Leo	10	59	27	49	40	10	B	2
The bright star of the flank, beta with Dub	Leo	15	7	57	45	8	40	B	2

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
he									
The bright star of the hind hip [Cox ae post erior is lucid a]	Leo	26	10	12	47	8	40	B	2
The bright star of the back , by the tail [Ter goris lucid a ad caud am]	Leo	26	49	57	51	37	10	B	2
The root of the tail,	Leo	4	36	27	54	17	45	B	2

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
------	------	---	---	---	-------	---	---	-----	-----

or
the
first
one
[Caudae
radi-
x,
seu
prima]

The middle of the tail [Media caudae]	Virgo	11	21	53	56	21	10	B	2
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The last of the tail [Ultima caudae]

The last of the tail [Ultima caudae]	Virgo	22	37	7	54	24	10	B	2
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The one in the

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
------	------	---	---	---	-------	---	---	-----	-----

The one in the	Cancer	19	2	30	40	2	45	B	4
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Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
muz zle [Qua e in rostr o]									
Below the left eye	Cancer	18	36	0	43	55	43	B	4
Adjacent to below this	Cancer	17	34	0	44	22	15	B	5
Above the right eye	Cancer	19	51	0	47	50	50	B	4
Above the left eye	Cancer	26	38	30	47	44	46	B	4
Toward the ear [Ad aure m sinis tram]	Cancer	26	8	30	51	36	42	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The lowest, in the little [△] of the neck [Infirma in part u △ colli]	Cancer	21	16	0	42	30	30	B	5
The following, in the same triangle	Cancer	26	28	0	43	5	39	B	4
The highest, in the apex of the same triangle [Super]	Cancer	29	25	0	46	21	48	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
rem a in Apic e eius d. Δ]									
The follo wing , on the neck [Suc cede ns ei in collo]	Leo	2	5	0	42	36	18	B	4
The follo wing , belo w this	Leo	5	3	30	38	15	45	B	4
In the left fron t knee [In genu sinis tro ante riori	Leo	1	57	30	34	34	46	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
] In the right foot, more northerly [In dext. pedebore alior]	Leo	27	21	0	29	15	48	B	3
] The more southerly one, in the same place [Australior ibidem]	Leo	28	35	0	28	38	20	B	3
] Below the right	Cancer	28	32	0	33	30	19	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
knee [Infr a genu dext rum]									
In the right knee itself [In ipso genu dext o]	Cancer	23	22	0	36	6	15	B	5
The upper r star of the left foot, hind most [Superior sinis tri pedis posterior]	Cancer	15	21	30	29	51	45	B	4
The	Cancer	16	30	30	28	45	10	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
following, and more southerly [Sequens, & australior]	er								
In the preceding hind knee [In genu praecedente poster.]	Cancer	23	58	0	35	14	15	B	4
The preceding, in the right hind foot [Pra	Cancer	2	15	0	26	14	13	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
eced ens in dext ro pede post er.]									
The follo wing , and mor e sout herl y [Seq uens , & aust ralio r]	Virg o	3	1	0	24	54	20	B	4
For mles s, betw een the tails of the Bear s and the Lion	Virg o	19	8	30	40	6	20	B	2

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Info rmis inter caud as Vrsa e, & Leon is]									
The one in the back [Qua e in dors o]	Canc er	29	35	0	41	30	15	B	5
In the left hind foot [In sinis tro pede post erior i]	Canc er	22	27	30	33	1	20	B	5
For mles s, betw een the Bear	Canc er	7	42	0	17	55	18	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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and
the
Lion'
s
head
[Info
rm.
inter
Vrsa
m, &
capu
t
Leon
is]

The	Leo	9	35	0	20	42	20	B	4
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[Qua
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m]

The	Leo	5	30	0	5	16	0	B	4
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one
this
prec
edes
[Qua

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
e hanc prae cedit]									
The follo wing of the two befo re thes e [Seq uens duar um ante has]	Leo	1	2	0	20	51	18	B	4
The prec edin g of the m [Ear um prae cede ns]	Leo	1	7	0	23	41	20	B	4
Bet wee n the foot,	Leo	15	37	0	21	53	19	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
and the Lion' s head [Inte r pede , & cap. Leon is]									
The nort hern follo wing [Seq uens bore alis]	Leo	20	0	0	25	4	17	B	4
The sout hern follo wing [Seq uens aust ralis]	Leo	21	32	0	26	6	19	B	4
The prec edin g, at the base	Leo	24	47	0	21	28	19	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
of the Oxy goni um [Pra eced ens in basi Oxy gonii]									
The follo wing [Seq uens]	Leo	27	34	0	20	44	20	B	3
The third bore al, in the said base [Tert ia bore al. in dicta basi]	Leo	24	58	0	24	58	15	B	4
The one betw een the	Leo	13	41	0	40	30	18	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
legs of the Bear [Qua e inter crur a Vrsa e]									
The first one, betw een the tail and the body [Pri ma inter caud am, & corp us]	Virg o	22	54	0	58	8	10	B	6
The seco nd	Virg o	25	20	0	47	14	6	B	6
The third	Virg o	21	14	0	47	30	12	B	6
The first betw	Virg o	24	42	0	46	30	15	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
een the Bear , and the head of the Lion [Pri ma m inter Vrsa m, & Cap ut Leon is]									
The seco nd	Leo	5	33	0	47	55	16	B	6
The third	Virg o	7	25	0	48	40	14	B	6
The four th	Virg o	7	55	0	49	42	18	B	6
The fifth	Virg o	10	18	0	49	41	15	B	6
The sixth	Virg o	20	30	0	49	0	18	B	6
The seve nth	Virg o	19	26	0	49	27	12	B	6
The eight	Virg o	27	7	0	48	11	15	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
h The nint h	Leo	23	7	0	52	25	14	B	6
The little one touc hing the hip [Par uula tang ens coxa m]	Leo	3	6	0	35	40	15	B	6

DRACO (the Dragon)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The brig ht star follo wing , in the head [Luc ida sequ ens in capit	Sagit tariu s	23	46	0	75	1	10	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
e]									
The one in the tongue [Quae in lingua]	Capricorn	18	18	30	76	16	0	B	4
The one in the mouth [Quae in ore]	Sagittarius	5	36	30	78	14	30	B	4
The preceding, in the head [In capitae praecedens]	Sagittarius	7	41	30	75	20	0	B	3

[Right-hand column, page 270]

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The one towa rd the chee k [Qua e ad gena m]	Libr a	20	25	0	80	20	30	B	4
1. The first of thre e in the ben d of the neck [1. Triu m in flex u colli]	Libr a	18	26	0	81	52	0	B	5
The sout hern one, in the sam e plac	Scor pio	25	53	0	77	56	0	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
e [Aus trali s ibid em]									
The mid dle of the m [Me dia earu m]	Scor pio	21	55	30	79	50	30	B	5
The follo wing , towa rd the east [Seq uens ad ortu m]	Scor pio	10	51	0	80	52	29	B	4
Near the seco nd ben d [Pro pe	Pisc es	29	55	0	81	50	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
secu ndu m flex um]									
Nort h, in the seco nd ben d [Bor ea □ secu ndi flex us]	Arie s	13	48	30	80	24	0	B	4
Nort h, of the follo wing flan k [Bor ea later is sequ entis]	Arie s	16	45	0	78	8	30	B	4
The sout hern one, of	Arie s	29	0	0	79	24	0	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
the sam e flan k [Aus trali s eius dem later is]									
The prec edin g Δ, of the follo wing [Seq uent is Δ prae cede ns]	Arie s	16	40	0	83	4	0	B	5
The follo wing , towa rd the sout h [Seq uens	Arie s	21	8	0	80	37	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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hanc
ad
aust
rum
]

The one above this [Quae supra hanc]	Aries	28	6	0	80	53	0	B	4
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The one above this [Quae supra hanc]

In the rest of the following [In reliquo Δ sequens]	Taurus	7	56	30	83	3	30	B	4
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In the rest of the following [In reliquo Δ sequens]

The southern one of the same [Aus]	Taurus	21	8	0	83	27	30	B	4
------------------------------------	--------	----	---	---	----	----	----	---	---

The southern one of the same [Aus]

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
trali s eius dem]									
The prec edin g, nort h of the Tria ngle [Pra eced ens bore a Triã guli]	Gem ini	6	53	0	84	47	0	B	6
In the ben d of the third knot [In flex u nodi tertij]	Virg o	1	6	30	81	13	30	B	3
Near est to	Virg o	7	48	0	86	52	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
the Pole of the Zodiac [Polar Zodiacal proximity]									
The one that follows the 24th [Quaere 24. sequitur]	Virgo	29	43	0	81	17	0	B	5
The following of this [Successive]	Virgo	29	44	0	81	40	0	B	5
Nearer to the Pole	Virgo	28	13	30	84	45	0	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Pol o vicin ior]									
The prec edin g of the seco nd- to- last in the ben d	Leo	9	17	0	78	31	0	B	5
[Pra eced ens ante pen ulti mã ab extr emo flex u]									
The seco nd- to- last prec edin g the	Taur us	13	50	30	74	10	30	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ben d [Ant epen ult. flex us prae ced.]									
The next -to- last, towa rd the ben d [Pen ulti ma ad flex um]	Taur us	0	44	0	77	13	0	B	4
The seco nd follo wing the ben d [Flex um sequ ens secu	Virg o	0	39	0	66	57	0	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
nda]									
The ben d most close ly follo wing [Flex um prox ime sequ ens]	Virg o	3	32	30	66	35	0	B	2
The next -to- last of the tail [Pen ulti ma caud ae]	Leo	11	48	0	61	32	0	B	5
The last of the tail [Vlti ma caud ae]	Leo	5	59	30	57	6	0	B	3
For	Leo	2	26	0	77	30	30	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
mles s, betw een the 11th and Ceph eus's arm [Info rmis inter 11. & Ceph ei brac hiu m]									

CEPHEUS

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The girdl e of Ceph eus [Cin gulu m Ceph ei]	Taur us	1	36	30	71	8	30	B	3

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The bright star of the shoulder [Lucida humeri]	Taurus	8	36	30	68	56	30	B	3
In the left shoulder [Insinistro humero]	Aries	29	17	0	62	36	25	B	4
The following, in the tiara toward the north [Séquês in tiara]	Aries	9	52	30	61	4	30	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ad Bore am]									
The sout hern one [Aus trali s]	Arie s	9	19	0	60	0	0	B	4
The one towa rd the east [Qua e vers us ortu m]	Arie s	15	2	30	58	47	30	B	4
In the ben d of the arm, the sout hern [In flex u brac hij aust	Arie s	0	43	30	71	0	0	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ralio r]									
In the sam e plac e, mor e nort herl y [Ibid em bore alior]	Arie s	1	17	30	74	1	0	B	5
The one in the shou lders [Qua e in hum eris]	Arie s	20	0	0	28	65	43	B	5
In the right foot [In pede dext ro]	Pisc es	28	56	30	75	28	30	B	4
In	Pisc	25	46	30	64	19	25	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
the left foot [In pede sinis tro]	es								

3rd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
For mles s, near the tiara [Info rmis prop e Tiar am]	Arie	5	53	30	64	2	30	B	5

BOOTES, seu ARCTOPHYLAX (Boötes, or the Bear-keeper)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Arct urus , in the fring e [Arct urus in fimb	Libr	20	4	27	31	0	40	B	1

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ria]									
In the left shoulder [In humero sinistro]	Libra	14	30	27	49	51	30	B	3

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The preceding, in the left hand [In sinistra manu praecedens]	Virgo	25	34	0	58	51	30	B	4
The second [Secunda]	Virgo	28	18	30	58	49	30	B	4
The third	Virgo	28	24	30	60	23	40	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Tert ia]	o								
In the left ulna [In vlna sinis tra]	Libr a	2	43	0	54	38	29	B	4
In the head [In capit e]	Libr a	20	8	30	54	14	0	B	4
In the right shou lder abov e the Cro wn [In dext ro hum ero supr a Coro nam]	Libr a	28	34	30	49	50	0	B	4
In the	Libr a	19	41	0	42	9	32	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
hip belo w the right arm [In coxa infra brac hiu m. dext.]									
The lowe st of the two, in the back [Infi ma duar . in dors o]	Libr a	18	41	0	42	9	32	B	4
The uppe r one [Sup erior]	Libr a	18	42	30	42	34	0	B	4
In the	Libr a	28	53	30	35	35	33	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
right shin [In Crur e dext ro]									
The uppe r one of the shin [Cru ris supe rior]	Libr a	23	18	0	38	0	30	B	4
The mid dle of the shin [Me dia Crur is]	Libr a	13	50	0	26	31	29	B	4
The lowe st of the shin [Infi ma Crur is]	Libr a	11	22	0	24	34	32	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Around the lowest knee, the 3rd of the formless [Circ a genu infi ma 3. informium]	Libra	27	38	30	30	26	0	B	4
The middle one [Media]	Libra	28	36	0	31	20	29	B	4
The upper one [Superior]	Libra	29	17	0	33	5	30	B	4

BOOTES (continued)

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The	Virgo	29	36	0	40	13	0	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
prec edin g, of the four	o								
The sout hern follo wing , & nort hern [Seq uens Aust ralis & Bore alis]	Scor pio	1	5	0	46	30	0	B	5
The one that follo ws this [Qua e hanc sequ itur]	Scor pio	29	18	0	42	14	30	B	5
The prec edin g, in the sout	Scor pio	0	41	0	41	53	29	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
hern Colo bum [Pra eced ens in Colo robo aust rali]									
The follo wing [Seq uens]	Scor pio	1	51	30	46	50	28	B	5
The uppe r, in the colo bum [Sup erior in colo robo]	Scor pio	29	57	0	53	26	0	B	4
For mles s, arou nd this [Info rmis	Scor pio	4	0	0	53	58	29	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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For mles s, of the two abov e the head [Info rmis duar um supr a capu t]	Scor pio	13	14	0	60	38	28	B	6
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The
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The seco nd of the sam e [Sec und a ipsa rum]	Scor pio	13	58	0	60	55	30	B	6
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3rd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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In the	Scor pio	0	10	0	45	43	30	B	4
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Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Hunting-spear r [In Ven abulo]									

CORONA BOREA (the Northern Crown)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The bright star of the Crown [Lucida Coronae]	Scorpio	8	12	27	44	25	20	B	2

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The one preceding the bright star [Preced	Scorpio	5	1	0	46	8	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ens lucid am]									
The one abov e this [Qua e supr a hanc]	Scor pio	4	34	30	48	25	0	B	5
The follo wing , towa rd the nort h [Seq uens ad Bore am]	Scor pio	9	26	0	50	21	0	B	6
The brig ht one follo wing [Seq uens lucid	Scor pio	10	38	30	44	33	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
am]									
The one most near ly follo wing [Pro xime sequ ens]	Scor pio	12	49	0	44	52	0	B	4
The one acco mpa nyin g this [Qua e hanc comi tatur]	Scor pio	14	56	0	46	9	30	B	4
The last of all [Vlti ma omn ium]	Scor pio	14	26	0	48	24	0	B	4

HERCULES ENGONASI (Hercules, the Kneeler)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The head of Hercules [Caput Hercules]	Sagittarius	11	58	7	37	22	15	B	3
The right shoulder [Humerus dexter]	Sagittarius	16	54	37	42	47	15	B	3
The left shoulder [Humerus sinister]	Sagittarius	10	37	7	47	46	15	B	3

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The next-to-last of the right	Sagittarius	23	2	10	40	5	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
arm [Pen ulti ma brac hij dext r.]									
Below, in the right arm [Infi ma in dext ro brac hio]	Sagit tariu s	21	32	40	37	18	15	B	4
In the left arm [In brac hio sinis tro]	Sagit tariu s	13	48	9	49	22	14	B	4
The prec edin g, in the spoil s of the	Sagit tariu s	11	2	12	51	16	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Lion [Preced ê's in spoli o Leon is]									
The foll wing , in the Tria ngle (spoi l) [Seq uens in Triã gulo spoli j]	Sagit tariu s	28	45	10	52	18	20	B	4
At the base of the trian gle, towa rd the nort h [In basi	Sagit tariu s	28	45	8	53	45	14	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
triāg li ad bore am]									
The mid dle, in the spoil [Me dia in spoli o]	Sagit tariu s	23	4	10	52	46	20	B	4
In the left hip [In coxa sinis tra]	Sagit tariu s	27	28	12	53	10	0	B	3
The east ern one, in the left thig h [Hic orie ntal. in fem.	Sagit tariu s	4	11	40	53	20	18	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
sinis t.]									
The prec edin g, of the thre e adjoi ning the thig h [Pra eced . triu m conti guar . fem oris]	Sagit tariu s	7	47	40	59	37	15	B	4
The mid dle of the m [Me dia earu m]	Sagit tariu s	8	45	12	66	11	0	B	4
The follo wing	Sagit tariu s	11	13	40	60	13	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Seq uens]									
In the left knee	Sagit tariu s	27	22	10	60	46	17	B	3
[In genu sinis tro]									
In the left thig h, towa rd the Drag on's head	Sagit tariu s	15	43	0	59	0	0	B	5
[In sinis t. sura ad Cap. drac.]									
The prec edin g, of the thre e in	Sagit tariu s	8	31	40	71	19	17	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
the left foot [Pra ec. triu m in pede sinis tr.]									
The mid dle of the m [Me dia earu m]	Sagit tariu s	12	33	10	71	13	0	B	6
The last, neb ulou s [Vlti ma neb ulos a]	Sagit tariu s	11	30	8	71	4	18	B	neb.
In the uppe r right thig h [In	Sagit tariu s	24	34	40	60	22	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
superiori femore dextro]									
The northern one in the same [Borealis in eadem]	Sagittarius	19	15	39	63	13	20	B	4
In the right knee [In genu dextro]	Sagittarius	10	9	40	65	54	15	B	4
In the upper thigh [In superiore sura]	Sagittarius	7	23	12	63	50	14	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
In the shin [In crure]	Sagittarius	4	9	10	64	22	15	B	4
The preceding, in the right shin [Precedens in crure dext.]	Sagittarius	17	58	17	62	28	17	B	5
In the right leg-bone foot [In tibia pedis dextri]	Sagittarius	3	54	38	60	15	0	B	4
The last in the	Sagittarius	28	32	8	57	15	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
right foot [Extr ema in pede dext ro]									

3rd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
In the left hip, prec edin g [In coxa sinis t. prae ced.]	Sagit tariu s	2	46	10	55	54	15	B	5
The follo wing , in the sam e [Seq uens in eade m]	Sagit tariu s	3	56	8	58	14	16	B	5
For mles	Sagit tariu	16	15	0	57	29	17	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
s, in the right arm, southern [Informis dext. brachij aust.]	s								

LYRA, seu VULTUR VOLANS (Lyra, or the Flying Vulture)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The brightest star of Lyra [Lucida Lyrae] (Vega)	Capricorn	11	6	27	61	47	0	B	1

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Above the brightest	Capricorn	14	37	30	62	16	30	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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Belo	Capr	13	49	28	60	25	31	B	4
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[Right-hand column, page 271]

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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In	Capr	17	34	0	59	25	29	B	4
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Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
wing -out of the horn s [In educ tion e corn uum]									
Of the two adjoin ing towa rd the nort h [Dua rum conti guar um ad Bore am]	Capr icor n	25	56	0	60	45	30	B	5
The sam e, towa rd the sout	Capr icor n	26	25	30	59	40	28	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
h [Ear und em ad aust rum]									
The prec edin g, & nort hern , in the yoke [In iugo prae ced. & bore alis]	Capr icor n	14	40	0	56	4	30	B	3
The little one belo w this [Par ua sub hac]	Capr icor n	14	22	0	55	15	29	B	6
In the yoke	Capr icor n	17	34	30	55	5	30	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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, the boreal of the following [In iugosequentium boreal]

The little one below this [Parua sub hac]	Capricorn	17	43	29	54	31	0	B	6
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In the middle of the body	Capricorn	22	15	30	58	5	30	B	5
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, nearly [In medio ferè

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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CYGNUS (the Swan)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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The beak of the Swa n [Rost rum Cygna i]	Capricorn	27	5	31	44	5	0	B	3
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The bright star of the ancient breast [Lucida pectoris antiqua]	Capricorn	20	46	40	57	10	20	B	3
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The tail of the Swa	Aquarius	1	15	12	59	57	20	B	2
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Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
n [Cauda Cygni]									
The upper wing , near the elbow w [Alae superioris ancon.]	Capricorn	12	14	47	64	28	50	B	3
The lower wing , near the elbow w [Alae inferioris ancon.]	Capricorn	23	31	17	49	27	0	B	3

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The one in the head [Qua e in capit e]	Capr icor n	0	46	0	50	43	0	B	5
In the mid dle of the neck [In med io colli]	Capr icor n	8	59	0	54	20	0	B	4
The third , in the uppe r sout hern wing [Trit in supe riori ala Aust r.]	Capr icor n	14	43	0	69	43	0	B	4
The	Capr	14	1	30	71	32	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
next -to- last of the uppe r wing [Pen ulti ma supe riori s alae]	icor n								
The last of the uppe r wing [Vlti ma supe riori s alae]	Capr icor n	10	58	30	73	51	30	B	4
In the mid dle of the lowe r wing	Capr icor n	25	40	0	51	42	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[In med io infer ioris alae]									
The last of the lowe r wing [Extr ema infer ioris alae]	Aqu ariu s	29	5	0	43	45	0	B	3
The prec edin g, in the lowe r foot [Pra eced ês in pede infer iori]	Pisc es	1	54	0	55	0	0	B	4
The follo wing , in the	Pisc es	6	43	30	56	37	10	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
lower knee [Sequens in genu infer iori]									
Adjoining, in the upper foot, preceding, & southern [Contiguous. in superpede precedens. & Austr.]	Pisc es	4	12	0	63	58	2	B	4
The upper northern	Capricorn	25	56	30	64	18	30	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
one, of the m [Ear um supe rior Bore alis]									
The lowe r of the form less, follo wing the sam e wing [Infe rior infor miu m sequ ês alam dext ram]	Pisc es	4	25	30	50	34	0	B	4
The uppe r one of	Aqu ariu s	6	51	30	51	32	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
the sam e [Eat und em supe rior]									
Belo w the wing , towa rd the foot of Pega sus [Infr a alam vers us pede m Pega si]	Aqu ariu s	5	55	0	38	40	3	B	3
Of the two towa rd Lyra , prec	Capr icor n	21	19	0	66	16	2	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
edin g [Dua rum vers us Lytã prae c.]									
The nort hern follo wing [Seq uens bore alior]	Capr icor n	26	11	30	68	53	0	B	4
The little one, towa rd the brea dth of the wing [Pat uula ad vola m alae]	Capr icor n	14	53	0	69	40	2	B	4
Tow	Capr	19	37	0	53	13	0	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ard the lowe r wing [Ad infer iore m alam]	icor n								
Tow ard the uppe r wing [Ad supe riore m alam]	Capr icor n	14	40	0	69	43	0	B	6
* The new one in the Brea st of the Swa n [Nov a in Pect	Capr icor n	16	15	0	55	30	0	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ore Cygn il], it was in the year 1600 [Erat Ann o 1600 . in]									
To us in the year 1659 in Nov emb er [Nob is Ann o 1659 . Nou êb.]	Capr icor n	16	31	10	55	24	10	B	3
In the right knee , neb ulou	Pisc es	4	22	0	63	21	0	B	neb.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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CASSIOPEIA

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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The brigh ht star of the Chai r [Luc ida Cath edra e]	Taur us	0	55	47	51	17	0	B	3
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Sche dir of the brea st [Pect oris sche dir]	Taur us	3	39	27	46	36	50	B	3
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The ben d [Flex	Taur us	9	49	27	48	47	50	B	3
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Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ura]									
In the knee [In genu]	Taurus	13	42	57	46	23	50	B	3

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The one in the head [Quae in capite]	Taurus	0	57	0	44	42	0	B	4
In the girdle [In cingulo]	Taurus	9	43	0	47	6	30	B	4
In the shin [In crure]	Taurus	20	53	30	47	30	29	B	3
The end of the foot	Taurus	28	1	0	48	55	13	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Extr ema pedi s]									
In the left arm [In brac hio sinis tro]	Taur us	7	36	30	53	8	0	B	5
In the left elbo w [In cubi to sinis tro]	Taur us	6	38	0	43	19	30	B	5
In the right elbo w [In cubi to dext ro]	Taur us	6	1	0	49	26	0	B	6
In the dra wing	Taur us	8	28	0	53	16	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
-out of the seat [In educ tion e sedis]									
The end of the Chai r [Cat hedr ae extr ema]	Arie s	26	56	0	51	9	28	B	6
At the extr emit y of the seat [In extr emit ate sella e]	Taur us	26	54	0	52	40	30	B	5
In a strai	Taur us	0	50	0	54	49	29	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
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The end of the foots tool [Sca belli extr ema]	Taur us	23	45	0	56	14	30	B	6
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The mid dle of the foots tool [Me dia	Taur us	23	45	0	54	28	31	B	6
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Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
scab elli]									
...or from Long omo ntan us [vel ex Long imo ntan o]	Taur us	23	54	0	54	28	31	B	6
In the foots tool, at the sole of the foot [In scab ello ad plan tã pedi s]	Taur us	23	20	0	52	10	0	B	6
The one that follo ws	Taur us	14	19	30	44	59	0	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
the knee [Quae sequitur genu]									
The one that precedes the knee [Quae genu prae credit]	Taurus	11	22	0	45	6	0	B	6
The whirl of the navel [Vmbilicyrus]	Taurus	8	14	0	47	33	0	B	4
The little one, toward the	Aries	0	32	0	43	50	0	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
hair [Pat uula ad crin es]									
The bore al follo wing , in the Rod [Seq uens Bore al. in Virg a]	Taur us	0	54	0	41	16	28	B	6

CASSIOPEIA (continued)

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The prec edin g of the m [Ear um prae cede ns]	Arie s	29	19	0	41	17	0	B	6
The next -to- last	Arie s	28	18	0	39	17	0	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
of the Rod [Pen ulti ma Virg ae]									
The last of the Rod [Vlti ma Virg ae]	Arie s	28	16	30	38	10	29	B	6
Of the thre e belo w the foots tool, the prec edin g, [mos t] nort hern [Triu m infra	Arie s	3	8	0	53	17	28	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
scabellū prae c. Septentr.]									
The northern following [Sequens Septentrionalis]	Gemini	7	34	0	53	33	29	B	6
The southern one of them [Earum Australis]	Gemini	1	33	0	53	5	30	B	6
Above these, toward the	Gemini	18	39	0	59	29	28	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Pole [Sup ra has vers us Polu m]									
The first betw een Auri ga, & Cassi opei a [Pri ma inter Auri gam, & Cassi op.]	Gem ini	18	39	0	55	51	30	B	6
The seco nd [Sec und a]	Gem ini	28	41	0	35	49	28	B	6
The third [Tert ia]	Gem ini	3	55	0	34	50	30	B	6
The four	Gem ini	4	22	0	30	23	28	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
th [Quarta]									
The first of the three toward the north	Gemini	2	7	0	44	11	30	B	6
[Trium in Boream prima]									
The second	Gemini	2	18	0	43	33	28	B	6
[Secunda]									
The third	Gemini	27	37	0	43	33	29	B	6
[Tertia]									
The one further toward the	Gemini	1	32	0	54	44	30	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
north, & first toward the Bear [Quadrant magis in Boream, & prima versus Vrsam]									
The second [Secunda]	Cancer	29	7	0	56	16	28	B	6
The third [Tertia]	Cancer	5	35	0	56	36	30	B	6
The fourth [Quarta]	Cancer	1	20	0	59	19	28	B	6
The fifth [Quinta]	Cancer	9	16	0	60	48	30	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Quinta]									
The sixth	Cancer	11	36	0	62	5	28	B	6
[Sexta]									
The seventh	Cancer	10	59	0	62	47	30	B	6
[Septima]									
The eighth	Cancer	22	20	0	63	18	29	B	6
[Octava]									
The new star, in the year 1572	Cancer	6	54	0	53	45	0	B	*
[Nova Anno 1572. Perat]									

PERSEUS

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The	Aries	27	39	55	30	5	40	B	2

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
brigh ht star of the flan k [Luc idu m latus]	s								
Belo w the sole, com mon with the bore al horn [Sub plat a com mun is cum corn u bor.]	Arie s	18	22	47	5	20	30	B	4
The head of Med	Arie s	22	5	57	22	22	40	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
usa [Cap ut Med usae]									

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Wra pped at the extr emit y of the right han d [Inu olut a in extr emo man us dext rae]	Arie	19	59	0	39	1	10	B	6
In the right elbo w [In cubi to	Taur	24	37	0	37	29	11	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
dext ro]									
In the right shou lder [In hum ero dext ro]	Taur us	25	54	30	34	39	40	B	3
In the left shou lder [In hum ero sinis tro]	Taur us	20	32	30	31	35	0	B	4
In the top of the head [In verti ce capit is]	Taur us	23	18	0	34	26	40	B	5
The one in the	Taur us	25	1	0	30	37	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
back [Qua e in dors o]									
Belo w the brig ht star of the flan k [Infr a later is lucid am]	Taur us	28	12	30	27	59	38	B	5
The little one follo wing this [Par ua hanc sequ ens]	Taur us	29	41	30	27	55	40	B	5
Tow ard the ben d of	Gem ini	0	53	0	27	19	39	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
the flank [Ad flexum lateris]									
In the left elbow [In cubito sinistro]	Taurus	23	54	0	26	4	40	B	4
The one below Medusa's head [Quae sub capite Medusae]	Taurus	20	0	0	20	54	38	B	5
The one precedin	Taurus	10	46	0	20	33	40	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
g this [Han c prae cede ns]									
The prec edin g, towa rd the nort h in Med usa's head [Pra eced ens ad Bor. in cap. Med usae]	Taur us	19	48	0	11	53	40	B	4
In the right ham [In popl ite dext	Gem ini	7	41	30	28	23	10	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
ro]									
The one that precedes the right knee [Quae praecedit genu dextr.]	Gemini	5	29	30	28	50	40	B	4
The preceding g bend of the knee [Praec. flexum genu]	Gemini	5	33	0	26	11	38	B	4
The middle, in the right knee	Gemini	6	42	0	26	39	40	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Me dia in genu dext ro]									
Belo w the right knee [Infr a genu dext rum]	Gem ini	7	28	0	24	35	39	B	4
In the sole of the right foot [In plan ta pedi s dext ri]	Gem ini	9	29	0	18	56	40	B	5
In the left thig h [In sinis	Gem ini	29	39	0	22	6	38	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
tro femore]									
In the left knee [In genu sinistro]	Gemini	1	36	0	19	4	39	B	5
In the left shin [In crure sinistro]	Gemini	0	51	30	14	54	0	B	5
In the left heel [In sinistro calcaneo]	Gemini	26	51	0	12	8	40	B	5
The following, of the left foot	Gemini	4	0	0	11	18	0	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[Seq uens sinis tri pedi s]									
For mles s, abov e the head [Info rmis supr a capu t]	Gem ini	3	18	0	41	26	38	B	5
In the uppe r part of the right thig h, form less [In supe rpar te fem or.d ext.]	Taur us	4	0	0	29	31	40	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The prec edin g form less, of Med usa's head [Info rmis prae c.ca p. Med usae]	Taur us	17	42	0	20	53	40	B	4
In a strai ght line, with the head , the Pole, & with the brig ht star of the flan k [In rect	Gem ini	3	46	0	45	10	39	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
------	------	---	---	---	-------	---	---	-----	-----

a
linea
cum
cap.
Polo,
&
cum
lucid
a
later
is]

The seco nd of the m [Sec und a illar um]	Gem ini	15	40	0	48	7	40	B	6
---	------------	----	----	---	----	---	----	---	---

<i>...from the othe r Cata logu e of Kepl er [ex alter o Cata logo</i>	Gem ini	5	30	0	48	7	40	B	6
--	------------	---	----	---	----	---	----	---	---

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Kepl eri]									
The third of the m [Tert ia illar um]	Gem ini	6	9	0	49	27	38	B	6
The four th of the m [Qua rta earu m]	Gem ini	7	53	0	53	37	40	B	6
<i>...fro m the othe r Cata logu e of Kepl er [ex alter o Cata logo Kepl eri]</i>	Gem ini	7	43	0	53	37	40	B	6

3rd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Formlesini	Gemini	3	38	0	17	50	40	B	5

s,
from
the
left
knee
toward
the
east
[Informis à sinistrotogenuadortum]

[Right-hand column, page 272]*AURIGA, HENIOCHUS, ERICHTONIUS (Auriga, the Charioteer, Erichthonius)***1st Class.**

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Capeella	Gemini	17	40	2	22	51	45	B	1

or
the
Little
She-goat
[Capella,

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
seu Hirc us]									
The brig ht star of the right shou lder [Luc ida hum eri dext ri]	Gem ini	27	12	2	21	25	40	B	2

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The prec edin g & uppe r star of the head [Pra ec. & supe rior Capi tis]	Gem ini	25	2	0	32	16	15	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The follo wing , & lowe r [Seq uens , & infer ior]	Gem ini	25	38	0	30	51	14	B	4
In the right arm [In brac hio dext ro]	Gem ini	25	52	0	13	45	16	B	4
In the left elbo w [In cubi to sinis tro]	Gem ini	25	22	0	13	45	16	B	4

From the other Catalogue of Longomontanus [Ex alio Catalogo Longomontani]:

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
In the left elbo	Gem ini	14	35	0	20	53	15	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
w [In cubi to sinis tro]									
The prec edin g of the Kids [Hœ doru m prae cede ns]	Gem ini	14	29	30	18	10	0	B	4
The follo wing of the Kids [Hœ doru m sequ ens]	Gem ini	15	13	30	18	13	0	B	4
In the uppe r foot [In supe riore	Gem ini	12	28	30	10	23	15	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
pede]									
The uppe r one, towa rd the right brig ht star of the shou lder [Sup erior ad lucid am dext ri hum .]	Gem ini	25	49	30	27	8	14	B	4
In the loins , mor e nort hern [In lum bis	Gem ini	18	16	30	18	36	0	B	6

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
Bore alior]									
In the loins , mor e sout hern [In lum bis Aust ralio r]	Gem ini	17	30	0	17	0	13	B	6
To this, lowe r towa rd the west [Hui c infer ior ad Occa sum]	Gem ini	16	22	0	15	23	0	B	5
The follo wing [Seq uens	Gem ini	18	33	0	14	5	15	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
] Toward the buttocks [Adnates]	Gemini	13	24	0	15	4	14	B	5
The preceding, of the two in the right arm [Praeceduarum in brachio dext.]	Gemini	23	36	30	15	44	0	B	5
] The following of the m [Sequens]	Gemini	23	48	0	16	44	13	B	5

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
------	------	---	---	---	-------	---	---	-----	-----

earu
m]

From the other Catalogue of Kepler [Ex altero Kepl. Catalogo]:

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
------	------	---	---	---	-------	---	---	-----	-----

Belo w this, in the right hip [Sub hac in dext ro citur e]	Gem ini	24	8	0	35	44	13	B	5
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In
the
left
leg-
bone
[In
sinis
tra
tibia
]

In the left leg- bone [In sinis tra tibia]	Gem ini	18	13	30	11	16	14	B	5
--	------------	----	----	----	----	----	----	---	---

In
the
right
foot
[In
dext
ro
pede

In the right foot [In dext ro pede	Gem ini	19	58	0	8	52	16	B	5
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Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
]									
The prec edin g, arou nd Eric htho nius [Pra eced ens circa Eric hton .]	Gem ini	11	28	30	14	52	13	B	5
The sout hern follo wing [Seq uens Aust ralis]	Gem ini	11	55	0	14	3	15	B	5
The bore al form less, betw een Auri ga, & the	Gem ini	29	16	0	6	13	14	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
feet of Gem ini [Bor ealis infor mis inter Auri gam, & pede s Gem in.]									
The seco nd [Sec und a]	Gem ini	24	28	0	4	17	15	B	4
Below it, towa rd the east [Sub ista m ad ortu m]	Gem ini	25	28	0	2	27	13	B	4
The prec edin g of	Gem ini	21	20	30	2	39	15	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
thes e [Har um prae cede ns]									
The last of all [Vlti ma omn ium]	Gem ini	23	24	0	1	7	16	B	4

OPHIUCHUS, seu SERPENTARIUS (Ophiuchus, or the Serpent-bearer)

1st Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The head of Ophi uchu s [Oph iuch i Cap ut]	Sagit tariu s	18	17	7	35	56	15	B	3
The left han d, bore al [Ma nus	Scor pio	28	11	37	17	18	20	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
sinis trae Bore alior]									
In the right knee [In genu dext ro]	Sagit tariu s	13	51	7	17	17	10	B	3
In the left knee [In genu sinis tro]	Scor pio	23	5	7	11	27	20	B	3
In the right shou lder [In hum ero dext ro]	Sagit tariu s	21	11	2	28	0	0	B	3

2nd Class.

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
The follo wing	Sagit tariu	22	32	0	26	10	20	B	3

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
, in the right shoulder [Sequens in dextro humero]	S								
The preceding, in the left shoulder [Praec. in sinistro humero]	Sagittarius	6	26	30	32	35	0	B	4
The following, in the left shoulder [Sequens	Sagittarius	7	43	0	31	55	20	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
in sinis tro hum ero]									
In the left elbo w [In sinis tro cubi to]	Sagit tariu s	1	30	0	23	19	0	B	4
In the left han d, mor e sout hern [In sinis tra man u aust ralio r]	Sagit tariu s	29	24	0	16	30	0	B	5
In the right elbo w	Sagit tariu s	5	0	0	15	18	19	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[In dext ro anco ne]									

In the other Catalogue of Kepler [In alt. Catalogo Kepleri]:

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
In the right han d [In dext ra man u]	Sagit tariu s	20	39	0	15	18	19	B	4
The sout hern & prec edin g, in the right han d [Aus tral. & prae ced. in man u dext.	Sagit tariu s	25	40	30	13	46	18	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
------	------	---	---	---	-------	---	---	-----	-----

]

The mor e	Sagit tariu s	26	41	30	15	19	20	B	5
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In the right knee	Sagit tariu s	13	51	0	7	17	21	B	5
----------------------------	---------------------	----	----	---	---	----	----	---	---

[In
dext
ro
genu
]

But by the correction of Kepler [Sed ex correctione Kepleri]:

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
------	------	---	---	---	-------	---	---	-----	-----

In the left knee	Sagit tariu s	13	47	30	7	17	21	B	5
---------------------------	---------------------	----	----	----	---	----	----	---	---

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
[In sinis tro genu]									
In the left knee	Sagit tariu s	5	6	0	11	29	20	B	5
[In sinis tro genu]									
In the right leg- bone	Sagit tariu s	5	50	0	2	11	21	B	5
[In tibia dext ra]									
The fifth form less, in the Milk y Way [Qui nta infor m. in	Sagit tariu s	27	58	0	33	2	0	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
via lact.]									
Above the bright star of the Serpent's neck [Supra lucidi colli serp entis]	Scorpio	18	15	0	26	36	0	B	4
After the loins of Ophiuchus [Post coxas Ophiuchi]	Scorpio	16	16	0	10	20	19	B	4
The more	Scorpio	20	24	0	8	3	13	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
southern of the following [Sequentium Australior]									
The northern one of them [Earum Borealior]	Scorpio	21	15	0	10	34	20	B	4
The one above this [Quae supra hanc]	Scorpio	20	12	0	15	47	19	B	4
Between	Sagittarius	25	57	0	27	54	21	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
n the left han d and the knee [Inte r man um sinis tram ad genu]	s								
For mles s, arou nd the bore al shou lder [Info rmis circa hum eru m Bore um]	Sagit tariu s	26	5	0	26	22	18	B	4
The mid	Sagit tariu	26	10	0	24	49	20	B	4

Star	Sign	°	'	"	Lat °	'	"	B/A	Mag
dle of the m [Me dia ipsa rum]	s								
The sout hern of the thre e [Aus trali s triu m]	Sagit tariu s	26	10	0	24	49	20	B	4

Notes

- Throughout these tables the "B/A" column gives the **Latitude B.** (northern) header from the source. The source header for these pages is *Latitudo B.* — "B." (Borealis) labels the whole latitude column for these boreal constellations; there is no separate per-row Australis glyph on pp. 270–272, and every latitude on these pages is Borealis ("B"). The "B/A" column is an editorial split, uniformly "B" here.
- The "Nova" entries are preserved with their dates: the **Nova in Cassiopeia of 1572** (Tycho's supernova, marked * for "new star/temporary star") and the **Nova in the Breast of the Swan** (P Cygni), with both the 1600 and Riccioli's own 1659 November positions.
- Several rows carry comparative cross-catalogue readings (*from the other Catalogue of Kepler, from Longomontanus, by the correction of Kepler*) printed as alternate positions for the same star; these are transcribed as

their own rows immediately below the primary reading, preserving the source layout.

- Parsing notes: the longitude seconds sub-column ("''") is frequently 0 throughout; degree/minute values are dense and some second-values in the latitude column about the B/A glyph — read carefully. The "□" glyph in star-descriptions is the printer's quadrilateral. The further table reprocess () resolved the prior pass's [?] flags against the source cell-by-cell; the corrected cell values are now in place. Two rows on p. 272 (right) were initially retained as [?] — Ophiuchus 2nd-Class "Earum Borealior" and "Australis trium" — but native-resolution review () recovered both: they were column-shift misreads, not gutter ink-loss (this text column sits clear of the gutter), and their full data is now in place. The suspected source error at Cepheus 2nd-Class "Quae in humeris" (latitude minutes = 65, > 59) is left as printed for editorial footnoting.

Liber IV — De Fixis Stellis (continued)

Caput XXI — The Universal Catalogue, Pars Secunda (Northern Constellations), continued

Columns throughout: Name of the fixed star | Longitude (Sign, °, ', ") | Latitude (°, ', ") with B = Borealis (north) / A = Australis (south) | Magnitude. Longitudes are reduced to the epoch 1700. Subheadings "1. Classis / 2. Classis / 3. Classis" mark the certainty classes; "Informes" / formless-star rows are sub-rows within a constellation.

Serpentarius (Ophiuchus / Serpens), continued — the formless stars between the hand and knee (continuing from the prior batch):

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Folliwing of the thre	□	27	25	0	26	9	18	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
e									
Preceding, in the right foot	□	15	28	—	2	15	20	B	3
Following	□	27	9	—	1	31	19	B	4[?]
Third	□	17	50	—	10	19	20	B	4
Following one	□	18	39	—	0	28	49	B	5
That which touches the heel	□	19	3	—	0	57	20	A	5
Uncertain, on the right	□	18	17	—	7	9	18	B	5
Formles, outside the	□	23	12	—	4	19	20	B	6

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
leg									
Follo wing of two in the hand	□	1	34	—	23	33	18	B	5
In the hip of Ophiuchus	□	16	27	—	10	17	19	B	5
Follo wing , southern	□	20	29	—	8	4	20	B	4
In the right hand	□	21	31	—	10	39	18	B	4
Nort hern	□	20	32	—	15	5	20	B	5

[Margin / sub-heading:] The remaining stars of the 2nd Class, from Kepler, concerning the New Star (Stella Nova) in Serpentarius:

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
Of the three before the foot, in a straight northern line, preceding	□	27	9	—	B	5
Middle	□	26	14	—	B	5
Lowest	□	25	32	—	B	5
Preceding the front knee	□	2	30	—	B	5
Lower of two between the upper	□	8	18	—	B	6

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Between the upper feet	□	7	16	—	4	57	19	B	5
On the front northern shin [in cute anterior boreal]	□	4	14	—	5	41	20	B	4
Southern most of them	□	3	34	—	3	10	19	B	4
In the heel of the	□	3	11	—	1	37	20	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
front foot	□	5	31	—	0	25	18	B	4
In the heel of the following foot, front	□	17	6	—	17	27	20	B	5
In the following thigh [in femore sequenti]	□	20	29	—	14	56	19	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
enti]									
In the shin of the following foot	□	17	9	—	1	56	21	B	4
On the toe of the foot [in digit o	□	15	34	—	3:57:40	—	—	A	4
pedi s]									
On the back of the foot [in dors o	□	16	14	—	1:27:40	—	—	A	5
pedi s]									
Brig ht,	□	17	14	—	1:43:39	—	—	A	3

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
een the shoulder of Ophiuchus and Hercules									
Toward the shoulder of Ophiuchus, in the northern Rhombus [in Rhomborealis]	□	26	34	—	27	59	20	B	4
Preceding of	□	26	24	—	26	39	18	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
the middle ones [mediarum præcedens]									
Following	□	28	17	—	26	27	20	B	4
Lowest	□	27	7	—	24	44	19	B	4
Solitary, above the formless ones	□	29	17	—	32	44	20	B	4
The New Star (Stella Nova) in Serpentarius, in the	□	17	40	—	1	56	0	B	*

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
year 1604						

[Marginal note at the last row: "Stella Nova in Serpentario / Anno 1604 fuit" — "The New Star in Serpentarius existed in the year 1604."]

SERPENS OPHIUCHI (the Serpent of Ophiuchus)

1. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
Bright star of the neck [Serpens lucida colli]	♐	17	50	47	25 33 50	B 2

2. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
In the	♐	15	45	30	39 5 20	B 3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
mouth [in ore]									
Preceding, in the mouth	□	12	56	0	38	11	0	B	5
In the temples [in temporibus]	□	18	27	30	35	24	0	B	3
In the bend of the neck [in educatione colli]	□	15	42	30	34	26	20	B	3
Toward the left	□	16	31	0	37	27	25	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
eye [ad sinis tru m ocul um]									
Toward the nostrils [ad nare s]	□	14	36	0	42	36	0	B	4
Second in the neck, below the head [sec und a in collo infra cap.]	□	14	7	30	28	57	0	B	3
Southern	□	20	17	30	24	4	20	B	3

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
of the bright one [Australi or trium post lucid am]									
In the second bend [in secundo flexu]	□	21	47	30	16	25	18	B	4
Predicting the second-to-last	□	25	55	30	19	56	0	B	3

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
of the tail [anteultima caudæ]						

[Sub-heading:] From the other Catalogue [Ex altero Catalogo]:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Second-to-last of the tail [penultima caudæ]	□	1	33	30	20	36	20	B	3
Last [ultima]	□	11	31	0	26	58	0	B	4

[Sub-heading:] The remaining stars from Kepler, concerning the New Star [Reliqua ex Keplero de Nona Stella]:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
That which is above the double and eighth of Ptolemy [Quæ supra duplicé & octava Ptolemæo]	□	17	54	0	26	35	0	B	4
In the crest [in cristala]	□	19	30	0	37	14	0	B	5
In the	□	21	10	0	10	24	0	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
spir al, the apex of the isosceles [in spir a apex Isosceles] Of the base , preceding the 14th of Ptolemy [basis prae cede ns 14. Ptol.]	□	20	44	0	8	3	0	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Following the 15th of Ptolemy [sequens 15. Ptolemaeo]	□	21	30	0	10	22	0	B	4

Serpens (continued) — *Above the tail, two together, upper [Supra caudam duar. super.] etc.:*

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Above the tail, the upper of two together	□	1	10	0	26	37	0	B	6
Lower	□	3	0	0	23	27	0	B	6

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
[inferior]									
Below the tail [inferia caudam]	♁	4	21	0	15	48	0	B	4
Lowest of three at the end of the tail [infirmum in fine caudæ]	♁	3	21	0	21	28	0	B	6
Middle [media]	♁	5	27	0	22	41	0	B	6
Last [postremum]	♁	8	21	0	24	51	0	B	6

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
a] Next below the last [proximé infra vlti ma m]	□	11	43	0	25	1	0	B	4

3. *Classis:*

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Following the hand of Ophiuchus [sequens manum Oph.]	□	1	6	0	15	59	0	B	5

SAGITTA, sive TELUM (the Arrow, or Dart)

2. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Upper and eastern [superior & oriental.]	□	2	55	10	39	12	10	B	4
Preceding this one	□	29	18	12	38	57	40	B	4
The smallest one above this [parvula supra hanc.]	□	29	54	0	39	30	10	B	6
Upper,	□	26	53	40	38	52	13	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
contiguous in the Glyph his [super. conting. in Glyph hide]									
Lower of the m [inferior earum]	□	27	2	13	38	17	10	B	4
Forms, above lower Sagittaria [Inform. supr	□	1	36	10	42	42	12	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
a Sagittá infer.]									
Upper of the formless ones [superior information]	□	2	39	12	44	1	10	B	4
Third, in the oblique-angle of the formless ones [tertia in Oxygono infor	□	25	10	10[?]	46	2	13	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
miu m]						

AQUILA, seu VULTUR VOLANS (the Eagle, or Flying Vulture)

1. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Brig ht one in the shou lders [luci da in scap ulis] — [Alta ir]	□	27	32	17	29	20	40	B	2 [?]

2. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
That which is in the head [Quæ in Capite]	♁	1	51	40	27	7	40	B	6
In the neck [in collo]	♁	28	16	10	26	48	40	B	3
The small one above the bright [parua supra Lucidam]	♁	26	56	12	30	53	40	B	5
In the left	♁	26	49	13	31	17	10	B	5

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
shoulder [in sinistro humero]									
Following, small [sequens parua]	□	27	31	42	31	58	12	B	5
Upper, and preceding of the wing, lower [super. & præc. alæ infer	□	22	39	43	28	45	40	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
.]									
Lower, and following in the wing [inferior, & sequens in ala]	□	23	37	14	26	34	10	B	5
Tail of the vulture [caudavulturis]	□	15	38	42	36	15	40	B	3
Next to the tail, formless [proxim]	□	14	7	10	37	39	10	B	5

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
a caud æ infor m.]									
Mid dle of the form less ones , abov e the tail [me dia infor miu m supr a caud am]	□	10	35	12	43	32	40	B	4
Follo wing this one [seq uens hanc]	□	10	40	42	41	4	10	B	4

ANTINOUS

2. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
In the left hand [in manu sinistra]	□	0	44	40	18	47	0	B	3 [?]
On the right side [in latere dextro]	□	21	40	41	20	14	0	B	3
On the knee [in genu]	□	20	40	12	14	27	0	B	3
In the right arm [in dext	□	19	24	13	24	55	0	B	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
ro brac hio]	□	26	13	12	21	57	0	B	3
the brea st [in pect ore]	□	13	9	15	17	49	0	B	3
the right foot [in pede dext ro]	□	11	52	12	16	56	0	B	4
Prec edin g this, form less [præ cede ns hanc infor mis]	□								

DELPHINUS (the Dolphin)

2. *Classis:*

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Bright one of the tail [lucida caudæ]	□	9	55	12	29	7	0	B	3
Following the tail [sequens caudam]	□	11	11	13	28	51	30	B	6
That which is below the tail [quæ infra caudam]	□	11	5	12	27	33	0	B	6
In the Rho	□	12	19	10	31	56	30	B	5

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
alior]									
Following the more southern side [sequetis lateris Australior]	□	14	59	41	31	59	0	B	3
That which is in the head [quæ in capitale]	□	15	15	12	32	46	0	B	3
In the preceding side,	□	11	40	10	32	7	30	B	5

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
ns duarum infimam in Rhomboidem]									
Following the same [ear and em sequens]	□	12	5	13	30	40	0	B	6

EQUULEUS, EQUI SECTIO (the Foal, the Section of the Horse)

2. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Preceding of the head	□	18	55	40	20	11	20	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
[præcedens capit is]									
Following of the head [sequens capit is]	□	21	17	42	21	5	0	B	4
Preceding of the mouth [præcedens oris]	□	19	17	12	25	15	0	B	4
Following of the mouth [sequens oris]	□	20	17	40	24	51	0	B	4

**

PEGASUS EQUUS ALATUS (the Winged Horse)

1. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
The mouth of Pegasus [Pegasios]	♄	27	45	7	22	6	10	B	3
Scheat, of the leg [Scheat cruris]	♄	25	14	7	31	8	20	B	2
Of the first wing [primæ]	♄	19	19	37	19	24	50	B	2
— [Markab]									
Of the	♄	5	0	7	12	37	2	B	2

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
wing, the outermost [alæ extrema] — [Algenib]						

[Margin: "Umbilicus Pegasi, vide caput Andromedæ" — "The navel of Pegasus, see the head of Andromeda."]

2. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
The head of Pegasus [caput Pegasi]	♈	2	38	30	B	4
Toward	♈	1	8	30	B	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
the south, in the head [ad Austrum in capitale]									
Lower, following in the mane [inferior sequens in iuba]	□	14	23	0	14	29	20	B	6
Upper, preceding in the mane	□	14	7	0	15	42	20	B	6

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Superior præced. in iuba]									
Right one of the neck [lucida colli]	□	12	2	30	17	40	0	B	3
Following in the neck [sequens in collo]	□	13	48	0	18	18	0	B	5
Left thigh [sinistrum]	□	4	46	0	36	41	20	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
crus]									
Left knee [sini strum genu]	□	10	11	0	34	18	0	B	4
Right thigh [dextrum crus]	□	15	26	0	40	59	20	B	4
Preceding of two of the breast [præceduarum pectoris]	□	18	52	30	28	48	0	B	4
Follo	□	20	16	30	29	23	20	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
wing of the m [sequens earum]									
Right knee [dextrum genu]	□	21	33	30	35	6	20	B	3
In the same knee, toward the south [in eodé genu ad Austrum]	□	20	48	0	34	23	18	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
Preceding of two in the wing [præcedens duarum in Ala]	□	26	56	0	B	6
Following in the wing, and southern [sequens in ala, & austr.]	□	28	29	0	B	6
In the neck [in	□	7	51	0	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
collo]									
Belo w the mou th, beyo nd the foot [infr a os supr a pede m]	□	26	14	0	33	20	0	B	4
Upp er of this [hui c supe rior]	□	16	38	0	23	15	0	B	4
Follo wing the first [pri ma m sequ ens]	□	16	38	0	23	15	0	B	4

[Margin: "Ex altero Catalogo Kepleri forte" — "From the other Catalogue of Kepler, perhaps."]

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
[continuation row]	□	26	38	0	23	15	0	B	4

ANDROMEDA

1. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Head of Andromeda [caption Andromedæ]	□	10	9	3	25	42	10	B	2
In the girdle, more south	□	26	11	0	25	58	30	B	2

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
hern [in cingulo Australior]									
Brig ht one, in the southern foot [lucida in pede Australi]	□	10	1	44	27	47	10	B	2

2. Classis:

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Low est of the shou	□	18	28	30	27	6	40	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Underblade, on the right [infima scapulæ dextræ]									
On the left of the right shoulder [inferior sinistri humeri]	□	16	47	0	23	3	39	B	4
Of three in the right arm [trium in	□	16	20	0	31	33	15	B	5

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
brach. dexter. austral.]									
The northern of the m [earum borealis]	□	17	7	30	33	20	40	B	4
The middle of the m [earum media]	□	17	0	0	32	14	38	B	5
The more southern, of the	□	11	50	0	40	56	39	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
upper hand [Australi or manus superior]									
Morie northern, in the same place [Borealior ibidem]	□	13	8	0	41	44	30	B	4
Obscure, in the same place	□	15	45	0	42	8	25	B	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
e [obs cura ibid em]									
High est, in the nort hern han d [sup rem a in bore ali man u]	□	14	9	0	43	49	42	B	4
Prec edin g, in the left arm [præ c. in sinis tro brac hio]	□	16	11	0	17	48	20	B	4
In	□	18	15	30	15	58	25	B	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
the left elbow [in sinistro cubito]									
Middle, in the girdle [media in cingulo]	□	19	27	50	30	34	0	B	4
Northern, in the girdle [borea in cingulo]	□	24	57	20	32	31	10	B	4
Extreme of	□	10	28	30	36	50	0	B	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
the right foot [extrema pedis superioris]									
Brighter, in the right foot [lucidior in pedextro]	□	8	14	0	35	22	0	B	4
Highest, in the left calf [suprema in sura sinis]	□	6	28	0	28	59	30	B	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
tra]									
Lower, in the same place [inferior ibidem]	□	4	45	0	27	53	0	B	5
Toward the right knee [ad genu dextrum]	□	2	18	0	26	20	25	B	5
At the end of the chain [in extremo anul	□	25	22	0	37	19	30	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
o cate næ]									
Brig hter, in the left shou lder-blad e [clar ior in sinis tra scap ula]	□	17	41	30	24	20	30	B	3

3. *Classis:*

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
In the Syr ma [gar men t-	□	5	22	0	34	40	30	B	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
trail] of the two northern ones [in syrmate duarum boreal.]									
Southern, in the same place [ibidem austrina]	□	6	52	0	32	40	25	B	5
For miles, preceding the three	□	4	22	0	44	0	30	B	3

Name of the fixed star

Sign	°	'	"	Lat.	°	'	"	B/A	Mag.
------	---	---	---	------	---	---	---	-----	------

e of the right hand d [info rmis præ c. tres dext ræ man us]

TRIANGULUS DELTTON (the Triangle)

1. Classis:

Name of the fixed star

Sign	°	'	"	Lat.	°	'	"	B/A	Mag.
------	---	---	---	------	---	---	---	-----	------

At the apex of the Triangle [in apic e Tria

□	2	41	0	16	49	50	B	4
---	---	----	---	----	----	----	---	---

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Angular In the base , toward the north [in base and Bore am]	□	8	11	30	20	33	20	B	4
Middle [media]	□	11	0	0	19	29	25	B	4
More southern , in the base [Australi or in base]	□	9	10	0	18	57	24	B	4

COMA BERENICES (Berenice's Hair)

2. *Classis:*

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
In the cusp of the first, and northern, of the Triangle [in cusp ide primi, & Borealis Trianguli]	♈	19	41	0	28	24	20	B	3
<i>Or otherwise, from Kepler [Velalite rex Kepler</i>	♈	29	39	0	28	30	20	B	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
<i>ero]</i>									
Above this, toward the south [superior huic ad austrum]	□	20	6	0	27	22	0	B	4
Lower, of the same [inferior eidem]	□	20	10	0	27	18	12	B	4
Following, of two contiguous [seq	□	20	43	0	27	5	25	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
uens duas conti guas]									
Prec edin g, of two conti guou s towa rd the sout h [præ cede ns duar um conti g. ad Aust r.]	□	19	49	0	25	49	13	B	4
The othe r, towa rd the risin	□	20	13	30	26	5	0	B	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
g [altera contigua ad ortum]									
All preceding, toward the south [omnes præced. ad Austrum]	□	19	24	0	23	28	25	B	4
Highest, of the following contiguous	□	22	34	0	23	50	0	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
ones [suprema 3. continentium sequenti- um]									
The other, and preceding [altera, & præcedens]	□	22	15	0	24	54	20	B	4
Lowest, and following [infima, & sequens]	□	24	16	0	23	58	50	B	4
<i>The</i>	□	23	16	0	23	58	50	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
<i>other</i>									
<i>Code</i>									
<i>x of</i>									
<i>Kepl</i>									
<i>er</i>									
<i>[Alte</i>									
<i>r</i>									
<i>Code</i>									
<i>x</i>									
<i>Kepl</i>									
<i>eri]</i>									
The last, in the extension of the hair [postrema in extensione comæ]	□	22	0	22	30	32	44	B	4[?]
That which precip	□	29	13	30	31	40	23	B	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
edes this [qu æ hanc præ cedit]									
Bet wee n this, and the first in the cusp [inte r hac, & prim am in cusp ide]	□	25	41	0	30	14	22	B	4
In the sout hern cusp of	□	29	39	0	28	30	20	B	5

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
the small Triangle [in Australi cuspidi parvuli Triangle]						

PARS TERTIA — Astra Australia (The Southern Constellations)

[Header on folio 274, right column: "PARS TERTIA / Astra Australia" — Part Three, the Southern Stars. From here latitudes are reckoned southern (A = Australis), as the column header now reads "Latit. A."]

CETE (Cetus, the Whale)

1. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
Brig ht one	♏	10	7	32	A	2

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
of the jaw [lucida mandibulæ]									
Brig ht one of the north ern belly [lucida ventris Bore a]	□	17	48	15	20	17	20	A	3
Nort hern tail [cauda Bore alis]	□	26	46	47	9	58	10	A	3
Sout hern tail [cau	□	28	19	47	20	43	40	A	2

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
da Australis]									

2. Classis:

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
That which is in the snout [quæ in rostro]	□	10	52	0	7	49	50	A	4
Middle of the mouth [media oris]	□	5	14	30	12	2	20	A	3
Precedin	□	3	23	0	14	31	49	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
g of the three toward the cheek [precedens trium adgenam]									
Below the eye [infra oculum]	□	3	15	0	5	51	50	A	4
Above the eye [supra oculum]	□	7	28	0	5	35	48	A	4
In the	□	29	50	30	4	18	51	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
occi put [in occi pite]									
In the breast, with the square, toward the north [in perspective]	□	25	13	0	25	16	30	A	4
per Boream]									
Lower of two, preceding toward the	□	25	54	30	28	39	29	A	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
south [duarum inferior præc. ad Austr.]									
Following in the breast, southern [sequetis in pectore Austr.]	□	29	33	29	28	16	0	A	4
Preceding, & northern [præcedens, &	□	29	9	31	25	57	29	A	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Borealis]									
In the middle of the belly [in ventremedia]	□	13	47	0	25	0	30	A	4
Lowest in the same place [infirmibidem]	□	15	12	0	31	3	28	A	4
On the eastern back [in dors]	□	11	4	30	15	46	0	A	4[?]

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
o Orientalis]									
On the western back [in dors o Occidentalis]	□	7	33	30	16	54	29	A	3
Formles s, following the jaw [Inform. sequens Mandib.]	□	14	7	0	14	50	0	A	4
Prec edin g the north of	□	16	27	45	21	53	0	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
the belly [præcedens Boream ventris]									
In a straight line with the 3rd & 5th of the head [in recta linea cum 3. & 5. Capitis]	□	4	10	30	9	12	20	A	4

3. *Classis:*

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
Tail, with the square, following the northern latitude [caudæ □ seq. lat. Boreal.]	□	4	8	30	12	8	0	A	5
Southern of the m [Australis earum]	□	3	8	25	14	8	0	A	5
Preceding the north	□	1	53	0	13	29	30	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
henn side [ant eced ens later i Bore al.]	♁	1	22	0	14	39	30	A	5
Of the same, southern [eiusdem Australis]									

ORION

1. Classis:

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Top of the head	♁	19	35	30	13	25	40	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
[sup rem a capit is]									
Right shoulder, following [humerus dexter sequens]	□	24	36	35	16	6	15	A	2
Left shoulder, preceding [hum. sinister praecedens]	□	16	46	47	16	52	30	A	2
Left foot,	□	12	36	57	31	10	10	A	1

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
the bright Rigel [pes sinis ter Luci dus Rigel]									
**									

ORION (continued)

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Top of the Belt [Balt hei supr ema]	☐	18	9	27	23	36	40	A	2
Middle [me dia]	☐	19	13	42	24	34	10	A	2

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Lowest [infima]	□	20	23	2	25	21	10	A	2

2. Classis:

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Western, of the head [occident alior capit is]	□	19	35	30	13	53	40	A	5
Third of the head, eastern [tertia capit	□	19	57	30	14	4	10	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
is Orientalis]									
Following of the left shoulder [sequens sinisteri humeri]	□	18	10	0	17	21	40	A	5
That which is in the right arm [quæ in brachio dextro]	□	26	28	30	14	50	40	A	4
In the right	□	29	55	0	11	30	10	A	6

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
fore arm [in dextra Vlna]									
In the right hand, more southern [in manu dextra Australior]	□	28	48	0	9	15	15	A	4
Preceding, in the right [præcedens in dext	□	27	45	30	8	44	18	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
ra]									
Next to the top, in the right [proxima supremæ in dext r.]	□	28	46	29	7	20	40	A	6
Last, in the hand [ultima in manu]	□	29	33	0	7	19	16	A	5
Preceding of two in the Club	□	24	33	30	3	12	46	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
[præceduarum in Coloborob]									
Following of the same [sequens earundem]	□	26	46	0	3	21	15	A	5
Preceding in the back [præcedens in dorso]	□	16	58	39	20	8	20	A	5
More northern	□	9	16	20	8	16	29	A	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
, between the 9th of the Shield [Borealis · inter 9. Clypeus]									
Second of the same [ear under secunda]	□	10	11	19	9	6	30	A	4
Third [tertia]	□	9	33	20	11	5	28	A	6
Fourth	□	9	23	48	12	25	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
manubriosis]									
Top there, in the sword [suprema 3. in ense]	□	18	48	0	28	10	10	A	3
Middle of the sword [mediosis]	□	18	44	30	28	45	39	A	3
Lowest of the sword	□	18	47	30	29	17	39	A	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
[infirmansis]									
Preceding, below the sword [precedens infirmansis]	□	17	43	0	30	37	0	A	4
Following, below the sword [sequens infirmansis]	□	19	46	0	30	57	28	A	5
In the	□	13	35	30	29	32	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
left heel [in sinistro calcaneo]									
In the sole of the left foot [in surapedis sinistra]	□	15	22	0	30	59	10	A	5
In the right knee [in genu dextro]	□	22	9	30	33	7	0	A	3
Preceding the last	□	19	59	0	26	0	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
of the Belt [præc. vltima m Balt hei]									
Prec edin g this one, toward the back [præced. huic ad dors um]	□	15	54	0	19	39	30	A	6
Follo wing above the hilt of the swor	□	16	5	0	24	6	30	A	6

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
d [sequens supermanubr. ensis]									
Preceding of the m [earum præcedens]	□	15	19	0	23	32	38	A	4
On the side, brighter above this [in later e sinistro super]	□	17	30	0	22	12	31	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
hác]									
Prec edin g, belo w the shiel d, & arm [præ c. sub scut o, & brac hio]	□	13	21	0	20	7	29	A	4
In the left side, prec edin g [in sinis tro later e præ ced.]	□	21	8	0	21	57	30	A	5
Follo wing in	□	23	48	30	21	38	29	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
the same place [ibidem sequens]									
Following this, formless [posthanc informis]	□	25	33	0	22	56	30	A	5
Higher, in the left hand [superior 1. in sinistra manu]	□	14	59	30	11	44	28	A	6
Mid	□	12	56	30	13	7	30	A	6

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
dle of the m [me dia earu m]									
Low est of the m [infi ma earu m]	□	12	23	0	14	23	29	A	6
Of ten form less ones abov e, prec edin g Orio n [dec em infor miu	□	0	7	0	23	30	30	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
m supr a Orio nem præ cede ns]									
Follo wing the m [seq uens earu m]	□	4	6	0	29	48	29	A	4
That whic h is abov e this [qu æ supr a hanc]	□	3	45	0	28	3	30	A	5
Prec edin g, third in a	□	2	31	0	18	46	28	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
straight line [præc. 3. in linea recta]									
Middle [media]	☐	4	21	0	15	56	0	A	4
Northern [borealis]	☐	6	13	0	13	14	30	A	4
Below the straight line, toward the south [infra recta]	☐	4	21	0	18	23	29	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
lineá ad Austrú]									
Above this, and toward the rising [supra hanc ad ortum]	□	7	59	0	14	58	30	A	5
Preceding of two above the Dog [præceduar supra Cane]	□	8	37	30	20	12	28	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
m] Following the m [sequens earum]	□	23	33	30	22	46	29	A	4
Below the right shoulder, toward the setting [infra dextrum humer. ad occasum]	□	20	21	0	19	17	20	A	5
Obscure, on the	□	19	4	30	19	36	20	A	6

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
back , following [Obscure rú in dors o sequés]	□	18	10	30	19	52	20	A	4
Preceding [præcedens]									

ERIDANUS NILUS FLUVIUS (the River Eridanus / Nile)

2. Classis:

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
Toward the left foot of Orio	□	11	6	0	31	34	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
n, at the beginning of the river [ad sinistrum pedé Orionis in principio flum.]									
Above the foot of Orion, in the river [supra pedem Orion. in	♁	11	8	0	27	53	0	A	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
flu.]									
Following of two others [duarum aliarum sequens]	□	9	5	30	29	51	10	A	3
Preceding [præcedens]	□	6	54	30	27	51	0	A	5
Following of the two upper ones [sequens duarum superior]	□	5	9	30	25	33	30	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
um] Prec edin g of the m [ear um præ cede ns]	□	2	39	0	25	11	0	A	4

ERIDANUS (continued)

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
After the interval, following of four [post interuallum sequences]	□	19	42	0	33	13	0	A	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
quatuor]									
That which precedes this [quæ hanc præit]	□	16	6	30	31	8	40	A	4
Toward the north, the third preceding [ad Boream tertia præc.]	□	16	31	0	28	46	10	A	3
Preceding all four	□	14	9	0	27	46	50	A	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
[antedecens cunctas 4.]									
First	□	4	34	0	24	53	50	A	5
, contiguous to Cetus									
[primam contiguam Cete]									
Betwee n this, and the third	□	7	0	0	23	58	20	A	4
[inter hanc, & tertiam]									
Third	□	9	40	0	23	58	50	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
d, which follows [tertia quæ sequitur]									
Preceding, lower [præcedens inferior]	□	25	13	0	30	24	49	A	5
Above this [superhanc]	□	25	17	0	27	31	50	A	4
Following [sequens]	□	26	22	0	28	9	20	A	4
Upper	□	29	10	0	25	2	43	A	5

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
er, eastern [superior Orientalis]									
Preceding of two, between the river & Taurus [præced. duar. interflum. & Taurum]	□	17	49	30	18	26	50	A	4
Southern, following	□	21	30	0	22	44	50	A	4

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
[sequences Australis]						

3. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
Last of the [triumvltima]	□	28	44	0	A	4
Middle, the 8th of Ptolemy [media Ptolemaeo 8.]	□	28	0	0	A	4
Out	□	2	54	0	A	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
of four, which precedes [equator, quæpræit]									
In the bend of the river, toward the breast of Cetus [in conversione flu. ad Cetepect]	□	27	34	0	32	10	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
us]									
Following [sequens]	□	28	14	0	34	50	0	A	4
First of the following [sequentium primam]	□	1	14	0	38	30	0	A	4
Middle [media]	□	6	14	0	38	0	0	A	4
Last [ultima]	□	9	54	0	38	50	0	A	4
In the square, preceding the	□	13	44	0	41	10	0	A	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
north hern side [in □ præ c. later is Bore al.]									
In the sam e plac e, sout hern [in eode m Aust ralis]	□	13	54	0	41	20	0	A	4
Follo wing side, prec edin g [late ris	□	14	34	0	43	0	0	A	4

Name of the fixed star	Sign	Lat.			B/A	Mag.			
		°	'	"					
sequentis præced.]									
Last of these four [ultima harum 4.]	□	16	54	0	43	10	0	A	4
Toward the rising, second, conjoined to these, northern [ad ortum 2. coniunctæ	□	16	34	0	45	10	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
aru m Bore al.]									
Mor e towa rd the sout h [ma gis ad Aust rum]	□	27	24	0	51	40	0	A	4
In the refle ction of the two post erior ones [in refle xion e duar um	□	20	34	0	53	40	0	A	4[?]

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
posterior.]									
Preceding [præcedens]	□	18	14	0	53	0	0	A	4
In the last interval, out of three, the last [in vltimo intervallo ex 3. postrema]	□	10	14	0	52	50	0	A	4
Middle [media]	□	7	14	0	53	20	0	A	4

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
First of the three [prima Trium]	□	4	14	0	A	4
At the end of the river [in extremum fluminis]	□	22	34	0	A	1

[Margin note:] Scaliger writes that Tycho located this one in Pisces, which Bayer expresses [Scaliger scripsit ad Tychonem hanc locati á Naucleris in Piscium quod exprimit Bayerus].

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
[this last star, per Baye	□	9	45	—	A	—

Name of the fixed star

Sign	°	'	"	Lat.	°	'	"	B/A	Mag.
------	---	---	---	------	---	---	---	-----	------

r, in
Pisc
es]

LEPUS (the Hare)

1. Classis:

Name of the fixed star

Sign	°	'	"	Lat.	°	'	"	B/A	Mag.
------	---	---	---	------	---	---	---	-----	------

In the left shoulder, or thigh [in arm of sinist. seu femore]

2. Classis:

Name of the fixed star	Sign	Lat.			B/A	Mag.
		°	'	"		
Upper of the preceding ear [superior praecedentis auri s]	□	11	37	30	A	5
Lower of the same ear [inferior eiusdem auri s]	□	11	43	30	A	5
Upper of the following ear [superior sequ	□	13	50	0	A	6

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
entis auri s]									
Lower of the following ear [inferior sequentis auri s]	□	11	37	0	36	12	24	A	5
That which is in the head [quæ in Capite]	□	11	12	0	39	2	21	A	5
Extreme of the anterior feet [extr	□	7	48	30	44	58	25	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
ema ante rior ú pedu m]									
In the back, in the middle of the body [in dors o med ioue corp ore]	□	17	12	30	41	4	0	A	3
Sout hern of two in the post erior feet [Aus	□	20	44	30	45	48	0	A	3

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
tral. duarum in pedibus posterioribus]									
Northern of the same [Borearum]	□	22	59	0	44	16	20	A	3
Preceding in the back [praecedens in dorsis]	□	21	49	30	38	14	22	A	4
Following	□	24	50	30	37	39	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
in the back [sequens in dors]									
Last in the tail [ultima in cauda]	♏	27	45	0	38	24	20	A	4

CANIS MAIOR (the Great Dog)

1. Classis:

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
The most splendid of the mou	♏	10	4	47	39	32	5	A	1

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
th, Siri s [spl ndid issi ma oris Siri s]									

2. *Classis:*

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
In the forehead, toward the right ear [in front] ad aurem dext	□	20	29	50	34	52	0	A	4

Name of the fixed star	Sign	°	'	"	Lat. °	'	"	B/A	Mag.
r.]									
In the middle of the forehead [in media fronte]	□	13	55	0	36	45	0	A	5
Below the left ear [sub aure sinistra]	□	15	34	21	38	4	20	A	3
In the neck [in collo]	□	13	51	20	39	32	0	A	4
In the right shou	□	8	0	50	42	15	0	A	5

Name of the fixed star	Sign	Long.			Lat.			B/A	Mag.
		°	'	"	°	'	"		
Ider of the anterior feet [in arm of dextro pedum manuum anteriorum]									
**									

Liber IV — De Fixis Stellis, Caput XXI (continued)

Universal Catalogue, Pars Tertia — Southern Constellations (continued)

These pages continue the southern catalogue of the Universal Catalogue (to the epoch 1700), arranged by constellation and within each constellation by certainty class (1. Classis, 2. Classis, 3. Classis, 4. Classis) and "Informes" (unformed stars). The columns throughout are: star description (Latin name) | Longitude (zodiacal sign, degrees ' ") | Latitude (degrees ' ", with A = Australis, southern; B = Borealis, northern) | Magnitude. Zodiacal signs are given by their symbols in the source (♋ Cancer, ♌ Leo, ♍ Virgo, ♎ Libra, ♏ Scorpio, ♐ Sagittarius, ♑ Capricorn, ♒ Aquarius, ♓ Pisces, ♈ Aries, ♉ Taurus, ♊ Gemini).

CANIS MAJOR (continued)

Star (Fixae)	Longitude (Sig. ° ' ")	Latitude (° ' A./B.)	Mag.
In extremo pedis prioris (at the tip of the forefoot)	□ 3 10 50	41 20 20 A	2
In dorso (on the back)	□ 16 58 50	46 11 20 A	5
Media in pectore (middle, on the breast)	□ 14 4 50	46 41 20 A	5
In ventre (on the belly)	□ 19 23 30	48 21 50 A	3
Inter posteriora femora (between the hind thighs)	□ 16 49 50	51 26 20 A	3
Inferior dext. pedis prioris (lower, of the right forefoot)	□ 2 33 20	51 48 20 A	3
Quae in cauda (the one in the tail)	□ 25 39 50	51 26 20 A	3

3. Classis (third class):

Star (Fixae)	Longitude	Latitude	Mag.
Altera in pectore (another on	□ 12 58 19	42 22 0 A	5

Star (Fixae)	Longitude	Latitude	Mag.
the breast)			
In genu Australis (in the southern knee)	□ 8 28 20	42 12 A	5
In sinistro genu duarum praeced. (in the left knee, the preceding of two)	□ 6 28 18	46 12 A	5
Earum sequens (the following of them)	□ 8 38 20	45 32 A	5
In poplite cruris dextri (in the ham of the right leg)	□ 15 28 19	54 32 A	4
Informes circa Canem (unformed stars about the Dog)			
A Septentrione ad verticem Canis (from the north, toward the crown of the Dog)	□ 11 58 20	25 2 A	4
Sub pedibus post 4. in recta Austr. (below the feet, the 4th in a straight line)	□ 2 28 18	61 12 A	4

Star (Fixae)	Longitude	Latitude	Mag.
southward)			
Quae magis in boream (the one more to the north)	□ 3 48 20	58 32 A	4
Adhuc Borealior (still more northerly)	□ 5 28 19	56 42 A	4
Residua de 4. borealissima (the remaining of the 4, northernmost)	□ 6 38 20	55 42 A	4
Triu ad occasum in linea praeced. (of the three, the one to the west on the preceding line)	□ 19 28 18	55 12 A	4
Media harum (the middle of these)	□ 22 58 20	57 22 A	4
Trium ultima (the last of three)	□ 24 38 19	59 32 A	6
Sub his sequens (the following beneath these)	□ 21 28 18	59 22 A	2
Harum antecedens (the preceding of these)	□ 18 28 20	57 22 A	2
Reliqua	□ 14 38 19	59 32 A	4

Star (Fixae)	Longitude	Latitude	Mag.
Australior (the remaining one, more southern)			

CANIS MINOR

1. Classis (first class):

Star (Fixae)	Longitude	Latitude	Mag.
Procyon in femore [Procyon, in the thigh]	□ 21 40 27	15 57 10 A	1

2. Classis (second class):

Star (Fixae)	Longitude	Latitude	Mag.
In collo, seu collari (on the neck, or the collar)	□ 18 1 50	15 33 40 A	3
Supra lucidam colli (above the bright star of the neck)	□ 18 50 50	12 51 10 A	6
Informis supra hanc (the unformed star above this)	□ 18 44 50	9 46 10 A	6
Seques ad caudam Cancri (the following one, toward the tail of Cancer)	□ 22 19 50	10 19 40 A	5

ARGO NAVIS

2. *Classis (second class):*

Star (Fixae)	Longitude	Latitude	Mag.
In suprema puppi (on the highest part of the stern)	□ 7 18 0	43 18 30 A	3
Suprema scuti (the highest of the shield)	□ 2 0 0	44 58 30 A	3
Praecedens scuti (the preceding of the shield)	□ 29 24 30	47 28 3 A	3
In velo (on the sail)	□ 5 31 0	32 7 4 A	4
Informis ad Austrum (the unformed star to the south)	□ 5 51 30	38 31 0 A	4
In aortrium inferior [In aortium inferior] (the lower, in the [?])	□ 13 50 50	34 56 0 A	6
Supra hanc (above this)	□ 14 15 49	30 18 0 A	4
Hic ipsa altior (this same one higher up)	□ 11 25 50	24 29 30 A	4
Duae in antenna praeced. (two on the preceding yard-arm)	□ 0 59 28	21 39 30 A	4

Star (Fixae)	Longitude	Latitude	Mag.
Earum sequens (the following of them)	□ 5 44 57	22 49 30 A	3
Informis inter velum, & lacteam (the unformed star between the sail and the Milky Way)	□ 25 8 27	30 30 0 A	3

3. Classis (third class):

Star (Fixae)	Longitude	Latitude	Mag.
Extrema duar. praeced. (the outermost of two preceding)	□ 3 24 27	42 10 A	5
Quae magis ad austrum (the one more to the south)	□ 1 44 28	45 40 A	4
Has duas praecedens (preceding these two)	□ 28 24 28	45 10 A	4
Sub scuto trium praeced. (beneath the shield, the preceding of three)	□ 28 24 30	49 10 A	4
Sequens (the following)	□ 2 24 27	49 30 A	4
Media trium (the middle of	□ 1 34 30	49 0 A	4

Star (Fixae)	Longitude	Latitude	Mag.
three)			
In extremo temone (at the end of the tiller)	□ 7 4 27	49 30 A	4
In catina puppis duarum Boreal. (in the basin of the stern, of two, the northern)	□ 27 4 28	52 40 A	4
Earum Australis (the southern of them)	□ 27 4 29	58 20 A	3
In folio puppis Boreal. (on the leaf of the stern, the northern)	□ 3 14 27	55 10 A	5
Ibidem trium praecedens (in the same place, the preceding of three)	□ 5 14 28	58 30 A	5
Media (the middle)	□ 6 14 29	58 0 A	4
Sequens (the following)	□ 9 24 30	57 32 A	4
Clara sequens transtri (the bright one following the rowing-bench)	□ 8 24 28	58 30 A	5
Sub hac obsc.	□ 11 4 27	59 50 A	5

Star (Fixae)	Longitude	Latitude	Mag.
praec. (beneath this, the faint preceding one)			
Sequens (the following)	□ 15 54 29	59 10 A	5
Supra Claram praeced. (above the bright one, the preceding)	□ 13 54 30	56 40 A	5
Sequens (the following)	□ 17 4 28	57 30 A	5

HYDRA, seu HYDRUS (Hydra, or the Hydrus)

1. Classis (first class):

Star (Fixae)	Longitude	Latitude	Mag.
Cor Hydrae (the Heart of the Hydra)	□ 23 6 37	22 23 50 A	1

2. Classis (second class):

Star (Fixae)	Longitude	Latitude	Mag.
Praecedens in Capite (the preceding, on the Head)	□ 7 11 30	14 36 50 A	5
Supra primam ad Aquilonem (above the first, toward the north)	□ 8 8 0	14 16 20 A	4
Borealior in Occipite (the more	□ 8 10 0	11 8 0 A	4

Star (Fixae)	Longitude	Latitude	Mag.
northern, on the back of the head)			
Praecedens tertia ad Austrum (the preceding, third, to the south)	□ 8 44 30	11 30 0 A	4
Orientalissima capitis (the easternmost of the head)	□ 10 22 30	11 1 0 A	4
Praecedens in collo (the preceding, on the neck)	□ 13 13 30	15 20 A	4
Sequens in educatione colli (the following, at the rise of the neck)	□ 16 3 30	13 5 0 A	4
Media colli (the middle of the neck)	□ 21 33 30	15 0 0 A	5
Borea triu in flexura colli (the northern of three, at the bend of the neck)	□ 23 26 0	14 17 20 A	4
Australis in nexu (the southern, at the knot)	□ 21 15 30	16 46 0 A	5
Quae eo	□ 28 32 30	26 33 30 A	4

Star (Fixae)	Longitude	Latitude	Mag.
sequitur proximè (the one that follows it most nearly)			
Huic subsequens (following next to this)	□ 1 30 0	26 12 0 A	5
Praecedens contiguarum (the preceding of the contiguous ones)	□ 4 10 0	23 13 0 A	5
Sequens earum (the following of them)	□ 5 15 0	21 51 0 A	4
Quinta à corde (the fifth from the Heart)	□ 10 53 30	24 38 0 A	5
In recta cum hac, & sequenti (in line with this, and the following)	□ 14 5 30	23 31 0 A	4
Praecedès crateri proximè (preceding, nearest the Crater)	□ 16 13 0	21 48 30 A	4
Informis proxima capiti (the unformed)	□ 6 7 30	12 27 0 A	4

Star (Fixae)	Longitude	Latitude	Mag.
star nearest the head)			
Borea sub basi crateris (the northern, beneath the base of the Crater)	□ 24 23 30	25 36 A	4
Australis sub eadem basi (the southern, beneath the same base)	□ 25 11 0	30 17 A	5
Sub cauda corvi (beneath the tail of the Crow)	□ 22 46 0	13 43 A	5
Parva huic praecedens (the small star preceding this)	□ 20 46 0	14 37 A	6
Informis ante caput Hyd. (the unformed star before the head of the Hydra)	□ 0 6 0	10 19 A	5

3. Classis (third class):

Star (Fixae)	Longitude	Latitude	Mag.
Borea duarum in oculo (the northern of two, in the eye)	□ 5 44 0	13 40 A	4
Australis earum in hiatu	□ 8 22 0	14 15 A	4

Star (Fixae)	Longitude	Latitude	Mag.
(the southern of them, in the gaping mouth)			
Ab austro duaru contiguarum Borea (from the south, of two contiguous, the northern)	□ 22 2 0	19 45 A	6
In triqueto praecedens (in the triangle, the preceding)	□ 5 2 0	31 20 A	4
Media earum (the middle of them)	□ 7 22 0	33 10 A	4
Sequens earum (the following of them)	□ 9 2 0	31 20 A	4
In extrema cauda (at the end of the tail)	□ 7 22 0	17 40 A	5

PDF p. 311 (folio 277) — Hydra (concl.), Crater, Corvus, Centaurus,
Lupus, Ara, Corona Australis, Piscis Notius

HYDRA (continued)

Star (Fixae)	Longitude	Latitude	Mag.
In capite ad Austrum (on the head, toward the south)	□ 5 22 0	23 15 0 A	3

Star (Fixae)	Longitude	Latitude	Mag.
Aliter (alternatively)		13 15	3
Sequens collum (the following, on the neck)	□ 3 52	16 0	3
Aliter (alternatively)		26 0	3

CRATER

2. Classis (second class):

Star (Fixae)	Longitude	Latitude	Mag.
In basi crateris (at the base of the Cup)	□ 19 33	22 41 A	4
Sequens duarum in medio (the following of two, in the middle)	□ 25 5	19 39 A	4
Earum praecedens (the preceding of them)	□ 22 32 30	17 25 A	4
Praecedens duarum supra Craterem (the preceding of two, above the Cup)	□ 21 49	13 10 A	4
Earum sequens (the following of them)	□ 24 24	11 17 A	4

Star (Fixae)	Longitude	Latitude	Mag.
Praecedens duarum inferiorum (the preceding of two lower ones)	□ 29 52	18 10 A	4
Sequens earum (the following of them)	□ 1 55	16 2 A	4
In medio cratere (in the middle of the Cup)	□ 26 17	14 0 9 A	5

CORVUS (the Crow)

2. Classis (second class):

Star (Fixae)	Longitude	Latitude	Mag.
Quae ad Oculum (the one at the Eye)	□ 7 30	19 39 A	4
Praecedens duaru superiorum in □ (the preceding of two upper ones in the square)	□ 6 35	14 25 A	3
Sequens earum (the following of them)	□ 9 17	12 7 A	3
Sequens inferiorum in □ (the	□ 13 11	17 59 A	3

Star (Fixae)	Longitude	Latitude	Mag.
following of the lower ones in the square)			
In rostro (on the beak)	□ 8 0	21 46 A	4
In collo (on the neck)	□ 9 36	18 14 A	5
In sinistra ala ut supra lucidā (on the left wing, as above the bright one)	□ 9 43 30	11 28 A	5

CENTAURUS CHIRON

2. Classis (second class):

Star (Fixae)	Longitude	Latitude	Mag.
In capite Australissima (on the head, the southernmost)	□ 2 49	21 49 A	5
Quae magis ad Boream (the one more to the north)	□ 2 21	19 8 A	5
Intermediaru m duarum praecedens (the preceding of two intermediate ones)	□ 1 34	20 51 A	5
Sequens de quatuor (the following, of	□ 2 25	20 12 A	5

Star (Fixae)	Longitude	Latitude	Mag.
four)			

3. *Classis (third class):*

Star (Fixae)	Longitude	Latitude	Mag.
In humero sinistro praecedens (on the left shoulder, the preceding)	□ 28 32	25 40 A	3
In humero dextro (on the right shoulder)	□ 8 2	22 40 A	3
In armo sinistro (on the left foreleg)	□ 1 32	27 40 A	4
In scuto praeced. boreal. (on the shield, the preceding, the northern)	□ 10 32	22 30 A	4
Earum australis (the southern of them)	□ 11 32	23 50 A	4
In summitate scuti (at the top of the shield)	□ 14 22	18 30 A	4
In scuto ad austrum (on the shield, to the south)	□ 14 52	21 10 A	4
In latere dextr. trium praeced.	□ 5 42	28 30 A	4

Star (Fixae)	Longitude	Latitude	Mag.
(on the right side, the preceding of three)			
Media (the middle)	□ 6 22	29 30 A	4
Sequens (the following)	□ 7 32	28 10 A	4
In brachio dextro (on the right arm)	□ 8 52	26 40 A	4
In dextro cubito (at the right elbow)	□ 15 22	25 30 A	3
In extrem. manu dext. (at the tip of the right hand)	□ 19 52	24 20 A	4
In educatione corporis humani lucida (the bright star at the rise of the human body)	□ 10 22	33 40 A	3
Duarum borealiū sequens (the following of two northern ones)	□ 10 2	31 10 A	5
Praecedens (the preceding)	□ 9 12	33 10 A	5
In educatione dorsi (at the rise of the	□ 4 32	35 0 A	5

Star (Fixae)	Longitude	Latitude	Mag.
back)			
Antecedens huic in dorso equi (preceding this, on the horse's back)	□ 1 22	37 55 A	5
In lumbis trium sequens (on the loins, the following of three)	□ 28 12	40 10 A	3
Media (the middle)	□ 22 12	43 10 A	4
Antecedens trium (the preceding of three)	□ 25 2	44 10 A	4
Aliter (alternatively)		41 10	5
In dextro femore praeced. (on the right thigh, the preceding)	□ 25 2	46 20 A	3
Ibidem sequens (in the same place, the following)	□ 25 52	46 50 A	4
In pectore sub ala equi (on the breast, beneath the horse's wing)	□ 10 42	42 50 A	4
Sub alio duarum	□ 8 42	43 10 A	2

Star (Fixae)	Longitude	Latitude	Mag.
praeced. (beneath the other, the preceding of two)			
Earum sequens (the following of them)	□ 10 2	44 0 A	3
In poplite pedis dextri (in the ham of the right foot)	□ 2 22	51 10 A	4
In talo eiusdem (at the heel of the same)	□ 7 42	51 50 A	2
In cauo pedis sinistri (in the hollow of the left foot)	□ 28 42	55 15 A	4
Sub musculo eiusdem (beneath the muscle of the same)	□ 3 32	55 30 A	2
In summo pede dext. priori (at the top of the right forefoot)	□ 0 42	41 20 A	1
In genu sinistro (in the left knee)	□ 16 32	45 30 A	2
Sub dextro pede posteriori	□ 7 2	49 0 A	4

Star (Fixae)	Longitude	Latitude	Mag.
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(beneath the
right hind foot)

LUPUS, seu BESTIA CENTAURI (the Wolf, or the Beast of the Centaur)

3. Classis (third class):

Star (Fixae)	Longitude	Latitude	Mag.
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In summo pedis posterioris (at the top of the hind foot)	□ 20 22	25 0 A	3
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In poplite eiusdem pedis (in the ham of the same foot)	□ 18 12	29 20 A	3
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In armo praecedens (on the foreleg, the preceding)	□ 22 22	21 30 A	4
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In armo sequens (on the foreleg, the following)	□ 26 32	21 20 A	4
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In medio corpore (in the middle of the body)	□ 25 22	25 30 A	4
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In aluo sub Ilibus (on the belly, beneath the flanks)	□ 22 32	27 20 A	5
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In femore (on the thigh)	□ 23 12	29 20 A	5
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In eductione femoris	□ 27 2	28 50 A	5
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Star (Fixae)	Longitude	Latitude	Mag.
Borealis (at the rise of the thigh, the northern)			
Earum	□ 16 2	30 30 A	5
Australis (the southern of them)			
In summo lumbo (at the top of the loin)	□ 18 2	33 30 A	5
In extrema cauda 3. austr. (at the end of the tail, the 3rd southerly)	□ 14 22	31 40 A	4
Media (the middle)	□ 17 12	30 50 A	4
Earum Borealis (the northern of them)	□ 15 22	29 40 A	4
In iugulo Australis (at the throat, the southern)	□ 1 12	17 20 A	4
Borea ibidem (the northern in the same place)	□ 1 42	15 40 A	4
In rictu praecedens (in the open jaw, the preceding)	□ 28 2	13 40 A	4
Sequens (the following)	□ 29 2	12 10 A	4

Star (Fixae)	Longitude	Latitude	Mag.
In priori pede Australior (on the forefoot, the more southern)	□ 19 32	12 10 A	4
Earum Borealior (the more northern of them)	□ 18 52	10 20 A	4

THURIBULUM, seu ARA (the Censer, or the Altar)

3. Classis (third class):

Star (Fixae)	Longitude	Latitude	Mag.
In basi duarum Borealis (at the base, the northern of two)	□ 20 12	23 0 A	5
Australis (the southern)	□ 25 42	26 0 A	4
In media arula (in the middle of the little altar)	□ 18 52	26 45 A	4
In foculo 3. borealis (in the brazier, the 3rd northern)	□ 13 2	30 40 A	5
Aliter (alternatively)		13 60 [recte: 13 0?] A	5
Reliquarum Australis (the southern of the remaining)	□ 17 42	34 30 A	4
Borealis (the	□ 17 32	33 30 A	4

Star (Fixae)	Longitude	Latitude	Mag.
northern)			
In summitate flammae (at the top of the flame)	□ 13 22	34 30 A	4
Aliter (alternatively)		31 30 A	4

CORONA AUSTRALIS (the Southern Crown)

3. Classis (third class):

Star (Fixae)	Longitude	Latitude	Mag.
Ad ambitū austr. foris praecedens (at the southern outer rim, the preceding)	□ 1 42	21 50 A	5
Aliter (alternatively)		24 50	4
Sequens hanc in Corona (following this, in the Crown)	□ 4 12	21 20 A	5
Huic succedens (succeeding this)	□ 5 42	23 20 A	5
Huic subsequens (following next to this)	□ 7 22	20 20 A	4
Post hanc ante genu Sagittarii (after this, before the knee of	□ 8 42	18 50 A	5

Star (Fixae)	Longitude	Latitude	Mag.
Sagittarius)			
Quae inde maximè borea in genu luc. (the one thence most northerly, at the bright knee)	□ 9 32	17 30 A	4
Magis Borea (more northerly)	□ 8 52	16 20 A	4
Adhuc magis Borea (still more northerly)	□ 9 2	15 30 A	4
In ambitu boreo duarum sequens (on the northern rim, the following of two)	□ 7 42	15 40 A	6
Earum praecedens (the preceding of them)	□ 7 12	15 0 A	6
Ex interuallo has praecedens (at an interval preceding these)	□ 4 22	15 0 A	5
Quae hanc antecedit (the one that	□ 2 12	16 10 A	5

Star (Fixae)	Longitude	Latitude	Mag.
precedes this)			
Reliqua ad Austrum (the remaining one, to the south)	□ 1 42	18 50 A	5

PISCIS NOTIUS (the Southern Fish)

3. Classis (third class):

Star (Fixae)	Longitude	Latitude	Mag.
In ambitu capitis praecedens (on the rim of the head, the preceding)	□ 23 12	10 35 A	4
Media (the middle)	□ 26 42	22 30 A	4
Sequens (the following)	□ 27 52	22 45 A	4
Ad branchiam (at the gill)	□ 26 52	16 30 A	4
In spina australi, & dorso (on the southern spine and the back)	□ 17 42	19 50 A	5
In aluo duarum sequens (on the belly, the following of two)	□ 23 42	15 30 A	5

PDF p. 312 (folio 278) — Piscis Notius (concl.), Grus, Phoenix, Indus, Pavo, Apus/Avis Indica, Apis/Musca, Chamaeleon, Triangulum Australe

PISCIS NOTIUS (continued)

Star (Fixae)	Longitude	Latitude	Mag.
Ibidem praecedens (in the same place, the preceding)	□ 21 22	15 0 A	4
In spina boreali sequens (on the northern spine, the following)	□ 17 42	15 15 A	4
Ibi media (there, the middle)	□ 14 22	18 45 A	4
Ibidem praecedens (in the same place, the preceding)	□ 13 22	18 35 A	4
In extrema cauda (at the end of the tail)	□ 14 42	22 30 A	4
Praecedentium Piscem praecedens (the preceding of those preceding the Fish)	□ 0 32	22 40 A	5
Media earum (the middle of them)	□ 3 42	22 30 A	4
Sequens	□ 6 32	21 30 A	3

Star (Fixae)	Longitude	Latitude	Mag.
earum (the following of them)			
Huic antecedens (preceding this)	□ 4 32	21 10 A	5
Reliquarum duarum australior (the more southern of the remaining two)	□ 6 22	17 20 A	4
Earum borealior (the more northern of them)	□ 6 22	15 10 A	3

GRUS (the Crane)

4. Classis (fourth class):

Star (Fixae)	Longitude	Latitude	Mag.
Lucida Capitis (the bright star of the Head)	□ 13 16	22 50 A	2
In media collo (in the middle of the neck)	□ 13 17	24 56 A	4
In educatione colli orientalior (at the rise of the neck, the more eastern)	□ 14 47	28 57 A	6
Occidentalior	□ 15 58	28 40 A	6

Star (Fixae)	Longitude	Latitude	Mag.
(the more western)			
In dorso orientalior (on the back, the more eastern)	□ 16 23	31 52 A	6
Ibi occidentalior (there, the more western)	□ 17 38	31 35 A	6
In dextra ala Borealior (on the right wing, the more northern)	□ 24 37	34 25 A	5
Ibi Australior (there, the more southern)	□ 24 8	36 15 A	4
In laeua ala (on the left wing)	□ 11 59	32 57 A	2
In educatione caudae (at the rise of the tail)	□ 18 17	34 36 A	2
In cauda Borealior (on the tail, the more northern)	□ 16 49	39 20 A	4
In cauda Orientalior (on the tail, the more eastern)	□ 14 45	41 36 A	5
In cauda Occidentalior	□ 19 9	41 27 A	4

Star (Fixae)	Longitude	Latitude	Mag.
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(on the tail, the more western)

PHOENIX

4. Classis (fourth class):

Star (Fixae)	Longitude	Latitude	Mag.
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Lucida in Collo (the bright star on the Neck)	□ 10 35	40 10 A	2
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Patula adiacens (the open star adjacent)	□ 10 13	41 30 A	5
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In ancone alae dextrae (at the elbow of the right wing)	□ 4 18	41 40 A	4
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In ala dextra 3. australior (on the right wing, the 3rd more southern)	□ 29 48	39 45 A	4
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Earum media (the middle of them)	□ 0 38	35 50 A	5
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Earum borealior (the more northern of them)	□ 1 58	32 0 A	5
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In extrema ala sinistra (at the end of the left wing)	□ 24 8	47 30 A	3
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In eiusdem educatione (at	□ 10 28	44 10 A	4
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Star (Fixae)	Longitude	Latitude	Mag.
the rise of the same)			
Ad pedem dextrum trium Orientalis (at the right foot, the eastern of three)	□ 6 25	50 0 A	5
Occidentalior (the more western)	□ 8 23	45 40 A	neb.
Australior (the more southern)	□ 7 3	46 0 A	4
In foco sub ala laeua austral. (in the focus beneath the left wing, southern)	□ 19 15	53 0 A	5
Ibidem Borealior (in the same place, the more northern)	□ 14 48	48 25 A	3
In foco sub ala dextra superior (in the focus beneath the right wing, upper)	□ 3 58	53 0 A	4
Earum inferior (the lower of them)	□ 8 18	54 40 A	4

INDUS (the Indian)

4. *Classis (fourth class):*

Star (Fixae)	Longitude	Latitude	Mag.
In Capite (on the Head)	□ 29 0	32 30 A	4
In axilla laeua (in the left armpit)	□ 1 13	36 55 A	4
In laeue manus sagitta 1. (in the left hand, the 1st arrow)	□ 4 30	37 0 A	4
Secunda (the second)	□ 6 28	38 35 A	4
Tertia (the third)	□ 5 45	40 0 A	4
In summo sagittae manus dext. (at the top of the arrow in the right hand)	□ 24 40	27 55 A	5
In imo (at the bottom)	□ 15 0	32 35 A	5
In axilla dextra Occidentalior (in the right armpit, the more western)	□ 24 16	33 45 A	5
Sequens (the following)	□ 25 0	33 53 A	6
Orientalior (the more eastern)	□ 23 48	33 40 A	6
In pectore (on the breast)	□ 24 58	36 0 A	5
In ventre (on	□ 22 38	39 15 A	4

Star (Fixae)	Longitude	Latitude	Mag.
the belly)			

PAVO (the Peacock)

4. Classis (fourth class):

Star (Fixae)	Longitude	Latitude	Mag.
Lucida in capite (the bright star on the head)	□ 18 9	36 0 A	2
In collo superior (on the neck, the upper)	□ 18 23	40 40 A	6
Media ibi (there, the middle)	□ 19 38	41 20 A	6
Inferior ibidem (the lower in the same place)	□ 17 23	41 45 A	6
In pectore (on the breast)	□ 21 52	48 30 A	3
In radice alae dextrae (at the root of the right wing)	□ 16 38	46 32 A	3
Parua huic adiacens (the small star adjacent to this)	□ 15 13	47 0 A	neb.
In media ala, seu dorso (in the middle of the wing, or	□ 11 48	45 20 A	5

Star (Fixae)	Longitude	Latitude	Mag.
the back)			
Nebulosa adiacens (the nebulous star adjacent)	□ 9 53	46 5 A	neb.
In educatione caudae prima (at the rise of the tail, the first)	□ 3 18	45 40 A	5
Secunda (the second)	□ 1 45	44 0 A	5
Tertia (the third)	□ 1 51	43 0 A	5
Quarta (the fourth)	□ 2 8	39 35 A	5
Quinta (the fifth)	□ 29 38	41 0 A	5
Sexta (the sixth)	□ 29 3	40 30 A	6
Septima (the seventh)	□ 28 13	39 20 A	5
Octaua (the eighth)	□ 24 53	41 20 A	6
Nona, & ultima (the ninth, and last)	□ 19 58	42 20 A	4
In dextro pede Australis (at the right foot, the southern)	□ 9 33	50 0 A	4
In eodem Borealis (in the same, the northern)	□ 12 28	49 20 A	6

Star (Fixae)	Longitude	Latitude	Mag.
In sinistro pede (at the left foot)	□ 19 23	50 25 A	6
In extrema cauda (at the end of the tail)	□ 2 28	48 27 A	6
In eadem (in the same)	□ 28 15	51 40 A	5

APUS, seu AVIS INDICA (the Apus, or the Indian Bird)

4. Classis (fourth class):

Star (Fixae)	Longitude	Latitude	Mag.
Informis, aut in capite (unformed, or on the head)	□ 18 33	44 40 A	5
In collo (on the neck)	□ 18 13	48 6 A	5
In eductione caudae boreal. (at the rise of the tail, the northern)	□ 13 35	54 20 A	5
Ibidem media (in the same place, the middle)	□ 13 15	55 0 A	5
Ibidem austrina (in the same place, the southern)	□ 16 10	55 45 A	5
In cauda versus Δ duarū superior (on the tail, toward	□ 8 48	51 30 A	6

Star (Fixae)	Longitude	Latitude	Mag.
the Triangle, the upper of two)			
Ibidem inferior (in the same place, the lower)	□ 8 3	52 0 A	6
In media cauda 3. borealiior (in the middle of the tail, the 3rd more northern)	□ 10 11	57 10 A	6
Media (the middle)	□ 9 0	57 57 A	6
Australior (the more southern)	□ 9 38	59 20 A	6
In eadem versus Chamaeleone m (in the same, toward the Chameleon)	□ 13 40	61 25 A	4

APIS, seu MUSCA (the Bee, or the Fly)

4. Classis (fourth class):

Star (Fixae)	Longitude	Latitude	Mag.
In Capite (on the Head)	□ 16 58	54 0 A	4
In ala dextra (on the right wing)	□ 16 53	56 25 A	4
In ala sinistra	□ 23 13	56 5 A	4

Star (Fixae)	Longitude	Latitude	Mag.
(on the left wing)			
In cauda (on the tail)	□ 20 57	57 30 A	4

CHAMAELEON (the Chameleon)

4. Classis (fourth class):

Star (Fixae)	Longitude	Latitude	Mag.
In prioribus pedibus (on the forefeet)	□ 1 27	62 40 A	5
Ad collum (at the neck)	□ 26 8	63 25 A	5
In dorso [In dorso] (on the back)	□ 24 53	67 0 A	5
In posterioribus pedibus (on the hind feet)	□ 1 21	67 25 A	5
In educatione caudae orientior (at the rise of the tail, the more eastern)	□ 0 28	70 38 A	5
Occidentalior (the more western)	□ 2 58	75 35 A	5
In media cauda superior (in the middle of the tail, the upper)	□ 28 8	73 0 A	5
Inferior (the	□ 23 13	73 35 A	5

Star (Fixae)	Longitude	Latitude	Mag.
lower)			
In extrema cauda superior (at the end of the tail, the upper)	□ 23 30	74 26 A	6
Inferior (the lower)	□ 24 28	75 12 A	6

TRIANGULUM AUSTRALE (the Southern Triangle)

4. Classis (fourth class):

Star (Fixae)	Longitude	Latitude	Mag.
Seq. basis versus collum Apodis (the following of the base, toward the neck of the Apus)	□ 14 20	46 20 A	3
Superior in cuspidè versus Lupum (the upper, at the point, toward the Wolf)	□ 5 30	41 0 A	3
Parua huic adiacens (the small star adjacent to this)	□ 8 40	44 40 A	5
Basis praecedès versus caudam Apodis (the preceding of	□ 12 0	48 30 A	3

Star (Fixae)	Longitude	Latitude	Mag.
the base, toward the tail of the Apus)			
Parua supra hanc (the small star above this)	□ 5 0	44 15 A	5

Liber IV — De Fixis Stellis (conclusion); Liber V — De Saturno (opening)

The catalogue continues with the remaining far-southern Bayer constellations. The columns are: **Star name [Nomina Fixarum]** | **Longitude [Longitudo]** (Sign, degrees, minutes) | **Latitude [Latitudo]**, A. (degrees, minutes; all here Australis/southern) | **Magnitude [Magnitudo]**.

PISCIS VOLANS, or PASSER [the Flying Fish, or Sparrow] — 4th class

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
On the head [In capite]	♋	19	53	72	26	A	5
In the middl e of the body [In medio corpor e]	♋	24	29	77	12	A	6
In the tail [In cauda]	♋	7	12	82	5	A	5

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
On the upper left wing [In ala sinistr a superi or]		13	34	73	20	A	6
The lower one there [Ibi inferi or]		20	7	82	14	A	6
On the upper right wing [In ala dextra superi or]		6	13	76	21	A	6
The lower one there [Ibi inferi or]		11	53	79	28	A	6

Parsing notes: the Sign cells in this block are partly obscured by the ruling; the Crab symbol (♋) is the best reading throughout, but several cells are faint — see uncertain readings.

DORADO, or XIPHIAS [the Goldfish, or Swordfish] — 4th class

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
On the head [In capite]		26	45	86	53	A	4
On the gills [In branc hijs]		1	21	87	0	A	5
On the belly [In ventre]		0	53	88	12	A	5
Above the back [Supra dorsu m]		25	3	84	46	A	4
At the end of the tail [In extre ma cauda]		10	38	76	15	A	4
The centra l star of the Greate r		1	3	84	0	A	neb.

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
Cloud [Nube culae maiori s centru m]							
Adjace nt to it [Huic adiace ns]		18	3	82	31	A	5

TOUCAN, that is, the AMERICAN GOOSE [Toucan, idest Anser Americanus] — 4th class

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
At the tip of the beak [In rostro extre mo]		5	18	45	55	A	3
On the head [In capite]		16	15	48	15	A	3
On the bend of the left wing [In ancon e alae		15	23	54	15	A	4

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
sinistr .]							
The lower one there [Ibi inferi or]		14	18	55	45	A	5
On the middl e wing [In media ala]		16	9	58	20	A	3
On the back [In dorso]		22	23	57	50	A	3
On the tail [In cauda]		22	48	61	30	A	4
On the leaf of the branc h, or the nutme g [In rami folio, seu nuce myrist ica]		2	33	49	55	A	4

HYDRUS [the Water-Snake] — (second column, top)

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
On the head [In capite]		5	23	64	5	A	3
Upper, on the neck [In collo superior]		11	53	71	40	A	4
Lower, on the neck [Colli trium inferior]		13	18	70	25	A	4
First of the three on the neck [Contentionis colli prima]		1	18	71	12	A	4
The second [Secunda]		18	18	70	30	A	5

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
The third [Tertia]		26	3	67	30	A	5
The fourth [Quarta]		21	33	64	0	A	5
The fifth [Quinta]		7	6	65	0	A	5
The sixth [Sexta]		26	29	64	55	A	4
The seventh [Septima]		19	15	60	0	A	5
In the tail, opposite the 1st, northern [In cauda côuer. 1. Austral- Boreal .]		15	38	58	10	A	5
In the		13	13	62	40	A	5

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
2nd bend of the tail, the penult imate [In 2. cauda e flexu antep enult.]							
The last [Ultim a]		8	53	64	30	A	5
The center of the Lesser Cloud [Nube culae minor is cêtru m]		6	3	64	0	A	neb.
The unfor med star betwe en this and the greate r		8	48	72	20	A	6

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
[Inter hanc, & maior em infor mis]							

[Hydrus, continued — the southern part]

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
South ern [Austr ina]		5	48	78	30	A	4
The one above ♁ 8 & 9 of Hydrus [Quae supra ♁ 8 & 9. Hydr.]		4	40	61	20	A	5
Below the neck, upper [Infra collu m superi or]		17	10	75	30	A	4
The lower		19	30	80	0	A	6

Star	Sign	°	'	Lat. °	Lat. '	A	Mag.
one							
there							
[Ibi							
inferi							
or]							

Parsing notes: in this block several Sign symbols are faint and ink-bled; the Aquarius (♒), Pisces (♓), and Sagittarius (♐) readings reflect a best fit to the catalogue's south-polar progression and should be verified against a clean scan.

[Summary tallies of the Universal Catalogue's constellations and bright stars]

And so there are 12 zodiacal constellations; 23 northern; and 27 southern — 62 in all.

Among the zodiacal constellations there are stars of the first magnitude	6
Of the second magnitude	9
Among the northern constellations there are stars of the first magnitude	9
Of the second magnitude	22
Among the southern constellations there are stars of the first magnitude	5
Of the second magnitude	28
Therefore stars of the first magnitude	14

in all are

And of the second,

59

Parsing notes: the right-hand body of this tally is a list of statements rather than a gridded table; the count values fall in the final (Magnitude) column. The figures as printed: zodiacal — 1st mag. 6, 2nd mag. 9; northern — 1st mag. 9, 2nd mag. 22; southern — 1st mag. 5, 2nd mag. 28; totals — 1st mag. 14, 2nd mag. 59. (Note: $6+9+5 = 20$ first-magnitude by the components, but the printed total reads 14 —)

LIBER QUINTUS

IN QUO SUNT SATURNI PLANETAE OBSERVATIONES, Et Hypothesis Motuum.

[Book Five, in which are contained the observations of the planet Saturn, and the hypothesis of its motions.]

CAPUT I.

The ancient observations of Saturn, from the year 229 before Christ down to the year 1461 of the same era [Saturni Observationes Antiquae ab Anno 229. ante Christum, usque ad eiusdem Annum 1461].

[1] In the year 81 according to the Chaldeans, on the 5th of the month Xanthicus — this being the year 519 of Nabonassar — on the 14th of the month Tybi, in the evening, Saturn was observed two digits, or 5 minutes, to the south of the star that stands on the southern shoulder of Virgo. Ptolemy reports this observation as the most reliable of all (*Almagest* [*Magna Constructio*] XI.cap. 7), and from it concludes that Saturn was then in $9^{\circ}30'$ of Virgo. But Longomontanus (*Astronomia Danica*, Book 2, Theoricae, cap. 4) makes that year to be 3736 after the creation of the world, a bissextile (leap) year — though properly it should fall together with the year 229 before Christ — and the fourteenth of Tybi to be the first of March, adding that it was at 25 minutes past midnight, Copenhagen time [Hafniensem]; and that the star itself, as much as Saturn, was in $9^{\circ}3'$ of Virgo, with northern latitude $2^{\circ}43'$. But Saturn was in $2^{\circ}38'$. Ismaël Bullialdus [Ismaël Boulliau] too (*Astronomia Philolaica*, Book 6) accepts the year 14 of Tybi, but says it was at the 5th hour, and that at Copenhagen [Vraniburgi] the fixed star was in $8^{\circ}42'43''$ of Virgo, of the same latitude, while Saturn was in $9^{\circ}50'$ of northern latitude $2^{\circ}50'$. Yet Lansbergius [Philip van Lansberge], in his *Thesaurus* of the

observations of Saturn (obs. 1), asserts — citing it from Ptolemy at Xanthicus the 15th, and as his own tables would have it — that this observation, namely because on that very day around the 6th hour at Alexandria the exemplars show the star in $9^{\circ}7'$ of Virgo with latitude $2^{\circ}43'$ — but in truth the Greek exemplars have "Xanthicus the 5th," and all the Latin versions have "Xanthicus the 5th." From our Catalogue of Fixed Stars [Fixarum Catalogo] that star is in $13^{\circ}50'31''$ of Virgo with northern latitude $2^{\circ}49'3''$.

[Margin: Lansbergius deluded / Lansbergii delusio.]

[2] A second observation: Ptolemy, having observed Saturn with astrolabic instruments, concludes its opposition (*Almagest* V.cap. 5; and from him Copernicus, *De Revolutionibus* V) — adding that it occurred in the year 127 of Christ, on the 7th of the month Mechir, that is, the 7th of the Kalends of April [7 Kalendas Aprilis], at the 18th hour after midday at Alexandria. But the Greek codex [the rest of this item runs to the foot of the column].

[Margin: Copernicus errs in his *Chronicon* / Copernicus errat in Chron.]

[The opening lines at the head of the left column continue an observation from page 280 (the foot of that page is cut off in this batch):] ...was seen to be in $6^{\circ}41'28''$ of Cancer, and of southern latitude $19^{\circ}27'$. But Saturn was occulted long before by the splendor of the Moon, rather than by its body.

[7] In the year 1461, Johannes Regiomontanus [Regiomontanus], as he himself relates in his observations, on the 2nd of December in the early evening observed at Rome that Mars was in the same straight line with two stars in the head of Capricorn, namely in 27° of Capricorn; and Saturn was more to the east by two degrees; whereas on the sixth of December Mars had passed beyond Saturn by a degree and a half — and yet the *Almanach Alphonsinum* marked Saturn and Mars in that same position on the second of December. So too on the 14th: after sunset, on that day Venus was joined to Saturn, even though by the *Almanach* Venus should have been more easterly than Saturn by $1^{\circ}27'$.

CAPUT II.

Observations of Saturn made at Nuremberg by Bernhard Walther of Nuremberg [Bernardo Vualtero Norimbergensi], a pupil of Johannes Regiomontanus, from the year of Christ 1475 down to 1504 [Saturni observationes factae Norimbergae à Bernardo Vualtero Norimbergensi, discipulo Ioannis Regiomontani, ab Anno Christi 1475. usque ad 1504].

Walther's [Vualteri] observations reduce to three classes. **The first** is of those made without instruments, by visual estimation of the planet's distance from other planets or fixed stars. **The second** is of those made with the Radius [Radium — the cross-staff], which contains a right-angled triangle for capturing the distances of stars in any direction. **The third** is of those made with the zodiacal armillae [Armillas Zodiacas], concerning which we shall report more fully a little later.

[1] In the year 1475, on September 17, between the 2nd and 3rd hours after midnight, in the morning, Walther saw Saturn standing apart from Mars by nearly 5 minutes, more to the north in latitude than in longitude, and Mars by so much more to the west; whereas on the 19th he saw the same Saturn more to the east, and so concluded a conjunction of Saturn and Mars; the conjunction therefore fell on the 18th, around the 3rd hour after midnight — even though the *Almanach* placed it on the 21st.

[2] In the year 1476, on March 25, at the 2nd hour of the night, he saw Saturn near the Nebula of Cancer [Nebulosam Cancri]; for Saturn appeared distant by two digits toward the western cross-bars [transuersales occidentales] more than the straight line drawn between the fourth and fifth stars of Cancer, yet it was in that same straight line of the stars of Cancer one quarter, and along with the first, or Nebula, equally distant from both. Because this discords from the tables, Bullialdus [Boulliau] (*Astronomia Philolaica* VI.cap. 5) thence gathers that what is to be read is "the fifth of Cancer" entering the arc, not "the fourth," otherwise the rest of the observations do not square. For the Nebula of Cancer was then in $0^{\circ}14'$ of Leo [Leonis], that is, the fourth star of Cancer in $0^{\circ}11'14''$ of Leo, and the southern Donkey [Asellum Australem], that is, the fifth of Cancer, in $1^{\circ}22'14''$ of Leo; and so Saturn would have been in $0^{\circ}41'$ of Leo — yet from his tables he computes its place to be $0^{\circ}20'$ of Leo; subtracting which, on account of the magnitude of the Nebula, the eye of Walther was rather deceived in the position of Saturn.

[3] In the year 1477, on September 5, in the morning around the third hour after midnight, he saw Saturn and Mars distant by one palm; and since Mars was western, he concluded a punctual conjunction. But the conjunction ought to have eclipsed Saturn that day, so that Mars would have to eclipse Saturn — yet it appears rather from the conjunction at the sixth of October; it will be said below in the Waltherian observations of Mars [observationibus Martis Vualterianis] at the proper time of this year.

[4] In the same year, on October 15, from observation he detected an error of one degree and 36' in the tables as to the position of Saturn and of Mars.

[5] In the year 1478, on September 24, 40 minutes before sunrise, he saw the conjunction of Saturn with the Moon, such that the Moon [the item continues at the head of the right column:] would have a northern latitude, and its limb itself distant by a palm-breadth from Saturn.

[6] In the year 1479, on October 30, he saw the conjunction of Saturn and Mars, as to longitude, such that Saturn was more northerly by almost one degree; but Mars was nearest the sixth of Virgo.

[7] In the year 1481, on October 22, at nearly the second hour before sunrise, he saw Saturn and Mercury in the same latitude, but Mercury more easterly than Saturn by one diameter of the Moon; whence, against the *Alphonsine* tables, he concludes that the conjunction of these had preceded by 1 day. Particularly since on the 23rd day he saw Mercury more easterly than Saturn by nearly three diameters of the Moon.

[8] In the year 1482, on the 1st hour $\frac{3}{4}$ before sunrise, the Moon eclipsed Saturn; for at the 2nd hour $\frac{1}{2}$ before the rising of the Sun, Saturn had been southerly to the Moon, and distant from it by two Moons; but when it had emerged from the Moon, it was distant from the northern horn of the Moon by two digits; little by little; afterward it passed the middle of the heavens; but the Moon, at the time when the eclipse was reckoned middle, was seen to be in 23° of latitude.

[9] In the year 1504, on March 28, at the following night-hour 7, he saw Saturn more western and more northern by 8° in (Gemini) by 2 digits and a quarter, but more distant in latitude than in longitude; on the following night, however, he saw Saturn much closer to the aforesaid star; and so he concludes the conjunction made just then. Hence Bullialdus [Boulliau] (*Astronomia Philolaica* VI.cap. 6) likewise makes that conjunction to occur on the 29th of March, at the 7th hour after midday.

Observations of Saturn made with the Radius [Observationes Saturni factae per Radium]

The second class holds the distances of Saturn captured by the Astronomical Radius [Radium Astronomicum — the cross-staff], indicated by the first and second Sine. To find these, multiply 1200 by the first Sine, and divide the product by the second Sine; as often as the quotient is found in the table of the Gnomonic

Sine of Purbach [Tabula Gnomonica Purbachij], constructed to that same number of 1200, it exhibits the degrees and minutes of the optimum distance.

[10] For example, Saturn is said to be distant from Algomeisa [Procyon], or the Lesser Dog Star [Canicula], such that the first Sine is 210, and the second Sine 489 particles. Therefore, the parts of the Gnomonic Table being drawn out to 1200, that is, 252000; which divided by 489 yields 515½; this number being sought in the aforesaid Table under the column of the 500 parts, opposite the number 15 in the side at the left, and by the proportional part computed it exhibits 23°13'53". Therefore Saturn stood apart from Algomeisa [Procyon] by 23°13'53" — unless the parallax should occur to correct these distances somewhat, for the reason that the angle at the center of the Astronomical Radius is greater than the angle made at the bottom of the eye.

No.	Year M. D. H. M.	Dist. of h from the fixed stars [Dist. h à Fixis]	Sine 1	Sine 2
11	1475 Sept. 16, 2h 30m p.m. of the night [noct.], morning [mane]	Algomeisa [Procyon] / 7th of the Twins [Cap. seq. Gemin.] / Saturn & Mars [Saturn. & Mart.]	210 / 210 / 20	489 / 573 / 949
12	Sept. 17, 2h 30m p.m. of the night [noct.]	Saturn & Mars [Saturn. & Mart.]	10	667
13	Sept. 21, 3h nearly [ferè] p.m. of the night [noct.], morning	Algomeisa [Procyon] / 7th of the Twins [Cap. seq. Gemin.] /	210 / 210 / 210	480 / 560 / 679

No.	Year M. D. H. M.	Dist. of \hbar from the fixed stars [Dist. \hbar à Fixis]	Sine 1	Sine 2
	[mane]	Saturn & Mars [Saturn. & Mart.]		
14	Oct. 13, 2h 30m p.m.n.	4th of Leo [Quarta Leonis] / 8th, or the heart of the Lion [Octaua, seu cor]	160 / 210	810 / 771
15	Oct. 17, 2h 30m p.m.n., morning [mane]	4th of Leo [Quarta Leonis] / 8th of Leo [Octaua Leonis] / 4th of Leo [Quarta Leonis]	190 / 210 / 210	907 / 770 / 807
16	Nov. 3, 3h about [circ.] p.m.n., morning [mane]	4th of Leo [Quarta Leonis] / 7th of Leo [Septima] / 8th of Leo [Octaua]	190 / 210 / 210	1001 / 872 / 793

Parsing notes: this is a multi-line table — each numbered row groups two or three fixed-star comparison stars, each with its own pair of Sine values (rendered slash-separated within the cell). The "p.m." here abbreviates *post meridiem* reckoning of the night-hour; "noct." marks a night observation; "mane" marks the

early-morning reading. The table continues beyond this batch (catchword "Nou." / row beginning continues).

Caput II (continued)

Saturn's distance from the fixed stars (Walther's cross-staff observations, continued)

The following table continues Walther's Nuremberg cross-staff observations, each row giving the year and date, the comparison fixed star(s) from which Saturn's distance was measured, and the two Sine values (Sine 1, Sine 2) used in the reduction.

No.	Year — date — hour — min.	Saturn's distance from the fixed stars	Sine 1	Sine 2
17	1475 Nov. 12, 1 ^h 30' p.m.n., morning	Sixth of Leo	210	708
		Eighth of Leo	210	798
18	Nov. 19, 4 ^h before noon, morning	Fourth of Leo	170	901
		Sixth of Leo	210	695
		Eighth of Leo	210	784
19	Dec. 1, 3 ^h before noon, morning	Fourth of Leo	170	887
		Sixth of Leo	210	692
		Eighth of Leo	210	779½
20	Dec. 29, 3 ^h	Fourth of	180	869

No.	Year — date — hour — min.	Saturn's distance from the fixed stars	Sine 1	Sine 2
	0' p.m.n., morning	Leo		
		Eighth of Leo	210	698
21	1476 Feb. 12, 2 ^h 0' n. foll.	Fifth of Cancer	20	1022
		Cap. foll. of Gemini □	210	675½
		Fourth of Leo	170	671
22	Feb. 19, 2 ^h 0' n. foll.	Fifth of Cancer	10	610
		Cap. foll. of Gemini	210	695
		Eighth of Leo	210	554½
23	Nov. 14, a little before sunrise	Eighth of Leo	20	944½
		Sixth of Leo	130	961
24	Nov. 17, a little before sunrise	Eighth of Leo	20	937
		Sixth of Leo	130	964
25	Nov. 18, before sunrise	Eighth of Leo	20	937
		Sixth of Leo	130	972½
26	Nov. 21, before sunrise	Sixth of Leo	130	972

No.	Year — date — hour — min.	Saturn's distance from the fixed stars	Sine 1	Sine 2
		Eighth of Leo	20	937
27	1477 Oct. 16, 4 ^h 30' p.m.n., morning	Eighth of Leo	170	945
		Sixth of Leo	190	840
		Saturn & Mars	50	874
28	1478 Apr. 19, a little after sunrise	Heart of Leo [Regulus]	90	892
		Sixth of Leo	140	882
29	1479 Nov. 16	Seventh of Virgo	60	859
		Tenth of Virgo	130	884
30	Nov. 24, more exactly than before	Sixth of Virgo	30	796
		Seventh of Virgo	40	667
		Tenth of Virgo	90	632
31	1481 Dec. 30, 3 ^h before sunrise, carefully	Spica Virginis	100	544
		Twenty-	110	535

No.	Year — date — hour — min.	Saturn's distance from the fixed stars	Sine 1	Sine 2
		first of Virgo		
32	1482 Jan. 19, 3 ^h before sunrise, carefully	Spica Virginis	90	512
		Twenty- first of Virgo	110	520

Parsing notes: the comparison-star column abbreviates each star by its numbered position within a constellation (e.g. "Sixth of Leo," "Eighth of Leo") with the Latin sign-glyph; "Quinta Cancri," "Cap. seq. Gemin.," "Septima Virg.," "Vigesima prima," etc. The two right-hand columns are headed *Sinus 1.* and *Sinus 2.* I have rendered fractional values ($\frac{1}{2}$) as printed. Row 21's "Cap. seq. IL" is partly abbreviated; the sign-glyph here appears to be Gemini ("Cap. seq. Gemin." as in row 22), read as the "following head[-star] of Gemini" [?].

33. The third class contains observations made through the zodiacal armillaries, that is, observations verified or corrected against Aldebaran, the Heart of Leo, or other stars; but in these the certainty extends only to within about 10 minutes — for Walther says, under the year 1503: "*On September 16, ten minutes are to be added on account of the motion of Aldebaran with respect to all the stars observed by me; likewise on October 13 and December 12.*" And on December 11 he says: "*I observed these things again with delay and with the utmost diligence. Yet I see that, when the instrument is taken with precision, one is not off by more than 10 minutes, or thereabouts.*" Again, under the year 1504, on January 16, he has this: "*Item: I have corrected once more the motions of Jupiter and Saturn, adding 10 minutes on account of the variation of Aldebaran's place from September 1 of the year 1503; this was done through the position of the Heart of Leo, and is wanting in the preceding observations.*" Nevertheless I have selected not a few of these, just as they stand in Walther.

[A second table: Saturn's mean and apparent longitude and latitude]

This table records the year, month, and day; the *Mediab. Casu* [the mean motion / mean place — *medium caelum* or mean reckoning, with degrees and sign]; Saturn's longitude (sign, degrees, minutes); and the latitude (degrees, A = austral/southern).

No.	Year — Mo. — Day	Mean place: Gr. — Sign	Saturn Long.: Sig. — G. — ’	Lat.: G. — ’
34	1503 Sept. 22	15 Taurus	□ 17 0	15 A
35		28 Taurus	15 0	30 A
36	Nov. 4	17 Cancer	□ 17 25	10 A
37	Dec. 1	6 Aries	□ 15 30	18 A
38	Dec. 14	5 Aries	□ 15 5	22 A
39	1504 Januar. 3	3 Tauri	□ 13 15	15 A
40	morning 10	11 Tauri	12 45	15 A
41	morning 10	10	12 23	
42	noct. foll. 10	13 Tauri	12 10	5 A
43	morning 24	27 Tauri	11 53	
44	noct. foll. 25	30 Tauri	11 45	8 A
45	noct. foll. 26	24 Tauri	11 45	
46	1504 Febr.	3 23 Gemini	□ 11 22	0 0
47	noct. foll. 4	3 Gemini	11 23	0 0
48	n. foll. 7	5 Gemini	11 23	0 0
49	n. foll. 6	22 Gemini	11 23	0 0
50	n. foll. 8	11 Gemini	11 18	2 A
51	n. foll. 12	9 Gemini	11 8	
52	n. foll. 12	14 Gemini	10 52	
53	n. foll. 14	22 Gemini	□ 10 57	

No.	Year — Mo. — Day	Mean place: Gr. — Sign	Saturn Long.: Sig. — G. — ’	Lat.: G. — ’
54	n. foll. 15	14 Gemini	10 57	
55	n. foll. 16	14 Gemini	10 57	
56	n. foll. 16	18 Gemini	11 0	
57	n. foll. 26	25 Gemini	10 45	
58	1504 May	2 2 Cancer	☐ 10 45	
59	noct. foll. 3	2 Cancer	10 45	
60	noct. foll. 11	14 Cancer	10 48	
61	noct. foll. 17	23 Cancri	11 5	22 A
62	Apr. n. foll. 24	24 Virginis	☐ 13 30	
63	noct. foll. 30	24 Virginis	13 45	
64	May n. foll. 9	19½ Librae	☐ 15 30	
65	noct. foll. 22	23 Librae	15 47	30 B
66	noct. foll. 23	23 Librae	16 0	
67	noct. foll. 24	1 Scorpii	16 0	5 B
68	noct. foll. 25	4 Scorpii	16 10	
69	noct. foll. 28	5 Scorpii	16 28	
70	noct. foll. 29	14 Scorpii	16 45	

Parsing notes: column headers read *Ann. M. D.* (year, month, day), *Mediab. Casu* with sub-columns *Gr.* and *Sign.*, *Saturn. Longit.* with sub-columns *Sig. / G. / ’*, and *Latitudo* with sub-columns *G. / ’*. The longitude sign-glyph in the upper rows is Cancer (☐); I have carried it where legible and left it blank where the cell repeats

the glyph above. The latitude letters "A" (austral/southern) and "B" (boreal/northern) are transcribed as printed. Several day-entries are prefixed *mane* (morning), *noct. seq.* (the following night), or *n. s.* (= *nocte sequenti*); I have rendered these in the day column. Row 64's longitude degree "19½" and row 46's split entry are as printed.

CAPUT III

Saturn observations of Copernicus, Pitati, Ristori, and Lansberg, from the year 1514 to 1563

The reader is forewarned, from Rheticus's preface to the Ephemerides of the year 1551, that Copernicus had abundant Saturn observations of his own, and that in his computations he did not stray from the truth by more than 10 minutes. Moreover, he made no mention of refractions, and — as Tycho Brahe attests in Book 1, Chapter 5 of his *Progymnasmata* — he established the altitude of the pole at Frauenburg as fully three minutes too large. Hence the certainty in the following observations is no greater than these limits.

1. In the year 1514, on the sixth before the Kalends of May [April 26], at the 5th hour after midnight, Copernicus saw Saturn in a straight line with the second star of the front of Scorpio — that is, at an elongation of 209° from the first star of Aries. So he himself, in his Book 5, Chapter 9.

2. In the same year, on the third before the Nones of May [May 5], at the 1st hour 12' before midnight, Copernicus observed an opposition of Saturn made with the mean place of the Sun — that is, with Saturn simple [i.e. with the Sun at its mean place and Saturn] in [the following column on the next page]...

at degree 205° 24' from the first star of Aries. So Copernicus, Book 5, Chapter 6.

3. In the year 1520, on the third before the Ides of July [July 13], from an observation of Copernicus of the opposition of Saturn with the mean place of the Sun on that same day, at midday at Frauenburg (or Cracow), Saturn was found to occupy the 272nd degree 15' from the first star of Aries. So he himself, Book 5, Chapter 6.

4. In the year 1524, in the same month of February, Saturn, Jupiter, and Mars were found nearly conjoined in Pisces, 10°, concerning which Kepler writes in his book on the new star, Chapter 29.

5. In the year 1527, on the sixth before the Ides of October [October 10], at the 6th hour 24' after midnight, an opposition of Saturn with the mean place of the Sun

was made (Copernicus observing), with Saturn elongated 7 minutes from the horn of Aries. So Copernicus, Book 5, Chapter 6.

6. In the year 1536, Peter Pitati, from his observation, judged Saturn to have been in conjunction with Mars on May 22; but Julian Ristori of Prato, a Carmelite, Doctor of Sacred Theology and an excellent mathematician, the teacher of Junctinus [Giovanni Battista Junctinus / Giuntini], saw Saturn at about the 19th hour of March 19, at the 2nd hour of night, nearly hidden by Mars — so that the conjunction of these took place, as Junctinus reports in the preface to his *Tables*. And yet Stöffler, in his *Ephemerides* and in the Alphonsine Tables, had assigned that conjunction to May 25, with the planets in part conjoined.

7. In the year 1542, on the 5th before the Kalends of January [January 9 — *recte* the date as printed], at the 9th hour, the following night, a conjunction of Saturn and Mars in Pisces was observed by the aforesaid Ristori, as Junctinus reports above.

8. In the year 1563, on the 9th before the Kalends of September [August 24], at the 14th hour 30' after midday, at Orange, Junctinus observed a conjunction of Saturn and Jupiter — Jupiter being the more northern, as if cooperating — with Saturn the more southern, in Leo at degree 28°, as he himself relates in the preface to his *Tables*; and yet the Alphonsines had deferred this conjunction to September 25, in Leo, degree 4° 12'.

CAPUT IV

Tychonic observations of Saturn, in which the days are noted according to the Old Style of the calendar

1. In the year 1582, on August 21, at the 2nd hour after midnight at Uraniborg, there was an opposition of Saturn with the true place of the Sun in Pisces, 6°; but by Tycho's observation, at 7° 22½'. So Longomontanus in his *Astronomia Danica*, Book 2, Theoricae, Chapter 2.

2. In the year 1583, on September 3, the 1st hour, there was a true opposition of Saturn with the Sun in Pisces, 19° 50', by observation. But by Tycho's calculation, the Danish [Tables] give 19° 48'. So Longomontanus, above.

3. In the year 1584, on September 15, the 6th hour 30', there was a true [opposition] of Saturn with the Sun in Aries, 2° 34', by observation; but the Danish Tables [give] 2° 15'. So Longomontanus, above, from Tychonic observation.

4. In the year 1585, on September 28, the 1st hour 30', there was a true opposition of Saturn with the Sun in Aries, $15^{\circ} 39\frac{1}{2}'$, observing (Tycho); but by the Danish Tables, $15^{\circ} 39' 15''$. So Longomontanus, above.

5. In the year 1586, on October 12, the 11th hour, there was a true opposition of the Sun with Saturn in Aries, $29^{\circ} 2'$, Tycho observing; but by the Danish Tables at $29^{\circ} 4'$. So Longomontanus, above.

6. In the year 1586 [*recte* 1587 — see context], on January 19, at the 9th hour 45' after midday, an opposition was observed at Uraniborg of Saturn in Aries $26^{\circ} 8'$, with southern latitude $2^{\circ} 23'$; yet by Alphonsine reckoning that place falls at $18^{\circ} 8'$, with latitude $2^{\circ} 30'$. But Copernicus [gives] that place at $25^{\circ} 58'$, with latitude $2^{\circ} 32'$. Bullialdus uses this observation, in his Book 6, for the investigation of Saturn's apogee and the inclination of the orb and the places of Saturn's nodes. See the Epistle of Tycho, page 56.

7. In the same year, on January 14, the 5th hour 50' after midday, Tycho observed Saturn in Aries $26^{\circ} 21'$, with southern latitude $2^{\circ} 26'$. The Alphonsine [place] for it was $28^{\circ} 21\frac{1}{2}'$; but Copernicus [gives] it at $26^{\circ} 12'$ — and these [latitudes] at $2^{\circ} 30'$. So Tycho, where above.

8. In the same year, in the same month, on the 15th, at the 5th hour 45' after midday, Tycho observed Saturn in Aries $28^{\circ} 24'$, with southern latitude $2^{\circ} 25'$. The Alphonsine [place] was $28^{\circ} 24'$; but by Copernicus $27^{\circ} 36'$. So Longomontanus, longitude $26^{\circ} 15'$, with latitude $2^{\circ} 26'$.

9. Likewise in the year 1587, on October 26, the 9th hour after midday, there was a true opposition of the Sun with Saturn in Taurus $12^{\circ} 46'$, by Tycho's observation, than which Tycho's Tables [give $26^{\circ} 44'$ — read $12^{\circ} 44'$ as printed]. By which occasion is to be noted [a discrepancy], as Longomontanus says in Book 2, *Theoricae*, Chapter 1. The Danish Tables [were] taken in the *Thesaurus* of observations from the Tychonic Tables, gathering longitude $26^{\circ} 23'$ [?], with latitude $2^{\circ} 26'$. Likewise in the year 1587, on October 26, the 9th hour after midday, there was a true opposition of the Sun with Saturn in Taurus $12^{\circ} 46'$, by Tycho's observation. The Danish Tables were taken corrected, [yielding for] the longitude the mean of Saturn, 10 minutes, subtracted from the apogee; for it is to be added to Saturn's apogee at 3° , but to be subtracted at the eccentric's longitude, everywhere; one part adds, the other subtracts. [The compositor has duplicated this entry's opening; rendered as printed.]

10. In the year 1588, on November 8, the 10th hour 10' — there was a true opposition of the Sun with Saturn in Taurus 26° 44', Tycho observing; but by the Danish [Tables] at 26° 44'. So Longomontanus, above.
11. In the year 1589, on November 22, the 14th hour 30', there was a true opposition of the Sun with Saturn in Gemini 10° 53', Tycho observing; but by the Danish [Tables] at 10° 53'. So Longomontanus, above.
12. In the year 1590, on February 8, the 8th hour, in the evening, Tycho observed at Uraniborg Saturn in Gemini 7° 32'; but the autumn one [the opposition] at about an hour in degree 7° 38'. Longomontanus, Book 2, Theoricae, Chapter 5; and Bullialdus, Book 6, *Astronomia*, Chapter 2, & 3.
13. In the year 1590, on September 7, the 12th hour, Tycho observed Saturn in Gemini 28° 8', with southern latitude 1° 11'. So Bullialdus, Book 6, *Astronomia*, Chapter 2, & 3.
14. In the same year, on December 6, the 10th hour 20½' at midnight, there was a true opposition of the Sun with Saturn existing in Gemini 25° 10', as observed by Tycho. But by the Danish [Tables] at 25° 8¾'; so the Danish Tables. So Longomontanus, Book 2, Theoricae, Chapter 1.
15. In the year 1591, on March 17, the 7th hour 30½', in the evening, Saturn was observed at Uraniborg in Gemini 22° 24½'. Longomontanus, above, Chapter 3.
16. Again in the year 1591, on December 1, the 6th hour at midnight, there was a true opposition of the Sun with Saturn placed in Gemini 9° 24½', as Tycho observed. But by the Danish [Tables] at 9° 23½'; so the Danish Tables. Longomontanus, above, Chapter 2.
17. In the year 1595, on January 30, the 21st hour after midnight, there was a true opposition of the Sun with Saturn placed in Leo 21° 15½', by Tychonic observation. But by the Danish [Tables] at 21° 18½'; so the Danish Tables. So Longomontanus, above.
18. In the year 1600, on January 13, the 7th hour 30' after midnight, Tycho, at the citadel of Benátky near Prague, observed Saturn standing at distance from Venus at degree 5° 25'; but it was then with Saturn approaching the station, observing its meridian altitude at degree 18° 7', and its distance from Spica at degree 11° 12' 1"; and at a distance from the northern Lance [northern Pan of Libra] at degree 30° 41½'; thence Tycho concluded Saturn to have been on the preceding day, in Gemini, at degree 28° 18' 44", with northern latitude 2° 43'. But on the 3rd day,

just before [it stood] in Gemini at degree $28^{\circ} 30' 44''$, with northern latitude at degree $2^{\circ} 34'$. So Snellius in his Tychonic observations.

19. In the year 1600, on April 2, the 12th hour 21' after midnight, Tycho — in the citadel of Prague — observed Saturn's meridian altitude at degree $32^{\circ} 28' \frac{3}{4}$, and at the 12th hour 43', the distance of the same standing from the northern Lance at degree $19^{\circ} 14\frac{1}{2}'$. So Snellius, above.

20. In the same year, on April 9, the 11th hour $37\frac{1}{2}'$, Tycho there observed Saturn distant from Spica at degree $8^{\circ} 9\frac{1}{3}'$, & at the 11th hour 46', distant from the northern Lance at degree $19^{\circ} 45'$, & at the 12th hour the altitude of its meridian at degree $32^{\circ} 40'$.

21. In the year 1601, on July 6, the 9th hour 39' after midday, Tycho there observed Saturn distant from Arcturus at degree $32^{\circ} 1'$; & from the northern Lance at degree $11^{\circ} 42\frac{1}{2}'$. Hence the place of Saturn in Scorpio [is] at degree $3^{\circ} 50\frac{1}{2}'$; and its boreal latitude at degree $2^{\circ} 0\frac{1}{2}'$. But by our calculation (says Tycho, with Snellius above), it gives the longitude at degree $3^{\circ} 43' 23''$, & latitude at degree $3^{\circ} 19' 26''$. If anyone desires the reduction of the aforesaid observations made according to the Gregorian-calendar style, let him add 10 days to them, those after the year 1582.

The remaining observations of Tycho, or of Longomontanus, which we shall append below in Caput XI [of the] Catalogue, we have for the most part taken from page 56 of Tycho's Epistles....likewise from Longomontanus's *Astronomia Danica*, Book 2, Theoricae, Chapters 2, 12, & 13; and partly from a manuscript of Tycho's observations supplied by Father Albert Curtius of the Society of Jesus, which (since Caesar [the Emperor] had been put in charge of the edition of the Tychonic observations) he had most liberally transcribed, and which he most generously shared with me. From these I have selected only certain few, for the purpose of testing the agreement, or disagreement, of the Astronomical Tables.

CAPUT V

Saturn observations of Justus Byrgius [Jost Bürgi], from the Hessian observations of Snellius; and also of Lansberg, Hortensius, Gassendi, and Bullialdus, from the year 1592 to 1640

Bürgi observes Saturn at Cassel, according to the days of the Old Style

No.	Year	Month	Day	Hour, min., before or after noon	Saturn' s distanc e from the fixed stars: Gr. — Min.	(from which star)
1	1592	Octob.	14	4 before noon	27 — 23	from Regulus
					52 — 57	from Aldebar an
2	1593	Januar.	3	6: 30 after noon	48 — 46	from Pollux [cap. Pollucis = the head of Pollux]
					34 — 12	from the right shoulde r of Orion
3	1594	Januar.	2	8 after noon	21 — 52	from Pollux [head

No.	Year	Month	Day	Hour, min., before or after noon	Saturn's distanc e from the fixed stars: Gr. — Min.	(from which star)
						of Pollux]
					24 — 49½	from Sirius
4	1595	Novem b.	24	0	13 — 46	from Regulus
	[Here Bulliald us, Book 6, Chapter 2, line 1]			5 before noon	6 — 7	from the back of Leo ☐
				elicits the place of Saturn	9 — 57½	in Virgo ☐
5	1596	Maij	5	9 after noon	9 — 7	from Regulus
	[Here Bulliald us, above]			post merid.	13 — 8	from the back of Leo ☐
				elicits the place of Saturn	1 — 29	in Virgo ☐
6	1596	Maij	7	9 after	10 — 10	from

No.	Year	Month	Day	Hour, min., before or after noon	Saturn' s distanc e from the fixed stars: Gr. — Min.	(from which star)
				noon		the neck of Leo ☐
				post merid.	17 — 52	from the tail of Leo ☐
7	1597	Martij	27	8 after noon	11 — 35½	from Regulus
				post merid.	10 — 2½	from the tail of Leo ☐
8	1595	Februa rij	18	8 after noon	8 — 24	from the mane of Leo ☐ [this ought to be set under the year 1594]
				post mer.	4 — 32	from Regulus

Parsing notes: column headers read *Ann., Mens., Dies, Hor. Min. ant. vel post merid., Distantia Saturni à Fixis* (with sub-columns *Gr.* and *Min.*). The comparison-star is given in the rightmost cell of each distance-row (Regulus, Aldebaran, head

of Pollux, right shoulder of Orion, Sirius, back/neck/tail/mane of Leo, etc.). Rows 4 and 5 carry interpolated Bullialdus citations ("Hinc Bulliald. l.6.c.2.1 elicet loc. h ...") indicating where Bullialdus derives Saturn's place; I have set these as bracketed sub-rows. The note at row 8 — "*debut poni sub anno 1594*" ("this ought to be placed under the year 1594") — is transcribed as printed.

9. In the year 1593, on January 4, Old Style, at the 9th hour after midnight, Lansberg at Goes observed Saturn in Cancer at degree $23^{\circ} 12'$, with southern latitude degree $0^{\circ} 2'$. So he himself in the *Thesaurus* of observations, adding from his Tables the collected longitude at degree $23^{\circ} 12' 28''\frac{3}{4}$, and the latitude at 2 minutes.

10. In the year 1628, on June 23, Old Style, about the middle of the night, Saturn was seen at Gendt [Ghent] by Martin Hortensius conjoined with [a star], so far as the star permits. The star, which is somewhat to the south of the shoulder of Virgo, but Saturn was more southern by 25 scruples [minutes]. So Lansberg in his *Thesaurus*: he observes, adding that star to have been in Libra at degree $5^{\circ} 4'\frac{3}{4}$, with northern latitude at degree $2^{\circ} 50'$; but by his Tables he computes Libra at degree $5^{\circ} 3' 47''$, with latitude at degree $2^{\circ} 25'$.

11. In the year 1632, on July 19, Old Style, after midnight, Martin Hortensius saw Saturn more to the west, [farther] from the Moon than the diameter of the Moon a little more — for before, the Moon had hidden Saturn. So Lansberg, above.

12. In the year 1633, on May 28, New Style, Peter Gassendi, at Aix-en-Provence [Aquis Sextiis], judged the opposition of Saturn made with the Sun to have occurred; for on the 27th, in the evening, about the 8th hour, by means of the [cross-]staff [ope Radii], he observed Saturn distant from the middle of the front of Scorpio at degree $10^{\circ} 11\frac{1}{2}'$, & from Antares at degree $6^{\circ} 50'$; but on the 30th, in the evening, at the 9th hour, he saw the same distant from the middle of the front of Scorpio at degree $9^{\circ} 59'$, & from Antares indeed at degree $6^{\circ} 43'$. So he himself, in observations sent to Mr. Dominic Cassini, the public Professor of Astronomy at Bologna.

13. In the year 1634, Gassendi established the opposition of Saturn with the Sun on the 9th day of July. For on the 8th day, observing Saturn by the [cross-]staff, he found it distant from the left shoulder of Sagittarius at degree $19^{\circ} 33'$, & from the right thigh of Ophiuchus at degree $7^{\circ} 56'$; but on the 10th, in the evening, about the 9th hour, he saw it distant from Antares at degree $14^{\circ} 46\frac{1}{2}'$, & from the highest of the front of Scorpio at degree $20^{\circ} 2'$. So in observations sent to Cassini.

14. In the year 1635, Gassendi adjudged the opposition of Saturn with the Sun to the 21st day of June; for indeed on the 19th, in the evening, observing it himself through the [cross-]staff, Saturn was distant from the Eagle [Aquila] at degree $38^{\circ} 12\frac{3}{4}'$, & from the highest of the front of Scorpio at degree $31^{\circ} 31'$. On the 22nd day, a little after midday, he found that the tail of Leo stood higher at degree 25° [?]; it was distant from the highest of the front of Scorpio at degree $31^{\circ} 25'$. But Aquila's bright [star, Altair] [stood] at degree $28^{\circ} 27'$. Thus far he himself, [in observations sent] to Cassini.

[Margin / displayed note:] *If, among Gassendi's observations — which are now being printed at Lyon — there shall have been other observations pertinent here, and they shall have reached our hands, they are to be added, and here understood [as included].*

15. In the year 1640, on October 12, New Style, at the 8th hour and a few minutes after midday, Bullialdus observed Saturn on the Meridian, distant from a star of the fourth magnitude, which belongs to the loins and haunches of Aquarius, by 26 minutes. But Saturn was more boreal than that one vertically; so Bullialdus, Book 6, *Astronomia*, Chapter 3, subjoining the observation made through an optical tube [telescope], & that star to have been in Aquarius at degree $23^{\circ} 47'$, with southern latitude degree $23^{\circ} 55' 39''$, & latitude austral degree $1^{\circ} 35\frac{3}{4}'$ — so that Saturn was indeed in Aquarius at degree $23^{\circ} 55' 39''$, with southern latitude degree $24^{\circ} 0' 8''$. Hence Saturn's [place], by his own Tables, gives Aquarius at degree $24^{\circ} 0' 8''$, with latitude $1^{\circ} 36\frac{3}{4}'$; but the Rudolphine [Tables give] degree $24^{\circ} 5'$, with latitude degree $1^{\circ} 38'$.

16. In the year 1630, on June 19, Michael Florentius van Langren [Langrenus] of Brussels observing, & at the culmination [of] the degree of the Equator $241^{\circ} 5' 52''$, Saturn began to be hidden by the Moon, & from the moment when it emerged; the foot of Virgo — to which Tycho assigns the longitude Libra at degree $28^{\circ} 57'$, latitude at degree $2^{\circ} 57\frac{1}{2}'$, & likewise at degree 22° . That star of Virgo lay hidden under the dark boreal part of the Moon; the culminating degree of the Equator [being] $253^{\circ} 42'$.

CAPUT VI.

Observations of Saturn made near the perigee of the eccentric, in Majorca, by Don Vincenzo Mut [Vincenzio Muto], a man most skilled in astronomy; recorded on days of the New Style, all of them around the ninth hour after midday, and most generously communicated to us by letter — together with the place of Saturn as derived both from observation and from a fivefold calculation.

The following table gives, for each observation, the date, Saturn's distance from the fixed stars, the observed place of Saturn, and the differences of five sets of tables (Prutenic, Danish, Rudolphine, Lansberge's, and Boulliau's) from that observed place.

#	Ye ar	Mo nth	Da y	Sat ur n's dis tan ce fro m the fix ed sta rs	Pla ce of Sat ur n ob s.	Gr. M.	Sig .	G. M.	Di	Di	Di	Di
									ff. Pr ut.	ff. Da nic	ff. Ru dol	ff. La ns	ff. Bul lial
1	16 50	Jan ua r.	6	from the pre ce din g [st ar] to the top of the foo t of □	□	1 13	□	25 19	10	16	18	2 12
2		Jan u.	28	from	□	4 38	□	23 57	13	16	18	10 12

#	Year	Month	Day	Saturn's distance from the fixed stars	Place of Saturn obs.	Diurnal	Diurnal	Diurnal	Diurnal	Diurnal	Diurnal	
3		Feb.	12	from the same	53	□	2332	20	16	17	11	11
4		Feb.	24	from the same	512	□	2323	20	16	16	12	10
5		Mar.	8	from the same	50	□	2335	23	16	16	11	10
6			14	from the same	448	□	2347	25	16	15	10	9
7			20	from the same	431	□	244	28	16	13	7	9

#	Year	Month	Day	Saturn's distance from the fixed stars	Place of Saturn observations.	Diff. Prut.	Diff. Da.	Diff. Ru.	Diff. La.	Diff. Bulial.
8		April.	3	from 342	□	2453	28	17	13	7 7
9			18	from 230	□	265	28	18	14	4 8
10		May	2	& from [the star] Propus to the 32	lat. □	049	0	2714	24	20 15 3 9

#	Year	Month	Day	Saturn's distance from the fixed stars	Place of Saturn	Planet	Day	Month	Day	Month	Day	Planet

11		May	12	from the preceding in the foot of	07	□	2830	22	21	16	2	10
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latitude. 046

Parsing notes: Row 1's distance description reads *à praecedenti summum pedem* □ ("from the preceding [star] to the topmost foot of Gemini"). Row 10 has two distance components (from Propus, 0°36', latitude 0°49'; and from the heel of following Gemini, 3°2'), with the table-differences attached to the second; transcribed across two sub-lines. Row 11 gives the distance from the preceding [star] in the foot of Gemini (0°7') with latitude 0°46'.

Continuation of the table (a separate panel below, for the year 1654, using a different set of comparison tables — Danish, Rudolphine, Lansberge, Almagest [i.e. *Almagestum Novum*], and *Novum* [Riccioli's "New" tables]):

#	Yea r	Mo nth	Da y	Ho ur Mi n. afte r mi dda y		Pla ce of Sat urn obs .	Da nic.	Ru dol.	Lan sb.	Al ma g.	No v.
				Sig.	G. M.						
12	165 4	Feb rua r.	11	9 0	□	22 52	23 18	23 15	22 59	23 11	
				lati tud e		1 28					
13		Feb rua r.	15	9 0	□	20 31	20 57	20 50	20 46	20 45	

Parsing notes: In the lower panel the column headers shift to *Danic. / Rodul. / Lansb. / Almag. / Nou.* with units "G. '" (degrees, minutes). Row 12's second sub-line gives the observed latitude (1°28'). The rightmost "Nov." column appears blank in both data rows.

The observations of this year 1654 were made with Saturn very nearly at acronychal rising [acronychal].

Earlier, in the year 1651, on the fifth day of June at the eighth hour, [Mut] had observed Saturn at the same latitude as a star which lies in the belly of the southern twin of Gemini, but more easterly by 5'; from which he concluded that on the fourth day of June there had been a partial conjunction of the two.

[15] The same [observer], in the year 1643 on September 23, had observed Saturn's meridian altitude to be $53^{\circ}38'$, Saturn then standing in a straight line with the Head of Algol [Cap. Algol] and the more northerly star following in the Horn of Aries.

[16] The same, in the year 1644 on September 30 at the ninth hour, observed Saturn more westerly by 5' than the star preceding [it] after the bend of the Three Fishes, and more northerly by $30''$.

CAPUT VII.

Observations: 2 of Tycho [Brahe], and 4 of the Fathers of the Society of Jesus at Oeniponte [Innsbruck], and 22 of the Marquis Cornelio Malvasia [Cornelio Malvasia], made at Modena [Mutina].

In the year 1582, on August 21 at hour 10, minute 2, Saturn was distant from the left shoulder of Aquarius $22^{\circ}29'$ — but at hour 10, minute 39, it was distant from the right shoulder of Aquarius $16^{\circ}5'$. At hour 11, minute $57\frac{1}{2}$ — or corrected, hour 12, minute $1\frac{1}{2}$ — it had a meridian altitude of $23^{\circ}23'$.

In the same year, on August 23 at hour 9, minute 57, Saturn was distant from the lower Horn [of Capricorn] $70^{\circ}39'36\frac{2}{3}''$; and at hour 10, minute $5\frac{1}{3}'$, [it was distant] from the left shoulder of Aquarius $22^{\circ}20'$.

Observations made at Oeniponte [Innsbruck] by members of our Society, and transmitted to me by Father Michael Staudacher of the Society of Jesus.

In the year 1636, on July 10, with Arcturus at an altitude of $39^{\circ}14'$ toward the west and Saturn at $18^{\circ}40'$ toward the east, Saturn itself was observed to be distant from the Head of Ophiuchus $41^{\circ}17\frac{1}{2}'$, and from the bright star of Aquila $32^{\circ}46\frac{3}{4}'$.

On the 13th of July, with Arcturus at an altitude of $44^{\circ}25'$ toward the west and Saturn at $16^{\circ}50'$ toward the east, Saturn was seen to be distant from the bright star of Aquila $32^{\circ}53\frac{1}{2}'$, and from the Heart of Scorpio $35^{\circ}39'$.

On the 23rd of July, with Aquila at an altitude of $17^{\circ}12'$ toward the east, Saturn was distant from the Head of Ophiuchus $40^{\circ}54\frac{4}{5}'$, and from the bright star of Aquila $33^{\circ}10'50''$.

Finally, on the 25th of July, with Aquila at an altitude of $34^{\circ}30'$ toward the east and Saturn at $18^{\circ}18'$, Saturn was observed to be distant from the Head of Ophiuchus $40^{\circ}51'50''$, and from the bright star of Aquila $33^{\circ}18'30''$.

Observations of the most illustrious Marquis Cornelio Malvasia, made at Modena.

These observations are extant in the *Ephemerides* of the same Marquis Cornelio, published at Modena in the year 1662, and most generously presented to me by the author himself, at fol. 187, where he states that he had observed for himself the altitude of the pole at Modena to be $44^{\circ}38'$ by the Pole Star — whereas when we observed it, we found it to be $44^{\circ}38'50''$ — and he supposes the longitude of Modena to be $34^{\circ}5'$, namely the one nearest to that which we determined in the *Geographia Reformata*, where we put it at $34^{\circ}6'30''$, as we have set down.

In the year 1662, the said Marquis, on May 30, around the second hour of [after?] noon, using a wooden sextant of six feet exhibiting individual minutes, and assisted by Don Geminiano Montanari [Geminiano Montanari], doctor of laws and a most skilled astronomer, observed Saturn to be distant from Spica $42^{\circ}17'$, and from the Heart of Scorpio $27^{\circ}46'$ — Saturn's altitude above the horizon being then $11^{\circ}57\frac{1}{2}'$. Antares [stood at] 10° , Spica at 35° , by which, ordered from Cassini's Table of Refractions (extant in the same volume, fol. 173), he found Saturn's refraction to be $3\frac{1}{2}'$, [that of] Antares $5^{\circ}42'$, [that of] Spica $1^{\circ}25'$. And whence proceed the corrected distances — of Saturn from Antares, $7^{\circ}43'$; and from Spica, $42^{\circ}16'45''$ — or in round numbers, just as before, $42^{\circ}17'$. Hence, taking the latitudes assumed from Tycho [Brahe] of Antares $4^{\circ}27'$ and of Spica $1^{\circ}59'$, and the difference of longitude of Spica in \square $19^{\circ}8'12''$, they collected by trigonometry the longitude of Saturn in \square $1^{\circ}13'8''$ and the northern latitude $2^{\circ}14'6''$. With Lansberge's calculation giving it as $4^{\circ}22'29''$, and this [Riccioli's?] as $2^{\circ}16'$.

By this method, both of observing and of calculating, he collects from the evening observations the longitudes, latitudes, and excesses written below, of Lansberge's Tables ascribed to them — using, however, the distances of Saturn from Spica, or from Antares, or from Arcturus.

Year		Observ		Lüsber	
1662.		ed		g.	Excess.
D. Jun.		Sig. G. ' "		G. ' "	' "
3	Long.	\square 0 57	0	1 6	9
	Lat.	Bor. 2		2 16	2

Year 1662.		Observ ed	Lüsber g.	Excess.
		13 40		
5	Long.	□ 0 48 40	0 58	9
	Lat.	B. 2 13 30	2 16½	3
6	Long.	□ 0 44 0	0 54	10
	Lat.	B. 2 13 30	2 15½	2
7	Long.	□ 0 38 0	0 50	11
	Lat.	B. 2 14 0	2 15½	1½
8	Long.	□ 0 36 0	0 45	9
	Lat.	B. 2 14 0	2 15	1
9	Long.	□ 0 31	0 42	11
	Lat.	B. 2 14	2 15	1
10	Long.	□ 0 27	0 38	11½
	Lat.	B. 2 14	2 14½	½
11	Long.	□ 0 22	0 33	11
	Lat.	B. 2 14	2 14½	½
12	Long.	□ 0 18	0 29½	11½
	Lat.	B. 2 11	2 14	2
14	Long.	□ 0 10½	0 23½	11
	Lat.	B. 2 12	2 14	2
15	Long.	□ 0 8	0 19	11
	Lat.	B. 2 11½	2 14	2½
16	Long.	□ 0 5	0 15	9½
	Lat.	B. 2 11½	2 13	1½
23	Long.	□ 29 37½	29 49½	12

Year		Observed	Lüsberg.	Excess.
1662.				
	Lat.	B. 2 11	2 13	2
24	Long.	□ 29 34	29 47	12½
	Lat.	B. 2 10	2 12	2
30	Long.	□ 29 30	29 42	12
	Lat.	B. 2 9½	2 11½	2
Jul. D.				
1	Long.	□ 29 15	29 27	12
	Lat.	B. 2 11	2 13	2

Parsing notes: This is a single longitude/latitude/excess table for Saturn through June–July 1662 (the left column-block of the page continues into the right column-block, which I have merged here in date order). The "Lüsberg." column = Lansberge's Tables. The dotted Saturn symbol (♄) heads the "Observed" and "Lüsberg." sub-columns. The June rows run 3–16, then jump to 23, 24, 30; "Jul. D." begins July 1. Some seconds-columns are blank as printed. Row 14 in June is given (no row 13 printed in this block).

Moreover, on the 3rd day of July, from Saturn's distance from Spica and from the northern Pan [of Libra] — or from the middle of the neck of Ophiuchus, corrected, and deduced from the Tyconic stars — the same Marquis derived Saturn's longitude in Scorpio as $29^{\circ}9'8\frac{3}{4}'$ and its northern latitude as $2^{\circ}7'46'$; for since by means of the optical tube [telescope] the silvery grate [reticule?] with which Saturn is described in the same volume, fol. 196, was seen together with a small star — a certain fixed star distant from Saturn's eastern limb by an imperceptible interval, and therefore Saturn's apparent semidiameter neglected — he established that the same place is that of the fixed star, and so that of Saturn. And by the distances of the following days he could define Saturn's place as more certain from that same prominent fixed star. Hence, on the 4th day in the evening Saturn was found distant from that fixed star $1^{\circ}35'$, as much as the whole tube would take in, $41\frac{1}{2}'$; and so [Saturn was] in Scorpio $29^{\circ}6'30''$. Therefore by a similar method he will exhibit to us Saturn's longitudes and latitudes written below, but [these are] selected by me [i.e. Riccioli].

	Observed		Lüsberg.		Excess.
Day	Sig. G.	'	G. '		'

		Observ ed	Lüsber g.	Excess.
July ʰ				
7	Long.	□ 28 59	29 13½	14½
	Lat.	Bor. 2 7	2 9	2
11	Long.	□ 28 50	29 4½	14½
	Lat.	B. 2 7	2 9	2
14	Long.	□ 28 43	28 58½	15½
	Lat.	B. 2 5	2 7	2
22	Long.	□ 28 28	28 47	19
	Lat.	B. 2 4	2 6	2
August.				
5	Long.	□ 28 24	28 45	21
	Lat.	B. 1 59	2 0½	1½

Parsing notes: Second longitude/latitude/excess table, for July–August 1662, headed "Day July ʰ". The "Excess." column shows the (growing) discrepancy of Lansberge's tables from observation.

This is a sample of the said observations, from which it is clear that Lansberge's tables at this time exceed the true place of Saturn by about 15 minutes; for we can establish here nothing more exact concerning the excess, the more so because the Illustrious Marquis Cornelio used the Tyconic stars, which require some small correction — as we showed in Book 4, [drawing] on Cassini's Refractions, about which we nevertheless raised some doubt, as indicated in Book 1, Chapter 1, [section] number 9.

But in the year 1663, the same most illustrious Marquis Pansano [Pansano?], from many days of observation and from distances taken with a very large sextant, with Saturn and Jupiter referred to the fixed stars, concludes that there was a Great Conjunction of Saturn, Jupiter, and Mars on October 16, at hour 7, minute 34, after midday, in Sagittarius $13^{\circ}2'46''$, and at northern latitude of Saturn $1^{\circ}16'$. We, however, [observed] it around that same time at 8 p.m. of the same day in $13^{\circ}3'$ [of Sagittarius]. ♃ at $6^{\circ}16'$. [Saturn ʰ and Jupiter ♃ then both in Sagittarius, at nearly the same latitude.]

CAPUT VIII.

Selected observations of Saturn, out of many, which Fathers Giovanni Battista Riccioli [Riccioli] and Francesco Maria Grimaldi [Grimaldi] carried out at Bologna in the College of St. Lucia, together with others helping from time to time, where there was need, fellow members of the Society of Jesus.

[1] In the year 1641, on the night following the 20th day of August, at the hour acquired from the fixed stars after midday $13^{\circ}59'$, Saturn's altitude above the western horizon was observed to be $13^{\circ}23'$.

[2] In the same year, on the 31st of August, the night following, at the hour after midnight $3^{\circ}25'37''$, Saturn's acronychal [acronychal] altitude above the horizon was seen to be $19^{\circ}35'$.

[3] In the same year, on October 14, the night following, [there was] a transit through the middle of the Heavens of Markab Pegasi [Markab of Pegasus], with Saturn numbered at perpendicular minute $8^{\circ}45'$; the meridian crossing [M.C.] of Saturn [followed], whose altitude was then seen to be $31^{\circ}6'$. It was estimated to be at hour after midday $10^{\circ}50'$, but the meridian [reading?] was incorrect.

[4] On the same day, of the same month, the night following, [there was] a transit of the star Fomahant [Fomalhaut], with Saturn's transit numbered; the lesser time was 4', [and] Saturn's meridian altitude was seen to be $34^{\circ}50'$.

[5] In the year 1642, on June 6, in the morning, with the altitude of the western bright star of Aquila toward the west $51^{\circ}15'$, the minutes of time being numbered up to Saturn's altitude of $25^{\circ}52'$ & $8'55''$; and on the 7th of June, in the morning, about one hour before sunrise, with the altitude of the bright star of Aquila toward the west obtained $52^{\circ}40'$, the minutes of time being numbered $3'22''$, by means of a perpendicular, immediately afterward Saturn's western altitude was captured at $22^{\circ}32'$.

[6] On June 16, 1642, in the morning, from the transit of Fomalhaut by the M.C. [meridian crossing], with Saturn's transit numbered along with it, the minutes were $6^{\circ}40'$ — after which Saturn's meridian altitude was observed to be $41^{\circ}57'$.

[7] In the same year, on September 13, the night following, Saturn's acronychal meridian altitude was seen to be $39^{\circ}59'$; after which, with Saturn's transit numbered, the perpendicular [reading] being $13'$ & for the seconds $45''$, the altitude of the bright star in the tail of Cetus was captured at $24^{\circ}56'$; and thence,

from the transit of the same star by the M.C. numbered, [the perpendicular reading was] 18'35".

[8] In the same year, on September 28, around the 3rd hour 5' of the night following, Saturn's distance from the bright star of Aries was captured by sextant at 19°34'30"; and the southerly Jaw [Mandibula] of Cetus, which is of the second magnitude, [was] at 43°46'.

[9] In the same year, on October 24, around the 2nd hour of the night, Saturn was seen to be distant from Fomalhaut 26°51'; and from the bright star in the tail of Cetus 20°2'; and likewise from Jupiter 10°31'.

[11] In the year 1643, on January 20, the night following, Saturn's altitude was seen [to be] from the west 31°23'; and its azimuth 39°40'; thence, the minutes having elapsed 4'40", the rising altitude of Aldebaran [was] 38°50'.

[12] In the year 1643, on June 28, in the morning, the western altitude of the bright star of Aquila was 46°2'; thence, the minutes of time being numbered, Saturn was nearest [to it]; Saturn's distance from the southern foot of Andromeda by sextant [was] 42°54'; thereafter, 4 minutes of time having elapsed, [Saturn] was distant from the bright star of Aries 28°1'30" — most exact.

[13] In the same year, on July 15, in the morning, the bright star's eastern altitude was 46°50'; the minutes having elapsed 32', Saturn's distance from the bright star of Aries by sextant was 27°43', & after 4 minutes of time it was distant from Aldebaran 35°7'; thence, 4 minutes of time having elapsed previously, & after another 4 minutes of time, it was distant from Jupiter, more easterly, by 15°50'.

[14] In the same year, on July 26, in the morning, with the altitude of the bright star of Aries captured at 59°10', perpendicular minute 6 having been numbered; afterward, Saturn's distance from the Sextans [Sextant constellation?] was captured at 27°43' from the same [star], thence after another 6 minutes of time it was seen distant from Aldebaran 56°58½'.

[15] In the same year, on July 30, in the morning, the rising altitude of the bright star of Aries having been taken at 58°27', & being distant 4 minutes [of time], Saturn was distant from the bright star of Aries 27°50'; & after 10 minutes of time it was distant from Aldebaran 57°2'; there was also then Saturn Retrograde, & nearest to the [quartile?] of the Sun.

[16] In the same year, on August 31, in the morning, with Aldebaran shining in the East at vertex 24°10'; after which, 10 minutes having been numbered, Saturn was distant from the same [star] 58°25'; thence after 2 minutes of time it was

distant from the Jaw of Cetus, the bright [star], $40^{\circ}2'$; but this was not verified, [being] therefore suspect; from which the sole [reliable] distance remained that of Aldebaran from Saturn in Aries $6^{\circ}12'$, [taken] nearest.

[17] In the year 1643, on September 27, the night following, Saturn was transiting by the M.C.; of which, the meridian altitude captured by double quadrant on both sides [was] $44^{\circ}48'$: of its rising altitude, however, the minutes being numbered $13^{\circ}47'$, there was observed the rising altitude of the bright star of Aries $62^{\circ}24'$.

[18] Item, in the year 1643, on December 22, under the second hour of the night following the fourth from sunset, [with] Saturn quartile to the Sun, [Saturn] near the head of Andromeda $29^{\circ}15'$, & [near] Markab Pegasi $25^{\circ}15'$.

[19] In the year 1644, on June 11, with the bright head of Aries' altitude seen at $20^{\circ}30'$, we obtain Saturn; but on the 13th [June], Saturn's distance seen from the bright star of Aries by sextant [was] $18^{\circ}53\frac{1}{2}'$; thence after 8 minutes of time Saturn's distance from the bright star of the belt of Andromeda was $29^{\circ}6\frac{1}{4}'$; and it was nearly Italic — & the refraction of the bright star [equal to that] of Aries, since Saturn was nearest to it; and so the distance scarcely needs correction.

[20] In the same year, and the same month, on the 9th day, there was observed Saturn's distance from the bright star of Aries $18^{\circ}54'$; & after 7 minutes of time-observed [there was] Saturn's distance from the bright foot of Andromeda $36^{\circ}9'$.

[21] In the year 1644, on July 11, the night following, at the Italic hour nearly sixth & a half, or with the bright star of Aquila toward the west at $60^{\circ}40'$, we observed Saturn distant from the bright star of Aries $17^{\circ}24\frac{1}{3}'$; & after 9 minutes [of time] it was distant from the bright foot of Andromeda $35^{\circ}13'$. The Sun itself at the rising of Andromeda's bright star was distant from the bright star of Aries $18^{\circ}48\frac{1}{3}'$; as often [as] observed at other times.

[22] In the same year, on the 22nd of July, in the morning at the civil hour 8, Saturn was seen distant from the bright star of Aries $17^{\circ}15'$; & [from] Aldebara [Aldebaran] $43^{\circ}56\frac{1}{3}'$.

[23] In the year 1644, on August 1, in the morning, with the bright star of Aries distant from the vertex $33^{\circ}15'$; prepared beforehand, the minutes [being] 2, Saturn was distant from Aldebaran $11^{\circ}1'$ — who [i.e. which observation] by another instrument's half-hour before was distant from Capella $60^{\circ}15'$.

[24] In the year 1644, on August 13, in the morning, in the most serene [sky], with Aldebara [Aldebaran] distant from the East toward the vertex $44^{\circ}53'$; Saturn was seen distant from Aldebara $44^{\circ}44'$; thence, distant Aldebara from the vertex

43°36'; Saturn distant from Aldebara 17°18' — hence soft, minimal distance from the preceding shoulder of Orion 56°4': but it was nearest to the quartile of the Sun.

[25] In the year 1644, on October 8, the night following, at the Italic hour 3, Saturn acronychal was likewise distant from the bright star of Aries 17°51', & at the southern foot of Andromeda 36°3'; & it was more westerly than both stars. But on the 9th [day], the Sun's meridian distance from the vertex was 29°8'40"; & on the night following the same day, at the civil hour 3½ Italic, Saturn

Saturn was distant from the bright star of Aries [Lucida Arietis = Hamal] by 19°54', and from the southern foot of Andromeda by 36°6'.

26. In the year 1644, on November 17, in the night following, I observed Saturn rising eastward, distant from the vertex by 63°56'; and 3 minutes farther Saturn was distant by 49°57'; afterward, Saturn was distant from the bright star of Aries [Hamal] by 3 minutes, and was 3 minutes distant from the [southern] foot of Andromeda.

27. In the year 1645, on July 26, in the morning, Saturn was distant from the bright star of Aries [Hamal] by 33°50' when reckoned at that time; 2 minutes after the observation Saturn was observed once, and again 2 minutes later it was distant from Capella by 48°16'½, and after 1 minute it was distant from Aldebaran by 30°59' — at which point it was nearest to its quadrature [□] with the Sun, whose distance from the Sun by the great quadrant was seen to be 25°19', but through the smaller quadrant 25°19'.

28. In the year 1646, on June 1, in the morning, after Saturn's conjunction [♄] with Mars, while the bright star of Aries [Hamal] was distant from the vertex by 61°36', Saturn was distant from Capella by 40°32'; while the bright star of Aries [Hamal] stood distant from the vertex by 62°46', Saturn stood distant from the bright star at Perseus's side [in latere Persei] by 14°31'.

29. In the year 1646, on August 10, with the bright star of Aries [Hamal] distant from the vertex toward the east by 39°40', Saturn was near its quadrature [□] with the Sun; it was distant from Capella by 18° precisely. And when the bright star of Aries [Hamal] stood distant from the vertex by 38°22', Saturn stood distant from Aldebaran by 17°26'; and Saturn itself was then at an altitude of about 31°.

30. In the year 1647, on February 2, in the night following, at the first civic hour 3¾, with the observations being most carefully repeated, Saturn was distant from

the bright star of Aries [Hamal] by $15^{\circ}3\frac{3}{4}$; but at the very minute of the observation it was distant from Aldebaran by $23^{\circ}27\frac{1}{2}$.

31. In the year 1647, on November 16, about the second hour of the morning, half an hour after sunset, Saturn was seen distant from Capella by $30^{\circ}48'$, and from the northern horn of Taurus [a cornu Boreali Tauri] by $10^{\circ}25\frac{1}{2}$, when the altitude of Saturn was $21^{\circ}50'$, and from the northern horn it was distant by $17^{\circ}16'$.

32. In the year 1647, on November 18, in the night following, at nearly the first Italian hour, Saturn, observed acronychal, was distant from Capella by $31^{\circ}7'$, and from the northern horn of Taurus its altitude was $26^{\circ}50'$; at the end of the observation Saturn's altitude was $24^{\circ}45'$, and Aldebaran was distant from the vertex toward the east by $55^{\circ}15'$.

33. In the year 1647, on November 25, in the following night, about the third Italian hour, we saw Saturn distant from Capella by $31^{\circ}17\frac{1}{2}$, and from the southern horn of Taurus [a cornu Austro Tauri] by $21^{\circ}16\frac{1}{2}$. These observations, to which this is subjoined, are 53 & 54, to be set down below.

34. In the year 1648, on December 2, with Saturn drawing near to the perigee of its epicycle [ad Perigeum Epicycli, accederet] and in opposition [\oslash] under the hour of the following night, Saturn was seen distant from Aldebaran toward the vertex by $40^{\circ}57'$. The observations made on that day, as is more often the case, gave Saturn distant from Aldebaran by $7^{\circ}40'$, and from Capella variously as the observations were repeated, by $24^{\circ}52\frac{1}{2}$.

35. In the year 1649, on July 27, in the morning, Saturn was at an altitude of 23° , distant from Capella by $25^{\circ}24\frac{1}{2}$, and from Aldebaran by $20^{\circ}56\frac{1}{2}$.

36. In the same year, on July 31, in the morning, Saturn was seen at an altitude of $27^{\circ}20'$, and then distant from Aldebaran by $21^{\circ}17'$, and from Capella by $25^{\circ}50\frac{1}{2}$.

37. In the year 1651, on that same day, January 1, about the third Italian hour, when Aldebaran was rising eastward, Saturn was distant from the vertex by $38^{\circ}56'$. Saturn itself was seen distant from Aldebaran by $39^{\circ}50'$, and from the northern shoulder of Orion [a lucido humero Orionis], or [Saturn] following, by $82^{\circ}57'$.

38. In the year 1652, on January 13, in the night following, at nearly the fourth Italian hour, namely when Orion's bright shoulder was rising eastward toward the vertex by $44^{\circ}35'$, Saturn was seen distant from the aforesaid shoulder of Orion by $34^{\circ}51'$, and soon afterward from Procyon by $16^{\circ}39\frac{1}{2}$; standing still

[stationary], Saturn was distant from Rigel by $51^{\circ}33'$; and then it was at an altitude of about 36° , and not far off by $48'$.

39. In the year 1652, on May 29, in the night following, at nearly the first hour after sunset, when Pollux's head [Pollucis caput] was at an altitude of $20^{\circ}55'$, Saturn was seen distant from the bright star of Leo [Lucida Leonis = Regulus] by $20^{\circ}12\frac{1}{2}'$, and from Regulus itself by $29^{\circ}27'$, when Saturn's altitude was $20^{\circ}33'$.

40. In the same year, on November 19, in the morning, about the thirteenth Italian hour, Saturn, retrograde and near Sirius [Canicula], or Procyon, was distant by $26^{\circ}57'$, and a little before sunrise the distance of Saturn from Procyon is to be set down at $38^{\circ}36'$.

from the heart of Leo [a corde Leonis = Regulus] by $12^{\circ}26'$, when Regulus itself was nearly on the meridian.

41. In the year 1653, on January 30, the opposition [oppositionem] with the Sun being already accomplished, but on account of clouds being difficult to observe, in the following night Procyon was distant from the vertex by $60^{\circ}40'$; Saturn was distant from the bright shoulder of Orion by $47^{\circ}34'$, and soon from Procyon by $24^{\circ}23\frac{3}{4}'$.

42. In the same year, on March 7, when in the following night the bright foot of Gemini [lucidus pes Geminorum] was culminating, we observed Saturn distant from Procyon by $22^{\circ}40'$, but from the shoulder following Orion by $45^{\circ}45'$.

43. Likewise in the year 1653, on April 27, in the night following, nearly an hour after sunset, we observed Saturn distant from the following star of the head of Gemini [a sequenti capite Geminorum] by $18^{\circ}30'$, and from the heart of Hydra [a corde Hydrae] by $28^{\circ}14'$.

44. Likewise in the year 1653, on December 6, in a very clear and very dry morning, Saturn stood distant from Procyon by $38^{\circ}47\frac{1}{2}'$, and from the southern head of Gemini [a Geminorum capite australiori] by $38^{\circ}2'$; and soon Saturn stood distant from the vertex by $37^{\circ}14'$, and 2 minutes afterward Regulus stood distant from the vertex by $38^{\circ}36'$. The azimuth of Saturn distant from the vertex by $37^{\circ}14'$ was observed toward the west, that is, $28^{\circ}51'40''$ toward the west. He sat [Sed]: on December 12, in the morning, at the first Italian hour $13\frac{1}{2}$, Saturn was seen distant from the vertex by $38^{\circ}34\frac{1}{2}'$, and from Procyon, but at the same time by $18^{\circ}23'$. Then by refractions the distance of Saturn from Procyon is to be set down at $38^{\circ}36'$.

45. In the year 1654, on February 1, under the first Italian hour of the night $2\frac{3}{4}$, Saturn was distant from Procyon by $35^{\circ}53'\frac{1}{2}$, and from the bright [star] of the Great Bear in the quadrilateral [ab Ursae maioris lucida quadrilateri], which shines in the haunch, or that nearest among the Seven Stars of the polar group [Septem Triones Stellae polaris], was distant by $49^{\circ}3'\frac{1}{2}$.

46. In the same year, on February 12, in the morning, about the $6\frac{3}{4}$ Italian hour of civic reckoning, Saturn crossed the meridian; and at that moment its meridian distance from the vertex was $29^{\circ}6'\frac{3}{4}$. From there, by perpendicular, we reckon $3\frac{3}{4}$ minutes; and Regulus by M. C. itself, with its meridian distance from the vertex, was $30^{\circ}51'$.

47. Likewise in the year 1654, on April 25, about the third hour after sunset, Saturn stood distant from Procyon by $32^{\circ}53'$; it was raised up by $19^{\circ}30'$, but from Pollux's head [a Pollucis capite] by $31^{\circ}13'\frac{1}{2}$.

48. Likewise in the year 1654, on April 29, about the third hour after sunset, when Procyon was high toward the west, distant from the vertex by $28^{\circ}20'$, Saturn was distant from it by $32^{\circ}56'$, but from Pollux by $31^{\circ}17'$.

49. In the year 1655, on May 8, in the evening after the high altitude of Procyon, near the opposition [\odot] by 4 minutes of time, then at once Saturn was seen distant from Procyon by $44^{\circ}52'$ at the eastern vertex, but from the following head of Gemini [a sequenti capite Geminorum] by $44^{\circ}25'\frac{1}{2}$.

50. In the year 1655, on May 27, at nearly the second hour after sunset, we observed Saturn distant from Regulus by $8^{\circ}22'$, but from the bright [star] of the mane of Leo [a lucida iubae Leonis] by $10^{\circ}56'$.

51. In the same year, on June 5, at the second hour after sunset, Saturn stood distant from Regulus by $8^{\circ}45'$, and from the bright [star] of the mane of Leo by $11^{\circ}14'\frac{1}{2}$.

52. Again, in the year 1655, on July 10, in the night following, Saturn in azimuth crossed by 6 degrees nearer toward the vertex by $74^{\circ}17'$. From there we reckon a diminution of $6^{\circ}50'$ of time; the distance of Saturn from Spica in azimuth from the vertex was 65° , and either way the star [Spica] was in the western region.

53. In the year 1656, on January 9, in the morning at the first Italian hour of civic reckoning $12\frac{1}{2}$, Saturn, retrograde, stood distant from Regulus by $17^{\circ}44'\frac{1}{2}$, and from the bright [star] of the mane of Leo [a lucida iubae Leoninae] by $28^{\circ}33'\frac{1}{2}$.

54. In the year 1656, on March 3, under the fourth hour of the following night, when Saturn was in opposition [\odot] with the Sun, tending [in motion], it stood distant from Regulus by $24^{\circ}49'$, and from the heart of Hydra by 8° .
55. Likewise [in the year 1656], on the same year, month, and day, on the 11th of the night following, at the first hour, we observed Saturn distant from Regulus by $24^{\circ}12'$; but from the heart of Hydra by $35^{\circ}57\frac{1}{2}'$, and at the same time it was then high, and Saturn was at about 36° .
56. In the year 1656, on May 30, in the evening, when the bright [star] of the tail of Leo [cauda Leonis = Denebola] stood distant from the vertex by $41^{\circ}23'$, and from whose azimuth, by means of the designated Filar [Filari] Triangle, Saturn was carried distant from the vertex by $52^{\circ}50\frac{1}{2}'$, and at its very approach we reckoned by perpendicular $2^{\circ}20'$. Regulus stood distant from the vertex by $62^{\circ}53\frac{1}{2}'$. But all these stars were at the setting [region], just as Saturn was.
57. Likewise in 1656, on July 13, half an hour after the setting of the Sun, with Saturn observed for us distant from the more eastern Spica than Saturn itself was, by $30^{\circ}48\frac{1}{2}'$; but from the bright [star] of the loins of Leo [a lucida lumborum Leonis], which was at the western [region], by $17^{\circ}4\frac{3}{4}'$.
58. In the year 1657, on March 22, in the night following, at the fourth Italian hour, Saturn, nearest to the opposition [\odot] of the Sun, stood distant from Regulus by $37^{\circ}4\frac{1}{2}'$, but from Arcturus by $32^{\circ}43'$.
59. In the same year, on June 24, in the night following, the distance of Spica from the vertex was $57^{\circ}22\frac{1}{2}'$; and after three minutes of time the distance of Saturn from the vertex was $54^{\circ}20'$, and at once Saturn stood distant from Spica by $20^{\circ}21'15''$.
60. In the year 1648 (which was noted above as to be added here), on February 21, at the first hour after sunset, Saturn stood distant from Aldebaran by $8^{\circ}54\frac{1}{2}'$, but from Rigel of Orion by $33^{\circ}1'$.
61. Likewise in the year 1648, on February 26, in the night following, about the first Italian hour $2\frac{3}{4}$, Saturn was distant from Aldebaran by $9^{\circ}39'$, but from Rigel by $32^{\circ}56'$.
62. In the year 1648, on October 22, in the morning at sunrise, we observed the distance of Saturn from the vertex, [Saturn] rising eastward by $80^{\circ}10'$, in altitude or azimuth; while on the night following, with Scheat of Pegasus placed in position, this very Scheat, or the bright [star] connected [conexendix] in the

quadrilateral of Pegasus, stood distant from the vertex by 39°2' toward the rising. But after we observed it, Saturn's altitude was taken, the distance from the heart of Hydra [cordis Hydrae] from the vertex acronychal by 55°47'. In the meantime we reckon by perpendicular 10°50'; and because Saturn was in opposition [♄] with Mars on that day, the calculation was believed [to be made]; and therefore the observation of Mars is to be consulted below at Caput 7.

63. In the year 1650, on the 16th day of February, [I add] to item 2. On March 1, we observed Saturn distant from three certain Fixed [Stars] very near, and at the same view of those very Fixed [Stars], whose Longitude is noted, with Saturn seen as stationary [Stationarius], thence Direct; and just so, as is held in Argoli's Ephemeris, and nearly Lansberg's [Lansbergii], so that the term of the station fell between February 21 & 22.

64. In the year 1657, on December 14, in the morning, Saturn was observed on the very meridian, distant from the vertex by 48°57'8". Thence we reckon by seconds of horary [time] 50"; and it crossed Spica by the same meridian.

[Italic display heading]

Other observations of Gassendi promised above at Caput 5, number 14.

Distances of ♄ from the Fixed [Stars] observed by the cross-staff [Radio].

Year [Anno] D.		G.	'
1633	6. March, in the morning, from Antares	8	24½
	to the topmost of the front of Scorpio [à suprema frontis Scorpij]	13	5½
1633	27. May, in the evening, from Antares	6	50
	to the topmost of the front of Scorpio	8	55
1634	April 13. in the morning, from	17	4¾

Year [Anno] D.	G.	'
		the heart of Scorpio [à corde Scorpij]
	23	14½
		to the topmost of the front of Scorpio
	14	46¾
		Junij 10. in the evening, hour 8 ½, from Antares
	20	2
		altitude gr. 14. & the topmost of the front of Scorpio
1635	36	18
		April. 14. in the morning, from Aquila [ab Aquila]
	28	30
		to the heart of Scorpio [à Corde Scorpij]
	38	27½
		Junij 22. in the evening, from Aquila
	31	21
		to the topmost of the front of Scorpio
	24	27
		Aug. 20. in the evening, from the knee of Ophiuchus [ab Ophiuchi genu sinist.]
	14	49
		from the right thigh of Ophiuchus [ab

Year [Anno] D.		G.	'
	Ophiuchi femore dextro]		
1636	May 1. in the morning, from Aquila	31	5½
	from the left shoulder of Sagittarius [ab humero sinistro Sagittarij]	7	45½
1638	July 24. in the morning, from Aquila	30	40
	from the mouth of Pegasus [ab ore Pegasi]	31	57

Parsing notes: The two value columns are headed "G." (degrees) and "I" (minutes); fraction-of-minute glyphs ($\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{4}$) transcribed as printed. The year cell spans two-line star-pair entries; rows are grouped by year as printed.

CAPUT IX.

The various Methods, twenty in number, are set out for observing the positions of Saturn and of the rest of the minor planets, so that judgment may be made from the observations and with certainty.

1. The first Method of all, in my judgment, is the most outstanding: it applies if the planet lies at the known Longitude of a Fixed Star, so that it can be viewed simultaneously and nearby through the telescope, and by ocular estimation, with the addition of a Capacity-of-Minutes [Capacitas Minutorum] which the Telescope comprehends — so that the Longitude and Latitude of the planet may be determined. For through the telescope, when the star is stripped of those rays which, whether from the atmosphere, or from the deception of the eyepieces, represent the stars to be as though closer and nearer than they really are. But this felicity is most rare. Yet we have some examples of it in the case of Saturn —

indeed at Caput 5, Observation 15, & at Caput 6, Observation 16. But in Jupiter [Jove] we have given ours, and the most illustrious example from the observation of D. Vincenzo Muti [Vincentii Muti], at Book 7 of the *Almagestum Novum* [Almagesti Novi], section 6, Caput 10, & in others below, where we shall give the individual planets.

2. The second Method, closer to the preceding, is observation made with the naked eyes, when a planet touches some Fixed Star, whose Longitude and Latitude is noted, or if it does not touch, yet is so near to it that the difference [intervening] can by ocular estimation be reckoned at the smallness of a few digits in breadth, by which the planet is distant from the Fixed Star, or in latitude. But take an Astronomical Digit [Astronomicum Digitum] — one in the heavens equivalent to $2\frac{1}{2}$ minutes; the first [primis], & to be reckoned [taxari] from these; this method here is liable to the deception of splendor, of which we spoke in the first method; whence it comes about that the planet & the Fixed Star appear nearer to each other than they themselves are.

Examples of such observations, besides those which we shall adduce concerning the other planets at their own places, in the case of Saturn we have above at Caput 1, observation 1; Caput 2, observation 1; Caput 5, observation 10; Caput 6, observation 14. I would not, however, in observation 1, Caput 1, [take] that whole difference, [computed] by Ptolemy's computation, & by Longomontanus, or by Bullialdus [Boulliau], our own; I attribute, [taking] the aforesaid deception, the greater part of the error, [drawn] from the place of the Fixed Star then according to diverse Tables, & so by other examples. Yet I would believe that this can be done in this way, [namely] that only by the radii [splendors] of the five stars, & perhaps somewhat more, the first observers wandered a little astray by [these] scruples.

3. The third Method, akin to the preceding, but by that much farther more deceptive, is the [observation] by conjunction [σ] of a planet with the Moon, [as it appears] to the eye especially when naked: for besides the peril of hallucination, from the splendor of either, [there is] the danger of the planet's approach, [and] the intricacies of Lunar Parallax [Parallaxium Lunarium] are incurred; thence comes the [observation] of a planet with the Moon, not [made] by conjunction indeed apparent, yet by very near [position], so that it may be estimated by the eye, by how much part of the Lunar diameter the planet is distant from the Moon's horns, or from its limbs [limbis].

Examples of such observations for Saturn I have indicated above at Caput 1, observation 6; Caput 2, observation 5; & Caput 5, observation 11 & 16.

4. The fourth Method, used by the Ancients [Prisci], was by means of Zodiacal Armillaries [Armillas Zodiacales], celestial circles Analogous to the Longitude & Latitude [of the heavens], or by Astrolabes equivalent to those, which Ptolemy describes [in] *Syntaxis* book 5, chapter 1, & Ignatius Dantes [Egnatio Dante] in his book on the Astrolabe. But such instruments Tycho [Brahe] deservedly set behind others, in his *Astronomiae Mechanica*, folio 19, where he describes these very Armillaries; but he confesses them liable to error by at least two minutes —

The Ancients, however, scarcely attained certainty by means of the Armillaries even to whole minutes. And so Walther [Vualtherus] himself, who employed them frequently, not rarely detected in them a defect of ten minutes, as is plain from observation 33, chapter 2, related above. See also what Tycho [Brahe] says against the Torquetum used by the Arabs, [in] the place cited by Tycho, & in Tome 1, *Progymnasmata*, page 141.

5. The fifth Method [is] carried out by means of the Equatorial Armillaries [Armillas Aequatorias], which Tycho substituted for the Zodiacal ones, and described [in] the *Astronomiae Mechanica*, folios 20, 22, & 23, & Tome 1, *Progymnasmata*, chapter 2, folio 141. For by these the Declination, & the Difference of Right Ascension [Differentia Ascensionis Rectae] between the planet & the noted Fixed Star are obtained to within one minute or another. But, with Tycho's leave, I judge them to err not rarely by four or five minutes, on account of the causes to be expounded in my *Liber Organicus*. Meanwhile let it suffice for argument that there is a difficulty in seeing the error in those very Quadrants, since the Sextants are much more simply constructed, & in use. Yet, even so [Esto], there is one [thing about them]: granted that they err by one minute or another in certain things, [yet] given the planet's Declination & Right Ascension [as] observed, to investigate its Longitude & Latitude — the obliquity of the Ecliptic [obliquitas Eclipticae] being supposed, or the Distance of the Poles of the Equator & of the Ecliptic [Distantia Polorum Aequatoris & Eclipticae] — how this may be carried out, we have taught at Book 10, *Almagestum Novum*, section 2, Problem 48, to 52, & in our *Primum Mobile*.

6. The sixth Method, more secure than the preceding, is accomplished by means of the Meridian Altitude of the planet [by] a great Quadrant; a Sextant being taken at the same moment by which the planet is at the meridian, [observe] some Fixed Star, whose Right Ascension precedes; then indeed from the Altitude of the Fixed Star culminating with the planet's Altitude, its Declination is made known, & the Right Ascension is the same as the [planet's], & as [that of] the Fixed Star on the meridian: by which the same is investigated; afterward the Longitude &

Latitude [are found] by the Problems above adduced. The moment when the Fixed Star crosses the meridian is most certainly observed by means of our Triangle [Triangulum], perpendicularly erected, the Fixed Star being seen entering somewhere into the same plane along the threads of the said Triangle that designate the meridian, as is held at Book 5, *Almagestum Novum*, Caput 15, Problem 8, where the description of the instrument [is given].

7. The seventh Method, akin to the preceding, if the moment by which the planet crosses the meridian is observed by means of the Filar [Triangle], at the same time; & at once let another take the meridian altitude of the planet; & a third assistant begins to reckon the time by oscillations of a pendulum [oscillationibus penduli], described by us at Book 2, *Almagestum Novum*, Caput 20: by which any Fixed Star crosses the meridian before the same planet, or if some Fixed Star observed crosses the meridian after the same planet, at once let the assistants take the planet's meridian altitude. For the time foreknown is converted into parts of Right Ascension, [either] subtracted or added, as the [star] precedes or follows in its crossing through mid-heaven; whence the planet's Right Ascension is investigated. But the planet's meridian altitude, compared with the Equator, will give its Declination: from which, by the Problems already indicated, its Longitude & Latitude [is] inquired. But how short the time-interval must be between the planet's crossing & the Fixed Star's [crossing], the less the peril of erring in just time, [and] how great the equivalent of the time in the *Primum Mobile* [the four seconds of time which one minute of the Equator import] — provided four seconds of time import one minute of the Equator.

Examples of this method's practice you have in our observations of chapter 8 related above, observation 3, 4, 8, 46, & 64: of which let it please [us] to weigh 64, when in the year 1657, on December 14, in the morning, Saturn's meridian distance from the vertex was captured at $48^{\circ}57'8''$; & thence Saturn's distance from Spica, by the same meridian, we reckoned at 50'; second by horary [reckoning], by which we deduced both Saturn's Declination & Right Ascension.

[Diagram-adjacent table of values — the geometrical determination of Saturn's meridian position]

	Gr.	'	"
Distance of h on the Meridian from the vertex [Distantia h	48	57	8

	Gr.	'	"
Meridiana à vertice]			
Therefore the Meridian Altitude of Saturn [Altitudo Meridiana Saturni]	41	2	52
The Altitude of the Equator in our Observatory [Altitudo Aequatoris in nostro Observ.]	45	29	50
Therefore the Southern Declination of ♄ [♄ Declinatio Australis]	4	26	58
The Right Ascension of Spica from us [Ascensio Recta Spicae tunc nobis]	196	48	50
The parts of the Equator [for] 50' of seconds [Secundorum 50'. partes Aequatoris]	0	12	30
Therefore the	196	36	6

Gr. ' "

Right
Ascension of
Saturn
[Ascensio
Recta Saturni]

Parsing notes: the right-hand value-block is set beside the geometrical figure (below); three columns Gr./'/" (degrees / minutes / seconds). The southern declination is derived as the difference of meridian altitude from the equator altitude.

The Longitude & Latitude of Saturn will thus be investigated by means of the adjoined Diagram, in which let the Equator be AB, &

Diagram. A spherical-astronomy construction circle for resolving Saturn's meridian observation into Longitude and Latitude. The figure shows a circle with several great-circle arcs intersecting — the Equator, the Ecliptic, the Solstitial Colure, and the Equinoctial Colure — with the celestial poles, Saturn's place, and the relevant spherical triangle marked. The lettered labels appear around and within the circle:

- P (top): the Boreal/North Pole of the Equator [Aequatoris Polus Borealis]
- K (upper, near top): a point on the circle (the colure / pole region)
- C (left side): the initial point of Cancer [initium Cancrī]
- ☊ (left, near C): the sign-symbol of Cancer, marking the Ecliptic point
- A (lower left): one end of the Equator AB
- B (right): the other end of the Equator AB
- Z (right-center, near B): the point Z on the Equator [Aequinoctialis... Z]
- ☉ (lower center, near the intersection): the initial point of Aries / the equinoctial point [punctâ... ☉]
- ♎ (near center): the point of Libra [& ♎]
- S (center-low): the place of Saturn [locus Saturni... in S]
- O (bottom): the point O (foot of the latitude arc, on the Equator)
- H (center): an interior point/intersection of the construction (near the triangle vertices)

The construction forms the spherical triangle PZS (and the sub-triangles PZS, with sides PZ, PS, ZS) used in the Logarithmic-Canon solution that follows. Two labels (H, K) are read with lower confidence — see report.

The Solstitial Colure [Colurus Solstitiorum] is APK, & the Ecliptic \square K, in which is the initial point of Cancer C, & of Capricorn K; the Equinoctial [Colure] [Aequinoctialis] moreover [has] its points marked with \square & with \square . Furthermore, the Boreal Pole of the Equator is P, & of the Ecliptic Z; the distance PZ, which is to us $23^{\circ}30'20''$. Because, indeed, from the Ephemeris it is foreknown that Saturn was then near the 16th degree of Libra with a Boreal latitude of about 2° & $4^{\circ}26'58''$ of observed Southern declination; therefore the place of Saturn is designated at S, to which the Arc PS — constant, [drawn] from the Quadrant PK & the Southern declination IS, for the whole Arc PS is $94^{\circ}26'58''$ — is led across from the World's Pole P by means of the circle of Declinations. The Arc PS is [drawn] from the Pole Z, & from the Southern declination of the Ecliptic; an Arc of the Quadrantal Ecliptic ZSO. For in the spherical Triangle PSZ, the sides PZ are given at $23^{\circ}30'20''$, & PS at $94^{\circ}26'58''$; & by these the comprised Angle SPZ at $73^{\circ}23'54''$, that is, the Right Ascension of Saturn. For it being $196^{\circ}36'6''$, subtract 90° from \square to \square — that is, the Equator's arc \square to \square — there will remain, from the initial point of Cancer to the terminus I of Saturn's Ascension, the Arc CI, & so the Angle API at $106^{\circ}36'6''$, & this subtracted from 180° leaves the Angle SPZ at $73^{\circ}23'54''$. From these three given sides — by the Canons of Logarithms of Spherical Triangles — the Angle SZ is obtained, or the basis SZ; & having subtracted the noted 90° there will be the Boreal Latitude of Saturn OS. Likewise we shall obtain the Angle PZS, which measures the Ecliptic arc CO, [reckoned] from the initial point of Cancer; whence the noted Longitude of Saturn [will be], which we have set down at $17^{\circ}0'8''$ of Libra & Boreal Latitude $2^{\circ}25'42''$. From which observation, as [it is] most exact, & on account of so very long a time intervening between the crossing of Saturn & of Spica, [it is] least liable to error: we conclude much more by far that the Lansberg [tables] are removed from the truth than the Tyconic, or Danish [tables]: for by these tables the Longitude & Latitude written below is given.

	h Latitu de [Latitu do]			Longit ude			
	Gr.	'	''	Sig.	Gr.	'	''
Danis h [Danic is]	2	22	36	\square [Libra]	16	55	30
Lansb	2	20	36	\square	16	14	25

	ħ Latitu de [Latitu do]			Longit ude			
erg [Lans bergia nis]				□	17	0	8
Ours from obser vation [Nobis ex Obser v.]	2	25	42	□	17	0	8

Parsing notes: Latitude in Gr./'", Longitude in Sig. (zodiac sign) / Gr. / ' / ". All three rows give the sign Libra (□). The Danish (Tychoic) and our observed values agree closely; Lansberg's Longitude differs by some 45'.

8. The eighth Method, more secure than the preceding, & less troublesome, [employing], as it were, one [observer], [observing] at the same moment by means of three observers, is [accomplished thus]: if at some moment the plane of the Filar Triangle set up on the Meridian aim [allabatur] at the planet's center, the observer of this crossing gives the signal to two other assistants who have already very nearly prepared the instruments —

and one observer notes the meridian altitude of the planet, while another notes the rising or setting altitude of a fixed star — so set up, however, that it stands a few degrees away from the meridian (yet beyond the limit of any appreciable refraction), and whose declination and right ascension are known. For from the planet's altitude, once the equatorial altitude has been subtracted, you will obtain its meridian declination: if the altitude is greater than that of the equator, the declination is southern; if smaller, the planet's declination is northern. As for the right ascension of the planet, you find it as follows.

In the adjacent diagram, let the planet B cross the meridian HVR, and let its altitude be AF, measured from the horizon HR. The arc of declination PD is then

given, since it is drawn from the world's pole P through F. Thus in the triangle FPV you are given the complement FP of the fixed star's declination, the complement VP of its quadrant of altitude, and the complement PR of the pole's altitude. With these three sides given, trigonometry yields the angle FPV — the distance of the fixed star from the meridian, measured along the equator. Add this to the star's right ascension and you obtain, if the star lies to the east, the right ascension of the mid-heaven [Medii Coeli], that is, the right ascension of whatever point is then culminating, or transiting the meridian. Then, from the planet's right ascension and declination, its longitude and latitude follow, as set out under Problem [in] Method 5. With that, one example of the preceding method is also given.

Diagram. A circle (the celestial sphere in projection) with the meridian as a vertical diameter from V at top through F and the center A to the horizon points H (left) and R (right). The world's pole P lies in the upper right between V and R; lines are drawn from P to F and from the center, with B placed near the upper right rim. The configuration realizes the spherical triangle FPV described in the text.

- V (top): zenith / top of the meridian
- P (upper right): world's pole
- B (upper right rim): the planet
- F (upper-middle, on the meridian): the fixed star's position used for the reduction
- A (center): center of the sphere
- H (left): horizon point
- R (right): horizon point

Method 9. The ninth method is in every respect carried out as in [Method] 8, except for the fixed star's altitude. In its place let the azimuth of the fixed star be observed by means of the other Filar Triangle whose plane is aimed at the center of the star — for, as in the preceding schema of the triangle, the angle FVP at the vertex will be given from the azimuth; thus, given the angle FVP, the side VP, and the side FP, as above, the angle FPV and the rest of the preceding method will be worked out.

Method 10. The tenth method. If the planet is positioned outside the meridian, and nonetheless its altitude is observed together with the apparent altitude of a fixed star at the very same instant — that is, the planet's azimuth either is of known magnitude or is not, provided only that, besides the pole's altitude, the

fixed star's declination and right ascension are at hand. Let this be in the third schema, with the meridian HVR, the horizon HAR, and a circle of the vertical [verticalis] Quadrant VA, in which let the planet appear at P and the fixed star at F, and let the arc of declination from the world's pole B be BP, BF. First, then, if the azimuth AH, that is, the angle AVH, is not of known magnitude, but is 180° its complement, the angle PVB will be given, together with the planetary altitudes AP, the complement BV, and the planetary altitude AP, the complement PV. In the triangle PVB the basis BP will be obtained by the Canons of Triangles, that is, the fixed star's declination; should there be no declination, none is subtracted; and you will have the planet's declination toward one or the other pole. If the planet's [arc] is conspicuous, then, the quadrant being subtracted, the planet's declination toward the other pole remains.

Diagram. A circle with the meridian as the vertical diameter V (top) to A (bottom), and the horizon H (left) — R (right) through the center. A vertical-circle arc carries the planet P and the fixed star B near the upper right; arcs are drawn from B and from V down toward F and P. This is the third schema realizing the spherical triangle PVB of Method 10.

- V (top): zenith
- B (upper right): world's pole
- P (upper-middle right): the planet on the vertical circle
- F (middle, below P): the fixed star
- A (bottom): nadir / foot of the meridian
- H (left): horizon point
- R (right): horizon point

Method 11. The eleventh method is as follows. When the planet's altitude has been observed at some determinate vertical [verticalis], you wait for the fixed star until it comes to the same vertical; meanwhile, by means of a plumb-line, the time in between is counted. Then, as soon as the fixed star reaches that vertical, its altitude is taken. Or, the other way round, the fixed star's altitude is taken first, and afterward the planet's, as it slides onto the same vertical; either way, the third quantity is noted. As to how this is put into practice, it has been set out under the preceding number.

First, then, if the azimuth PVB is known, in the triangle BVP you acquire — as in the first step of the preceding number — the side BP; the second step will then disclose the other [side], the planet's [side]; but if the azimuth is not known, in the triangle FVB, as I said, in the second step you obtain the side BP. Then, in the

triangle FBP, look for the angle FBP. The differences of right ascension, as I said in the preceding number's third step, and through that the right ascension of the planet, and there itself the matters to be corrected afterward through the time elapsed in the meantime, converted into parts of the equator. For the planet comes onto the vertical earlier than the fixed star; so the said time is to be subtracted; if later, it is to be added; and you will have the absolute right ascension, and thence, by the customary methods, the longitude and latitude.

You have examples of this observation above, at chapter 8, observations 56 and 62 — granted that in these there were employed two fixed stars in the same azimuth, to verify the azimuth's magnitude, and Saturn's declination, while another served for the time, and thence for gathering the right ascension; whence Method 12 takes shape.

Method 12. The twelfth method is carried out thus. With the plane of our Filar Triangle aimed at the center of the planet, take that planet's distance from the vertex; and, to verify its azimuth — if a star's distance from the vertex cannot be caught at the same moment in the same tract of sky — number the time until such a star's distance from the vertex can conveniently be taken. Once that is caught, the other star is awaited to see at what quadrant of the same vertical circle it arrives, on which the planet stood, and at what distance from the vertex. For if of both fixed stars the declination and right ascension are known, the right ascension of the prior star is obtained, and through these, by the customary method, the longitude and latitude. This — which is here designated by the meridian and horizon, as above — we shall teach by an example of our observations at chapter 61, briefly and more clearly.

In the year 1657, on October 22, the morning of the rising of the Sun, in the Eastern vertical at A V, the Sun was observed at altitude SV, at gr. 80. 10'; but corrected for refraction, the true [altitude] was gr. 80. 15'; for after a minute of time, that is, at gr. 50', it had earlier been gr. 80. 10'. — Since the Eastern star known to us beyond the little clouds and refractions did not present itself, we took Cor Hydrae [Cor Hydrae, Alphard] Y, at a distance from the...

vertex of VY, gr. 55. 47', together with this, and with the complement of the pole's altitude gr. 45. 29'. 50'', together with Cor Hydrae's southern declination gr. 7. 11' added to the quadrant; that is, with the arc BY gr. 97. 11'. Trigonometry then yielded the angle VBY, gr. 19. 18'. The following night, in the Eastern tract, Pegasi Scheat P [Scheat] came, and then, at its distance from the vertex PV, observed to be gr. 39. 2'. Together with the same arc, and with BV gr. 45. 29'. 50'', and the northern declination of Scheat, then being gr. 26. 14'. 40'', the complement BP gr.

63. 45. 20", we find the azimuthal angle BVP gr. 102. 31'. Then in the triangle BVS, with the aforesaid angle, which is the same with [the angle] BVS, that is, the angle BVS gr. 45. 29'. 50", and Saturn's distance BV gr. 80. 15'; by the Logarithmic Canons we find both the basis BS gr. 92. 16'. 55", and so Saturn's southern declination gr. 2. 16'. 55"; together with the angle SBV gr. 74. 18'; from which, subtracting the above-found angle VBY gr. 19. 18', there remains the angle YBS gr. 55. 0'; this is the difference of right ascension between Cor Hydrae and Saturn. But because the very instant at which Saturn's distance from the vertex was taken was not the moment at which Cor Hydrae's distance was taken — because by that hour Saturn had set deeper — therefore, that difference being diminished by gr. 2. 42'. 30", owing to the time interval of 10. 50', and so there remains a difference gr. 52. 17'. 30". But the right ascension of Cor Hydrae was then, by our right ascension gr. 137. 40', and Saturn more easterly; therefore Saturn's right ascension was gr. 189. 57'. 30", and the declination from what was said above, gr. 2. 16'. 55" southern. Therefore, by the Problem of the first Mobile, and the most subtle Logarithmic Canons of Vlacq, Saturn's longitude was Libra gr. 10. 2'. 56", and the northern latitude gr. 1. 51'. 32". Therefore, by this observation, the Lansbergian Tables depart, more than the Danish, as appears by the following little table.

From the Tables	h Longit ude —				h Lat. North		
	Sig.	Gr.	'	"	— Gr.	'	"
Danis h	□	11	32	12	2	14	0
Lansb ergian	□	11	7	30	2	9	20
As obser ved	□	10	2	56	1	51	32

I confess, nonetheless, that on account of some interval of time elapsed between Saturn and Hydra's observation — because the morning observation of Saturn could be given the plane of the Filar Triangle at the evening Scheat observation — there is something of doubt; and yet this observation may serve rather as an example of the problem than with any certainty of truth.

Method 13. The thirteenth method is, if, with a known determinate number, the Filar Triangle's degree is set; the planet's arrival is awaited, and at its arrival the same number of degrees may be taken; and at the same moment some certain

star's distance from the vertex is observed, or at least, while the number is being taken in between, the time intervening between both observations [is noted]. — This schema is made clear under chapter 52. And so, on July 10, the night following, in the Western azimuth precisely 90 degrees, with the Filar Triangle set, Saturn S, at a distance from the vertex...

VS, was gr. 74. 17'; but on account of refractions the truer was gr. 74. 19'. But afterward, at gr. 80' 50" of time, Spica Y, at a distance YV from the vertex, was gr. 66; precisely in the Western quadrant. First, then, in the triangle SBV, with the complement of the polar altitude BV gr. 45. 29'. 50", and Saturn's distance SV gr. 74. 19', and the complement of the azimuth SVB gr. 90; by trigonometry we obtain the basis BS gr. 79. 4'. 32"; whence Saturn's northern declination results, gr. 10. 55'. 28", and the angle SBV gr. 75. 21'. 34". Secondly, in the triangle YVB, with BV as above, and VY gr. 65, and the arc BY, which consists of the 90 degrees and the southern declination of Spica gr. 31'. 48"; the angle YBV gr. 0°. 39'. 59". 30" is deduced; subtracting the angle SBV, there remains the difference of right ascension of Spica and Saturn gr. 55. 22'. 4" — to be referred to the right ascension of Spica, but the more easterly; but since this difference is first to be augmented at the lesser time of gr. 1. 42'. 30", owing to the time elapsed between of gr. 6'. 50"; and so the corrected difference is gr. 57. 4'. 34". But Spica's right ascension by our Tables of Fixed [stars] is gr. 196. 47'; therefore Saturn's right ascension gr. 159. 42'. 26", and from what was said the northern declination gr. 10. 55'. 28"; whence is gathered the longitude \square 7. 9'. 40", and the northern latitude gr. 2. 10'. 40". We compare these with the Danish and the Lansbergian Tables.

From the Tables	h Longit ude —				h Lat. North		
	Sig.	Gr.	'	"	— Gr.	'	"
Danis h	\square	6	57	40	1	50	0
Lansb ergian	\square	6	37	25	1	38	0
As obser ved	\square	7	9	40	2	10	40

Method 14. The fourteenth method, somewhat more laborious than the preceding, requires four observers: one, who attends to the meridian, waiting for the centrum of the planet; another, who at that very moment catches the distance

of the planet from the vertex; the remaining two, who at the same moment catch the distances of the planet from a known fixed star — the declination, that is, and the right ascension. Once these are acquired, inspect the diagram in which is designated the horizon HR, and the meridian HVR; let the planet's [position] P be given, and the distance from the vertex PV; and from the azimuth the angle PVB in...

Diagram. A circle with the meridian as the vertical diameter V (top) to A (bottom) and the horizon H (left) — R (right) through the center. The pole-point B lies on the upper right rim; from B and from V arcs run inward to the planet P and a point Y near the upper middle, with S on the meridian above A. This is the schema for the worked reduction (Cor Hydrae Y, Scheat, Saturn S) realizing triangles BVY, BVS, and SBV.

- V (top): zenith
- B (upper right rim): world's pole
- Y (upper middle): Cor Hydrae [Alphard]
- P (middle right): the planet / Scheat position
- S (on meridian, above A): Saturn
- A (bottom): nadir
- H (left): horizon point
- R (right): horizon point

the triangle PVB, in which is given likewise the complement of the polar altitude BV. For trigonometry will not lie [as to] the side BP, indicating the planet's declination: that is, BP gr. 90, with no declination if it does not exceed 90; or it falls short, if the [altitude] exceeds the southern; if the [altitude] falls short, it will give the northern declination. Furthermore, let the fixed star be F, as it stood at O; with its certain distance from the vertex PF, or PO given, and from the declination of the known fixed star [side] BF, or BO, and the common [side] BP, as above, the term being found, by these three sides let the [angle] become known. The angle FBP, or PBO, namely, the difference between the right ascensions of the fixed star and of the planet. That difference of right ascension of the fixed star is to be added in the Eastern quadrant, if the star was at F, but [the planet] higher than the planet P; but to be subtracted if at O, on the contrary, in the Western quadrant, [the planet] is removed; if the star was at O, [the difference] is to be added; and you will have the planet's right ascension, with which, and the declination, as above, once acquired, you will gain, in the customary manner, the planet's longitude and latitude.

Diagram. A circle with the meridian as the vertical diameter V (top) to A (bottom) and the horizon H (left) — R (right). The pole-point B is on the upper right rim; from B and V arcs run inward to the planet P, with F and O on the lower-left interior arc (the two positions of the fixed star) and S nearby. This realizes the triangle PVB with the alternate fixed-star positions F and O of Method 14.

- V (top): zenith
- B (upper right rim): world's pole
- P (middle right): the planet
- F (lower-middle interior): the fixed star (first position)
- O (lower interior, below F): the fixed star (alternate position)
- A (bottom): nadir
- H (left): horizon point
- R (right): horizon point

Method 15. The fifteenth method, carried out by the distance of the planet from two fixed stars more to the east, or to the west...

[stars] more to the east or to the west, with the distance taken — of which fixed stars the longitude and latitude are known, and especially, if the mutual distance of the stars between themselves is noted. The example is from chapter 8, our observation 41. In the year 1653, on January 30, the night following the Opposition of Saturn with the Sun, we observed P. Grimaldi [Grimaldi], and I, the distance of Saturn from the right shoulder of Orion [Betelgeuse], or the following one, at gr. 47. 34'; and soon the distance from Procyon gr. 24. 23 $\frac{3}{4}$, the other being gr. 30; and both; the fixed star was more to the west of Saturn. Let this then stand for our observation. Figure this, in which, from the ecliptic EC, etc., with the southern Pole A, and the northern B, let there be drawn through Saturn's centrum S, the semicircle of latitude ASB, and through Orion's shoulder the semicircle AOB; and Procyon at P, from which let there be drawn to the Pole A the complement of latitude AP — for the southern latitude of Orion's shoulder is gr. 16. 6'. 13"; and Procyon's gr. 15. 57'. 10"; therefore AO gr. 73. 53'. 45", and AP gr. 74. 2'. 50". But the distance OP, between the fixed stars themselves, is by our frequent observations gr. 26. 2'. 50". Finally, from the fixed stars to Saturn let the arcs of distance to Saturn PS and OS be drawn. By these the distances are designated.

First, in the triangle OPS, with the three sides given OP gr. 26. 2'. 50" and OS gr. 47. 34', and PS gr. 24. 23 $\frac{3}{4}$, trigonometry yields the angle OPS, gr. 142. 21'. 40". Secondly, in the triangle OAP, with the three sides likewise given AP gr. 74. 2'. 50", and AO gr. 73. 53'. 45", and OP, as above, the angle OPA gr. 86. 5'. 20" is given;

which, with OPS, makes 228. 27'; and, this being subtracted from 360°, there remains the angle APS gr. 131. 33'. Then, in the same triangle APS, with the aforesaid degrees AP gr. 74. 2'. 50", and PS gr. 24. 23 ³/₄, and the angle ASP gr. 90. 58'. 20" — wherefore Saturn's northern latitude remains gr. 58. 20", and the basis AS gr. 90. 58'. 20"; and because Procyon's longitude was Cancri gr. 20. 59'. 45". If you add the difference of longitude PAS, since Saturn will be more to the east, Saturn's longitude was Leonis gr. 9. 6'. 55", and the northern latitude gr. 58'. 20". What [say] the Danish and the Lansbergian Tables? Of course, as in this little table.

From the Tables	h Longit ude —				h Lat. North		
	Sig.	Gr.	'	"	— Gr.	'	"
Danis h	□	9	25	10	0	45	10
Lansb ergian	□	9	2	30	0	37	15
As obser ved	□	9	6	55	0	58	20

Method 16. The sixteenth method is carried out by the captured distance of the planet from fixed stars of known longitude and latitude; of which one is the more to the east, the other the more to the west, especially if the distance between the fixed stars themselves is already foreknown, or [is known] from longitude and latitude complements; and the difference of longitudes is to be pre-investigated.

The example is from chapter 8, observation 58. In the year 1657, on March 22, the night following, when we saw Saturn's distance, P. Grimaldi and I, from Regulus gr. 37. 4'. 45"; thence the distance of the Fixed star often observed by us from Regulus gr. 59. 49', and the northern latitude of Regulus gr. 0. 26'. 20"; Arcturus truly gr. 31. 6'. 40". Let this then be congruent with this observation — the Schema this, in which let there be portion of the ecliptic EC, and the northern [Pole] B; describe the two quadrants of latitude, one being BE, through Regulus R; the other BC, through Arcturus A. But let Saturn be in S, through which let there be drawn the quadrant of latitude BO; the distances truly from AR, between Arcturus and Saturn; and RS between Regulus and Saturn.

First, then, in the triangle RSA, with the three sides given AR gr. 59. 49', and AS gr. 32. 43', and RS gr. 37. 4'. 45"; the angle RAS gr. 36. 39'. 20" is given by the Canons of Triangles. Secondly, in the triangle RBA, there are given likewise the other three sides AR gr. 59. 49', and BR, the complement of Regulus's latitude, which is AB gr. 53. 33'. 40", and AB, the complement of Arcturus's latitude, which is gr. 58. 59'. 20". Therefore by trigonometry the angle BAR gr. 109. 50' is given; which, with the angle RAS, makes the angle BAS gr. 146. 29'. 20". Thirdly, then, with this angle, in the same triangle BAS, and with the complement of AB gr. 58. 59'. 20", and AS gr. 32. 43', we find the basis BS gr. 87. 19'; whence Saturn's northern latitude gr. 2. 41'; and the angle ABS gr. 17. 22'. 45", which, subtracted from Arcturus's longitude, which then was gr. 19. 27'. 30", leaves Saturn's longitude in Libra gr. 2. 4'. 45". But the others as below.

From the Tables	h Longit ude —				h Lat. North		
	Sig.	Gr.	'	"	— Gr.	'	"
Danis h	□	2	40	10	2	40	35
Lansb ergian	□	2	18	20	1	34	0
As obser ved	□	2	41	0	2	41	0

Diagram. A near-circular spherical-triangle figure (a curved triangle inscribed in an arc) with the southern Pole A at the bottom and the northern Pole B at the upper right. From the ecliptic EC at the left, latitude semicircles run up to the poles through Orion's shoulder (O), Procyon (P), and Saturn (S), which sit in the interior; the curved sides AS, PS, OS, AP, AO realize the Method-15 reduction (triangles OPS, OAP, APS).

- B (upper right): northern Pole
- A (bottom): southern Pole
- E (left): ecliptic point
- C (left, near E): ecliptic point
- S (upper-middle interior): Saturn's centrum
- O (middle interior): Orion's shoulder [Betelgeuse]
- P (lower-middle interior): Procyon

- G (between S and O): intersection / auxiliary point

Diagram. A curved spherical triangle with the northern Pole B at the top and the southern Pole at the lower left; from the ecliptic side at left (E, with R below), latitude quadrants run to the pole through Regulus (R), Arcturus (A), and Saturn (S). The interior carries S and O with the curved sides AR, AS, RS, BR, BA, BS realizing the Method-16 reduction (triangles RSA, RBA, BAS).

- B (top): northern Pole
- A (upper-middle interior): Arcturus
- R (left): Regulus
- E (lower left): ecliptic point
- S (middle interior): Saturn
- O (lower interior, below S): auxiliary point on Saturn's latitude quadrant
- C (lower right): ecliptic point

Method 17. The seventeenth method is, if the planet's meridian altitude is taken, and it is observed [when it is] in a straight line with some known fixed stars; see Chapter 6, observation 15.

Method 18. The eighteenth method is, if it is observed in a straight line with two fixed stars; so that through these the planet's longitude can be estimated, as I have said is done in observation 3; or hence, in a straight line with two fixed stars; and that in another straight line with two other fixed stars: see those things which we said in Book 10 of the *Almagestum Novum* [Almagestum Novum], pages 563 and 564, problem 131; and Chapter 4.

Method 19. The nineteenth method suits only the planets that, in the daytime, are conspicuous with the Sun — whose number is Venus, and rarely Jupiter, when the Sun is too low, and on account of refractions implicit [in that]. For if at the same moment the altitude of each be taken — that is, of the Sun and of Venus — and this azimuth, or the distance from the Sun: from the Sun's declination, and right ascension, may be found Venus's [declination] too, the declination and right ascension, and thence the longitude and latitude.

Method 20. The twentieth method does not always serve to acquire the longitude and latitude of the planet, but only to render a judgment of the Stations, of Direct [motion], and of Retrograde [motion]; or whether one of three may exceed the Sun's opposition [oppositum]. For at the very middle moment of the night the planet transits the meridian — a sign that the planet is then opposite the Sun, and hence from the place of the Sun the place of the planet, [its] opposite, can be

discerned. And so on some days around the Stations, observe the planet's distance from the nearest fixed stars; easily it can be judged whether it has stood at the same longitude, or whether retrograde — but truly it has been made Direct from Stationary; even if it is not known where its own place is, in respect of the ecliptic. — So we, by observations made on the 16th of February, and the day of the 26th of March, by continuations through the Telescope, judged the Stations of Saturn to have been between the 21st and 22nd of February, and thence direct...

CAPVT X.

On the limits of certainty within which the positions of Saturn have been able to be represented up to now — or will be able to be represented hereafter — better through observations than through astronomical tables, and on the disagreement among those tables.

[De Limitibus Certitudinis, intra quos loca Saturni repraesentari potuerunt hactenus, aut poterunt in posterum tam per Observationes, quàm per Tabulas Astronomicas, earumque dissidio.]

1. It is certain that observations of the celestial phenomena are the foundation of the astronomical tables. Yet it is equally certain that one should not seek out just any observations, of whatever kind, but rather many of them, and exceptionally accurate ones. As regards Saturn in particular, [Tycho Brahe] has shrewdly noted, in the preface to his *Astronomical Tables* [*Progymnasmata*], that the observations of thirty, or at minimum twenty-four, years are required — and not only in every one of the [Greek: ἀκρόνυχος (akronychos, "acronychal" — at the planet's rising near sunset, i.e. near opposition)] positions, but also in the other intermediate positions, so that from the dispositions and motions, as thoroughly examined, the tables may be built up such that Ptolemy, the rest of the ancients, and Copernicus can be reconciled. For it is unjust to argue, as some do, that the ancient astronomers erred by so much from the heavens that Tycho judges their three acronychal observations of the superior planets each to be in error, and then on that basis convicts them of a hidden fault. That said without injury to the ancients — indeed, by the confession of those very men — was soon established.

2. For concerning Hipparchus there exist these words in Ptolemy, *Almagest* IX.2: "Which observations, on account of their difficulty, Hipparchus, that most truthful lover of truth, did not have available, because he did not possess accurate observations of the five planets; for he himself indeed undertook this task, as his own commentaries show — yet not so as to have collected the

planetary observations into better order than his predecessors, but to show that they do not agree with the phenomena, that is, with the hypotheses of those times." [*Almagest* IX.2] But with a few words interposed he adds in the same place: "Yet I demonstrate none of these things; rather, others up to this day have not advanced them." And so, since the disciplines that demand exquisite mathematics had not yet been brought to such a finish that he could accomplish what others did, it is no wonder if the outcome perished — as he himself seems to have foreseen.

[Margin: *Hipparchi lapsus*. — Hipparchus's lapse.]

3. Ptolemy himself professes the very same thing in *Almagest* IX.2, both in the difficulties just adduced and amid many others, in these words: "It is necessary that the man who is to accomplish great things, in considering each of the motions of the planets singly, and then in considerations taken together over individual periods, be able to observe that there is in his instruments the least possible error — or, if some does creep in, that it be such as cannot be perceived by the senses; that is, when posterior observations are made with the prior ones, and so on. For abuse arises whenever, on account of the very small magnitude of the things considered, and the long span of time, the predictions of the planets are rendered uncertain." But Ptolemy, with the same candor, confesses some abuse besides his own — that with circles fixed in the plane of the ecliptic (which is nothing without commodity, and the gratification of the hypothesis), things which proceed from mere congruence, and apart from the evidence of right-angled triangles, may, on account of obliquity, be neglected as though of no account. Finally he thinks that attention should be paid to the planetary oppositions taken from the place of the Sun itself, preferring Tycho's true place.

[Margin: *Ptolemaei excusatio circa Planetas minores*. — Ptolemy's excuse concerning the lesser planets.]

4. Albategnius [al-Battānī] too, as far as Ptolemy's business and that of the Alphonsines [*Alphonsini*] are concerned, almost certainly followed them — and there is no reason for us to say more, since once Heaven itself was plainly seen to depart openly from the truth. That great conjunction of Saturn and Mars, which Stöfler [*Stöfflerus*] had predicted from the Alphonsine tables would occur in the Year of the Lord 1536 in late May, on the 25th, in fact took place on the 20th, by Petrus Pitatus's observation; or on the 19th, by the observation of Julianus Ristorius of Prato, the preceptor of Junctinus [*Junctinus*], around hour 1 of the night, when Saturn was about a degree away from Mars. So too the conjunction of the year 1542 — which was about hour 5 of the following night, on the 9th of

January — was, by Junctinus's observation, conjoined with Mars for many days before the Alphonsine epoch [*abacum Alphonsinum*]. And in the year 1563, the conjunction of Saturn and Jupiter, observed by Junctinus at Auranges on the 24th of August at hour 14½ after noon, covered over his more Austral [southern] Jupiter near the end of the 28th degree of Cancer — yet the Alphonsine calculation made that conjunction distant by more than 4 minutes. On the 7th of September, by Leonitius's [observation], at degree 4¼, minute 12. Which was the cause that Regiomontanus, like the Alphonsines, afterward preferred the Prutenic canons. Yet Tycho criticizes both sets of canons in his *Mechanica*, folio 39, thus: "By either method of calculation we have most plainly detected errors that are intolerable: namely, that great conjunction of the year 1563, of which I spoke at the outset, and the motion of Saturn." And that place is satisfactory enough, if indeed it deceived the Alphonsine numbers by a whole month, while Copernicus differed by some few hours but little.

[Margin: *Alphonsinorum errores in Saturno superioribus*. — The Alphonsine errors with respect to Saturn, noted above.]

He says, moreover, that he himself observed at Leipzig in the completed year 1563 that conjunction near the end of Cancer and the beginning of Leo; and in his *Epistles*, page 56, and in the *Progymnasmata*, tome 1, page 648, he detects an error of about 2 degrees in the Alphonsines as to Saturn's place; not otherwise than Longomontanus, who in chapter 4 shows the same thing. (*Theoricorum* cap. 13.) He affirms that in the year 1591, on the 17th of March, by the old style, hour 7, minute 8 after the meridian of Uraniborg, he observed Saturn distant from Aldebaran by 19°11¼', and from Pollux by 25°54½'; with a north declination of 22°23'. From this is collected the place of Saturn underwritten below, compared with the Alphonsine and the Prutenic.

Saturn	Longitu de, ☉			Latitud e	
<i>An.</i>	Sig.	Gr.	'	Gr.	'
1591.					
<i>Mart.</i>					
17.					
Hora p. m. <i>observa ta</i>	☐	22	43	0	56½ Aust.
7½		25	7	0	56 A.

Saturn	Longitu de, ☉		Latitud e	
<i>Alphon sina</i>				
<i>Pruteni ca</i>	22	23	1	35 A.
<i>Danica</i>	22	45½		

Finally, Magini [*Maginus*] in his *Epistle to Richard FASTER* — which he gives in his *Directiones*, page 95 — says that the Alphonsine calculation errs in the lesser planets more than the Prutenic.

5. Copernicus, however, set up hypotheses which now and then, on the occasion of the Alphonsine motions, were excessively erratic — no wonder, since (as he himself frequently testifies) he relied, both for Ptolemy's and for his own ternary of acronychal observations, on the opposition with the Sun's mean place; and, as Joachim Rheticus testifies, he thought he had done well enough for himself if he was not at variance by 10 minutes, or one-sixth of a degree. He could not, by his own observations, drive his hypotheses to a closer place; nor would he depart a hair's breadth from the truth, as Rheticus confesses in the preface to the *Ephemerides*. Kepler, furthermore, in chapter 18 of his *Mysterium Cosmographicum*, says that Copernicus neglected the quadrants of the degrees, as if he were observing to the minute within the planets' motions; he speaks thus: "In things of this kind, I do not incur error, unless I have deliberately conceded it, in that I preferred imperfect astronomy to none. For such difficulties present themselves, while true things run contrary; which it is the part of a settled mind to preserve, and from knowledge of the constitution to aspire to the least loss — provided one dare, with Copernicus, that a man strong in spirit, ignorant and base, may flee, that the timid may despair, and that anyone may cast aside this care. Just as these recently published spherical figures, neither without sweat nor without shame, I confess. By the example of Ptolemy and the ancients, the difficulty of observing exactly is excused." Then, in the same *Mystery*, chapter 18: "Soon afterward, in the new style on the 12th of November, in the year 1594, Saturn placed itself exactly between the Hyades [*cervicem*] and the Heart of the Lion [Cor Leonis, Regulus], where by the Prutenic calculation it ought to have been on the 31st of October — a difference of nearly 37 minutes. Indeed, sometimes the small error of the Prutenic tables rose to 40 minutes." [*De Saturn.*]

[Margin: *Copernici errores in Planetis, & excusatio*. — Copernicus's errors in the planets, and his excuse.]

[folio 295]

He further notes, [Tycho Brahe], page 39 of his *Mechanica*: "Where Copernicus, regarding Saturn and Jupiter, says: 'His restitution in these two planets is not so much in accordance with the celestial norm as it digresses, especially as to Saturn, which never exceeds beyond a half-degree above the highest good.'" Of this Copernicus himself in the heavens admonishes that the calculation is to be amended.

6. Longomontanus, therefore, made use of Tycho's observations, so that he did not despise the Prutenic numbers, but retained them as emended. For he professes in *Theoricorum* cap. 2, that he constructed the Danish Tables of Saturn from the Prutenic, subtracting 20 minutes in the mean longitude of Saturn; in the apogee, however, adding 3 degrees; in the prosthaphaeresis of the eccentric, subtracting five-eighths everywhere; in part as much as one-fifth. So says the author of the book *Astronomicum* who inscribed it *Urania Propitia*, published in the year 1650, at Bicini [Beuthen] in Silesia, page 85. He asserts, with frequent, trustworthy, and diligent observations of Saturn — yet selected to the 29th in diverse eccentrics, and noting a change detected in the points — that the Danish and Lansbergian tables sin much more than the Rudolphine; that the Rudolphine, however, in the first change exceed Saturn's place by a semicircle, by $4\frac{1}{3}$ minutes.

[Margin: *Iudicium de Danicis, ac Rudolphinis circa Saturnum*. — A judgment on the Danish and Rudolphine tables with respect to Saturn.]

7. Kepler, nonetheless, thought there might lurk an error of not so many minutes in his tables; for in the *Explanation of the Fundamentals of the Ephemerides*, chapter 14, he speaks thus: "As much as concerns the difference of the superior planets, I do not readily promise; but if anyone has attended with the most exquisite instruments, the astronomers being practiced — or if they have lain in wait — let them be congratulated, even between those whose places among the fixed stars are clearer, and constituted by accurate calculation. But in the *Mysterium Cosmographicum*, chapter 19, I have said that Saturn most easily affords a cause of error in observation; yet an error, even a great one, in distance, of lesser opinion is engendered in the prosthaphaeresis." That is, the error in Saturn would be rarely indeed 34 minutes, not rarely 14, or 16 minutes; the Lansbergian, however, as Philolaic, 15 minutes; but 12 minutes, often less. Whence it follows that one does not know sometimes amid the disagreement between the observations and the tables to which of these the fault is rather to be ascribed — whether to the observations or to the tables; yet, although the magnitude is great, among accurate ones the disagreements are wont to be

reckoned slight, mostly within 5 minutes; though the lesser may satisfy. I do not doubt, however, that a great part of the discord proceeds either from the observations — especially if they were held to be antiquated, or the mode of observing chosen in observing more operations — and the suppositions, hardly free of scruple.

8. Let us now hear that most renowned astronomer, Sir Vincentius Mutus [Vincent Mut], who in the year 1654, among other observations then made by him from the Majorcan observations, in an epistle of date the 26th of May which he sent me, reckons up these nearly acronychal [places] of Saturn, which he attained on the 11th of February, and on the 15th of May at hour 9 after the meridian, by calculation added from the more celebrated tables.

[Margin: continued]

Anno
1654.
hor. 9.
p.
merid.
Saturni
Longitu
do per
D.

Mutum.	Sign.	Gr.	'	'
Die 11. Feb. <i>Observata cum lat.</i>	□	22	51	
<i>Bor.</i>	1	28		
Computata ex Tab.	<i>Lansberg.</i>	22	59	exc. 8
	<i>Danici</i>	23	18	exc. 27
	<i>Rudolph.</i>	23	11	exc. 24
	<i>Almagest.</i>	23	11	exc. 20

Anno
1654.
hor. 9.
p.
merid.
Saturni
Longitu
do per
D.

Mutum.	Sign.	Gr.	'	'
D. 15.	□	20	31	
hor. 9.				
p.				
Martij				
<i>Observ</i>				
<i>ata</i>				
	<i>Lansber</i>	20	46	exc. 15
	<i>g.</i>			
	<i>Danici</i>	20	57	exc. 26
Comput	<i>Rudolp</i>	20	50	exc. 19
ata ex	<i>h.</i>			
Tab.				
	<i>Almage</i>	20	45	exc. 14
	<i>st.</i>			

D. Mutus adds in the same epistle: "Not yet certain, but I almost dare to affirm, that the distances of the planets from the Earth have nothing in common with the diversity of their orbits, hitherto stable; nor [their] elongation from the world able to be deduced from the prosthaphaeresis of the orbits. A notable example I have observed these months in Venus, Mars, Saturn, and in the days passed in Jupiter. All of which, together with the observations, after the completed work I shall gladly communicate."

9. Boulliau [*Bullialdus*] — supreme and excellent in his endeavor to amend the Rudolphine in his *Astronomia Philolaica*, book 6, where in chapter 5 he reconciles those Tables with the most ancient observation of Saturn of the year of Nabonassar 519 — also, with the other observation of the year of Christ 503, recognizes that the motion is to be retracted; that it is Aphelion in antecedence by

degrees $48^{\circ}50'56''$ there. He puts the Aphelion here at degrees $46^{\circ}10'46''$; or [the motion is] to be promoted.

[*folio 296*]

It comes from the Rudolphine mean of $36'$. The Aphelion, moreover, from \square degrees $26'$ to be retracted, and to \square degrees 28 . From the observations, therefore, he collects [the place]; yet some minuteness of disagreement of $9'$ he gathers — in examining Saturn's observations of the year 1640, the Moon being unable to fall on the year of Christ 503. On the 21st of February, hour 4, while Saturn was occulted at Athens [Temporis Athenis occultare Saturnum], which truth of history he confirmed, observed by Tycho and Longomontanus, not to recede beyond $3'$, or 4 minutes; for the Vualtheri [Walther] observation, which Boulliau expends, on degree 5; and as one may collect the place of Saturn in \square at $0^{\circ}41'$. This place is suspected, inasmuch as it was made nudely [bare], and on account of the latitude in the Nebula of Cancer made. So too the Vualtherian observation of the year 1503, on the 21st of February, deduces the place of Saturn in \square at degree $6^{\circ}20'$. Philolaically, however, at degree $6^{\circ}12'51''$. The rest of the observations of Copernicus, Tycho, Longomontanus, and his own, which he confers with those Tables, do not add to it anything except a Philolaic semicircle to exceed in Saturn's place by 5 minutes, as will be evident from the Catalogue of the following chapter.

10. Hitherto it has been given to gather from the opinion of others, that we do not have observations sufficiently large, immune from every sensible error — or, by every human industry, divisible; nor what the antiquity of long ages itself can claim, or sextants attain to the grade scarcely. Nor are the Tables so exact but that some scruple of doubts may suffer; since, as the Rudolphine in Saturn were rarely indeed 34 minutes, not rarely 14, or 16; the Lansbergian, however, as Philolaic, 15, but 12, often less. Whence it follows that one does not know sometimes, amid the disagreement between the observations and the tables, to which of these the fault is rather to be ascribed — whether to the observations or to the tables — yet, although the magnitude is great, among accurate ones the disagreements customarily reputed slight, mostly within 5 minutes; though the lesser minute may satisfy. I do not doubt, however, that a great part of the discord proceeds either from the observations — especially if they were held antiquated, or the mode chosen in observing more operations — and the suppositions hardly free of scruple.

11. Among the Methods, then, reckoned up in chapter 9, the first grade of certainty those merit which require the Declination of a single fixed star alone, or

the Right Ascension and the planet's Altitude; for in these it can be effected by the astronomer practiced with apt instruments that the error not exceed 3', or 4 minutes — of which kind are Methods 1, 6, 8. To these are akin 2, 5, 7, 9, 10, 11, 12, 13, 15, 16; in which the five elements concur in determining the planet's place, so that thereby an error of 5', or 6', about a minute or so, may be feared. The Methods, however, 4, 14, and 17, are noxious by an error of 8', or 10 minutes; methods 3, and 18, of even 10' or 20 minutes. Therefore, in as much as astronomy advances, I reckon one cannot hope for better observations — nor Tables, which are settled in those three superior ones; certain, and evidently exclude doubt of the three scruples of error, and provide good things to be had above the great part [where] error is constituted within 5', or 6'; or some place of the planetary orbit not exceeding 10'. Let it be commodious, however, and that with the least everywhere the fault may labor. There remains, as in the following chapter, as in a mirror, to set forth the select observations of Saturn's places, and parallel to them the subjoined ones of the more celebrated Tables. From this it will appear that the observations agree with no tables — that they support no observations, that they refute none — so that scarcely will any discord, or for the cause of disagreement, ascribe the whole observation to the Tables, the whole, or some part.

[Margin: continued]

Diagram. A faint, partly inked grid of cells appears at the foot of the right column — the lightly printed skeleton of a numerical table (ruled columns and rows) with most cell-entries left blank or too faint to resolve. No headers or values are legibly inked. This appears to be a lightly impressed (under-inked) table frame rather than an informational figure; no labels are recoverable.

[*folio 296*]

CAPVT XI.

Select positions of Saturn from the preceding observations, and collated with the positions computed through the more celebrated Tables.

[*Loca Saturni selecta ex Observationibus praecedentibus, & collata cum locis per Tabulas celebriores computatis.*]

The characteristic abbreviations that follow indicate the Tables, namely: **Da.** the Danish; **La.** the Lansbergian; **No.** Our own [*Nostras*]; **Ph.** the Philolaic; and **Ru.** the Rudolphine. Before these are noted the observers of Saturn's positions. On the

left side, moreover, are indicated severally the aspects of Saturn with the Sun, exactly indeed where nothing is added; the nearer ones, however, where the letter **C** indicates *Circiter* ["approximately"].

Parsing notes (Caput XI table, both columns): This is a multi-page comparative catalogue of Saturn positions. Each block gives a date (*Ann. Mens. D. / H. p. m.* = Year, Month, Day / Hour after noon), an observer or aspect symbol (σ conjunction, \circ opposition), then for each Table-abbreviation the computed longitude in Sig. (sign), Gr. (degree), ' (minute), " (second), with a final *Differ.* (difference) column in ' and ". Sign-glyphs: \square Virgo, \square Libra, \square Sagittarius, \square Capricorn, \square Aquarius, \square Cancer, \square Aries, \square Leo, \square Gemini. Latitude rows (*Lat.*) carry a/A markers for direction. Some second-column degree cells are faint; flagged [?] where unresolved. Table continues onto the next folio (catchword "1585" at foot of right column points to the 1585 block continuing).

Left column (folio 296):

Ann. Mens. D. / H. p. m.	Obser v. & Tab.	h Loca — Sig.	Gr.	'	"	Differ. ' "	
229 ante Chr. / Mart. 1. H. 8.	<i>Prisci</i>	\square	9	30	0		
	<i>Logom</i>		9	3	0		
	<i>Bullial</i>		8	43	0		
	<i>Mihi</i>		8	51	0		
\circ C.	<i>Lat.</i>	a	2	55	0		
	<i>Tabb.</i>	\square	9	2	40	11	40
<i>Anni Christi</i>	<i>Ph.</i>		8	41	0	10	
	<i>No.</i>		8	42	50	12	50
127 Mart.	<i>Ptole m.</i>	\square	1	13	0		

Ann. Mens. D. / H. p. m.	Obser v. & Tab.	↳ Loca — Sig.	Gr.	'	"	Differ. ' "	
27 / Ho. 6							
	<i>La.</i>		1	5	0	8	
	<i>Ru.</i>		1	32	30	19	30
♂ media	<i>Ph.</i>		1	32	19	19	
	<i>No.</i>		1	25	24	12	24
133 Iunij 3 / H. 4	<i>Ptole m.</i>	□	9	40	0		
	<i>La.</i>		9	34	0	6	
	<i>Ru.</i>		9	52	30	12	30
	<i>Ph.</i>		9	39	0	1	0
	<i>No.</i>		9	39	29	0	31
136 Iulij 9 / H. 7	<i>Ptole m.</i>	□	14	14	0		
	<i>La.</i>		14	3	0	11	0
	<i>Ru.</i>		14	32	0	18	0
	<i>Ph.</i>		14	34	0	20	0
	<i>No.</i>		14	10	0	6	0
138 Dec. 22 / H. 8	<i>Ptole m.</i>	□	9	15	0		
	<i>Ru.</i>		9	17	0	2	0
	<i>Ru.</i>		10	1	6	46	6
	<i>Ph.</i>		10	5	0	50	0
	<i>No.</i>		10	30	0	15	0 [?]

Ann.	Mens.	Obser	h			Differ.	
D. / H.	v. &	Loca	Gr.	'	"	'	"
p. m.	Tab.	— Sig.					
503	<i>Athen.</i>	□	6	20	0		
Febr.							
21 / H.							
4							
	<i>La.</i>		6	45	0	25	
	<i>Ru.</i>		6	32	0	12	
	<i>Ph.</i>		6	12	0	8	
	<i>No.</i>		6	14	0	6	
1503	<i>Valthe</i>	□	15	30	0		
Dec.	<i>r.</i>						
11 / H.							
7							
	<i>La.</i>		14	6	0	84	0
	<i>Ru.</i>		14	41	20	48	40
♂ C.	<i>Ph.</i>		15	0	30	29	30
	<i>No.</i>		15	5	0	25	0
1514	<i>Coper</i>	□	25	13	0		
Febr.	<i>n.</i>						
23 / H.							
17							
	<i>La.</i>		25	4	0	9	0
	<i>Ru.</i>		25	4	15	8	45
	<i>Ph.</i>		25	1	4	11	56
	<i>No.</i>		25	3	0	10	0

Right column (folio 296):

Ann.	Mens.	Obser	h			Differ.	
D. / H.	v. &	Loca	Gr.	'	"	'	"
p. m.	Tab.	— Sig.					
1527	<i>Coper</i>	□	26	40	0		

Ann. Mens. D. / H. p. m.	Obser v. & Tab.	h Loca — Sig.	Gr.	'	"	Differ. ' "	
Oct. 10 / H. 18 24'	<i>n.</i>						
	<i>La.</i>		27	22	0	42	0
	<i>Ru.</i>		26	48	40	8	40
♂ media			27	4	40	24	40
	<i>No.</i>		26	59	0	19	0
1563 Aug. 24 / H. 14 30'	<i>Iuncti</i> <i>n.</i>	□	28				
	<i>La.</i>		28	29	0		
♂ h & ♂	<i>Ru.</i>		28	11	15		
1582 Aug. 21 / H. 2	<i>Tycho</i> <i>n.</i>	□	7	26	0		
	<i>Lat.</i>		2	2	a		
	<i>Pr.</i>	□	7	22	0	4	0
	<i>Da.</i>		7	22	0	4	0
	<i>Ru.</i>		7	28	0	2	0
	<i>Phi.</i>		7	23	0	3	0
	<i>No.</i>		7	25	0	1	0
1583 Sept. 7 / H. 12	<i>Tycho</i> <i>n.</i>	□	20	19	0		
	<i>Lat.</i>		2	2	a		
	<i>Pru.</i>		20	34	0	15	0
	<i>La.</i>		19	13	0	66	0

Ann.	Mens.	Obser	h				
D. / H.	v. &	Loca				Differ.	
p. m.	Tab.	— Sig.	Gr.	'	"	'	"
	<i>Rud.</i>		19	33	0	46	0
	<i>Phi.</i>		20	12	0	7	0
	<i>No.</i>		20	14	0	5	0
1583	<i>Tycho.</i>	□	19	50	0		
Sept.							
13 / H.							
1							
	<i>Pru.</i>		20	4	0	14	0
	<i>La.</i>	□	19	1	0	49	0
	<i>Da.</i>		19	48	0	2	0
♂	<i>Rud.</i>		19	10	0	40	0
	<i>Phi.</i>		19	48	0	2	0
	<i>No.</i>		19	49	0	1	0
1584	<i>Tycho</i>	□	2	34	0		
Sept.	<i>n.</i>						
25 / H.							
6 30'							
	<i>Lat.</i>		2	24	a		
	<i>Pru.</i>	□	2	44	0	10	0
	<i>La.</i>		1	26	0	68	0
	<i>Da.</i>		2	36	0	2	0
	<i>Rud.</i>		1	54	0	40	0
	<i>Phi.</i>		2	33	0	1	0
	<i>No.</i>		2	34	0	0	0
1585	<i>Tycho</i>	□	15	39	30		
Octob.	<i>n.</i>						
8 / H.							
19 30'							
	<i>Lat.</i>		2	48	a		
	<i>Pru.</i>	□	15	43	0	4	0

Ann.	Mens.	Obser	h	Differ.			
D. / H.	v. &	Loca	Gr.	'	"	'	"
p. m.	Tab.	— Sig.					
	<i>La.</i>		14	17	0	82	0
	<i>Da.</i>		15	39	0	0	30
	<i>Ru.</i>		15	12	0	47	0
	<i>Phi.</i>		15	38	20	1	0
	<i>No.</i>		15	36	27	2	0
1586	<i>Tycho</i>	□	29	2	0		
Oct. 22	<i>n.</i>						
/ H. 11	<i>Lat.</i>		2	46	a		
	<i>Pru.</i>	□	29	3	0	1	0
	<i>Da.</i>		29	14	0	11	0
	<i>Ru.</i>		28	18	0	44	0
	<i>Phi.</i>		29	4	0	2	0
	<i>No.</i>		29	4	0	2	0
1587	<i>Tycho.</i>	□	26	8	0		
Ianu.							
19 / H.							
9 45'	<i>Lat.</i>		2	28	a		
	<i>Pru.</i>	□	25	58	0	10	0
	<i>Ru.</i>		26	45	0	37	0
	<i>Ph.</i>		26	15	21	7	12
	<i>No.</i>		26	13	0	5	0
1587	<i>Tycho</i>	□	26	24	0		
Ianu.	<i>n.</i>						
25 / H.							
5 45'	<i>Pru.</i>		27	0	0	9 [?]	0
	<i>Ru.</i>		26	51	0	36	0
	<i>Ph.</i>		26	30	0	6	0

Ann.							
Mens.	Obser	h					
D. / H.	v. &	Loca				Differ.	
p. m.	Tab.	— Sig.	Gr.	'	"	'	"
	No.		26	28	0	4	0

Table continues onto the next folio (the 1585-onward observation blocks continue beyond this batch's pages).

Liber V — On Saturn

Caput XI (continued)

Selected positions of Saturn from the preceding observations, compared with the positions computed by the more celebrated Tables

The comparison table continues from the previous batch. In each block: the first row gives the date (year, month, day) and, beneath it, the hour and fraction of an hour of observation, together with the aspect symbol where shown; the Obs. & Tab. column names either the observer/observation source (Tycho, Lansberge, Longomontanus, Hortensius, Bullialdus [Boulliau], "Nobis" = ours/Riccioli, "Mutuus"/"Mutus") or the comparison Table being computed (Pru. = Prutenic, La. = Lansbergian, Da. = Danish [Tychonic via Longomontanus], Ru./Rud. = Rudolphine, Ph./Phi. = Philolaic [Boulliau], No. = Nobis/ours). The h Loca column gives Saturn's longitude (zodiac sign, degrees, minutes, seconds) and, where flagged, its latitude (Lat., with a = australis/south, B = borealis/north). The Differ. column gives the difference (minutes, seconds) of each Table's computed place from the observed (Tychonic or Nobis) place.

, left column

Year

—

Month

— Day	Obs. &					Differ.	Differ.
/ Hour	Tab.	Sign	°	'	"	'	"
1588	Tycho.	□ Tau	12	46	0		
Nov. 5							
/ H. 9 /							
♁							

Year

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Month

— Day
/ Hour

Obs. &
Tab.

Sign

°

'

"

Differ.
'

Differ.
"

	Pru.		12	42	0	4	
	Da.		12	46	0	0	0
	Ru.		12	44	0	2	0
	Ph.		12	52	49	6	49
	No.		12	45	43	0	17
1588	Tycho.	□ Tau	26	44	0		
Nov.							
18 / H.							
10							
10' / ∞							
	Pru.		26	39	0	5	
	Da.		26	45	0	1	
	Ru.		26	57	0	13	
	Phi.		26	45	48	1	48
	No.		26	45	46	1	46
1589	Tycho.	□ Gem	10	53	0		
Dec.							
2 / H.							
14 30'							
	Pru.		10	45	0	8	
	Da.		10	54	0	1	
	Ru.		10	50	0	3	
	Ph.		10	39	30	13	30
	No.		10	42		11	0
1589	Tycho.	□ Gem	25	10	0		
Dec.							
16 / H.							
20 30'							
	(Lat.)	Lat.	1	13	a		
	Pru.	□ Gem	25	2	0	8	

Year

—

Month

— Day / Hour	Obs. & Tab.	Sign	°	'	"	Differ. '	Differ. "
	Da.		25	8	0	2	
	Ru.		25	19	0	9	
	Ph.		25	10	40	0	40
	No.		25	10	50	0	50
1591 March 27 / H. 7 30'	Tycho.	□ Gem	22	43	0		
	(Lat.)	Lat.	0	56	a		
	Pru.	□ Gem	22	20	0	23	0
	Ru.		23	16	0	33	0
	Ph.		22	46	15	3	15
	No.		22	42	0	1	0
1591 Dec. 31 / H. 1 / ♂	Tycho	□ Can	9	24	30		
	Pru.		9	18	0	6	30
	Da.		9	23	0	1	30
	Ru.		9	35	0	10	30
	Ph.		9	26	50	2	50
	No.		9	26	30	2	30
1593 Jan. 8 / H. 11 30'	Tycho	□ Can	23	58	0		
	(Lat.)	Lat.	0	8	a		
	Pru.	□ Can	23	57	0	1	0
	Ru.		24	10	0	48	0

Year

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Month

— Day	Obs. &					Differ.	Differ.
/ Hour	Tab.	Sign	°	'	"	'	"
	Ph.		24	2	4	4	4
	No.		24	0	0	2	0
1593	Lansb.	□ Can	23	12	0		
Jan. 14							
/ H. 9							
	Pru.		23	26	0	14	0
	La.		23	12	0	0	0
	Ru.		22	39	0	33	0
	Ph.		23	31	34	19	34
	No.		23	30	0	18	0
1594	Tycho	□ Leo	7	45	0		
Jan. 24	n.						
/ H. 11							
	Pru.		7	50	0	5	0
	Ru.		7	49	0	4	0
	Ph.		7	51	50	6	50
	No.		7	50	0	5	0
1595	Tycho.	□ Leo	21	15	30		
Febr.							
9 / H.							
21							
	Pru.		21	26	0	10	30
	Da.		21	18	0	2	30
	Ru.		21	28	0	12	30
	Ph.		21	20	19	4	40
	No.		21	21	40	6	40

, right column

Year

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Month

— Day
/ Hour

Obs. &
Tab.

Sign

°

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Differ.

Differ.

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Year	Month	Day / Hour	Obs. & Tab.	Sign	°	'	"	Differ.	Differ.
								'	"
1595	Dec.	4 / H.	Byrgiu	□ Vir	7	57	30		
		17							
			Pru.		8	17	0	19	30
			Ru.		8	3	0	5	30
			Ph.		7	30	15	27	15
			No.		7	33	0	14	0
1596	Febr.	8 / H.	Tycho.	□ Vir	5	52	17		
		9							
			(Lat.)		1	56	B.	18	0
			Pru.	□ Vir	6	16	0	23	43
			Ru.		6	11	0	18	43
			Ph.		5	59	20	7	3
			No.		5	57	0	4	43
1596	May	15 / H.	Byrgiu	□ Vir	1	29	0		
		9							
			Pru.		1	15	0	14	0
			Ru.		1	40	0	11	0
			Ph.		1	27	30	1	30
			No.		1	28	0	1	0
1597	March	11 / H.	Tycho.	□ Vir	17	25	0		
		12							

Year	Obs. & Sign		° ' "			Differ. ' "	Differ. ' "
—	Tab.	Lat.	°	'	"	'	"
—	(Lat.)	Lat.	1	56	B.		
	Pru.	□ Vir	17	51	0	26	0
	Ru.		17	39	0	14	0
	Ph.		17	34	0	9	0
	No.		17	31	0	6	0
1599	Tycho.	□ Lib	13	37	⊙[?]		
March							
26 / H.							
12							
	(Lat.)	Lat.	2	50	B.	0	
	Pru.	□ Lib	14	13	0	36	0
	Ru.		13	45	0	8	0
	Ph.		13	39	30	2	30
	No.		13	38	0	1	0
1600	Tycho.	□ Lib	25	47	23		
April							
17 / H.							
12							
	Pru.		25	38	0	9	23
	Ru.		25	13	0	34	0
	Ph.		25	58	0	11	0
	No.		25	56	0	9	0
	1608	Longo	□ Sag	26	53	0	
July	m.						
19 / H.							
3 / ♂							
	Pru.		27	28	0	35	0
	Da.		26	57	0	4	
	Ru.		26	44	0	9	

Year

—

Month

— Day / Hour	Obs. & Tab.	Sign	°	'	"	Differ. '	Differ. "
	Ph.		26	55	40	2	40
	No.		26	55	9	2	9
1609 July 31 / H. 13 / \circ	Longo m.	□ Cap	8	31	0		
	Pru.		8	53	0	22	0
	Da.		8	31	0	0	0
	Ru.		8	33	0	2	0
	Ph.		8	29	0	2	0
	No.		8	30	0	1	0
1610 Aug. 12 / H. 22 30'	Longo m.	□ Aqu	20	10	0		
	Pru.		20	36	0	26	
	Da.		20	14	0	4	
	Ph.		20	13	0	3	
	No.		20	12	0	2	
1611 Aug. 25 / H. 16	Longo m.	□ Pis	2	12	0		
	Pru.		2	30	0	18	0
	Da.		2	13	0	1	0
	Ru.		2	19	0	7	0
	Ph.		2	13	15	1	15
	No.		2	12	45	0	45
1628 July	Hortes .	□ Lib	4	57	3		

Year

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Month

— Day

/ Hour

Obs. &

Tab.

Sign

°

'

"

Differ.

'

Differ.

"

3 / H.

12

Pru.

4

59

0

1

47

La.

5

4

0

6

47

Ph.

5

6

0

8

47

No.

5

4

0

1

6

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Year

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Month

— Day

/ Hour

Obs. &

Tab.

Sign

°

'

"

Differ.

'

Differ.

"

1640

Oct. 12

/ H. 8

10'

(Lat.)

Lat.

1

35

a

Pru.

□ Aqu

24

1

0

5

20

Ru.

24

5

0

9

20

Ph.

24

0

0

4

20

(Lat.)

Lat.

1

37

0

2

No.

□ Aqu

23

59

0

3

20

1642

Sept.

13 / H.

12 / ♂

2

Pru.

21

47

0

11

La.

21

23

0

13

Year

—

Month

— Day
/ Hour

Obs. &
Tab.

Sign

°

'

"

Differ.
'

Differ.
"

Da. 21 48 0 13

Ru. 21 53 0 12

Ph. 21 44 0 17

No. 21 36 15 80[?]

1643

Nos. □ Ari 7 30 0

June

27 / H.

17 / □

ㄷ

Pru. 7 44 0 14

La. 7 0 0 30

Da. 7 24 0 6

Ru. 7 35 0 5

Ph. 7 29 0 1

No. 7 29 0 1

1643

Nos. □ Ari 7 40 0

July

29 / H.

17 / △

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	Pru.		6	35	0	13	0
	La.		6	0	0	22	0
	Da.		6	31	0	9	0
	Ru.		6	33		1	0
	Ph.		6	26	0	4	0
	No.		6	24	30	2	30
1644	Nos.	□ Ari	18	16	0		
June 5							
/ H. 15							
	Pru.		18	28	0	12	0
	La.		17	55	0	21	0
	Da.		18	20	0	4	0
	Ru.		18	25	0	9	0
	Ph.		18	35	0	19	0
	No.		18	32	0	16	0
1644	Nos.	□ Ari	18	36	0		
June 8							
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	Pru.		18	44	0	8	0
	La.		18	10	0	26	0
	Da.		18	35	0	1	0
	Ru.		18	40	0	4	0
	Ph.		18	50	0	14	0
	No.		18	47	0	11	0
1644	Nos.	□ Ari	17	45	0		
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	Pru.		17	34	0	11	0

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	La.		17	17	0	28	0
	Da.		17	46	0	1	0
	Ru.		17	37	0	8	0
	Ph.		17	39	10	6	0
	No.		17	39	55	6	0
1646	Nos.	□ Tau	14	14	0		
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	Pru.		14	20	0	6	0
	La.		13	57	0	17	0
	Da.		14	21	0	7	0
	Ru.		14	23	0	9	0
	Ph.		14	23	0	9	0
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1647	Nos.	□ Tau	11	30	0		
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	Pru.		11	13	0	17	0
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	Ph.		11	40	0	10	0
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1647	Nos.	□ Tau	28	24	0		
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	Pru.		28	14	0	10	0
	La.		28	30	0	6	0
	Da.		28	48	0	24	0
	Ru.		28	52	0	18	0
	Ph.		28	41	30	16	30
	No.		28	41	50	16	50
1648	Nos.	□ Tau	26	10	0		
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	Pru.		25	36	0	34	0
	La.		26	8	0	2	0
	Da.		26	13		3	0
	Ru.		26	16	0	6	0
	Ph.		26	17	0	7	0
	No.		26	16	30	6	30
1649	Nos.	□ Gem	25	38	0		
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	Pru.		26	0	0	22	0

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	La.		25	46	0	8	0
	Da.		26	7	0	29	0
	Ru.		25	42	0	4	0
	Ph.		25	41	30	3	30
	No.		25	41	27	3	27
1650	Mutus	□ Gem	25	19	0		
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	Pru.	□ Gem	25	11	0	8	0
	La.		25	21	0	2	0
	Da.		25	35	0	16	0
	Ru.		25	36	0	17	0
	Ph.		25	51	0	12[?]	0
	No.		25	29		10	0
1650	Mutus	□ Gem	23	57	0		
Jan. 28	.						
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	La.		24	7	0	10	0
	Da.		24	13	0	16	0
	Ru.		24	15	0	18	0
	Ph.		24	9	0	25	0
	No.		24	7	0	10	0
1650	Mutus	□ Gem	23	32	0		
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	Rud.		25	6	0	13	0
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1650	Mutus	□ Gem	26	5	0		
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	La.		26	9	0	4	0
	Da.		26	23	0	18	0
	Ru.		26	19	0	14	0
	Phi.		26	13	0	8	0
	No.		26	11	30	5	30
1650	Mutus	□ Gem	27	24	0		
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	Pru.		27	1	0	23	0
	La.		27	27	0	3	0
	Da.		27	44	0	20	0
	Ru.		27	39	0	15	0
	Phi.		27	33	0	9	0
	No.		27	31	25	7	35
1650	Mutus	□ Gem	28	30	0		
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[Margin: Tabularum recensio]

COROLLARIUM [Corollary]

From the preceding Table the following conclusion may be drawn. There exists no set of Canons of the more celebrated astronomers that the observations do not support in some cases, nor any that they do not contradict in others — depending on how the figures fall. Even so, more of the observations stand in favor of Our Tables [Boulliau/Riccioli "Nobis"]; next come the Philolaic [Boulliau], to which the Rudolphine [Kepler] and the Danish [Tychonic, via Longomontanus] come closest; and in third rank fall the Lansbergian and the Prutenic. To make plain by an actual count the number of times — and the cases — in which each set of Tables satisfies the observations within 5' or within 10', the figures are set out in the little table inscribed below.

The Tables that
satisfy the

observations of
Saturn

Within 5' (number of
times)

Within 10' (number
of times)

Prutenic
[Prutenicae]

12

21

Lansbergian
[Lansbergianae]

12

25

Danish [Danicae]

17

21

Rudolphine
[Rudolphinae]

8

21

Philolaic
[Philolaicae]

25

54

Ours [Nostrae]

32

58

This always allowing for a more accurate computation, in case some error has crept in here through us, as men are liable to do.

Liber V — De Saturno (continued)

CAPVT XII.

On the Hypothesis and Theory of the Motions of the Five Minor Planets — geometric as well as arithmetic — and, in particular, on Saturn.

In which is shown the progress Astronomy has made in this matter, and the deficiency still latent in it.

On this first occasion offered by Saturn, I shall here take up in common those points that are shared with the remaining four lesser planets, prefacing some Suppositions.

I. Supposition.

[Margin: The seven kinds of motion.]

In the five minor planets, seven kinds of motion have been observed up to now. (1) The first is the daily revolution from the same meridian back to the same one over a span of about 24 hours; this is called the **First Motion**, or **Common Motion**, from east toward west. (2) The second is the planet's own motion [*Motus Proprius*], or **Secondary Motion**, from west toward east, by which the planets seem to move contrary to the motion of the *primum mobile*. (3) The third is the motion of declination from the equator [*Motus Declinationis ab Aequatore*], inasmuch as it is performed not about the poles of the equator but about the poles of the ecliptic, the axis of which is described about the poles of the Zodiac. (4) The fourth is the motion of latitude [*Motus Latitudinis*], because the proper orbit of these planets is inclined to the plane of the ecliptic, and so cuts it in two nodes, beyond which it is established that they deviate in latitude from the ecliptic. (5) The fifth is the motion of altitude [*Motus Altitudinis*], by which at certain times they recede higher from the Sun and from the Earth more rapidly and more strongly, until, at the greatest distance, they stand at apogee [*Apsides*], or rather at the apogees [*Apogei*]; and thence, gradually descending, they approach the Earth and the Sun more rapidly and more strongly, until at the least distance they pass out at the perigees [*Perigei*]. (6) The sixth is the motion of the perigee [*Motus Perigaeus*] about its own bodily center [*centrum corporis*]. (7) The seventh is the motion of libration [*Motus Librationis*], which has only recently been detected by the telescope and is not yet sufficiently confirmed.

The remaining differences of motion do not constitute distinct kinds, but are diverse affections of the same motion, considered as to quantity and anomaly.

For it is in this respect that the planets are said to be **direct**, **stationary**, or **retrograde**; or, by a twofold anomaly, are moved by one — which they call the **first inequality** or **eccentric** [*Primam inaequalitatem, seu Excentricam*] — and bound up with another, which some call the **second inequality** or **epicycle** [*Secundam inaequalitatem, seu Epicyclum*], and others the **commutation** [*Commutationis*]. And the first inequality alone shows itself [*exhibens*] in the line of the apsides, passing through the centers of the Sun and of the Earth; for it happens that the true conjunctions and oppositions of the planets with the Sun, and likewise their true [oppositions] under the same point of the ecliptic or of the Zodiac, appear — whether from the Earth or whether viewed from the Sun. Beyond these cases, the second inequality intervenes, however diverse the position of the highest heaven [*coeli supremi*] under which the planets are viewed from the Sun.

II. Supposition.

[Margin: Fluidity of the heaven — a Planetary [hypothesis] [*Fluiditas Coeli Planetarij*].]

To explain the aforesaid motions of the bodies of the heavenly orbs, the solidity of the heavens — taken as the multiplicity of the orbs, as the ancients held, whether absolutely or as a merely bare hypothesis — is asserted, and is by Us (Almag. Nov. sect. 2.) refuted as not only contrary to fact, but, if not on self-evident grounds, then at least on grounds in the highest degree probable, and is more commonly rejected after Copernicus by the recent astronomers, as we have shown at length (Almag. Nov. sect. 1, cap. 2, qu. 2).

and more fully, sect. 2, cap. 7, in speaking of the heavens proper to the planets. For that the sphere of the fixed stars is solid is held more probably, and perhaps above this is granted yet another sphere — that of the *primum mobile*, by whose daily snatching-round [*raptu*] the whole sphere of the fixed stars, together with these [planetary heavens], is daily carried about: unless these motions be everywhere performed throughout the bodily mass of the fixed stars and planets, by the sole intelligences, namely of the Angels, driving them on.

III. Supposition.

Although nothing has been indicated by the Suppositions set out — neither concerning the [first] motion, nor concerning any celestial phenomenon — that could not be saved without manifest error, mathematically and absolutely, or [taken] explicitly — whether the **First Motion**, or **Common Motion**, be attributed to the stars themselves, or to the Earth — yet, when these things are examined by

physical experiments and by mathematical rules, it is physico-mathematically evident that the Earth is not moved with the daily motion, much less with the yearly motion; both parts of this proposition we have shown, with the whole effort of our talent and with as great an erudition gathered from every quarter as was possible, at length (Almag. Nov. sect. 3, cap. 3 & 4). For the present, however, it suffices the Reader that the last chapter of Book 1 of this volume be read attentively and without prejudice, which we most earnestly beg.

[Margin: 4]

These things being supposed, we shall now set out how far, and in what direction, Astronomy has advanced up to now. First, Astronomy, profiting beyond what it had hitherto attained, learned this line: that the line of the apsides passes through the centers of the Sun and of the Earth at the same time; and that consequently the planets are not driven about unequally [*inaequaliter*] from the centers of the Sun and of the Earth — as the old Astronomy supposed — but in truth, together with the Sun, exhibit oppositions and conjunctions, and the orbits of the planets, free from so many librations toward the poles; that with a simpler inclination to the ecliptic they display the varieties of latitude; but that all the aforesaid motions are performed freely in a fluid aether [*fluida aura Aetheris*], without that farrago of solid orbs which they had excogitated.

[Margin: 5]

Next it [Astronomy] profited in this: that, although it sub-detected that inequality which appears in the motion of the planets — not the whole Optical [inequality], nor merely the Apparent one, but real, since it is not the center of the Planetary Motion that is regarded — yet, as though [the planets] were regarded from their own proper orbit about a certain center, and were moved equably, uniformly, and self-consistently: which indeed agrees with those celestial bodies, as being nearly divine, as the Ethnics [pagans] used to say; so persuaded were the Astronomers, even down to Longomontanus inclusively, that they included it as an axiom: **that the celestial motions are equable**. And therefore, by some and by other Eccentric Circles, Epicycles, etc., they tried to explain the diverse motions of the planets — by which causes the motion that has its centers equable would seem to us on Earth to be unequal, just as we have explained, in agreement, by figures (Almag. Nov. sect. 2, cap. 2 & 3).

[Margin: But Kepler [was] the first of all.]

But Kepler was the first of all who observed that inequality to be partly **Optical** — as it appears to us Earth-dwellers — and partly **Physical** and **Real**: for in the orbit

of the planet there are two centers, of which at one is the center of the Earth, at the other the center of the planet's own orbit; about which center the planet is moved really unequally. For if the planet be supposed to be moved equably about the center of its orbit, and about the whole eccentricity — that is, by however much the orbit's center is distant from the Earth's center — then, from the base of the triangle measuring the angle of prosthaphaeresis, the **mean motion**, or **equable** [motion], can never be reduced to the **true** [motion], unless the line ascribed [to it] exactly satisfies the places of the planet exactly observed. But if the eccentricity be bisected, three points are set up in the line of the apsides: one is our Earth, the other the center of the planet's orbit, and the third in the middle, which is distant from the Earth by an interval equal to that by which the planet is distant from the center of the orbit; about which middle point the planet is moved equably: which arises far more justly from the equation compounded from the **Physical** [equation], whose basis is the distance of the orbit's center from the center of the Earth, and from the **Optical** [equation], whose basis is the distance of the orbit's center from the center of the Earth.

[Margin: 6]

But because the Ellipse has this property — that in its diameter there are three points equally distant, namely the center of the Ellipse, and from it on either side the two foci, or umbilici [*foci, seu vmbilici*], and that the points which coincide with the [reflected] radius—

—[the radius] reflected from the periphery, and that the physical power [*virtus physica*] is dispersed through it: therefore Kepler, by his own sagacity, perceived the Orbit of the planets to be not circular but **elliptical**, and the causes of the planetary motion to be physical. For from the Ellipse he renders the reason why the planet, at the extremities of its greater diameter, is there at aphelion and apogee, here at perihelion and perigee, and dispenses its motions according as they appear. He showed, however, the manner of constructing the **prosthaphaereses** in the Ellipse, and of investigating the **Aphelion**, or Apogee — but did not demonstrate it geometrically [*non demonstrauit Geometrica*]
[Margin:... [*deficit*]].

[Margin: 7]

Ismaël Boulliau [Bullialdus] succeeded Kepler, who not only (Astron. Philolaica cap. 13 & lib. 11) endeavored to demonstrate the motion of the planet, in such a way that it should describe an Ellipse through diverse circles upon the surface of a single cone — yet [a thing] soluble by equipollence into several circles — but

also taught the same by an exact method of the way of investigating the prosthaphaereses in the Ellipse, and the places of the aphelia: though indeed not so exact in subtlety [*subtilitate*], so that there remained for Sethus Wardus [Seth Ward] the place [task] to emend it, then for Boulliau to investigate the places of the aphelia more exactly in the Ellipse. But Count Pagan [the Comte de Pagan] showed the Elliptical figure rather felicitously, [the figure] in use for demonstrating the planetary motions; and the same [is] essayed by our most friendly Io. Dominicus Cassinus [Giovanni Domenico Cassini].

[Margin: 8]

Thus far recent Astronomy has progressed; but it still seems to me that it must profit yet, until we recognize that the motion of the planets is to be saved not from a part only, but as a whole; that it is to be made not equable, but uniformly non-uniform; that the heavenly bodies are not adorned [*decorem*] without reason, but most highly in agreement with the bounds set by God the supreme Maker: for those equalities which seem to us beautiful are themselves beautiful; but those inequalities are more beautiful, which constitute the regular harmony of the World by a regular [law], as I have set forth in many other examples (Opificio Dei). Furthermore, I consider that [the motion] is to be resolved not only into several circles through an Ellipse, but also through Eccentrics, and Copernican Epicycles, or Danish [ones], not rarely [*representing*] the observed places of the planet more exactly — which is an indication that we do not yet hold that genuine figure by which the measure of the planetary motions is defined.

[Margin: 9]

Moreover, I suppose that the aforesaid Authors, who by a single Ellipse expound the planet's motion, hold the Earth to be moved by the **First Motion** from east to west; otherwise the **First Motion** cannot be saved by a single Ellipse, by the fluidity of the Planetary heaven, of which [we treat] in Supposition 1. And just as the First Motion cannot be reconciled with the Second by a single Ellipse — and with the remaining [motions] enumerated in Supposition 1 — and since the Earth's being so moved is false from what was said in Supposition III: it remains, therefore, that it be expounded by the Astronomers in what way the aforesaid motions, without physical repugnance, are continually performed by a single planet.

[Margin: 9 (continued)]

Now indeed, if what was found by Kepler — too friendly to his own inventions — seemed absurd, then at last Astronomy will be recalled to that [view], so that we

recognize the Planets to describe a Conical surface from east to west toward others, and otherwise [toward others], by spirals as it were circular, now broader, now narrower, according as the five prior motions enumerated in Supposition 1 require; and easily not only will the First Motion be reconciled with the Second, but also at once with the remaining three; and at once the planets will appear: now stationary, direct, or retrograde, but in very fact perpetually carried about toward the west in their circumference, and then they will seem not to advance in the Zodiac, when they come to the same meridian at the same moment together with some one of the fixed stars, after [the interval] by which it was the previous day under the same meridian; **direct**, however, when they return more tardily to the same meridian than the same fixed star; but **retrograde**, when they revert thither more swiftly than the fixed star, with which they had been the previous day under the very same meridian.

[Margin: 10]

Nor indeed does it befit Astronomers to be of so confined a breast that they should not comprehend this spiral motion, because it cannot be drawn by a single simple figure; especially since, with a kind of [gypsum] string [*gypso*] turning about the surface of a cone [*conum*], the spiral motion is unrolled, and through any point a section can be made of such a vestige left on the conic surface — and that point [section], if not exactly Elliptical, yet very near, approaching the Elliptical — even though by this the orbit of the planet itself is not really moved.

[Margin: 11]

Finally, Astronomy ought to profit in the observing—

—of the places of the planets most exactly, by mutual conjunctions [*congressus*], or with the fixed stars by aid of the Telescope, or by appulse with the fixed stars to the meridian: so that all the places may be noted, and free from error of many minutes; then there will be by far a more certain measure from observation, whether of a single Ellipse, or of the figure described by spirals — equipollent to the Ellipse; and so, from a sounder foundation, Tables yet more certain are to be constructed for setting up the places of the planets. But, retaining meanwhile the Elliptical figure — whether really or whether equipollently — we lay down in Saturn these things that follow.

[Table — Saturn's mean motions and apogee/node motions. Three columns of motion-arc groups under a tabular rule. Headers read across: Sig. (signs) | G. (degrees) | I | II | III | IV | V (successive sexagesimal orders).]

Mean motion from □		Sig.	G.	I	II	III	IV	V
	Daily [<i>Diurnus</i>]	0	0	2	0	35	13	38
	Annual [<i>Annuus</i>]	0	12	13	34	17	54	32
Of the Apogee [<i>Apogei</i>]	Daily [<i>Diurnus</i>]	0	0	0	0	18	45	14
	Annual [<i>Annuus</i>]	0	0	1	54	5	12	10
Of the Nodes [<i>Nodi</i>] [Boul liau]	Daily [<i>Diurnus</i>]	0	0	0	0	4	15	36
	Annual [<i>Annuus</i>]	0	0	25	54	51	[?]	43

Parsing notes: The first column-block is the row-label group (apogee / node bracketed to their Diurnus/Annuus rows); the body labels "Apogei" and "Nodi

Bo[ulliau]" sit beside the Diurnus rows. The "♈" in the heading is the symbol for Aries. The IV-order entry of the Nodes-Annual row is partly obscured (read "51"); flagged. The leading "Diurnus/Annuus" pair without a row-label belongs to the mean motion itself.

Epoch of Christ, at noon of the last day of December, in the Meridian of Bologna [*Bonon.*].

[Table — radix (epoch) positions for Saturn.]

	Sig.	Gr.	I	II
Mean motion [<i>Motus medij</i>]	2	13	1	45
Apogee [<i>Apogei</i>]	7	5	15	25
Nodes ♁ [<i>Nodi</i>]	3	8	59	18

For the Geometric Figure of the Hypothesis.

The Ellipse having meanwhile been chosen — whose nearest traces the planet's daily motion designates, made toward the west through some [points], and through others as it were circular about the cone — let the measures written below be chosen.

Of such parts as the radius, or semidiameter, of the Solar Ellipse is 100000, its bisected eccentricity is 1740. Of such parts is the following.

[Table — Saturn's ellipse dimensions and distances. Two-column structure; the upper block gives semidiameters and eccentricity referred to "If the Radius of the Orbit ☉ be 100000."]

	If the Radius of the Orbit ☉ be 100000
Major Semidiameter of Saturn's Ellipse	100000
Or its mean distance from the Sun [<i>Seu eius media à Sole distantia</i>]	954198

If the Radius of the Orbit ☉ be
100000

Minor Semidiameter of the Ellipse	946965
Whole eccentricity [<i>Excentricitas tota</i>]	110190 [?]
Half of the eccentricity [<i>Semissis</i> <i>Excentricitatis</i>]	55095 ½ [?]

[Table — Saturn's greatest and least distances from Sun and Earth, at apogee and perigee, aphelion and perihelion.]

		Distance [<i>Distantia</i>]
Sun at Apogee, Saturn at Aphelion [<i>Sole Apogeo,</i> <i>Saturno Aphelio</i>]	from the Sun [<i>à Sole</i>]	1009293
	from the Earth [<i>à Terra</i>]	1111035
Sun at Apogee, Saturn at Perihelion [<i>Sole Apogeo,</i> <i>Saturno Perihelio</i>]	from the Sun [<i>à Sole</i>]	899103
	from the Earth [<i>à Terra</i>]	797363
Sun at Perigee, Saturn at Aphelion [<i>Sole Perigeo,</i> <i>Saturno Aphelio</i>]	from the Sun [<i>à Sole</i>]	1009293
	from the Earth [<i>à Terra</i>]	1007553
Sun at Perigee, Saturn at Perihelion [<i>Sole Perigeo,</i> <i>Saturno Perihelio</i>]	from the Sun [<i>à Sole</i>]	899103
	from the Earth [<i>à Terra</i>]	800843

See the remaining distances in Volume 2, Table 97.

[Table — Saturn's orbital inclination and maximum latitudes (continued from the distance tables). Columns: Gr. | I | II.]

		Gr.	I	II
Inclination of the Orbit to the Ecliptic [<i>Inclinatio Orbitae ad Eclipticam</i>]		2	30	0
	Sun at Apogee, Saturn at Aphelion [☉ <i>Apog.</i> ☽ <i>Aphelio</i>] in ☐ [conjunction]	2	16	12
	[same] in ☉ [opposition]	2	46	48
Maximum Latitude of Saturn [<i>Latitudo Maxima Saturni</i>]	Sun at Apogee, Saturn at Perihelion [☉ <i>Apog.</i> ☽ <i>Perihelio</i>] in ☐	2	14	44
	[same] in	2	49	18

	Gr.	I	II
♁			
Sun at Perigee, Saturn at Aphelion [☉ <i>Perig.</i> ♁ <i>Aphelio</i>] in ☐	2	16	40
[same] in ♁	2	16	8
Sun at Perigee, Saturn at Perihelio n [☉ <i>Perig.</i> ♁ <i>Perihelio</i>] in ☐	2	15	12
[same] in ♁	2	48	4

Parsing notes: The conjunction/opposition symbols are rendered by Riccioli with the planetary aspect glyphs (here transcribed ☉ for conjunction-with-Sun and ♁ for opposition); each latitude-case is paired across these two aspects. "in σ / in ∂" in the source are the aspect symbols; read as conjunction (☉) and opposition (♁) of Saturn with the Sun.

You have the figures described and explained (Almag. Nov. sect. 2 & 3) — but [read] in place of the Ellipse, the Circle [*Circulus*], and its use.

The right-hand column of p. 302 [recto text block, continuing the prose]:

re-read in this Volume Book One, and its Chapter XI with the Appendix; or read the Geometric Astronomy of Seth Ward [*Sethi Vuardi*], published at London in the year 1656, in which he teaches how to investigate, both by the circle and by the Ellipse, the inequality in the quality of the planets, the Nodes, the Inclinations, etc. — whether the eye be placed in the Sun, or in the Earth, or in some other [point] from which the Sun is seen. But in that work it requires Observations

somewhat too delicate, and bound to certain precise moments of time, which cannot be reduced to the nearest [value] with ease, and [it requires] subtlety; so that perhaps who would think it could be done — and the precepts of these, by occasion, not rarely, are sub-derived from clouds, or from elsewhere. If, however, the Astronomers should at length persevere in this study with patience [*longanimiter*], it can finally be brought about that such [Tables] may be made, or that, from so many observations obtained, and by the benefit of the Geometry demonstrated by Ward, they may perfect Astronomy. But it is always incumbent upon them [to reconcile] the daily motion of the *primum mobile* — which at the end we show cannot be attributed to the Earth — to reconcile [*conciliare*] it with the Sun, with the proper motion of the stars.

BOOK SIX

IN WHICH ARE THE OBSERVATIONS OF THE PLANET JUPITER, AND THE HYPOTHESIS OF ITS MOTIONS.

CHAPTER I.

Ancient Observations of Jupiter, from the Year 241 before Christ down to the Year 807 of the same era.

1. In the year 45 — according to Dionysius, on the 10th of the month Parthenon, that is, in the year 83 [of the Era of Nabonassar?] reckoned from the death of Alexander the Great, on the 17th of Epiphi, the next day being the 18th — at the first hour after midnight Jupiter approached the southern Donkey [the Aselli], which lies in the Nebula [Praesepe] of Cancer (Ptolemy, *Almagest* XI, ch. 3). Ptolemy judged that this star lay one degree to the east of Jupiter. Longomontanus (*Theoricae*, Book 2, ch. 7) and Boulliau [Bullialdus] (*Astronomia*, ch. 7) hold that this fell in the year 241 before Christ, and they place it [the observation] on the 3rd of September. The hour was 16, reckoned after noon at Uraniborg, when the star stood with Jupiter in Cancer at $7^{\circ}33'$, as Longomontanus has it — or, by Boulliau's calculation, at minus $6'$ — with southern latitude $25'$. But Lansberg, in his *Thesaurus* of observations, says that it was the year 507 of Nabonassar, the 17th of Epiphi, and the hour 17, [placing] the Asellus, that is, Jupiter, in latitude $10'$ south, and the longitude of Cancer at $7^{\circ}32'$ by the observation, but at $7^{\circ}54'$ by his own Tables. Truly it was the 3rd of September; nevertheless [Lansberg makes it?] fixed at Cancer $7^{\circ}11'$ with southern latitude $5^{\circ}30'$.

2. In the 17th year of the Emperor Hadrian, on the 1st day of Epiphi, at the first hour before the middle of the following night, Ptolemy at Alexandria gathered from his observation, made by the acronychal opposition, that it [the opposition] had occurred with the mean place of the Sun, Jupiter standing in Scorpio at $23^{\circ}11'$ (so he himself, *Almagest* XI, ch. 1, and also Copernicus, Book 5, ch. 10). That year was the year of Christ 133, and the 18th of May.

3. In the 21st year of Hadrian, on the 13th of Phaophi, at the second hour before the middle of the following night, Ptolemy, observing at Alexandria, judged it [an opposition] to have been made by the acronychal opposition of Jupiter, [occurring] with the mean place of the Sun, Jupiter standing in Pisces at $7^{\circ}54'$ (so he himself, *Almagest* XI, ch. 1, and Copernicus likewise). That was the year of Christ 136, and the 31st of August.

4. In the first year of the Emperor Antoninus, on the 20th of the month Athyr, the next day being the 21st, at the fifth hour after midnight, Jupiter stood opposite the mean place of the Sun in Aries at $14^{\circ}23'$, by observation and by Ptolemy's reasoning (*Almagest* XI, ch. 1); and indeed it is designated in Greek thus: ἀθὺρ κ̄ εἰς τὸν κα κ̄ [Greek: athyr 20, into the 21st — a date-formula, "Athyr the 20th, going into the 21st"]. That is, Athyr 20 going into the 21st. Copernicus erroneously placed the day at the 15th (Copernicus, Book 5, ch. 10). It was the year of Christ 137, and the 7th of October.

5. In the 2nd year of Antoninus, on the 26th of the month Messori, the next day being the 27th, at about the fifth equal hour after midnight, Ptolemy, observing at Alexandria, compared Jupiter with the bright [star] of the Hyades [Succula], and judged it to be in Aries $15^{\circ}45'$ (Geminus also reports it, Book 11, ch. 2). Lansberg, in his *Thesaurus* of observations, reports this same observation of Jupiter in the year 139 [of Christ?], July 20, hour 17, after noon at Alexandria, and [states] that Jupiter together with the splendid star of the Hyades stood in Gemini at $15^{\circ}36'$ (so Longomontanus, Book 2, ch. 7); and so it was indeed the year 139, the first of Antoninus 136 to 139, the 20th of July, the next day being the 21st, in the year 139.

6. In the year of Christ 508, that is, the year of Diocletian 225, on the 30th of the month Thoth — that is, the 28th of September — Jupiter was seen in the morning at Athens to be very close to the Heart of Leo [Cor Leonis, Regulus], three digits distant from it; this is the minutes $7\frac{1}{4}$, [measured] from the north toward the Boreal side. So Boulliau, Book 7, *Astronomy*, ch. 7, from a manuscript of the Library of the Most Christian King [the French royal library], adding that the Heart of Leo then stood in Leo at $8^{\circ}49'54''$. And in the same manuscript it is indicated that the conjunction of Jupiter and Mars was observed in the year of

Diocletian 214, the 6th of Pachon, coming in the 7th [year], at the second hour after midnight.

In the year of Christ 807, on the day before the Kalends of February [31 January], on the 17th day of the Moon, the star of Jupiter was seen to pass across, as it were, below the Moon, as is recorded in the *Annals of the Franks* and in the *Life of Charlemagne* [Charles the Great].

CHAPTER II.

Observations of Jupiter made by Johannes Regiomontanus and by Bernhard Walther, from the Year of Christ 1471 to 1504.

The First Class consists of observations made by visual estimation.

1. In the year 1471, March 15, Regiomontanus at Esztergom [Strigonium] saw Jupiter very nearly in a straight line between the brighter of the two stars in the middle of Virgo and a dimmer one near the eye, toward the side of Leo; and he distinguished it [its position] more obscurely as two-fifths of the interval between the said stars. On the 9th of August, at evening, he saw Jupiter and Venus at Nuremberg distant from each other by $1^{\circ}13'$; using his own [observing] Rods [Radii], let it be supposed. The Alphonsine reckoning would require it to be $4^{\circ}33'$.
2. In the year 1478, Bernhard Walther observed, both on the 22nd of August and on the 30th of September, that Jupiter [lay] in a straight line with the two eyes of Taurus, as if 3 [units] after midnight, and from the more westerly eye toward the west it was distant by half the interval of the eyes of Taurus.
3. In the year 1488, October 8, with [Jupiter] standing in M.C. [the meridian-crossing or mean conjunction?] at $13^{\circ}\frac{1}{2}$, it was observed by Walther in degree $13^{\circ}20'$ of Pisces, with southern latitude one degree. Boulliau (*Astronomy*, ch. 7) says that Jupiter was in degree $14^{\circ}16'$ of Pisces. If the place of Aldebaran is corrected, it was in Gemini at $2^{\circ}36'$; but this observation looks toward the armillaries, concerning which see below.
4. In the year 1497, February 15, in the morning at the 4th hour after midnight, the Moon and Mars and Jupiter were equally distant by a lunar diameter, says Walther; but this distance, for the half on the latitude side, [showed] Mars to be the more westerly and southerly of Jupiter, although by the *Almanac* their conjunction, which was still to come, had passed by.
5. In the year 1503, September 8, in the morning at the 4th hour after midnight, I saw, says Walther, Jupiter near a star, which is the eighth of Gemini, on the right

side of the preceding [star], and it had been almost in the same conjunction in longitude with that star; so that, if you imagine an arc drawn through the Pole of the Zodiac and the star, it would touch the western limb of Jupiter; but truly toward Jupiter's eastern part it [transgressed?] by the breadth of two digits beyond it. Moreover, the aforesaid star, distant from the Ecliptic of Ptolemy toward the north, [stood at] degree $2^{\circ}40'$; granted that by the armillaries it was observed by Walther to have scarcely any latitude. Lansberg, in his *Thesaurus*, gathers that Jupiter was in Cancer at degree $12^{\circ}2'$ from the Tables $11^{\circ}56'$, with southern latitude $6'$. But the aforesaid fixed star, which he says [is at] $12' - 11'$. The fixed star itself [Mihi Fixa] is at Gemini $11^{\circ}55'$, with northern latitude $56\frac{2}{3}$. But the fixed star [is at] Gemini 12° , latitude $15'$.

6. In the year 1503, October 6, I judged, says Walther, by ocular [estimate] the conjunction of Jupiter and Mars in longitude; but Mars was more northerly than Jupiter by one [digit], at about the rising of the Moon, before the rising of the Sun by two hours.

7. In the year 1504, February 9, Walther notes the conjunction of Jupiter with Mars; and on the 29th of April [he notes] the conjunction of Jupiter with the eighth of Gemini after noon, [Jupiter being] in longitude according to the half-degree, with Jupiter standing more northerly by half a degree; but Boulliau (Book 7, ch. 7) affirms that Walther, here as in the observation of the year 1503, September 8, was deceived in reading the catalog of Ptolemy, [confusing] the eighth of Gemini with another twelfth, which is in the left groin of the following Gemini; and that the time of that observation was Cancer $11^{\circ}33'$ with southern latitude at least $13'$; but from the Tables he gathers the place of Jupiter to be in Cancer at degree $12^{\circ}0'25''$.

[Margin / table: the right-hand column carries this observation table, headed by the source's running note.]

The Second Class contains only two observations made by the Rods [Radii], concerning whose use see the Saturnine observations of Walther, no. 10.

8. I have already mentioned the first observation. The other was made in the year 1478, August 24, in the morning, when the first interval of distance between Jupiter and the right eye of Taurus was 70 [units], and the second interval 811; but between Jupiter and the left eye of Taurus the first interval was 30, the second 942.

The Third Class is of Observations by the Zodiacal Armillaries, concerning whose uncertainty within 10 minutes see the observations of Walther on Saturn, no. 33, above.

Table of Jupiter's positions observed:

No.	Year/ Mon./ Day	☿ Place observe d (Sign)	Gr.	M.	Med. coeli Gr.	Sign
9	1487 Oct. 7 n.s.	Pisces	13	20	13	Capricorn
10	Dec. 9 n.s.	Pisces	17	45	4	Pisces
		Lat. A.	1	45		
11	1503 Sept. 11 morn.	Cancer	12	0	hor. 4 p.m.	
		Lat. B.	0	15		
12	Sept. 16 morn.	Cancer	12	15	h. 2½ p.m.	
		Lat.	0	9		
13	Sept. 22 morn.	Cancer	13	0	15	Cancer
		Lat.	0	0		
14	Sept. 28 morn.	Cancer	13	45	15	Taurus
		Lat.	0	0		
15	Nov. 16 p.m.	Cancer	14	45	16	Aries
		Lat. A.	0	17		
16	Dec. 12	Cancer	10	53	21	Aries
17	Dec. 14	Cancer	10	50	4	Aries
18	1504 Jan. 5 morn.	Cancer	7	50	1	Aries

No.	Year/ Mon./ Day	Place observe d (Sign)	Gr.	M.	Med. coeli Gr.	Sign
	Jan. 10 morn.	[Cancer ?]	7	0	3	Taurus
		Lat. B.	0	15		
19	Jan. 19 morn.	[Cancer ?]	6	25	10	Libra
20	Jan. 20	[Cancer ?]	6	8	9	Taurus
		Lat. B.	0	15		
21	Jan. 22	[Cancer ?]	6	0	7	Gemini
		Lat. B.	0	15		
22		[Cancer ?]	5	40	23	Taurus
23	Jan. 24 n.s.	[Cancer ?]	5	30	25	Tauri
24	Jan. 26 n.s.	[Cancer ?]	5	30	25	Tauri
25	Jan. 26 n.s.	[Cancer ?]	5	21	19	Tauri
26	Feb. 11 n.s.	Cancer	5	15	11	Gemini
		Lat. B.	0	10		
27	Feb. 4 n.s.	[Cancer ?]	5	7	1	Gemini
28	Feb. 5 n.s.	[Cancer ?]	5	5	5	Gemini
		Lat. B.	0	22		
29	Feb. 6 n.s.	[Cancer ?]	4	53	19	Gemini
30	Feb. 8 n.s.	[Cancer ?]	4	48	9	Gemini
		Lat. B.	0	18		

No.	Year/ Mon./ Day	Place observe d (Sign)	Gr.	M.	Med. coeli Gr.	Sign
31	Feb. 9 n.s.	[Cancer ?]	4	45	15	Gem.
32	Feb. 12 n.s.	[Cancer ?]	4	45	15	Gem.
33	Feb. 13 n.s.	[Cancer ?]	4	45	20	Gem.
34	Feb. 14 n.s.	[Cancer ?]	4	47	20	Gem.
35	Feb. 15 n.s.	[Cancer ?]	4	45	15	Gem.
36	Feb. 16 n.s.	[Cancer ?]	4	45	15	Gem.
37	Feb. 20 n.s.	[Cancer ?]	4	53	15	Gem.
		Lat. B.	0	25		
38	Feb. 26 n.s.	Cancer	4	45	2	Cancri
39	Mart. 5 n.s.	Cancer	5	0	2	Cancri
40	Mart. 11 n.s.	Cancer	5	35	14	Cancri
41	Mart. [?] n.s.	Cancer	5	50	23	Cancri
		Lat. B.	0	20		
42	Mart. 27 n.s.	[Cancer ?]	6	50	19	Leonis
43	April. 24 n.s.	[Cancer ?]	11	0	19	Virginis
44	April. 29 n.s.	[Cancer ?]	11	20	20	Virginis
45	April. 30 n.s.	[Cancer ?]	11	40	21	Virginis

No.	Year/ Mon./ Day	☿ Place observe d (Sign)	Gr.	M.	Med. coeli Gr.	Sign
		Lat. B.	0	20		

Parsing notes: This is a four-part table — observation number, date (Year/Month/Day, "n.s." = new style, "manè" = morning, "p.m." = post meridiem), the observed place of Jupiter (☿) by sign/degree/minute (with latitude rows interleaved, "Lat. A." = northern/austral?, "Lat. B." = boreal/northern), and the *Medium coeli* (meridian) by degree and sign. Several rows in the central sign column read only the degree/minute, the sign being carried down from "Cancer" (Cancrī) above; I have bracketed [Cancer?] where the sign is implied by the column rather than freshly printed. Row 41's day is ink-faint ([?]). The latitude sub-rows ("Lat. A."/"Lat. B.") belong to the observation immediately above them. The "Med. coeli" entries mixing hour-values ("hor. 4 p.m.", "h. 2½ p.m.") for rows 11–12 are as printed.

Table of Jupiter's positions observed (continued, left column):

No.	Year/ Mon./ Day	☿ Place observe d (Sign)	Gr.	M.	Med. coeli Gr.	Sign
46	1504 Maij 9 n.s.	Cancer	13	18	4	Librae
47	Maij 18 n.s.	[Cancer]	15	2	19	Librae
48	Maij 23 n.s.	[Cancer]	15	53	26	Librae
49	Maij 24 n.s.	[Cancer]	16	0	1	Scorpij
		Lat. B.	0	20		
50	Maij 25 n.s.	[Cancer]	16	13	4	Scorpij
51	Maij 28 n.s.	[Cancer]	16	53	5	Scorpij
52	Maij 29 n.s.	[Cancer]	17	3	14	Scorpij

Parsing notes: Continuation of the Class-Three armillary table from folio 304. Same column layout. The sign "Cancer" is carried down from the foot of the previous page's column; I bracket [Cancer] where the printed cell shows only degree/minute. The right-hand column of this page (rows 1–3) belongs to a *different* comparison table (observed vs. Alphonsine vs. Copernican places), transcribed separately below.

CHAPTER III.

Copernican Observations of Jupiter, from the Year of Christ 1520 to 1530.

It must be noted that Copernicus reckons the longitudes of the planets from the first Fixed Star at the preceding horn of Aries, which in the year 1525 he places at a distance of $20^{\circ}40'$ from the Vernal Equinox; the longitude is thence derived in due order.

1. In the year 1520, on the 11th of the Kalends of March [19 February], in the morning, at hours 6 before noon, Copernicus by an instrument most diligently observed Jupiter [the distance of the intervals], to precede the first Star, which is in the forehead of Scorpio, the brighter one, whose place I have said to have been in the parts $224^{\circ}15'$ scruple [of arc] 9 — that is, with respect to the inerrant [fixed] sphere — and so the place of Jupiter was then in the parts $215^{\circ}9'$ of Scorpio at $16^{\circ}48'$ (Copernicus, Book 5, *De Revolutionibus*, ch. 14).
2. In the year of Christ 1520, the day before the Kalends of May [30 April], in the middle of the preceding night, Copernicus, as he himself asserts, diligently observed Jupiter acronychal in degree 200 [parts] of the Fixed Stars, scruple 18, that is, in Scorpio at $10^{\circ}57'$ (so he himself, Book 5, ch. 11).
3. In the year of Christ 1526, the 4th of the Kalends of December [28 November], at hours 3 [past?] the middle of the night, Copernicus observed Jupiter acronychal in the parts $47^{\circ}33''$ of the Fixed Stars, that is, in Gemini at $2^{\circ}36'$ (Copernicus, Book 5, ch. 11).
4. In the year of Christ 1529, on the Kalends of February [1 February], the night of the transit, at hours 19 from the middle of the night, Copernicus observed Jupiter acronychal in degree 113° of the Fixed Stars, scruple 44, that is, in Leo at $14^{\circ}28'$ (Copernicus, Book 5, ch. 11).

CHAPTER IV.

Observations of Jupiter by Tycho.

Tycho himself, in his *Letters to the Landgrave of Hesse* [Wilhelm IV of Hesse-Kassel], page 56, sets down the following observations of Jupiter made at Uraniborg [Vraniburg] in the year 1587, and noted in the Old Style, with the calculation drawn from the Alphonsine and Copernican Tables.

Comparison table — observed vs. Alphonsine vs. Copernican places of Jupiter:

No.	Hour H. : M. after mer.	Source	Longit. of Jupiter (Sign : Gr. : M.)	Latitude (Gr. : M.)
1	9 : 15	Observed	Cancer 7 : 52	0 : 9 B
		Alphonsine	7 : 55	0 : 6
		Copernican	7 : 32	0 : 32 A
2	14 : 8	Observed	Cancer 7 : 19	0 : 8 B
		Alphonsine	7 : 0	0 : 5 A
		Copernican	7 : 1	0 : 32 A
3	15 : 6 : 10	Observed	Cancer 7 : 15	0 : 8 B
		Alphonsine	7 : 1	0 : 5 A
		Copernican	6 : 56	0 : 32 A

Parsing notes: A three-row comparison table, each row giving the time after meridian (H : M, with row 3 carrying a third sub-figure), then three rows of values (Observed / Alphonsine / Copernican) for the longitude of Jupiter (sign Cancer + degree : minute) and the latitude (degree : minute, with "B" = Boreal/north and "A" = Austral/south). The sign "Cancer" is printed once per observation and applies to all three sub-rows.

Lansberg, in his *Thesaurus* of Observations of Jupiter, no. 4, examines the Tyconic observation of day 14, and gathers from his own Tables the place of Jupiter in Cancer at 7°19'59", with northern latitude 9'.

Longomontanus, in the *Astronomia Danica*, Book 2, *Theorica*, ch. 1, exhibits eight acronychal places of Jupiter from the Tychonic observation — to be sure, with the place of Jupiter supplied from the latest three by the Prutenic Tables, but corrected, by adding to the mean longitude $4^{\circ}\frac{2}{3}$, and to the apogee $40'$. The prosthaphaeresis, moreover, everywhere uses the twenty-fourth part, and these are of the kind [reckoned] in the Old Style of the [Julian] Calendar.

From the aforesaid acronychal [positions] Boulliau, Book 7, *Astronomia Philolaica*, uses observations of the years 1583, 1584, 1591, and 1596, in ch. 1 and 2, which you may consult.

There follow the latest Tychonic observations, made in the fortress of Benátky near Prague, in the year 1600 — or at Prague, in the house of Curtius, in the year 1601 — recorded by Snellius in the *Observations* published at Leiden of the Batavians [Lugduni Batavorum] in the year 1618.

12. In the year 1600, February 3, when the bright [star] of Hydra was distant from the meridian toward the south by about one degree, and the head of Hydra had crossed [the meridian] before about one hour of the meridian, Tycho observed Jupiter distant from the head of Pollux by degree $29^{\circ}51'\frac{2}{3}$, and corrected for refraction by $29^{\circ}52'\frac{3}{5}$; and from the bright [star] of the feet of Gemini by $44^{\circ}11'\frac{1}{2}$, but corrected by $44^{\circ}11'50''$.

13. In the year 1600, February 4, in the New Style, on the following night the meridian altitude of Jupiter was observed to be degree $56^{\circ}29'\frac{1}{3}$; immediately afterward the meridian altitude of the more southerly [star] in the head of Leo was taken, and was degree $65^{\circ}15'\frac{3}{5}$; and the following [stars] in the other foot of Leo were degree $65^{\circ}15'\frac{3}{5}$; and at that time Jupiter had withdrawn from the meridian, by as much as was the diameter of its own body.

14. In the year 1600, April 12, in the New Style, at hour 9, 46' after noon, Jupiter stood distant from the bright [star] of the feet of Gemini by degree $39^{\circ}0'\frac{1}{3}$; and at hour 9, minute 53', it was distant from Regulus by degree $12^{\circ}36'$.

15. In the year 1601, July 16, in the New Style, on the following night at hour 9, 40', Jupiter was high by degree $10^{\circ}40'$ and was seen to be distant from Arcturus by degree $41^{\circ}26'$; and at hour 9, 29', it was high by degree $9^{\circ}51'$ and distant from Saturn by degree $45^{\circ}18'$.

There follow the observations of Jupiter completed by Tycho from the year 1583 down to 1599 at Uraniborg, with the rest in Bohemia, which the Reverend Father Albert Curtius of the Society of Jesus selected from a manuscript of Tycho, and

transmitted to us, to be published by us among the Tyconic observations once entrusted to the Emperor [Caesar], noted in the Old Style.

Caput IV (continued) — Jupiter's Observations by Tycho

(continuation of Tycho's 1583–1599 series at Uraniborg and in Bohemia, Old Style)

The table continues the numbered observations begun in the prior batch.

Columns: item number; year, month, and day; H. M. p. mer. (hour and minute past the meridian); Long. ♃ observ. (Jupiter's observed longitude — zodiac sign, degrees, minutes); Lat. observ. (observed latitude — degrees, minutes, with the A/B marginal direction-flag where present).

No.	Year, Month, Day	H. M. (past mer.)	Long. ♃ observ. (Sign G. M.)	Lat. observ. (Gr. M.)	flag
16	1583 Augusti 5	12 0	♋ [Pisces] 27 14	1 30	
17	— 28	12 0	24 49	1 36	
18	Septemb. 5	12 0	♋ [Pisces] 23 45	1 36	
19	— 6	12 0	23 38	1 36	
20	— 10	12 0	23 7	1 37	
21	Decemb. 11	8 30	20 59	1 18	
22	1584 Augusti 20	10 0	♋ [Taurus] 5 22	1 14	
23	— Octob. 11	9 30	0 22	1 30	
24	1585 Martij 5	7 15	6 44½	0 58	
25	1589 Ianuarij 30	1 23	♋ [Virgo] 15 45½	1 47	
26	— Februar.	0 30	♋ [Virgo] 13 2	1 30	

No.	Year, Month, Day	H. M. (past mer.)	Long. \sphericalangle observ. (Sign G. M.)	Lat. observ. (Gr. M.)	flag
	11				
27	1590 Ianuarij 24	4 26	\square [Leo] 17 45	1 28	
28	— Martij 15	4 16	13 56	1 36	
29	— 21	12 22	13 11½	1 37	B
30	— 9	9 50	12 39½	1 36	
31	April. 16	16 0	9 54¾	1 34	
32	Iulij 11	9 51	11 19¾	1 19	
33	1591 April. 14	11 0	\square [Aquariu s] 14 16½	1 23	B
34	— 21	2 22	13 38¼	1 20	B
35	— 22	11 52	13 15½	1 21	B
36	— 23	11 52	13 7½	—	B
37	— 24	11 41	12 58	1 20	B
38	— 26	9 44	12 44	1 20	B
39	— 29	11 40	12 22½	1 21	B
40	— 30	11 46	12 15½	1 20	B
41	1592 Maij 16	12 45	\square [Sagittari us] 15 33½	0 37	B
42	— 18	12 50	15 23½	0 37	
43	— 22	11 45	14 46	0 38	
44	— 28	11 34	14 3	0 38	
45	— 30	11 12	13 49½	0 39	
46	— 31	11 7	13 39½	0 36	
47	1594	11 35	\square	1 8	A

No.	Year, Month, Day	H. M. (past mer.)	Long. \sphericalangle observ. (Sign G. M.)	Lat. observ. (Gr. M.)	flag
	Augusti 4		[Scorpio] 22 31		
48	— 11	11 45	22 25	1 8	A
49	Octob. 28	6 34	18 43½	1 17	A
50	1595 Sept. 7	0 30	□ [Pisces] 29 47	1 39	A
51	— 10	5 15	29 17½	1 39	
52	— 19	0 10	29 10	1 39	
53	Octob. 17	—	24 30	1 32	A
54	Novemb. 13	—	24 5½	1 21	A
55	Decemb. 6	6 0	23 16½	1 21	A
56	1596 Ianuarij 16	5 0	□ [Aries] 1 7½	1 9	A
57	— 26	5 30	0 53	1 9	A
58	— 25	5 48	0 47½	1 10	A
59	Febr. 23	6 25	9 7½	0 59	A
60	— 29	7 47	10 43½	0 57	A
61	Martij 25	6 40	12 4	0 59	A
62	Iulij 25	1 0	□ [Taurus] 0 47	1 14	A
63	Augusti 8	3 0	10 32	1 18	A
64	Octob. 1	11 0	□ [Taurus] 7 59	1 27	A
65	— 9	11 0	6 34½	1 27½	A
66	— 11	11 30	6 30½	1 27	A

No.	Year, Month, Day	H. M. (past mer.)	Long. \sphericalangle observ. (Sign G. M.)	Lat. observ. (Gr. M.)	flag
67	— 23	10 30	6 6½	1 28	A
68	— 27	10 0	5 8½	1 26	A
69	— 24	11 0	4 52½	1 26	A
70	— 30	11 0	4 45½	1 26	A
71	Decemb. 5	7 56	□ [Taurus] 0 55½	1 16	A
72	— 12	7 30	0 46½	1 14	A
73	— 18	6 30	0 45½	1 13	
74	— 20	6 30	0 53	1 9	
75	1597 Ianuarij 8	6 0	□ [Taurus] 1 44½	1 6	A
76	— Martij 15	8 0	12 9½	1 10	A

(right-hand column of folio 306 continues the same table)

No.	Year, Month, Day	H. M. (past mer.)	Long. \sphericalangle observ. (Sign G. M.)	Lat. observ. (Gr. M.)	flag
77	1599 Ianuarij 9	—	□ [Cancer] 13 8½	1 15	A
78	— 26	—	11 5½	0 17	A
79	Octob. 20	—	□ [Leo] 10 5½	0 39	B
80	Decemb. 31	—	20 0¾	0 9	
81	1600 Ianuarij	20 50	□ [Leo] 20 5½	0 52	B

No.	Year, Month, Day	H. M. (past mer.)	Long. \sphericalangle observ. (Sign G. M.)	Lat. observ. (Gr. M.)	flag
	1				
82	Febr. 1	17 4½	12 49	0 49	
83	Martij 15	12 53½	13 3½	1 7	
84	April. 7	11 45	12 1	1 2	
85	— 27	12 25	11 59	0 59	
86	Maij 1	12 45	12 45	0 59	

Parsing notes: In the right-hand block (items 77–86) the printed "H. M." cells are blank in the source for items 77–80 (no time recorded for those four rows); the longitude column carries distinct degree-minute values, not a repetition of the H. M. column. The zodiac sign is given only at the head of each sign-group (♋ Cancer for items 77–78, ♌ Leo from item 79 onward). The A/B flags in the rightmost column mark the marginal direction-letters as printed.

After the Bologna printing of the Tyconic observations had already begun, Fr. Curtz sent me the specimen of the observation transcribed below, made in Bohemia in the year 1600:

(A second detailed table follows. Columns: item number; Month, Day [with explanatory note]; Distance from fixed stars [Distantia à Fixis]; Jupiter's [reading] in degrees, minutes [I], seconds [II].)

No.	Month, Day	Distance from fixed stars (à Fixis)	Jupiter Gr.	I	II
87	Ianuar. 6, with Jupiter high in the meridian , grad. 44. 6¾	from the heart of ♌ [Leo, i.e. Regulus]	27	57	40

No.	Month, Day	Distance from fixed stars (à Fixis)	Jupiter Gr.	I	II
		repeated twice	27	57	40
		corrected nonethel ess	27	55	40
		from Spica ☐ [Virgo]	26	16	0
		repeated	26	16	0
		corrected	26	14	0
88	Ianuar. 9	from the heart of ☐ [Leo]	28	0	40
		repeated twice	28	0	40
		corrected	27	48	40
		from Spica ☐ [Virgo]	26	19	0
		repeated twice	26	19	0
		corrected	26	17	0
	Jupiter's meridian altitude was 44		44	14	40

Note to item 88: Jupiter was in a straight line with Arcturus and with Vindemiatrix [☐ Virginis], and by nearly the diameter of its own body it inclined to the south of the line drawn through the heart of Leo, and a third of that.

No.	Month, Day	Distance from fixed stars (à Fixis)	Jupiter Gr.	I	II
89	Febr., on the last day of the following night	from the heart of Leo [Regulus]	24	2	0
		repeated	25	0	0
		repeated twice	23	59	0
		then [pone]	23	56	30
		corrected	23	56	0
		from Spica Virginis	30	17	30
		repeated	30	18	0
		repeated	30	19	0
		then [pone]	30	18	30
		corrected	30	16	0

On this observation, item 89, Riccioli notes: This discrepancy among the observations was caused by the unreliability of the instrument, by the excessive height of the pedestal, and by the mobility of the sextant suspended from it. But at that time Jupiter's meridian altitude was:

	Gr.	I	II
by the quadrant	46	2	20
by the sextant — better	46	5	0

No.	Month, Day	Distance from fixed stars	Jupiter Gr.	I	II
90	Mart. 3, h. 11.30'	Longitud e ♃: ♌ [Leo]	18	12	30
		Latitude, southern	1	33	30

Note to item 90: Since from the altitude of the Sun observed on the same day, which ought to have been 32. 5'. 14", it is gathered that the quadrant fell short of the true altitudes by 3' less than it should — these have been added to that altitude of Jupiter, and thus corrected.

On the same day [Jupiter] was distant:

	Distance from fixed stars	Gr.	I	II
from the heart of Leo [Regulus]	23		34	0
repeated	23		35	30
repeated	23		34	0
from Spica Virginis	30		42	30
repeated twice	30		42	0
♃ meridian altitude	46		9	50

(The second detailed table continues at the head of folio 307. Columns as before: Month, Day; Distance from fixed stars; Jupiter Gr., I, II.)

No.	Month, Day	Distance from fixed stars	Jupiter Gr.	I	II
91	Mart. 4, near oppositio n with ♃ ☉ ♁ [Jupiter– Sun oppositio n], with [Jupiter] ♁ from the heart [of Leo]		23	25	0
	repeated twice		23	25	30
	from the bright star in ♌ [Leo]		24	39	30
	repeated twice		24	40	0
	from the third in the wing of ♍ [Virgo]		17	0	0
	♃ meridian altitude, by quadrant		46	11	0
	from the eastern		46	13	0

No.	Month, Day	Distance from fixed stars	Jupiter Gr.	I	II
	horn [sextant orichalc.]				
	distant from Spica □ [Virgo]		30	49	30
	repeated twice		30	50	0
	≈ hour 11. 30'. Jupiter's longitude in □ [Leo]		17	47	30
	northern latitude		1	31	4

To this, on the 4th of March, [the following additional readings:]

	Distance from fixed stars	Gr.	I	II
Jupiter's declination		6	17	40
hence Jupiter's right ascension comes out		169	14	44
distance corrected from the third in the wing of □		16	58	20

Distance from fixed stars	Gr.	I	II
[Virgo]			
hence Jupiter's right ascension	169	13	50
Jupiter's distance from the bright star in the neck of ♌ [Leo], corrected	24	37	50
hence Jupiter's right ascension	169	14	17
Jupiter's distance from Spica ♍ [Virgo], corrected	169	15	37
right ascension everywher e limited [reconciled]	169	14	0
hence again Jupiter's longitude	17	38	30
northern latitude	1	30	50

[Margin / closing rubric:] **Thus far from Tycho's autograph** [Hactenus ex Authographo Tychonis].

CAPVT V.

Jupiter's Observations made at Kassel by Jost Bürgi [Iusto Byrgio], the instrument-maker of Landgrave [William IV] of Hesse, selected from Snel among the Hessian observations, together with the Keplerian and Longomontanian observations.

(A table follows. Columns: item number; year, month, day, hour, minute [Ann. Mens. D. H. M.], Old Style, past the meridian; Jupiter's distance from the fixed stars [Gr., M.]; the reference star.)

No.	Year, Month, Day, H., M. (Old Style, past mer.)	Distance Gr.	M.	from the star
1	1590 Dec. 5 13 18	4	2	from Spica
		8	20	from the northern arm [Lance Borea]
2	1591 Ian. 20 16 30	4	13½	from Spica
		8	20	from the northern arm [Lance Borea]
3	— Iunij 8 9 10	10	37½	from Spica
		35	21	from Arcturus
4	1593 Apr. 7 15 0	47	28	from Antares [Antare]
		29	10	from the

No.	Year, Month, Day, H., M. (Old Style, past mer.)	Distance Gr.	M.	from the star
				bright star of the Eagle [lucida Aquilæ, Altair]
5	1594 Iulij 23 10 0	40	31¼	from the bright star of the Eagle [Altair]
		50	48	from the head of Andromeda [cap. Andromed æ]
6	— Sept. 16 8 30	7	1	from the bright star of the Eagle [Altair]
		46	52½	from the shin of Pegasus [crure Pegasi]
7	1597 Sept. 13 14 45	15	2½	from Aldebaran [Aldebara]
		16	53½	from the right shoulder of Orion [lium. dext.]

No.	Year, Month, Day, H., M. (Old Style, past mer.)	Distance Gr.	M.	from the star
				Orió.]
8	— Oct. 1 13 11	13	5	from Aldebaran
		27	4½	from Capella
9	1595 Sept. 11 0 33	59½ [?]		from the third of Aries [tertia Arietis]
	(it had to be set down above)	33	9	from the shin of Pegasus [crure Pegasi]

Note following the table: Boulliau [Bullialdus], book 7, ch. 3, having used the observation of the year 1591, Jan. 29, gathers Jupiter's place to be \square [Scorpio] 17. 9'. 22", with northern latitude 1. 21'. 14"; but for the year 1597, Sept. 13, the place \square [Pisces] 16. 14'. 11", in \square [Scorpio] [the operative sign], with southern latitude 0. 35'. 29".

(Continuing in the right-hand column, three further numbered items close out the Longomontanus / Kepler material before Caput VI. These are observational prose, not tabulated.)

10. In the year 1593, Sept. 28, Old Style, at the 8th evening hour, Longomontanus, observing at Hven [Huena], found Jupiter high above the horizon by $33^{\circ} 59'$; and from the right knee of Ophiuchus [Ophiuchi] it was distant by $13^{\circ} 33'$. From the far tip of the tail of Capricorn it was distant by $33^{\circ} 59'$. Having removed the refraction, he deduced Jupiter's longitude as Capricorn $13^{\circ} 56'$, with southern latitude $0^{\circ} 25'$. So Longomontanus, *Theoricæ* lib. 2, ch. 6.

11. In the year 1604, Sept. 27, New Style, at Prague at the 8th hour after midday — or perhaps a little after — there occurred a conjunction of Saturn and Mars; but on the 10th day, in October, at the 1st hour before midday, from observations

before and after, there was a conjunction of Jupiter and Mars, as Kepler reports in his book *On the New Star in Serpentarius* [*De Stella Nova in Serpentario*], ch. 11.

12. In the year 1616, on March 10, Old Style, in the morning at the 4th hour, Longomontanus at Copenhagen [Hafniæ], using a sextant, observed Jupiter distant from the heart of Scorpio [Antares] by $23^{\circ} 46'$; and from the bright star of the Vulture [Vulturis, i.e. Altair] by $39^{\circ} 44\frac{1}{2}'$. Since [Jupiter's] altitude was 10° , having eliminated the refraction and parallax, he deduced Jupiter's place to be in Sagittarius $27^{\circ} 41'$, with northern latitude $0^{\circ} 24'$ — so he himself, *Theoricæ* lib. 2, ch. 6, & from Boulliau lib. 7, ch. 3, who uses this same observation.

13. The remaining observations of Longomontanus concerning Jupiter, acronychal, for the years 1607, 1610, and 1613, I have reported above with the Tyconic ones, nos. 9, 10, 11. See also what I noted above concerning Fr. Albert, no. 33, where Longomontanus reports (*Theoricorum* lib. 2, ch. 13) — saying that in the year 1591, on April 14, at the 11th hour of night, he observed Jupiter to be in Scorpio $14^{\circ} 16'$, with northern latitude $1^{\circ} 25\frac{1}{2}'$.

CAPVT VI.

Jupiter's Observations made by Pierre Gassendi [Petro Gassendo], Ismaël Boulliau [Ismaele Bulliando], Martin Hortensius [Martino Hortensio], Lansberge [Lansbergio], Johannes Hevelius [Ioanne Heuelio], and Vincenzo Mutus [Vincenzio Muto], from the year of Christ 1620 to 1650.

1. In the year 1620, on November 4, New Style, at the 8th hour past midday, at Aix [Aquis Sextijs], Pierre Gassendi observed with a radius [cross-staff] Jupiter's distance from the head of Medusa to be $23^{\circ} 58'$; and soon afterward $23^{\circ} 5'$ from Aldebaran [Aldebara], but $18^{\circ} 30'$; or perhaps $31'$; and from the foot of Orion, and likewise from the right shoulder, $18^{\circ} 34'$ — which, according to Tycho, is $18^{\circ} 35'$. Hence he deduced Jupiter's longitude to be in Taurus $16^{\circ} 25'$, with southern latitude $1^{\circ} 18'$. So he himself in the *Life of Claude Fabri de Peiresc* [Claudij Fabricij Peireskij], ad fin. anni.

2. In the same year, on November 5, at the 7th hour and $3\frac{1}{2}'$, Gassendi there saw Jupiter distant by $24^{\circ} 4'$ from the head of Medusa; then $5'$; then $9^{\circ} 55'$ from the bright star of the Pleiades [lucida Pleiadum]; then $55\frac{1}{2}'$. Whence he inferred Jupiter's longitude to be in Taurus $16^{\circ} 16'$, with southern latitude $1^{\circ} 16\frac{1}{2}'$. The same [observer] in the same *Life*, on which see above.

3. In the year 1620, on November 7, at Aix, the same [Gassendi] observed Jupiter's opposition with the Sun, as we have it in the papers [schedis] sent to me by D. Giovanni Domenico Cassini [D. Io. Dominicum Cassinum].

4. In the year 1623, October 12, at the 17th hour, at Loudun [Loduni] in France, Boulliau observed Jupiter in a more advanced longitude than Regulus by 3', and more northerly by 8'; whence he deduced Jupiter to have been in Leo 24° 40', with northern latitude 35'. So he himself, lib. 7, *Aston. Philol.* ch. 3.

5. In the year 1627, on April 25, Old Style, at the 1st hour past midday, Martin Hortensius at Leiden [Leydæ] observed Jupiter to be more westerly, by the supreme [topmost] point of the front of Scorpio, almost by a third [of a degree] — 5'. So Lansberge [Lansbergius] in his *Thesaurus* observes the 5th of January, affirming that very star [the topmost of the front of Scorpio] to have been in Scorpio 28° 6', with northern latitude 1° 4'; and so [reckons] Jupiter to have been in Scorpio 28° 1', but from his own *Tables* in Scorpio 28° 1' 47'', with northern latitude 1° 5'.

6. In the year 1629, October 20, Old Style, Jupiter was observed at Middelburg [Middelburgi] in a straight line with two stars preceding it, the horn-tips of Capricorn; thus Lansberge in his *Thesaurus* observed the 6th of October, who concludes from this that Jupiter was in Aquarius 17° 44'. *Theoric.* ch. 44.

7. In the year 1633, Pierre Gassendi computed Jupiter's opposition with the Sun, on December 9. For on the 14th day, in the evening, before the [first] hour, he had seen Jupiter distant from Aldebaran by 19° 21'; and from the left shoulder of Orion by 19° 35'. But on the 16th day, at the 8th hour, in the evening, he saw it distant from Aldebaran by 21° 56', and likewise — at the 9th evening hour — by 19° 29'; he reports this in the observations sent to me from Bologna by D. Cassini.

8. In the year 1633, on December 17, in the evening, Gassendi at Digne [Diniæ] saw Jupiter retrograde, at Propus of the Twins [Propodi Geminorum], so that at the margin [edge] it neither receded nor moved, or was absent; and with the telescope it seemed to be discerned scarcely a little. The situation of the Medicean stars indicated the [star] left behind toward the south. On the 18th day, in the evening, at the 8½th hour, near the naked eye it was being concealed under Jupiter's rays, but with the telescope it was being seen distant about eight Jupiter-diameters, & northward. On the 19th day, in the morning, at the 8th hour, it was nearer, and still further northward; nor could the angles which they constitute be determined, the [star] having been led through the Medicean ones, distant by 4½ from Jupiter. At the Jovial [hour], in the evening of the same day, at the 8th hour,

Jupiter was now more easterly, and distant from it — as much as in the morning it had been more easterly — yet less, since the morning angle had been made sharper toward the east than it had been more westerly in the morning. Moreover, this line of the satellites of Jupiter is periodically inclined to the Ecliptic, can be brought under the conjunction of Jupiter, and Propus reduced to a mean time, or under the meridian of the 19th. So [Gassendi] in his *Epistles Meteorolog.* p. 906.

9. In the year 1634, Gassendi, observing Jupiter's station, comparing it with the telescope to a small fixed star, to which Jupiter was approaching, the 15th of February, sub hour 10, in the evening, it stood almost normal in respect of the line of the Medicean [stars]; standing apart from the said star toward the south by three of its own diameters; and at the same situation it appeared on the 16th. If the situation of the 17th was the same as that of the 16th, it stood distant by three diameters from the said star; but on the 17th the diameters were three and a half. Likewise the situation of the 18th was equal — its distance from Aldebaran was $17^{\circ} 17'$; and from the right shoulder of Orion $16^{\circ} 10'$; with a more westerly altitude $17^{\circ} 12'$. Tycho found Jupiter at this point in Gemini $21^{\circ} 7'$, with northern latitude $0^{\circ} 8'$. So Gassendi above.

10. In the year 1634, Jupiter, now direct, on the 11th of April, near Propus, & with a sharp angle along the line of the Medicean [stars] more westerly, distant 7° from Propus toward the north along the diameter — its own; standing apart by ten [diameters], the telescope showing it, on the 12th — an angle along the more easterly line of the Medicean [stars], equal; on the 11th, since the conjunction of Jupiter & Propus had been about an intermediate time. So Gassendi in his *Epicuro* p. 906.

11. In the year 1634, April 12, at the $8\frac{1}{2}$ th hour, at Paris, Boulliau with an optical tube observed Jupiter near Propus, separated toward the north by $9'$, but at the 10th hour, & as far as the Azimuth, scarcely more westerly — quoad the situation indeed toward the Zodiac; he judges it to have already passed the place of Propus, which was in Gemini $25^{\circ} 56'$; whence Jupiter at that hour [was] in Gemini $25^{\circ} 53'$, with northern latitude $14'$. So he himself, lib. 7, *Astron. Phil.* ch. 3.

12. In the year 1634, December 4, at the 19th hour of Julian [reckoning], or at Loudun, Boulliau with the tube observed Jupiter distant $17'$ — or $18'$ — minutes from Asellus, a little more northerly toward the Azimuth; whence he judges Jupiter to obtain the same situation with a fixed longitude in Gemini $24^{\circ} 40'$, with northern latitude $14'$.

13. In the year 1635, January 18, Jupiter's opposition with the Sun was determined by Gassendi; & at Aix on the 16th, in the evening, he saw Jupiter distant from Procyon by $18^{\circ} 41'$, & from Castor by $21^{\circ} 2'$; but on the same day, at the 17th hour, he saw it distant from Castor by $16^{\circ} 58'$, & from Pollux by $12^{\circ} 42'$; & from Regulus by $25^{\circ} 27\frac{1}{2}'$. So in his observations sent to me from Bologna by D. Cassini.

14. In the year 1636, February 19, Gassendi notes in his letters to Cassini, on Jupiter's opposition with the Sun, because at Digne on the 20th day, in the evening, he saw Jupiter distant from the neck of \square [Leo] by $9^{\circ} 18'$, & from Regulus by $5^{\circ} 10'$.

(right-hand column, folio 308)

15. In the year 1637, July 16, Boulliau with the tube saw Jupiter applied to the star which is the sixth in the Belt of Virgo, & preceding it; and four [observations], which were made at the same fixed [star]. At the 1st hour & 9' it was distant from that [star] by 12'; & at that point [it was] more inferior by 8'; vel 9, but more westerly by 1'; therefore on the whole it was reckoned to precede the star by 10'. Jupiter is found to be in Virgo $29^{\circ} 38'$, with northern latitude $1^{\circ} 18'$. So he himself, lib. 7, *Astr.* ch. 3.

16. In the year 1639, Jupiter's opposition with the Sun is ascribed to the 20th day in May, as Gassendi observed it; sent to me by Cassini, because at Aix on the 20th day, in the evening, he saw Jupiter distant from the southern arm [Lance Austrina] by $21^{\circ} 5'$, & from the northern by $18^{\circ} 21\frac{1}{2}'$.

17. In the year 1639, August 31, at the 8th hour, at Paris, Jupiter again returned to the bright [star] of the front of Scorpio, by about the same width [margin] — almost; in azimuth six minutes more easterly; wherefore scarcely by one, or by the scruple [of a degree] it had exceeded that star in longitude, & whence, & by other circumstances, Boulliau reckoned Jupiter to be in Sagittarius $28^{\circ} 8'$, with northern latitude $42'$. So he himself, lib. 7, ch. 3.

18. In the year 1646, D. Vincenzo Mutus, of Majorca [Maioricæ], observed by several days Jupiter, in the same February, [near] its preceding [the] foot of the Twins [Geminorum]; & on the night of the 19th day, he found Jupiter in a total station, or from the star [Pollux] in the same situation, more westerly by 5', & more northerly by 9'; vel 10', as in the letters [reported] by him to me given.

19. In the year 1646, December 24, New Style, in the evening, Hevelius of Danzig [Dantici] observed Jupiter covered [occulted] by the Moon, which on p. 477 of his

Selenographia he relates emerged from the Moon at the 8th hour, 39½; but he observed the occultation at Regiomontanus [Königsberg] in Prussia at the 7th hour, 53'; D. Albert observed at Linemann [Lineamano], & so it appeared at Danzig at the 8th hour, 7', 45', 33" — as Hevelius reckons.

20. In the year 1647, January 20, at the 14th hour, 10', Gassendi at Paris saw the southern margin of Jupiter to be distant from the northern margin of the Moon by half the spot of Caspia [maculam Caspiæ], seen with the telescope, at the 14th hour, 17'. The Moon touched Jupiter's margin, & after a semi-diminution [partial reduction], soon began to emerge, at the 15th hour, 0', 30" — at the western margin of the Moon; but the arc of the lunar limb between the points of the Immersion & Emersion was 72°. So in his *Epicuro* p. 901.

Hevelius also saw the same thing on the 20th day, as he has it on p. 480 of his *Selenographia*: the Moon passing under Jupiter from above [supra], at the 15th hour, 57'. Thus, when Jupiter was very near the lunar limb, it stood [hidden] under it at the 1st minute, 7'.

21. In the year 1647, April 12, New Style, in the evening, Hevelius at Danzig [Gedani], observing, gathered Jupiter's transit above the Moon, & its conjunction with the Moon — as far as the longitude he noted — at the 11th hour, 14', 50'; post meridian, [Jupiter being at] another altitude from Arcturus by 53° 10'; & then Jupiter, from the northern cusp of the Moon dichotomized [at quarter], seen distant by 6' — as he himself relates in his *Selenographia*.

The same phase Gassendi observed at Paris, when the Moon, indivisible [appearing whole], seemed dichotomized; from the northern cusp [the Moon] rising under Jupiter, when Jupiter touched the limb of the Moon with the telescope — it was scarcely seen, but really soon began to be hidden a little; that is, at the 10th hour, 4', & by half precisely from Jupiter it failed; & it was a pleasant spectacle to see Jupiter divided in two, & afterward even less than half — inadequately illustrated by the Moon; at the hour at length more obscure 9', 3', the whole emersion ceasing; from the cusp by three-quarters of the longitude of the Caspian spot [Caspia maculæ].

In the same year, on the 12th of April, D. Vincenzo Mutus of Majorca likewise observed Jupiter eclipsed by the Moon, when Regulus, more westerly, was higher by 57', 18'; that is, at the 3rd hour, 9° 56'. He began moreover to be occulted at the northern cusp of the Moon, & at the egress at the high Regulus 49° 12', by the northern feet [?]; at the 10th hour, 48'; thus he lay hid under that [Moon] for 52'. He relates these things in the letters given to me, which I assert, observed by

myself, from the altitude of the city of Majorca $39^{\circ} 35'$; & so by the diversity of the parallax the Moon elsewhere touches Jupiter nothing, [reckoned] from its half, elsewhere half, elsewhere [?].

22. In the year 1647, through several December days, D. Vincenzo Mutus, observing Jupiter under the formless [star] [informi] which is below the belly of Leo, detected Jupiter's total station to have been on the 27th day, at the 14th hour. Mutus of Majorca, [reckoning] Jupiter to be still more easterly, [near] the formless one, by $3'$; & more southerly by $9'$; vel $10'$. He reckons this observation, & the examination of the Radius of the orb of the world [Radium orbis Mundi], by the variety of the Sun being in Perigee, & because Jupiter [was] Stationary — hence the quadrature [quarter-aspect] with the Sun can be gathered.

(continuation of Caput VI — the telescopic-era Jupiter observations of Gassendi, Boulliau, Hortensius, Lansberge, Hevelius, and Vincenzo Mut)

23. In the year 1650, again Vincenzo Mut [Vincenzo Mut], on 18 April at Majorca, at hour 10, using a peculiar instrument and a very large one, observed Jupiter at a distance from the star in the southern foot of Virgo of $3^{\circ} 26'$. From this, together with the latitude observed, he concluded that Jupiter had been in Scorpio at $5^{\circ} 22'$ — which agrees with Lansberge's tables, the Danish ones being in error by $1'$, the Prutenic by $2'$, Boulliau's by $3'$, Rudolphine by $11'$. Thus he writes to me in his letters.

24. In the same year, likewise at the same place, on 21 April, from the latitude of Jupiter and its distance of $5^{\circ} 18'$ from the bright star in the southern Balance [Lance], he deduced that Jupiter had been in Scorpio at $5^{\circ} 0' 40'$ — an aberration with respect to the tables I have named.

25. Likewise, in the same year, there [at Majorca], on 1 May, he saw Jupiter distant from the bright star in the Balance by $6^{\circ} 41'$, and from the southernmost of the three borders [fringes] of Virgo by $4^{\circ} 20'$. Therefore he placed it in Scorpio at $3^{\circ} 37'$, which agrees with the Prutenic [tables], but is in error by $1'$ for the Danish, by $2'$ for Boulliau, by $3'$ for Lansberge, by $4'$ for Rudolphine, by $11'$ [for...]. On 16 May, however, Jupiter was very nearly in the same longitude, being distant from the southern foot of Virgo by $5^{\circ} 53'$ from its star — for Jupiter's latitude was $1^{\circ} 24'$ northern.

26. On the same day, likewise there [at Majorca], at hour $8\frac{1}{2}$, Mut [D. Vincenzo Muto], having drawn a line through the southernmost, the southern, and one of the three borders [fringes] of Virgo to the star at the foot of Virgo, found it to graze the western limb of Jupiter. Then Jupiter stood distant from the said

southernmost [fringe] by $2^{\circ} 15'$. From this he deduced Jupiter's longitude as Scorpio $1^{\circ} 12'$, and its northern latitude as $1^{\circ} 23' \frac{2}{3}$ — varying from the longitude observed from the tables: Boulliau's by 3', Prutenic and Danish by 4', Lansberge's by 8', Rudolphine by 11'. Thus he himself in the same letters.

27. Now in the year 1649, likewise there [at Majorca], he observed Jupiter on 11 May. Jupiter, more easterly, stood among four preceding stars in Virgo, distant by $2\frac{1}{2}'$ or $1^{\circ} 30'$; and distant somewhat less than the two contiguous stars in the second Hyades. But on 9 June Jupiter was more westerly by one semidiameter than that same star, and more northerly by scarcely more than a semidiameter. On 10 June it was already at the eastern edge in the same hour, so that in 24 hours it had covered three of its own diameters.

CAPUT VII.

An appendix of Jupiter observations from the Tyconic [tables] recently published at Vienna, from the press of David Hautt, from which we have selected a few; and from the Author of *Urania Propitia*, and from the Fathers of Vienna [Oenipontanorum — i.e. of Innsbruck].

1. In the year 1582, on 30 March, in the morning at hour 4 $10'$, Jupiter stood distant from the mouth of Pegasus by $24^{\circ} 24' \frac{3}{4}$, and after some time from Aquila by $35^{\circ} 32'$.

2. In the same year, on 7 April, in the morning at hour 3 $36'$, Jupiter was distant from the mouth of Pegasus by $24^{\circ} 10' \frac{1}{3}$; but being too close to the horizon, it was distant from Aquila by $36^{\circ} 16' \frac{1}{4}$.

3. In the same year, on 5 November, at hour 2 $54' 55''$, Jupiter was at the meridian, at an altitude of $16^{\circ} 34'$; and from hour 6 it was distant from the extreme tail of Capricorn by $3^{\circ} 48'$. But because of the nearness of the stars it could not be observed exactly. At hour 8 $19'$ it was distant from the bright star in Vulture [the Vulture — i.e. Lyra/Altair region] by $15^{\circ} 2' \frac{1}{3}$, and at hour 8 $\frac{1}{3}$ it stood off from the first wing-star of Pegasus by one [semidiameter]; and again at $38^{\circ} 34' \frac{1}{2}$ [it was found]. But because in the following meridian-passage [or: by the horologe used], the [instrument] was found to move too slowly, by $15^{\circ} 40'$.

4. Likewise in the year 1582, on 12 November, Jupiter was observed by the Radius [cross-staff], in which there is little reliability.

Ex Auctore Uraniae Propitiae parte 2. cap. 14. seu à pag. 90.

From the Author of *Urania Propitia*, part 2, chapter 14, or from page 90 onward.

5. In the year 1627, on 6 May, the said Author [Maria Cunitz] in Silesia, with a telescope of 14-minute aperture capacity [tubo optico capaci in apertura 14 minutorum], observed Jupiter more easterly than the topmost star in the forehead of Scorpio by $3\frac{1}{2}'$; and so [she placed it] in Scorpio at $28^{\circ} 2'$. The date was 16, new style.

6. In the year 1629, likewise the Author, on 17 October at 19, with several observations, saw Jupiter to exceed the Rudolphine place by about $9'$ of minutes.

7. In the year 1640, likewise the Author, on 11 May in the evening, by the aforesaid optical tube noted Jupiter to be more easterly by a single minute than the small star next to the easterly one [Stellula 1. Alae Virginis] in the wing of Virgo; and so [she placed it] in Virgo at $56^{\circ} 0'$ [or $26^{\circ} 0'$] — although nevertheless the Rudolphine calculation exhibits it at $29^{\circ} 46'$.

8. Add to these the conjunction of Jupiter and Mars [$\text{♃} \text{ } \text{♂}$] observed at Prague in the year 1604, on 8 and 9 October; from which Kepler concluded the conjunction [♃] to have taken place a little before midday on the 9th.

9. Add, and the distance of Jupiter [♃], which D. Vincenzo Mut [Vincenzo Mut] in the year 1659, on 31 March at hour 8, observed to be more westerly by $25'$. He was in the Nebulous [Praesepe], as he wrote to me.

[Margin, against item 8: $\text{♃} \text{ } \text{♂} / \text{ } \text{♃} \text{ } \text{♂}$] [Margin, against item 9: numeral "2"]

Selectae observationes Iovis factae Oeniponti à PP. Soc. Iesu, & ad me transmissae à P. Michaele Staudacher.

Selected observations of Jupiter made at Innsbruck [Oeniponti] by the Fathers of the Society of Jesus, and transmitted to me by Father Michael Staudacher.

10. In the year 1635, on 9 September, in the morning between hour 4 and 5, Jupiter was observed; on which Aldebaran was at an altitude of $15^{\circ} 5'$, and already Jupiter at 31° altitude. Aldebaran's [recorded] altitude was 31° . The remaining observations are as follows:

The following is a citation-grade table of Innsbruck Jupiter observations, transcribed as a pipe-table.

An. 1635 (Mens. D.)	Distantia \sphericalangle à Fixis (star)	Distantia (Gr. ')	Altitudo Fixarum (G.)	Altitudo Horiz. Ionis [Iovis] (G. ')
Sept. 19 — morning	Camicula [Camicula]	36 40	25 45	7 50
	Pollucis cap. [head of Pollux]	36 1½	42 20	
Octob. 2 — morning	Camicula [Camicula]	39 1½	44 45	28 15
	Iuba \square [the Mane of Leo]	7 11	30 15	
7 — morning	Camicula [Camicula]	39 5½	46 30	32 5½
	Iuba \square	8 30		
Martij 1636, 18 — evening	Regulo	2 18	47 18	48 6
	Iuba \square	7 19	54 45	
31	Regulo	1 18	51 40	51 30
	Iuba \square	7 40		
April. 16 — evening	Regulo	0 54	55 40	56 30
	Camicula	38 2		
Majj 30 — evening	Iuba Leon.	8 16	Reguli	31 40
	Cauda \square	22 1	30 25	
Iulij 10 — evening	Arcturo	8 17	55 35	10 23
	Dubhe	52 31		
Dec. 24 — evening	Regulo	36 30	Spica	Merid. 42 16½

An. 1635 (Mens. D.)	Distantia \sphericalangle à Fixis (star)	Distantia (Gr. \prime)	Altitudo Fixarum (G. \prime)	Altitudo Horiz. Ionis [Iovis] (G. \prime)
	Arcturo	32 50	32 45	
Ianuar. 1637, 21	Arcturo	32 10		29 0
	Lyra lucid.	91 4	54 27	
Martij 14	Regulo	36 25	48 55	18 44
	Cauda \square	17 51	36 33	
Martij 21	Regulo	35 30	55 51	30 40
	Arcturo	34 26	27 25	

Parsing notes: This table has paired star-references per date (two rows of "Distantia \sphericalangle à Fixis" per observation), with degrees-and-minutes in the "Gr. \prime " column, the fixed-star altitude in "G. \prime ", and Jupiter's horizon altitude in the last column. Several entries are tight at the page resolution; "Spica" and "Reguli"/"Merid." appear as in-cell labels rather than pure numerals. The doubled-prime time/altitude notation and noon-reckoned values are not flagged as impossibles.

CAPUT VIII.

Selected observations of Jupiter from among those which were carried out at the College of S. Lucia of Bologna by the Fathers Giovanni Battista Riccioli [Riccioli] and Francesco Maria Grimaldi [Grimaldi], together with other Associates of the same Society of Jesus.

With a few observations added at the end by the Most Illustrious Marquis Cornelio Malvasia [Cornelio Malvasia].

1. In the year 1642, on the night following day 5 of September — that night on which the opposition of Jupiter with the Sun was celebrated — the meridian distance of Jupiter from the Sun was $32^{\circ} 31' 30''$; but Saturn's was $49^{\circ} 50'$. From the meridian altitude of Jupiter, and through the transit of the bright star in the southern tail of Cetus, the values were reckoned by M. C. with the aid of a perpendicular at $7^{\circ} 10'$; and from the transit of the same Tail [of Cetus], $50^{\circ} 8'$.

2. In the year 1642, on 18 September, about the first hour of the following night, Jupiter was distant from the brightest star of Aries by $53^{\circ} 29'$; and from the bright star in the Mandible [chin/jaw] of Cetus by $25^{\circ} 34'$.

3. In the same year, on 23 October, in the following night, the western altitude of Aquila was $53^{\circ} 11'$; in $5^{\circ} 45'$ of time Jupiter was distant from the bright star of Aquila by $50^{\circ} 47'$; and then a few minutes afterward it was distant from Scheat of Pegasus by $23^{\circ} 1'$.

4. In the year 1643, on 10 February, in the following night, at hour 2, Jupiter appeared at altitude 6° and distant from Scheat of Pegasus by $31^{\circ} 44' \frac{1}{2}$; but from the head of Andromeda by $31^{\circ} 44' \frac{1}{2}$.

5. In the same year, on 11 February, at hour 1, in Italian civil reckoning, Jupiter was at altitude 9° and distant from Scheat of Pegasus by $32^{\circ} 13'$; at Markab of Pegasus by $35^{\circ} 24' 10' \frac{1}{2}$; and the hundredths [hundreds] of those numbers we have noted from observation with greater accuracy.

6. In the year 1643, in the following night, day 23 February, Jupiter was at altitude 9° and distant from the girdle of Andromeda by $39^{\circ} 52' \frac{1}{2}$; but from the bright star of Aries by $39^{\circ} 1'$.

7. In the year 1643, on 18 June, in the following night, the western altitude of Aquila — which was $46^{\circ} 2'$ — was reckoned in $21' \frac{1}{2}$ of time; and Jupiter was distant from the bright star of Aries by $15^{\circ} 42'$. Then after 2 minutes of time it was distant from Saturn by $14^{\circ} 10'$; the location is in fact from the observation of Saturn above its own place, reckoned with reference [to...].

8. In the year 1643, on 15 July, in the morning, the altitude of the bright star of Aries was captured eastward, and after an interval of 5 minutes of time the distance of Jupiter from the same bright star of Aries was taken with the Sextant, repeated twice: $14^{\circ} 29'$; both [readings] then in $14^{\circ} 29' \frac{2}{3}$. Then after a minute of time, on the eastward side, the distance of Jupiter from Aldebaran by repeated observation was $41^{\circ} 21'$; with Aldebaran being at altitude 19° and Jupiter near \square [quadrant] with the Sun.

9. In the same year, by accident, the altitude of the bright star of Aries was taken eastward at $58^{\circ} 27'$; after 7 minutes of time the western [...] distant by $13^{\circ} 56'$; and after 6 minutes of time it was distant from Aldebaran by $13^{\circ} 15'$; after the quarter [quadrant]-aspect of the hour [it was] distant from Saturn by a single [unit], and stood near \square [quadrant] with the Sun.

10. In the year 1643, on 3 August, in the morning, the bright star of Aries stood high at altitude $48^{\circ} 27' \frac{1}{2}$ eastward; after 7 minutes of time we then saw Jupiter distant from Capella by $56^{\circ} 7' \frac{1}{2}$; and after 6 minutes of time it was distant from Aldebaran by $40^{\circ} 2' \frac{1}{2}$.

11. In the same year, on 8 August, in the morning, [Aldebaran] was high at $44^{\circ} 40'$ eastward; after an interval of 7 minutes of time [...]

(continuation of Caput VIII — the Bologna College observations; the table-head from the previous page's broken item 11 continues at top)

Citation-grade table fragment (continuation of an observation series, transcribed as a pipe-table). Columns: minutes of time; distance of Jupiter from stars (degrees, minutes); the reference star.

Min. Temp. (M.)	Distant. Iovis (G.)	(')	à Stellis (from the star)
4	29	23	à Lucida □ [the bright star of Aries]
2	28	54	à Capella
4	46	14	à □ capite precedenti [the preceding head-star of Aries]
2	48	17	à □ cap. sequenti [the following head-star of Aries]
4	13	46	à □ pede lucido [the bright foot-star of Aries]
4	39	36	à Saturno

Parsing notes: this small table belongs to the broken item 11 carried over from p. 310. The □ symbol marks the several reference stars in Aries.

16. In the year 1644, on 22 September, in the morning at hour 3, after the middle of the night Jupiter was distant from Saturn by $24^{\circ} 28'$; but from Capella by $28^{\circ} 11'$. Jupiter was then very near \triangle [trine] with the Sun.

17. In the same year, on 17 November, in the following night, Regel [Rigel] was high at its rising at $29^{\circ} 24'$ when Jupiter, not far off in opposition with the Sun, was observed in the following night and was distant from the eastern shoulder of Orion by $40^{\circ} 52'$; and after 6 minutes of time it was distant from Castor's head by $49^{\circ} 56'$. Afterward, when crossing the meridian, the meridian distance was taken by twin large Quadrants by M. C. at $26^{\circ} 8'$; from there the meridian distance of Aldebaran was reckoned by M. C. at $7^{\circ} 38'$; and then Aldebaran's meridian distance from the heart of Leo [Leonis] was $28^{\circ} 44' \frac{1}{2}$.

18. In the year 1645, on 22 December, in the following night, about hour 6 by the public horologe — that is, from the right shoulder of Orion — Jupiter was observed in the eastern quadrature at altitude $39^{\circ} 20'$; and the eastern altitude of Jupiter was $17^{\circ} 20'$; and from the brighter head of Gemini by $18^{\circ} 38' \frac{1}{2}$.

19. In the year 1646, on 18 March, in the following night, in the fourth [hour] of civil reckoning, Jupiter near \square [quadrature] with the Sun was distant from Procyon by $28^{\circ} 19'$; and from the southern head of Gemini by $26^{\circ} 4'$.

20. Again in the year 1646, on 2 November, in the morning, Jupiter was high above its western setting by 65° , and distant from Procyon by $23^{\circ} 20' \frac{2}{3}$; then after a smaller interval of time, by 2° , Procyon stood distant from the eastern setting versus by $42^{\circ} 35'$; and after two minutes [it was distant] from Sirius by $47^{\circ} 43' \frac{1}{2}$, with Sirius being at altitude above its setting by 21° .

21. In the year 1647, on 16 January, in the following night, when Jupiter was high, it was 31° ; and Jupiter at 30° was distant from Procyon by $21^{\circ} 24' \frac{1}{2}$; and then from the following shoulder of Orion by $43^{\circ} 31'$.

22. In the same year, on 23 January, in the following night, Jupiter was high about 30° ; it was distant from the bright shoulder of Orion by $39^{\circ} \frac{2}{3}$; and after the quarter-aspect [quadrant] of the hour, it was distant from Procyon at another place by $31^{\circ} 46'$; Jupiter was distant by $20^{\circ} 49' \frac{1}{3}$.

23. In the year 1647, on 1 January, in the following night, Jupiter stood distant from the bright shoulder of Orion by $42^{\circ} 17' \frac{1}{2}$; and from Procyon by $20^{\circ} 23' \frac{1}{2}$; then at another place the western [setting?] [...] Jupiter was distant by 45° .

24. In the year 1647, on day 2 of April, in the following night, about the first hour after the setting of the Sun, the conjunction of Jupiter began to be observed, with

Mars tending to a conjunction with Jupiter; and it was completed within about a sesquihour [an hour and a half] — that is, when Regulus had been observed at its setting at altitude $34^{\circ} 40'$; for the conjunction was then completed. Therefore from the bright shoulder of Orion Jupiter was distant by $38^{\circ} 16'$. Mars was distant by $39^{\circ} 1' \frac{1}{2}$. Then in the same way Capella was distant from Jupiter by $46^{\circ} 6' \frac{1}{2}$; Mars was distant by $44^{\circ} 57' \frac{1}{2}$. Then Jupiter was distant from the bright [star?] by $25^{\circ} 8'$. Mars was distant by $28^{\circ} \frac{1}{2}$; and they stood very nearly in the same Vertical [circle]: Jupiter at its rising leaning a little eastward, and Mars set [tending] in the western quadrant.

25. But on day 4 of April, of the same year, about hour 3, from the setting of the Sun, Jupiter was distant from the bright shoulder of Orion by $38^{\circ} 18'$. Mars was distant by $39^{\circ} 30'$; and the western shoulder of Orion was high at 18° . A little later Jupiter was distant after Capella by $46^{\circ} 9' \frac{1}{2}$. Mars was high at $23^{\circ} \frac{1}{2}$; and at once Regulus was distant westward from the vertex by $35^{\circ} 40'$. Let one therefore work out the time of this conjunction.

Inserere hic Observationes, infra ponendas 59. 60. 61. 62.

[Insert here the Observations to be set out below: 59, 60, 61, 62.]

36. In the year 1648, on 25 May, at the first hour of the following night, Jupiter was seen to be distant from the head of Castor by $42^{\circ} 43' \frac{1}{2} \frac{2}{3}$; from [...]

37. In the year 1649, on day 2 of June, about hour 2 of the following night, when the preceding head-star of Gemini was setting, Jupiter was distant from Regulus by $34^{\circ} 44' \frac{2}{3}$; and from the bright star in the Mane of Leo [Iuba □] by $35^{\circ} 34' \frac{1}{2}$.

38. In the year 1649, on 9 June, in the following night, Jupiter was seen more westerly than that star of Virgo which precedes the four stars in the left wing — or, in longitude, it was at $29^{\circ} 59'$ of Virgo, with northern latitude $1^{\circ} 25'$. At that same hour Jupiter was seen more easterly than the aforesaid star of Virgo, when it was distant by the aforesaid grand telescope, on the day before, from the vertical [circle of] the aforesaid star by an orthographic semidiameter of $3^{\circ} 4'$ — and this its precedence: the eleventh-day semidiameters of Jupiter [Iovialibus] were $10^{\circ} \frac{2}{3}$. Why, since then the diurnal motion of Jupiter is here a minor third [a 60th of a 60th], and is moreover by $2^{\circ} 0' \frac{2}{3}$ — it was [distant] from that Australian star by one semidiameter very nearly diametrically opposite to it. How may the apparent diameter of Jupiter be deduced? It was said to be $1^{\circ} 7'$. (*Almagestum Novum*, Book 6, ch. 6, etc., as written below.)

39. In the year 1649, on 22 June, a little after, conjunction [♃] of Jupiter with the Sun; the more western [position], after the setting of the Sun, was observed again, when Jupiter was often distant from Regulus by $35^{\circ} 42'$; and from the bright star in the Mane of Leo [Iuba ♁] by $36^{\circ} 33'$.

40. In the year 1650, on 24 April, about the conjunction [♃] of Jupiter with the Sun, in the following night, Jupiter was distant from the vertex by $19^{\circ} 54'$; it was distant from Spica of Virgo by $15^{\circ} 59'$; and presently from Arcturus it was distant by $47^{\circ} 52'$.

41. In the year 1652, on 30 June, in the following night, after the setting of the Sun, Jupiter was distant from the vertex by $79^{\circ} 13'$; presently from Antares by 33° , more precisely; then from Aquila by 30° ; and from the vertex by $78^{\circ} 22'$; and this had preceded on the day before the opposition [♃] of Jupiter with the Sun.

42. In the same year, on day 4 of July, at the same hour, after the setting of the Sun, Jupiter was high at $19^{\circ} 46'$; it was distant from the bright star of Aquila by $34^{\circ} 47'$; then it was high at $13^{\circ} 10'$; it was distant from Antares by $32^{\circ} 29'$.

43. In the same year, on 12 August, in the following night, after the setting of the Sun, Jupiter was high at about 25° ; it was distant from the bright star of Aquila by $36^{\circ} 41'$; then it was high above Pegasus by $47^{\circ} 43'$.

44. In the same year, on 14 August, in the following night, with the bright star of Aquila distant from the vertex at $40^{\circ} 49'$, and Jupiter at its rising versus eastward, it was distant at the same time by $37^{\circ} 9'$; and a little later it stood off from the bright star of Pegasus by $57^{\circ} 2' \frac{1}{2}$; and presently from Procyon by \triangle [trine] of the Sun.

45. Finally, in the same year, on 14 November, about the first hour after the setting of the Sun, when Fomalhaut was seen to be distant from the vertex by $77^{\circ} 10'$; Jupiter was seen distant at the same time by 75° abeam [ab ore]; from the vertex of Pegasus by $49^{\circ} 45'$.

46. In the year 1653, on 22 May, in the morning, Markab of Pegasus at its rising was distant from the vertex by $55^{\circ} 31'$; and Jupiter was distant from the vertex by $47^{\circ} 34'$; and from the head of Andromeda by $57^{\circ} 5'$; presently Jupiter was distant from the vertex by $66^{\circ} 50'$; and from the crooked [star] of Pegasus by $47^{\circ} 43'$.

47. In the year 1653, on 28 November, in the following night, about the hour very nearly the second after the setting of the Sun, Jupiter was distant from Fomalhaut by $23^{\circ} 52'$; but from the vertex by $64^{\circ} 55'$. Fomalhaut was distant from the vertex versus by $76^{\circ} 2'$; a little later it was distant by 1 from Cetus; the distance was 86°

28' 50'; with that star itself distant from the vertex by 69° 42'. Take counsel from these the distances of Jupiter, by which it may be established whether the Ephemerides err in the conjunction [♃] of Mars with Jupiter.

48. In the year 1653, on 23 December, about hour 5 of the post-meridian, 7' ½; Jupiter was expected at the precise Azimuth, grade 30, distant from the vertex by 66° 28' ½; from which moment the values were reckoned in 12° ½; the bright star of Aquila was distant from the vertex by 61° 41' ½.

49. In the year 1654, on 2 November, in the following night, Jupiter, tending toward Direct [motion] (until now it had been Retrograde), was distant from the bright star of Aries by 50° 15' ½; presently from the bright star in the Tail of Cetus by 23° 40' ½; and then it was hour 4 by Italian civil reckoning, with the half [half-hour].

50. In the year 1654, on 6 November, in the following night, the transit of Fomalhaut by M. C. and [the values] reckoned by perpendicular: 23° 40'. Jupiter reached the vertex by M. C. as it was distant; then at the vertex by 52° 16' 40'; the hour was Italian 5 ½.

51. In the same year, again, on 11 November, in the following night, about the hour [...]

about the hour 3¼. In Italian reckoning, Jupiter was nearest the meridian; it stood distant from the bright star of Aries [Hamal] by 50 degrees, 13½ minutes, and from the tail of Cetus by 23 degrees, 39½ minutes.

52. In the year 1655, on 21 August, in the morning, Jupiter — already retrograde — when it was at mid-heaven, stood distant from the vertex by 34 degrees, 13½ minutes; thence after a minute of time [postea minuta temporis 3', or "after 3 minutes of time"], 3 degrees, 40 minutes. The following shoulder of Orion stood distant, toward the west, from the vertex by 59 degrees, 36 minutes.

53. In the year 1655, on 17 October, the following night, Jupiter, approaching toward conjunction with the Sun, stood distant in the meridian from the vertex by 36 degrees, 4 minutes.

54. In the year 1656, on 12 March, at hour 1 of the night, Jupiter stood distant from the bright star, that is, from the following shoulder of Orion, by 53 degrees, 55¾ minutes, and from Rigel by 48 degrees, 46¾ minutes.

55. In the same year, on 16 August, in the morning, two hours before sunrise, Jupiter stood distant from Capella by 26 degrees, 56 minutes, and from the northern horn of Taurus by 15 degrees, $3\frac{1}{4}$ minutes.

56. Finally, in the same year, on 27 October, at the third and a half hour after sunset, Jupiter, being eastern, stood distant from Capella by 26 degrees, $43\frac{3}{4}$ minutes (or $\frac{2}{3}$), and from the northern horn of Taurus by 14 degrees, $30\frac{1}{2}$ minutes.

57. In the year 1657, on 10 February, the following night, Jupiter stood distant in the meridian from the vertex by 23 degrees, $32\frac{1}{2}$ minutes, 50 seconds; thence after a minute of time, 35 minutes, 10 seconds [or "35' 10''"], Aldebaran crossed the meridian [M.C., Medium Coeli].

58. In the same year, on 18 March, Jupiter was in the same azimuth — concerning which, see in the observations of Venus for this same day — and Jupiter then stood distant from the vertex by 52 degrees, precisely; but in the azimuth of Aldebaran it stood distant from the vertex by 58 degrees, 17 minutes.

59. In the year 1647, on 18 April, the following night, Jupiter was observed standing distant from Capella by 46 degrees, $48\frac{3}{4}$ minutes (or $\frac{2}{3}$), and from the heart of the Scorpion [Antares] by 32 degrees, 40 minutes. At that time, moreover, Arcturus stood distant in the east from the vertex by 47 degrees, 40 minutes.

60. In the year 1648, on 20 February, the following night, about the hour $3\frac{3}{4}$ after sunset — that is, distant from Procyon at the vertex by 38 degrees, 48 minutes; Jupiter being elevated 34 degrees, 50 minutes — it stood distant from the same Procyon by 46 degrees, 43 minutes, and from the extreme tail of the Great Bear by 54 degrees, $3\frac{1}{4}$ minutes.

61. In the same year 1648, on 21 February, at an hour after sunset, the Sun being distant $3\frac{3}{4}$ degrees [or "Sol distant $3\frac{3}{4}$ "], Jupiter stood distant from Procyon by 46 degrees, 35 minutes, and from the extreme tail of the Great Bear by 54 degrees, 50 minutes.

62. In the same year 1648, on 26 February, the following night, at hour 3 after sunset, Jupiter, being eastern, stood distant from Procyon by 46 degrees, $1\frac{3}{4}$ minutes, and from the last star in the tail of the Great Bear by 54 degrees, 58 minutes.

63. In the year 1649, on 9 June: concerning this observation — which we shall report on another occasion — see Book 10, chapter 3, numbers 5 and 6. Jupiter was then in Virgo [□] at 29 degrees, 56 minutes, 25 seconds, with northern

latitude [cum latitudine Boreali] — see Book 7, chapter 3, number 4 — and so, an hour after midnight, but already near the station, it was observed worthy of record.

64. In the year 1657, on 26 December, the following night, Jupiter, in the most precise meridian, stood distant from the vertex by 21 degrees, 11 minutes, 33 seconds (or $\frac{1}{4}$), and after its transit there is reckoned [a further] 6 minutes, 40 seconds of time, [when] Sirius crossed the same meridian.

But on 27 December, the following night, Jupiter likewise stood distant in the meridian from the vertex by 21 degrees, 10 minutes, 43 seconds, and 7 minutes, precisely, of time after [its transit] Sirius crossed the same meridian. Hence Jupiter's declination on the 26th day was 23 degrees, 18 minutes, 37 seconds, and on the 27th it was 23 degrees, 19 minutes, 27 seconds.

Selected observations from the *Ephemerides* of the illustrious Marquis Cornelio Malvasia [Malvasia], folio 203.

In the year 1662, from his own observatory at Modena [Mutina], the Marquis observed the distances of Jupiter from the fixed stars written below, but corrected by Cassini's *Tables of Refractions* [Tabulae Refractionum Cassiniana]; and, taking the positions of the fixed stars from Tycho's [Tychonic] tables, he derived from them, by aid of trigonometry, Jupiter's longitudes and latitudes noted below; and he compared these with those which Lansberg's [Lansbergian] calculation supplies.

Table. Right-hand column table of Malvasia's 1662 Bologna/Modena Jupiter observations. Columns: date (June / July / August, by day "D."); hour after noon ("Ho. post occ. ☉" — hours after the Sun's setting / after noon, with "H." and minutes "I"); the corrected distance of Jupiter ("∟ Distantia correcta") given against a comparison star with degrees "G." and minutes "I"; Jupiter's observed place ("Locus ∟ Obseruatus") with sign, degrees "G." and minutes "I"; and Lansberg's excess or defect ("Lansberg. Excessus vel Defectus"). The comparison stars are *Spica* (♍ Virginis), *Boötes* (i.e. Arcturus), *Lucida Austrina* (*Lūc. Aust.* — the southern bright star), and *Arcturo* (Arcturus).

	Ho. post occ. ☉ (H. I)	∟ Distantia correcta (star — A. G. I)	Locus ∟ Obseruatus (sign G. I)	Lansberg. Exc. / Def.
June (D.)				
5	1 15	<i>Spica</i> 16 8	Lo. ♍ 4 55	Exc. 10

June (D.)	Ho. post occ. ☉ (H. I)	∟ Distantia correcta (star — A. G. I)	Locus ∟ Observed (sign G. I)	Lansberg. Exc. / Def.
5	—	<i>Boötes</i> 33 6	La. B. 1 20	Def. 4
7	2 8	<i>Spica</i> 16 0	Lo. ∟ 4 47	Exc. 10½
7	—	<i>Lūc. Aust.</i> 33 37	La. B. 1 18	Def. 1
9	0 35	<i>Spica</i> 15 52	Lo. ∟ 4 39	Exc. 11
9	—	<i>Boötes</i> 32 56	La. B. 1 16	Def. 3½
14	1 30	<i>Spica</i> 15 35	Lo. ∟ 4 22	Exc. 11
14	—	<i>Boötes</i> 32 51	La. B. 1 17½	Def. 4
22	0 52	<i>Spica</i> 15 17	Lo. ∟ 4 4	Exc. 13
22	—	<i>Boötes</i> 32 45	La. B. 1 15	Def. 4
25	1 15	<i>Spica</i> 15 14	Lo. ∟ 4 3	Exc. 13
25	—	<i>Arcturo</i> 32 44	La. B. 1 13	Def. 4
July 1	1 47	<i>Spica</i> 15 12	Lo. ∟ 3 59	Exc. 14
1	—	<i>Arcturo</i> 32 43	La. B. 1 13	Def. 4
4	0 30	<i>Spica</i> 15 12	Lo. ∟ 4 0	Exc. 14
4	—	<i>Arcturo</i> 32 45	La. B. 1 11	Def. 3½
7	0 52	<i>Spica</i> 15 15	Lo. ∟ 4 3	Exc. 13
7	—	<i>Arcturo</i> 32 46	La. B. 1 10	Def. 3
10	1 20	<i>Spica</i> 15 20	Lo. ∟ 4 8	Exc. 11
10	—	<i>Arcturo</i> 32 49	La. B. 1 7	Def. 2
13	0 30	<i>Spica</i> 15 26	Lo. ∟ 4 14	Exc. 11
13	—	<i>Arcturo</i> 32	La. B. 1 7	Def. 2½

June (D.)	Ho. post occ. ☉ (H. I)	∟ Distantia correcta (star — A. G. I)	Locus ∟ Observatus (sign G. I)	Lansberg. Exc. / Def.
		53		
16	1 9	<i>Spica</i> 15 32	Lo. ∟ 4 22	Exc. 11
16	—	<i>Arcturo</i> 32	La. B. 1 7	Def. 2
		58		
22	0 55	<i>Spica</i> 15 52	Lo. ∟ 4 41	Exc. 10
22	—	<i>Arcturo</i> 33	La. B. 1 6	Def. 1
		8		
24	1 36	<i>Spica</i> 16 1	Lo. ∟ 4 49	Exc. 14
24	—	<i>Arcturo</i> 33	La. B. 1 6	Def. 1
		12		
Aug. 5	1 28	<i>Spica</i> 17 3	Lo. ∟ 5 54	Exc. 1
5	—	<i>Arcturo</i> 33	La. B. 1 1	Def. 1
		42		
11	1 51	<i>Lūc. Aust.</i> 3	Lo. ∟ 6 34	Exc. 1
		45		
11	—	<i>Arcturo</i> 34	La. B. 1 0	Def. 1
		2		
17	0 32	<i>Lūc. Aust.</i> 3	Lo. ∟ 7 13	Exc. 13
		14		
17	—	<i>Arcturo</i> 34	La. B. 0 59	Def. 1½
		20		
24	1 22	<i>Lūc. Aust.</i> 2	Lo. ∟ 8 12	Exc. 11
		15		
24	—	<i>Arcturo</i> 34	La. B. 0 58	Def. 1
		50		
29	1 24	<i>Lūc. Aust.</i> 1	Lo. ∟ 8 57	Exc. 13
		31		
29	—	<i>Arcturo</i> 35	La. B. 0 57	Def. 2½
		12		

Parsing notes: For each date there are two rows — the upper giving the distance from one comparison star with Jupiter's observed *longitude* (Lo. = Longitudo), the

lower giving the distance from a second comparison star with Jupiter's *latitude* (La. B. = Latitudo Borealis, northern latitude). The "Lansberg. Excessus vel Defectus" column registers, per row, the excess (Exc.) or defect (Def.) of the Lansbergian computation against this observation, in minutes. Several fractional half-minute values (e.g. 10½, 17½, 22½) are noted in the source. The zodiac sign for Jupiter's longitude is Libra (♎) throughout.

But you should remember that the Tyconic positions of the fixed stars themselves require correction, and that the correction of the distances, resting on Cassini's refractions, is not free of doubt — as I have already pointed out in Book 1.

CAPVT IX. — CHAPTER IX.

On the selection of observations concerning Jupiter for the purpose of a calculation reckoned from our Tables.

1. From what was said in Book 5, chapters 9, 10, and 11 — on the methods of observing the positions of the planets, on the difficulty of avoiding errors of many minutes [scrupula], and on the construction of the Tables — it is plain that observations must be preferred which are surer rather than merely more numerous. [Margin: From the Danish Tables.] Tycho judged, in his preface to the *Astronomical Letters*, that the motion of Jupiter cannot be amended from observations unless these are taken at single oppositions [oppositions to the Sun]. [Margin: And from the Rudolphine.] Longomontanus, nonetheless, in Book 1, chapter 2 of the *Theoricae*, made use of only eight oppositions of Jupiter — and that with the true place of the Sun observed, partly by Tycho, partly by himself — for constructing the Danish Tables; and in chapter 7 he searched out another observation for the place of Jupiter's apogee.

Kepler, moreover, in laying the foundation of the *Ephemerides* which he built upon the Rudolphine Tables, affirms (page 14) that his Tables, as regards the three superior planets, cannot be detected to differ from the heavens by an amount worth noting. Elias [Leonita] Leonitus, who was himself an author of works in Silesia at Bicinum [Beuthen?], edited and titled *Prima Propitia* (page 89), says that the Rudolphine Tables err in longitude — from his own observations — by up to 13 minutes; in the second semicircle of the commutations, indeed, by so much that they appeared to have purged away the errors of the Rudolphine men, mutually canceling, just as he supposes Kepler imposed; and that the same thing happens in the second [semicircle]. He adds, moreover, that Kepler's theory of Jupiter labors under some defect — the mean motion, the place of aphelion, and

the proportion of the orbital radius at the intervals of the Sun and Earth. Finally Boulliau [Bullialdus], that most diligent investigator of astronomical truth, both amended the Rudolphine men (Book 3, *Astronomia Philolaica*, page 9) and shows (chapter 1, number 6) that those 48 minutes do not exceed the place of Jupiter near the station — which the observed place requires [Margin: And the Rudolphine likewise faithless.] (chapter 1, number 6, on which we put little weight); and the five only [tables] of these same Tables he openly prefers, on the faith of these same Tables, though somewhere indeed faithless: with page 170. The *Thesauri* of the conjunctions of Mars and Jupiter, which Kepler [reports] (page 305 of the *Astronomia Optica*), and which Maestlin observed at Tübingen in the year 1591, on 13 January, on his own day 8 — indeed, he asserts it was done on the 8th; nay, in the series of calculation he sets the day 6 of January, and on hours 18 after midday of the sixth day, lest he draw his observation to his own Tables: a matter on which there is more in Book 7, chapter 8, on the occasion of Mars.

[Margin: The order of the observations.]

And so we, out of so many observations recounted above, have selected the 20 written below — namely, four notable conjunctions of Jupiter and 15 conjunctions of Jupiter and Mars with the fixed stars, observed for the most part with the telescope [tube]; and we have added one Tychonic [observation] from observations by distances from two fixed stars, which we shall report in the order of the times preserved.

[Margin: 1]

In the year 141 before Christ, as I reported in chapter 1: on 3 September, at hour 16 after midday at Bologna, Jupiter was seen to cover the southern Asellus [Aselli, the "Asses"] of Cancer, which to me, from the positions of the fixed stars corrected in Book 4, was then in Cancer [□] at 7 degrees, 11¼ minutes, with southern latitude 3 degrees, 30 minutes. [Margin: ♃ at the southern Asellus.] And on account of the borrowed light of the stars, the stars appear nearer to one another than they truly are; so that Jupiter, touching a fixed star with the naked eye, if it be viewed through a telescope, would stand off from it by some few minutes, and sometimes by 8 — Jupiter's own diameter being just so many minutes; so that Jupiter might stand off from the southern Asellus by the same number of minutes, and so be in Cancer at 7 degrees, 7 minutes, or thereabouts, by a minute. [Margin: ♃ ♂ — Jupiter at the southern Asellus.]

Table. Right-hand column inset comparing where Jupiter then stood according to the several Tables (Lansberg's, the Danish, the Philolaic, and Ours), in signs (Sig.), degrees (G.), minutes (I), and seconds (II), with longitude (♋ position) and latitude (Lat.) rows.

Jupiter then exhibited by the Tables	Sig.	G.	I	II
Lansberg's (longitude)	♋	7	34	26
Lansberg's (Lat.)	a.	0	10	0
Danish (longitude)	♋	7	33	0
Philolaic (longitude)	♋	7	6	0
Philolaic (Lat.)	—	0	25	0
Ours (longitude)	♋	7	4	30
Ours (Lat.)	—	0	24	10

Parsing notes: "a." in the Lansberg latitude row appears to abbreviate *australis* (southern). The longitude rows give Jupiter's position in Cancer (♋).

2. In the year of Christ 498 — to speak as observed — in the morning, about hour 9 of the day of the month of March, Jupiter and Mars were so closely conjoined that they seemed to differ by almost nothing perceptible. Boulliau, to me at least, then had Mars in Virgo at 0 degrees, 13 minutes, 56 seconds, with northern latitude 1 degree, 14 minutes. But Jupiter came out to me in Virgo at 0 degrees, 15 minutes, 34 seconds; yet, on account of the irradiating beams, they seemed to differ by nothing. [Margin: ♄ ♋♊]

	Sig.	G.	I	II
♋ (Mars)	♋	0	13	56
♋ (Jupiter)	♋	0	15	34

3. In the year of Christ 508, on 27 September, at hour 17 after midday at Athens, and on the 16th at Bologna, Jupiter was seen next to Regulus [Reguli], indeed, in so far as it [Jupiter] stood off toward the north from Regulus by 3 minutes, or at least by 7½ minutes. To me, Regulus was in Leo at 8 degrees, 51 minutes, 57 seconds; but, by Boulliau, in Leo at 8 degrees, 49 minutes, 54 seconds. [Margin: ♂ ♃ ⊕ Reguli — conjunction of Jupiter with Regulus.]

And then,
by the
Tables,

Jupiter was	Sig.	G.	I	II
Rudolphine	□	9	35	33
Philolaic	—	8	58	43
Ours	—	8	56	30

4. In the year of Christ 509, on 13 June, at hour 9 at Athens, Jupiter was seen rather more eastern than Mars by 1 minute, or at least 2½ minutes; but at all events more, on account of the adventitious beams. And then, by the Tables written below, they were as follows. [Margin: ♂ ♃ ♂]

	♃	Sig.	G.	I	II	□	Sig.	G.	I	II
Rudolphine	□	□	11	58	0	□	□	11	50	0
Philolaic	□	□	11	57	43	□	□	11	54	10
Ours	□	□	11	56	40	□	□	11	52	2

5. In the year of salvation 1591, Kepler, by means of Maestlin at Tübingen, saw Jupiter rather more eastern [a Marte] than Mars by 9 [minutes], on 13 January; but he himself, since he has Lansberg, and so it is left to a civil clock, struck the hour 12; whence it had now begun at hour 13: but for the year hour 13 Jupiter was in Scorpio [□] at 14 degrees, 59 minutes, 12 seconds. Mars was in the degree of Scorpio at 14 degrees, 58 minutes, 53 seconds. [Margin: page 305. *Astronomia Optica*. ♂ ♃ ♂]

Day H.

13. after

midday	☿ in	□	14	59	12
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	□ in	□	14	58	53
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6. In the year 1587, Tycho writes in the *Letters* that Jupiter was observed by him in Cancer [□] at 7 degrees, 19 minutes, on 14 January, at hour 8 after midday.

[Margin: ☿ ☿]

	Sig.	G.	I	II
Therefore Jupiter's observed place		7	19	0
The place computed for me		7	18	16

7. In the year 1604, Kepler — from observations made at Prague — concludes that the conjunction of Jupiter and Mars fell on the 9th day of October, a little before midday. To me, by my Tables, at hour 23, 50 minutes after midday of the 8th day, the positions came out reduced and curtailed [Reducta & Curtata]. [Margin: ☿ ☿ □]

	Sig.	G.	I	II
☿ ☿ in	□	19	15	37
☿ ☿ in	□	19	15	38

8. Boulliau relates that in the year 1623, on 12 October, at hour 17 after midday, at Loudun in Poitou [Pictavis] — that is, at hour 18 at Bologna — it was observed...

[that it was observed] through the telescope [tube], by a conjunction performed a little before, that Jupiter was then in Leo [□]; the Tables exhibit Jupiter then in Leo at 24 degrees, 40 minutes, but to me [it was] in Leo at 24 degrees, 46 minutes. [Margin: ☿ ☿ & Reguli — conjunction of Jupiter with Regulus.]

9. In the year 1627, on 25 April, old style, Hortensius at Leiden [Leydae], at hour 11 (which at Bologna is hour 11, 28 minutes), observed with the telescope [tube] that Jupiter was rather more western than the topmost [supreme] of the forehead-stars of Scorpius [frontis Scorpii] by something like 5 minutes. But that

brightest star of the forehead was then to me in Scorpio at 27 degrees, 54 minutes, 53 seconds; therefore Jupiter was then in Scorpio at the degree 27, 54 minutes, 53 seconds. [Margin: ♂ ♃ with the forehead of Scorpius.]

10. On 27 April, Elias [Leonitus] at Leontium [Leontinum?], where the planet [Pius] is in Virgo at degree 27, 50 minutes — Elias, indeed, who saw at Vraniaburg [Uraniborg] Propitia [the star], saw on the 22nd of the same year, at hour 1, 25 minutes after midday in Silesia. Jupiter, standing distant in consequence [eastward] by 18 minutes, [was] from the topmost forehead of Scorpius, and so in Scorpio at 27 degrees, 37 minutes. [Margin: ♃ — Jupiter came out to me on the day.]

Jupiter
came out to
me on the

day	Sig.	G.	I	II
22	☐	27	41	0
25	☐	27	46	53

11. In the year 1633, on 19 December, Pierre Gassendi [Petrus Gassendus], from diverse observations made with the telescope, reckoned the conjunction of Jupiter with Propus [Propode, the star Propus = η Geminorum] to fall under the meridian of the day at Digne [Diniaë]. To me, Propus was then in Gemini [♊] at 25 degrees, 47 minutes, and at the meridian Jupiter was in Gemini at 25 degrees, 54 minutes; wherefore Jupiter was then more eastern at midday; and Jupiter was retrograde. [Margin: ♂ ♃ with Propus.]

12. In the year 1634, Pierre Gassendi at Digne, at hour 12 after midday on 11 April — which at Bologna was hour 12, 22 minutes — judged with the telescope that Jupiter had already, by a direct conjunction, indicated Propus of Gemini as regards longitude, [being] rather more northern than Propus by 8 minutes, or thereabouts. Boulliau, indeed, who was observing Jupiter's conjunction with Propus at Paris on the same day — that is, on 11 April, at hour 8, 30 minutes after midday, which at Bologna was hour 9, 10 minutes — saw with the telescope that Jupiter was 9¾ minutes more northern than Propus as regards longitude, [Jupiter being] 3 minutes more eastern than Propus. Since therefore to me Propus was then in Gemini at 25 degrees, 46 minutes, 22 seconds, and since Jupiter's own daily motion follows at hour 12, 22 minutes on the following day, the 11th — Jupiter was rather more western than Propus by 6 minutes, but not conjoined with Propus; dividing therefore the errors of both observations, Jupiter will have

been, at hour 12, 22 minutes, in Gemini at 25 degrees, 43 minutes, 30 seconds. Our Tables give Jupiter in Gemini at 25 degrees, 41 minutes, 27 seconds. [Margin: $\sigma \sphericalangle$ with Propus.]

Jupiter's place	Sig.	G.	I	II
Observed	\square	25	43	30
Computed		25	41	27

13. In the same year 1634, on 4 December, at hour 10 after midday at Loudun in Poitou [Pictavis] — but at Bologna hour 10, 50 minutes — Boulliau judged with the telescope that Jupiter was a little more eastern than the southern Asellus, which to me was then in Leo at 3 degrees, 34 minutes, 9 seconds; therefore Jupiter was in degree 3, 36 minutes; but further, our Tables give degree 3, 40 minutes, 13 seconds. [Margin: $\sigma \sphericalangle$ with the southern Asellus.]

Jupiter's place	Sig.	G.	I	II
Observed, about	\square	3	36	0
Computed		3	40	13

This observation is notable for eliciting Jupiter's mean motion, since it returned to the southern Asellus, with which it had once been conjoined — as said above, observation 1 — after Julian years 1874, and on the same days 105, hours 14, 50 minutes. [Margin: $\sigma \sphericalangle$ with the southern Asellus.]

14. In the year 1637, on 16 July, at Paris, at hour 9, 40 minutes after midday — but at Bologna hour 9, 40 minutes — Boulliau saw with the telescope that Jupiter was 7 minutes more western, and $8\frac{1}{2}$ minutes more southern, than the sixth star of Virgo's wing, which precedes among the four [stars] of Virgo's left wing. To me, by my Fixed [stars], the star was then in Virgo at 29 degrees, 47 minutes, with northern latitude 1 degree, 24 minutes, 10 seconds; therefore Jupiter was in Virgo at 29 degrees, 40 minutes, with latitude 1 degree, 16 minutes. Our Tables then give Jupiter less than three minutes more western. [Margin: continues]

Jupiter's place	Sig.	G.	I	II
Observed	\square	29	40	0
Computed		29	37	7

15. In the year 1639, on 31 August, the same Boulliau, at Paris, at hour 8 after midday — that is, at Bologna hour 8, 40 minutes — observed with the telescope...

by a conjunction performed a little before, [that] Jupiter's place in Leo, the Tables then exhibit Jupiter in Leo at 24 degrees, 46 minutes.

16. In the year 1646, on 19 February, the following night, Don Vincenzo Mutus of Maiorica [D. Vincentius Mutus Maioricae — Vincenzo Mutus] noted with the telescope that Jupiter was rather more eastern, by one minute or another, [than] the northern of the forehead-stars of Scorpius, which to me was then in Scorpio at 28 degrees, 5 minutes, 10 seconds. Therefore Jupiter was in Scorpio at 28 degrees, 6 minutes, or at least 7 minutes; but the Tables answer to the marvel, for me. [Margin: ♂ ♃ — with the forehead of Scorpius.]

Jupiter's place	Sig.	G.	I	II
Observed	☐	28	7	0
Computed		28	7	10

17. In the year 1649, on 11 May, at hour 1 of the first after midday — at hour 8 at Maiorica — Don Vincenzo Mutus, with the telescope [tube], saw Jupiter rather more eastern, by 1½ or 2 minutes, [than] the star preceding among the four of the left wing of Virgo; but Elias Leonitus saw in Silesia that this very star [stood] more eastern at almost the same moment of time, whence indeed it is notable, and accords with certainty. To me that star was then in Virgo at 29 degrees, 57 minutes, 10 seconds; therefore Jupiter was in Virgo at 29 degrees, 58 minutes, 40 seconds, and perhaps in Virgo at 29 degrees, 59 minutes. [Margin: ♂ ♃ with the wing.] What [say] the Tables?

Jupiter's place	Sig.	G.	I	II
Observed	☐	29	58	40
Computed from the Tables, or Prutenic		29	45	0
Lansberg's		0	0	40
Danish	☐	29	58	0
Rudolphine		29	46	0

Jupiter's place	Sig.	G.	I	II
Philolaic		0	1	10
Ours		0	0	50

18. In the same year 1649, on 9 June, when Jupiter had already gone direct, Father Francesco Maria Grimaldi [Grimaldi] and I, with the telescope, at hour 1 after sunset, plainly saw Jupiter so much more western than the preceding star among the four of the left wing of Virgo, by 4 minutes, that on the 10th we saw it [had become] more eastern by that same amount; or perhaps on the 10th day, at the same hour, it had become a little less eastern than it had been more western on the 9th, when we beheld Jupiter's conjunction made — as set forth in Book 9 of the *Almagestum Novum* [Almag. Novi], section 6, chapter 10. But that star was then in Virgo at 29 degrees, 57 minutes, 16 seconds. [Margin: ♂ ∽ Direct, with the wing.]

Jupiter's place	Sig.	G.	I	II
Observed	☐	29	57	16
Prutenic		29	40	0
Computed from the Tables — Lansberg's Danish		0	0	52
Ours	☐	29	59	6

19. In the year 1650, on 18 April, Don Vincenzo Mutus of Maiorica, at hour 10 — namely at Bologna hour 10, 37 minutes — observed Jupiter with the telescope [tube] in Scorpio at degree 5, 22 minutes. [Margin: ♂ ∽]

Jupiter's place	Sig.	G.	I	II
Observed	☐	5	22	0
Computed from the Tables — Prutenic		5	25	0

Jupiter's place	Sig.	G.	I	II
Lansberg's		5	22	0
Danish		5	21	0
Rudolphine		5	33	0
Philolaic		5	21	0
Ours		5	23	30

20. Likewise in the year 1650, the same Don Vincenzo Mutus of Majorca, on 24 May, at hour 8, 30 minutes after midday — which at Bologna...

at Bologna it was 9h7'. With the telescope he noted Jupiter in Scorpio at degree 1 and minute 12.

Comparison table (item 20, 1650 May 24, Mut at Majorca, reduced to Bologna):

☾ position	Sig.	G.	I	II
Observed	☾ (Scorpio)	1	12	—
Computed from the Tables: Lansbergian	☾	1	18	0
Danish	☾	1	21	30
Rudolphine	☾	1	16	0
Philolaic	☾	1	31	0
Ours	☾	1	15	0
(Ours)	☾	1	14	40

Parsing notes: the first computed line is headed "Comput. ex Tab." (computed from the tables), then the table-sigla Lansberg., Danic., Rudolph., Philolaic., Nostris run down the rows. The Prutenic row is given (☾ 1 18 0 appears against "Pruten."); the printed block lists "Pruten. — 1 18 0", "Lansberg. 1 21 30", "Danicis 1 16 0", "Rudolph. 1 31 0", "Philolaic. 1 15 0", "Nostris 1 14 40", with the observed value ☾ 1 12 at the head. The two-column degree/minute alignment is tight in the gutter; values transcribed as printed.

Since we have now applied to twenty observations as reliable and as carefully selected as these, we shall have given a not improbable demonstration of the excellence of our Tables. If any discrepancy remains in some of the observations, that could be accounted for without great difficulty. But it would be superfluous to heap up here, at the cost of more tedium, the other comparisons we have drawn between our Tables and observations made by others — and not without some weariness. And so, although we have also examined the eight acronychal positions [loca 8. Acronychia] which Longomontanus examined one by one, we nevertheless do not place as much trust in them as in the twenty and more we have used. The doubtful uncertainty of minutes could undermine their reliability, on account of the motion of the Sun assumed in the Tychonic Tables — which is false — and other quantities assumed in the Prutenic Tables for fixing the moment and the place of the true opposition with the Sun.

CAPVT X.

De Hypothesi Arithmetica, & Geometrica Motuum Iouis.

[On the Arithmetical and Geometrical Hypothesis of the Motions of Jupiter.]

The things to be selected are those we discussed in Book V, Chapter 12, inasmuch as they are common to the five lesser planets. The remaining matters proper to Jupiter are written out below.

Mean motions of ♃ [Motus ♃]:

Motion of ♃	Sig.	G.	I.	II.	III.	IV.	V.
Mean from ♈ (Aries)	0	0	4	59	15	58	33
—							
Diurnal							
Mean from ♈	1	0	20	32	11	9	7
—							
Annual							

Motion of α	Sig.	G.	I.	II.	III.	IV.	V.
Apogee — Diurnal	0	0	0	0	14	38	11
Apogee — Annual	0	0	0	1	29	2	15
Node ϑ — Diurnal	0	0	0	0	4	2	52
Node ϑ — Annual	0	0	0	0	24	37	28

Parsing notes: the "Apogei Annuus" and "Nodi ϑ Annuus" rows each carry a sixth/seventh sexagesimal place in the source (Sig.G.I.II.III.IV.V. columns); the Annual-apogee row reads "0 0 0 1 29 2 15 18" and the Annual-node row "0 0 0 0 24 37 28 0", which run one place beyond the column header count — transcribed verbatim as printed.

The epoch of the motions is set to the beginning of the Common Era of Christ, at the last meridian [i.e. midnight/noon] of the preceding December, on the meridian of Bologna [in Meridiano Bononiensi].

Right column (continuation of the mean-motion / hypothesis data):

α	Sig.	G.	I	II
Mean motion from \square (Aries)	5	29	49	45
Apogee [Apogei]	4	28	25	24
Node ϑ	2	27	40	25

☾

Sig.

G.

I

II

[Nodi ☽]

For the geometrical hypotheses, see what was said in Book 7 of the *Almagestum Novum* [Almag. Noui], Section 2 and 3, and here in Book 5, Chapter 12, and at the end. But choosing for the present an ellipse, whose track [vestigia] near the apsides [conum, i.e. the cone of the apse-line] seems to mark out the diurnal motion of the planet through the several other (intermediate) parts — let there also be selected measures, written out below, in the parts of which the radius of the Orbit of the Solar Year [Radius Orbis Annui Solis], that is the greater semidiameter of the Sun [maior semidiameter Solaris], is.

Si Radius Orbis ☉ fit
[If the radius of the
Sun's orbit be]

Let the ellipse be [Ellipseos sit]	100000.	100000.
And the bisected solar eccentricity [Et bisecta Solis Excentricitas]	1740.	

Greater semidiameter of the
ellipse of ☾, or its
[Semidiameter maior Ellipsis ☾
seu eius à]

Mean distance from the Sun [Sole media distantia est]	522521
Lesser semidiameter of the ellipse [Semidiameter minor Ellipsis]	521794
Whole eccentricity from the Sun [Excentricitas tota à Sole]	50736
Bisected eccentricity [Excentricitas bisecta]	25368

Distances [Distantia]:

With ☾ at [Sole Apogeo & ♃]		from the Sun [à Sole] / from the Earth [à Terra]	
Sun at apogee & ☾ — Aphelion [Aphelio]	from the Sun	547889	
	from the Earth	649629	
Sun at apogee & ☾ — Perihelion [Perihelio]	from the Sun	497153	
	from the Earth	395413	
Sun at perigee & ☾ — Aphelion [Aphelio]	from the Sun	547889	
	from the Earth	646149	
Sun at perigee & ☾ — Perihelion [Perihelio]	from the Sun	497153	
	from the Earth	398893	
	Gr.	I	II
Inclination of the orbit to the Ecliptic [Inclinatio orbitæ ad Eclipticam]	1	42	20

Greatest variations of latitude [Varietas latitudinum maximarum]:

	Gr.	I	II
Sun at apogee & ☾ —	1	8	30
Aphelion, in ♋ (Cancer) [in ♋]			
Aphelion, in ♎ (Capricorn) [in ♎]	1	40	25
Sun at apogee & ☾ —	1	7	50
Perihelion, in ♋			
Perihelion, in ♎	1	42	50
Sun at perigee & ☽ —	1	9	20
Aphelion, in ♋			
Aphelion, in ♎	1	39	40
Sun at perigee & ☽ —	1	8	18
Perihelion, in ♋			
Perihelion, in ♎	1	41	55

Parsing notes: in the latitude block the "in ♋" / "in ♎" entries are paired under each Aphelio/Perihelio sub-bracket of "Sole Apogeo & ☾" and "Sole Perigeo & ☽". The zodiac sigla read ♋ (Cancer) and ♎ (Capricorn) in the source.

For the remaining distances, see in the 2nd Volume, Table 97 [Reliquas Distantias vide in 2. Volumine Tab. 97].

LIBER SEPTIMVS

IN QVO SVNT

MARTIS PLANETÆ OBSERVATIONES

Et Hypothesis Motuum.

[BOOK SEVEN]

[IN WHICH ARE CONTAINED]

[THE OBSERVATIONS OF THE PLANET MARS,]

[And the Hypothesis of its Motions.]

CAPVT I.

Martis Obseruationes Antiquæ ab Anno ante Christum 357. vsq; ad Annum Christi 509.

[Ancient Observations of Mars from the year 357 before Christ down to the year 509 of Christ.]

1. Aristotle, in Book 2 of *On the Heavens* [*De Cælo*], Chapter 12, in the text numbered 60, reports as follows: "*For we saw the Moon, being half-full [dichotomam], approach the star of Mars [Stellam Martis] — which is the star observed in the front (face) of Scorpio [in fronte Scorpjij obscuram partem Lunæ] — and it [the star] went behind the dark part of the Moon, but came out again on the bright and shining side.*" From this observation Kepler gathers that this happened at the Moon's first quarter; but Aristotle, in his work *On Mars* [*de Marte*], Chapter 69, affirms that it could not have happened at any other time than the common epoch [vulgarem Epocham] of April 4, in the evening, the Sun being in Aries 10, Mars with the Moon in Taurus 3, of Leo's year [Leonis annum], 357 before Christ — when Aristotle was 21 years old and was a hearer of Eudoxus.

2. In the year 13, according to Dionysius, on December 20, in the consulship of Capricorn [Capricornius? — i.e. dated by the archon], in the third year from the death of Alexander, in the 476th year of Nabonassar, on the 21st day, in the morning [manè], the star of Mars seemed to be incumbent on the northern front of Scorpio [Boreali frontis Scorpij], which then was in Scorpio at gr. 2, 15. So Ptolemy, in Book 10, Chapter 9. Hence Lansbergius, in his *Thesaurus* of observation 1 of Mars, supposing the highest (star) in the front of Scorpio [supremam in fronte Scorpij], Mars to be in Scorpio at gr. 1, 42, 12, with northern latitude gr. 1, 13; and he commends his own Tables as exhibiting Mars in Scorpio at gr. 0, 53, 12, and at latitude gr. 1, 13. Bullialdus [Boulliau], however, in Book 8, Chapter 13, says it was at gr. 1, 17, after the meridian, as Rudolphinus [the Rudolphine] gathers. Fixing this same time, he holds the observation of Mars to have been in Scorpio at gr. 0, 34, and Mars in Scorpio at gr. 2, 33, 41. Kepler, indeed, in *On Mars*, Chapter 69, says that in the year before Christ 272, on January 18, in the morning, and (so Chapter 70) confesses that his own calculation differs from the observation by half — that the first observation in Scorpio was that Mars was more to the west by gr. 1, 31, 28; and therefore he thinks Ptolemy erred in Scorpio, using the first place in Scorpio for the fifth, because the observer called it "more northern in the front of Scorpio" [Borealiorem frontis Scorpij]. Of these stars, the fifth was elongated from Regulus by gr. 94, 46, 3; from which Regulus Mars was elongated by gr. 94, 49, or gr. 51, 3 — so Bullialdus, Book 8, Chapter 13. But Longomontanus, in Book 2, *Theoric.*, Chapter 10, contends that the first ought to be retained.

3. In the year 15 of Adrian [Hadrian], Ptolemy obtained from his observation that Mars was in opposition to the mean place of the Sun on day 26, Tybi, the morning following, hour 1, equally after midnight, when Mars was in gr. 21 of Gemini. So Ptolemy himself, Book 10, Chapter 7; and from him Copernicus, Book 5, Chapter 15. But Kepler, in *On Mars*, Chapter 69, calls this observation into doubt on suspicion of an error in the time, in the refractions, in the places of the fixed stars, and for the gr. 21 of Gemini he holds it should at least be gr. 21, 30; or rather gr. 21, 4. It was the year 135 of Christ, and day 14, December.

4. In the year 19 of Adrian [Hadrian], Ptolemy observed an opposition of Mars with the mean place of the Sun on the following day 7, at hour 3 before midnight, in Aquarius [♒] at gr. 28, 50. So he himself, Book 10, Chapter 7, and from him Copernicus, Book 5, Chapter 15. Kepler, nevertheless, in *On Mars*, Chapter 69, says it was in Leo [♌] at gr. 29, 29, or 31. It was the year 138 of Christ, and day 21, February.

5. In the year 2 of the Emperor Antoninus, on the day of Epiphi 12, the following day 13, hour 1, equally before midnight, Mars was seen in opposition to the mean place of the Sun, existing in Sagittarius [Sagittarij] at gr. 2, 34. So Ptolemy observed it, Book 10, Chapter 7; and from him Copernicus, Book 5, Chapter 15. Kepler, in *On Mars*, Chapter 69, says Mars was in Sagittarius [Sagittarij] at gr. 1, 36, or rather gr. 0. It was the year 139 of Christ, day 27, May, the 28th.

6. In the same year 2 of Antoninus, on Epiphi the following 15, the 16th, hour 3, equally before midnight, the sky was clear, Mars in Libra [Libræ] at gr. 20, and the Sun, according to the mean motion, existing at gr. 5, 17 of Gemini [Geminorum]. So Ptolemy observed Mars by comparison with Spica in Virgo [Spicam □] at gr. 1, 36. But Lansbergius, in his *Thesaurus* of observation 2, says Mars was in the year of Christ 139, May 30, hour 9, after the meridian, in Sagittarius [□] at gr. 1, 34, 38. But Kepler, in *On Mars*, Chapter 70, gathers from his own Tables that Mars was in Sagittarius [□] at gr. 1, 43, adding the instruments of Ptolemy —

— Ptolemy's [instruments] to admit an error of 10 minutes; and in truth it was day 30 of May, the following day 31.

7. In the year 498 of Christ, as Bullialdus [Boulliau] reports in Book 8, *Astron.*, Chapter 13, and from a manuscript of the Royal Library of Paris [Bibliothecæ Regiæ Parisinæ] an unnamed observer says: "*I saw, after the setting of the Sun, under Diocletian 214, on Pachon day 6, in the seventh hour of the night, Mars conjoined with Jupiter, in such a way that there was no interval and it [Mars] hid it [Jupiter].*" Bullialdus adds that it was the year 498 of Christ, day 1, hour 9; and then from his own Tables that Jupiter was with Mars in Virgo [Virginis] at gr. 13, 57, with northern latitude gr. 1, 13.

8. In the year 509 of Christ, as Bullialdus relates in Book 8, Chapter 13, in the same Royal manuscript this observation lies: "*In the year 225 of Diocletian, on Payni 19, after the setting of the Sun, the star of Mars touched the star of Jupiter, in such a way that they were seen to be at the same distance in the preceding part, but in the south by a digit [in Austrum vero digitis 2]*" — as much as the canonical numbers, and the *Magna Syntaxis* [Almagest], show, that the two planets were seen at the same distance in the same part, day 21, the said month — on which day they were seen very close to one another mutually. Bullialdus adds that, in that year 509 of Christ, on June 13, hour 9, after the meridian, at Uraniborg [Vraniburgi], Jupiter was, by his own Tables, in Leo [Leonis] at gr. 11, 57, 43. Mars, however, from the Rudolphine [Tables], was in Leo [□] at gr. 11, 50, 50 — though it ought to have

been in gr. 11, 55. He adds Mars [♂] with Regulus in the year 508, September 27, in the morning.

CAPVT II.

Martis Obseruationes ex Opusculo obseruationum Io. Regiomontani.

[Observations of Mars from the Little Work of Observations of Johannes Regiomontanus.]

1. In the year of Christ 1461, on December 2, at the beginning of the night, Johannes Regiomontanus [Regiomontanus], at Rome, saw Mars in a straight line with two stars of the head of Capricorn [capitis Capricorni], distant between themselves by gr. 2, and distant from Mars by the same amount, that is gr. 2 — which stars Alphonsine calculation [Alphonsinus calculus] placed as conjoined. On December 5 he saw them conjoined, but on account of intervening clouds could not note the hour. At the beginning of the sixth night he saw that Mars had already passed Saturn by gr. 1, $\frac{1}{2}$, because the distance between them was about subsesquialterate [subsesquialtera] of the distance of the two stars of the head of Capricorn. Hence Lansbergius, in his *Thesaurus* of observation 3, attests its reliability with his own Tables, as far as the observation of December 2.

2. In the year 1461, on December 14, at the beginning of the night, Regiomontanus saw Mars conjoined, as to longitude, in a more lucid (star) in the tail of Capricorn [cauda Capricorni], than he said it then was in Aquarius [♊] at gr. 14, 29. Alphonsine calculation places Mars in ♊ at gr. 17, 20; he doubts whether it was from the place of the Fixed star.

3. In the year 1462, on September 15, in the morning at hour 10, the same (observer) saw Mars almost in a straight line with Leo's seventh and eighth (stars), and distant toward the north by an eighth, that is, the heart of Leo [corde Leonis] across one diameter of the Sun. Bullialdus, Book 8, Chapter 13, says the seventh star of Leo was indeed astral, three in the neck [collo], of the third magnitude, in Leo [♌] at gr. 20, 21, 41, with longitude, and northern latitude gr. 4, 51; the eighth at gr. 4, 51, that is the heart of Leo [Cor Leonis], to have been in ♌ at gr. 22, 18, 41, with longitude, and northern latitude gr. 26, minutes; and therefore, although the Tables exhibit gr. 1, 17; and therefore he holds Mars to have differed from Regulus toward the north by gr. 51, and to have been in ♌ at gr. 21, 58. See the rest in Bullialdus.

4. In the same year 1462, on September 19, he saw in one straight line Regulus, Mars, and Venus, in such a way that, with Regulus more Austral [Australior],

Venus was, and Mars more Boreal [Borealiior], the distance of Mars from Regulus being sesquiquarter [sesquiquarta] of the distance of Venus from the same.

5. In the year 1462, on October 16, in the morning at hour 11, Mars, says Regiomontanus, was not yet conjoined with the twenty-fourth star of Leo, just as among themselves, and the distance of Mars was estimated equal to four diameters of Venus; and it happened that Mars was more Southern [meridionalior] than that star — I conjecture it to be the twenty-fifth (star) of Leo. On day 17, October, in the morning at hour 11, he saw Mars already —

Right column, page 317 (items 6–11, top right):

— having passed the said star, and from that distant by a space of sesquialterate to yesterday's distance; and Mars was more meridional [meridionalior].

6. In the year 1464, December 11, hour 13, after the setting of the Sun, Regiomontanus at Rome saw Mars in a straight line with the 22nd and 23rd stars of Virgo [Virginis], but Mars was more Boreal [Borealiior], by gr. 23, and at the same distance, by double — and from the said distance the Alphonsine calculation differs in latitude by very nearly gr. 2.

7. In the year 1465, June 19, about the beginning of the night, Regiomontanus saw Mars as if in a straight line with the first and second of Sagittarius [Sagittarij], a little more Boreal [Borealiorem], and distant from the first and second by a sesquialterate interval.

8. In the year 1468, April 26, in the beginning of the night, on the same day he saw Mars pass a little over the straight line, in which it had been Jupiter, and the tail of the Lesser Bear [cauda Vrsæ minoris], and because Jupiter was in the beginning of Cancer [principio Cancrī], besides their other earlier conjunction, and on the 29th. On April 1st he saw Jupiter, Mars, and the sixth (star) of the third of Gemini [Geminorum] in a straight line with the Boreal head of Gemini [Boreali capite Geminorum]; yet Mars was more profound [profundior] than Jupiter, and more Boreal [Borealiior], at a distance, in such a way that from Jupiter [♃] there might be just over a quarter the distance between itself and that thirteenth star.

9. In the year 1471, July 26, in the morning at hour 2, after midnight, at Nuremberg [Norimbergæ] Regiomontanus saw Mars in a straight line with the eyes of Taurus [oculis Tauri], and a little more eastern [orientaliorem] than that straight line, by gr. 3, about minutes, and distant from the obscure eye of Taurus [obscuriore oculo Tauri], by as much as those eyes are distant between themselves, by gr. 10, and the fourth part of (a gr.) of Taurus.

10. In the same year (1471), September 9, at Nuremberg, Regiomontanus, with the radius standing at the distance of Mars from the right shoulder of Orion [humero dextro Orionis], obtained the first bosom [Sinum primum] 210, and the second 674; but for the distance from the head of Castor [capite Castoris] (he obtained) the first bosom 210, and the second bosom 662.

11. In the year 1474, on the 7th of March, Regiomontanus at Nuremberg saw Mars more eastern [orientaliozem] than the Boreal ass [Asino Boreali] by a diameter of the Moon, it seemed; and it was approaching that star, but was already beginning to direct (its course) [dirigi, i.e. become direct].

CAPVT III.

Martis Obseruationes Norimbergæ habitæ à Bernardo Vualthero ab anno 1475. Christi ad 1504.

[Observations of Mars made at Nuremberg by Bernhard Walther from the year 1475 of Christ to 1504.]

Prima Classis est obseruationum oculari æstimatione peractarum.

[The First Class is of observations carried out by ocular estimation.]

1. In the year 1475, September 17, in the morning between the third (hour) and the fourth, after midnight, Mars and Saturn [♂ & ♄] were distant from one another by very nearly five minutes, as to longitude — though more probably to be conjoined, as to latitude, from which Walther [Vualtherus] judges them to be conjoined, without doubt, on the 18th; and in truth on the 19th, Mars [stood] in eastern aspect to Saturn — by how much Saturn's aspect [vsus] had appeared the day before the 17th. Let this Almanac of conjunctions stand, this differing to day 21.

2. In the year 1477, September 5, in the morning at hour nearly the third, after midnight, Walther saw Saturn with Mars [♄ cum ♂], more western [occidentaliori], distant by one palm [palmum], in the same latitude; whence it concurs that on the day of the said eclipse of Saturn [Saturnum] from Mars, Lansbergius indeed of observation 4 dares to say (pro 5). On September 6, October, because however little (it was) by his own Tables, he found that conjunction. At Walther's, however, the *Quinta Septembris* [the Fifth of September] stands, just as Snellius [Snellius] (has) in the observations of Walther [Vualtherianis], nevertheless in truth Walther subjoins on the 15th, in the

morning, to have observed Mars more eastern [orientaliozem] than Saturn at gr. 2, 47; but it is to be seen whether it was Retrograde [Retrogradus].

Caput III (continued)

Mars Observations made at Nuremberg by Bernhard Walther, from the year 1475 to 1504 — First Class, by ocular estimation (continued)

3. In the year 1478, on March 16, in the morning at the 2nd hour after midnight, he saw Mars together with the sixth star of Virgo, which lies midway between the other three stars on the left, in nearly the same longitude but more southerly by a little over half a degree.
4. In the year 1479, on October 5, [Mars] was in conjunction according to longitude with Saturn, and Saturn was nearly half a degree more northerly. Mars was very close to the sixth star of Virgo. Lansberge, in his *Thesaurus*, reduces this to the 4th morning hour from his own tables, placing Saturn in Virgo at 27 deg. 4 min., with northern latitude 2 deg. 1 min., and Mars in Virgo at 27 deg. 56 min., with latitude 1 deg. 12 min.
5. In the same year, on November 7, he saw Mars more than a full degree more southerly than the seventh star of Virgo, but so close in conjunction with respect to longitude that Boulliau, in Book 8, Chapter 13, says it was in conjunction with Mars in Libra at 1 deg. 51 min., and the northern latitude of the star at 2 deg. 56 min.
6. In the year 1482, on November 28, at the 1st hour of the night, or nearly so, Walther says, the Moon eclipsed [occulted] Mars.
7. In the year 1486, on September 7, in the morning at the 4th hour after midnight, he saw Mars between the two horns of Taurus, in the same straight line with them, more southerly with respect to the southern horn by two lunar diameters.
8. In the year 1488, on October 3, he saw Mars and the two heads of Gemini [Castor and Pollux] in one straight line, more easterly than the following [eastern] head of Gemini by nearly twice the distance separating the two heads.
9. In the year 1490, on September 18, he saw Mars a little more southerly than the nebulous [object] of Cancer [Praesepe], in the morning at the 4th hour after midnight; and the same Mars, after midnight, he saw to be by then more easterly, indeed a little more so than on the preceding day at about

the same intermediate time — hence its conjunction with the nebulous [object] had occurred at the intermediate time.

10. In the same year, on September 21, in the morning at the 3rd hour after midnight, he saw Mars distant from the fifth part [star] of Cancer by a quarter of a lunar diameter, and distant by a palm along a line drawn through the fourth part of Cancer, and by a fifth [part] through the fifth.
11. In the year 1491, on January 6, he observed the beginning of the retrograde motion of Mars in one straight line with the twenty-second and twenty-third stars of Leo.
12. In the same year, on March 13, in the morning at the 2nd and a half hour after midnight, Mars was seen in one straight line with the sixth and eighth stars of Leo, distant from the eighth by two-fifths of the interval between the sixth and the eighth.
13. In the year 1492, on September 27, in the morning at the 5th hour, or nearly so, after midnight, Mars was nearly in a straight line with the sixth and seventh [stars of Leo], and more southerly — being midway between the sixth and seventh, but Mars more westerly than that line.
14. In the year 1495, on March 25, Mars was more easterly than the seventh [star] of Virgo, a little more than a lunar diameter, in nearly the same latitude; on the 27th it was more easterly by four lunar diameters; and on the 29th more westerly than the seventh [star] of Virgo by a lunar diameter.
15. In the year 1497, on February 15, in the morning at the 4th hour after midnight, Mars was distant from Jupiter by a lunar diameter, yet such that it looked like half this distance to the eye on account of the latitude; and Mars was more easterly and more southerly than Jupiter.
16. In the year 1504, on March 27, Mars was seen also by armillaries in Cancer at 17 deg. 45 min., Aldebaran being placed at 2 deg. 45 min. of Gemini. Hence Boulliau, in Book 8, *Astron.*, Chapter 13, says that Mars was in Cancer at 17 deg. 48 and three-quarters min., because Aldebaran was at that time more advanced [easterly], in Gemini at 2 deg. 48 and two-thirds min.

The Second Class contains observations made with the cross-staff [Radius] — Sinus 1 and Sinus 2 — concerning the use of which see the Saturn observations of Walther, number 10.

[The following large table on this page continues the First Class observations, numbered 17–50, giving for each the date, the distance from fixed stars, and the two cross-staff sines.]

Table — First Class observations 17–50. Columns: No. | Year, Month, Day, Hour | Distance from fixed stars | Sinus 1 (Sinus prim.) | Sinus 2 (Sinus secund.).

No.	Year Mon. D. H.	Distance from fixed stars	Sinus 1	Sinus 2
17	1475 Sept. 1 3 / after midnight	from the prec. [star] of Gemini	210	772
18	Sept. 3 3 / p. m. n.	from the foll. [star] of Gemini	180	950
		from the prec. [star] of Gemini	210	725½
19	Sept. 4 3 / p. m. n.	from the prec. [star] of Gemini	210	623
		likewise from Algomisa [Procyon]	210	705
		from the prec. [star] of Gemini	210	960
20	Sept. 5 2½ / p. m. n.	likewise from Algomisa	210	614½
		from the foll. [star]	210	685

No.	Year Mon. D. H.	Distance from fixed stars	Sinus 1	Sinus 2
		of Gemini		
21	Sept. 6 3½ / p. m. n.	from the foll. [star] of Gemini	210	662½
		from the foll. [star] of Gemini	210	882½
22	Sept. 7 2½ / p. m. n.	from the foll. [star] of Gemini	210	638
		from the foll. [star] of Gemini	210	844
23	Sept. 16 2½ / p. m. n.	from the foll. [star] of Gemini	210	611
24	Sept. 17 2½ / p. m. n.	Algomisa	210	493
		from the foll. [star] of Gemini	210	791
25	Sept. 21 below 3	Algomisa	210	484
		from the foll. [star] of Gemini	210	523
26	Sept. 23 2½	from the foll. [star] of Gemini	210	448
		from the foll. [star] of Gemini	210	495
27	Sept. 26 2½	from the	210	824

No.	Year Mon. D. H.	Distance from fixed stars	Sinus 1	Sinus 2
		heart of Leo [Regulus]		
		from the sixth [star] of Leo	210	948½
28	Oct. 13 2½ / p. m. n.	from the sixth [star] of Leo	60	1127
		from the heart of Leo	210	1046½
29	Oct. 30 2½ / p. m. n.	from the sixth [star] of Leo	110	982½
		from the sixth [star] of Leo	160	960
30	Nov. 3 3 / p. m. n.	from the sixth [star] of Leo	140	983
31	Nov. 12 6	from the heart of Leo	210	889½
		from the tail of Leo [Denebola]	210	878
32	Nov. 28 7	from the tail of Leo	210	783
33	Dec. 1 3 / p. m. n.	from the heart of Leo	180	1010
		from the	210	549

No.	Year Mon. D. H.	Distance from fixed stars	Sinus 1	Sinus 2
		heart of Leo		
		from the 27th [star] of Leo	140	797
34	1476 Jan. 3 6	from the seventh [star] of Virgo	150	837
35	Febr. 5 4	from the fifth [star] of Virgo	60	849
		from the seventh [star] of Virgo	170	835
36	Febr. 19 4 / p. merid.	from the fifth [star] of Virgo	50	761
		from the prime [star] of Virgo	10	958½
37	Febr. 20 4 / p. merid.	from the twenty- seventh [star] of Leo	140	926½
		from the twenty- second [star] of Leo	180	888
38	Mart. 20 2 /	from the	130	869

No.	Year Mon. D. H.	Distance from fixed stars	Sinus 1	Sinus 2
	p. merid.	twenty- seventh [star] of Leo		
39	Mart. 29 2 / noct.	from the twentieth [star] of Leo	190	897½
		from the twenty- seventh [star] of Leo	160	897
40	April 4 1 noct.	from the heart of Leo	210	932½
41	April 7 1 noct.	from the twenty- seventh [star] of Leo	210	895
		from the heart of Leo	210	960½
42	This was the sixth day	from the twenty- seventh [star] of Leo	210	964
43	April 12 1 noct.	from the heart of Leo	200	962½
		a little after this from	210	901

No.	Year Mon. D. H.	Distance from fixed stars	Sinus 1	Sinus 2
		the same heart		
44	1477 Oct. 15 4½	from the heart of Leo	190	947
		from the heart of Leo	210	814½
45	1478 May 1 1 / after the setting of the Sun	Spica	80	838
		the tenth [star] of Virgo	80	941
46	1481 Nov. 19 1 / before the rising of the Sun	Spica	80	941
		the twenty- first [star] of Virgo	120	598
47	1486 Aug. 18 4 / morn. p. m. n.	Aldebaran	70	588
		northern horn of Taurus	110	635
48	Aug. 20 3 / morn. p. m. n.	Aldebaran	70	587
		northern horn of	100	559

No.	Year Mon. D. H.	Distance from fixed stars	Sinus 1	Sinus 2
		Taurus		
49	Aug. 26 4 / morn. p. m. n.	Aldebaran	70	580
		northern horn of Taurus	100	571
50	Aug. 31 4 / morn. p. m. n.	Aldebaran	120	535
		northern horn of Taurus	60	547

Parsing notes: The "Hour" column entries carry sub-rows distinguished by "p. m. n." (post mediam noctem, after midnight), "p. merid." (post meridiem, after noon), and "noct." (of the night); these are reproduced as part of the date/hour cell. The "sub 3" at item 25 is read "below 3" (i.e. shortly before 3). Item 42's left cell reads "Sic fuerat die sexta" ("Thus it had been on the sixth day"). The two Sinus columns are unitless cross-staff readings (the *Radius* scale), not degrees; values above 1000 (1127, 1046½, 1010) are legitimate Sinus-secundus entries, not errors. Several rows are sub-rows of a single dated observation (two or more reference-star bearings sharing one date); the date and number columns are blank on the sub-rows.

Caput III (conclusion) — Third Class, by zodiacal armillaries

The Third Class holds observations made with zodiacal armillaries, whose uncertainty extends to about 10 minutes — see Walther's Saturn observations above at number 33. For this reason we select only a few of them, and only those for which Walther assigns the hour; for the rest, dismissing them, he notes the meridian altitude [mediation] of the heavens [in place] of the hour, by expressing the altitude.

Table — Third Class armillary observations 51–56. Columns: No. | Year, Month, Day, Hour, Min. | Place of observation (Sign, Degree).

No.	Year Mon. D. H. M.	Place of obs. (Sign Gr.)
51	1489 April 5 8 0 p. merid.	Cancer 29 0
52	1503 Aug. 26 3 0 morn. p. m. n.	Gemini 23 59
53	Sept. 16 2 30 p. m. n. / northern latitude	Cancer 5 15 / 0 15
54	Sept. 19 2 30 p. m. n. / northern latitude	Cancer 6 45 / 0 15
55	Oct. 13 4 morn. p. m. n. / northern latitude	Cancer 17 0 / 0 30
56	1504 Jan. 3 3 morn. p. m. n.	Cancer 10 45

CAPVT IV.

Copernican Mars Observations.

1. In the year of Christ 1512, on the Calends of January [January 1], at the 6th hour before noon, in the morning, Copernicus at Frombork [Fruenburg] saw Mars [at] a quarter degree distant from the bright first claw [star] of the Claws [of Scorpio/Libra], or rather more southerly, but deflected toward the summer-solstitial rising — which was an indication that Mars had begun to retrograde from that separation in longitude by 7 and a half min., and as to northern latitude by 12 min. (*Copernicus*, Book 5, Chapter 19). For he supposes that elongated star of the first [part] of Aries to be at 191 deg. 20 min., with latitude 40 min. northerly, and hence the place of Mars in the first part [of Aries] at 191 deg. 28 min., with northern latitude 51 min.; and hence Mars to have been in Scorpio at 1 deg. 53 min., according to his hypothesis of the first [star] of Aries.
2. In the year of Christ 1512, on the 9th of June at the 1st hour after midnight, Copernicus at Frombork, from his own observation, says he found Mars retrograde [*acronychal* — at opposition] in the 235th part [degree] of the ecliptic, [counted from a scruple of] 33 — this is in Sagittarius at 15 deg. 58 min. — and the Sun in opposition existing in the 55th part 33, this is in Gemini at 15 deg. 58 min. (*Copernicus*, Book 5, Chapter 16).

3. In the year of Christ 1518, on the day before the Ides of December [December 12], at the 8th hour after noon, Mars appeared retrograde [acronychal] to Copernicus at Frombork, and at opposition, in the 63rd part 2, this is in Gemini at 3 deg. 2 min., from the first star of Aries (*Copernicus*, Book 5, Chapter 16).
4. In the year of Christ 1523, on the eighth of the Calends of March [February 22], at the 7th hour before noon, Copernicus observing at Frombork, Mars was seen in the 133rd part, scruple [min.] 20, from the first star of Aries — namely in Leo at 24 deg. [from the first star of Aries] (*Copernicus*, Book 5, Chapter 16).

CAPVT V.

Tychonic Mars Observations, from the Year of Christ 1580 up to 1601, noted in the Old Style, [made] at Uraniborg unless otherwise added, [and] made for hours after noon.

Tycho himself, in his *Letters to the Landgrave of Hesse [Epistolae ad Landgravium Hassiae]*, page 56, places these three of the year 1587, [in] January, made with Alphonsine and Copernican calculation.

Table — Three 1587 January Mars positions. Columns: No. | January (Day, Hour, Min.) | Longitude of Mars (Sign, Deg., Min.) | Latitude (Deg., Min.) | source note.

No.	January D. H. M.	Long. Mart. (Sig. G. M.)	Latitude (G. M.)	Note
1	9 17 15	Libra 3 5	3 4 B	observed
			[north]	
		Libra 0 43	2 48	Alphonsine
2	14 16 40	Libra 2	2 50	Copernican
		Libra 1 25	2 12 B	observed
		Libra 4 56	2 57	Alphonsine
3	15 15 50	Libra 1 25	2 59	Copernican
		Libra 4 2	3 13 B	observed
		Libra 1 32	2 58	Alphonsine
		Libra 5 3	1	Copernican

Parsing notes: Each numbered observation gives three rows — the observed Mars longitude, then the longitude computed from the Alphonsine tables, then from the Copernican. The sign for all entries here is Libra (♎); it is printed only on the first sub-row of each group and carries down implicitly to the Alphonsine/Copernican sub-rows (which give degree-minute only). Latitude "B" = Borea (northern). The lone latitude "1" in item 3's Copernican sub-row is a minutes-only entry with the degree truncated; transcribed as printed (suspected dropped field).

There follow the acronychal [opposition] places of Mars from Tycho's observation, as to the apparent place — but as to the true place, with the place of Mars added as computed from the restored tables [Solar tables], then from Longomontano, Book 2, *Theoricorum*; then from Kepler reduced [in his work] *On Mars*, Chapter 15; finally, as to the opposition with the mean motion of the Sun, in *On Mars*, Chapter 8.

Table — Mars oppositions From Longomontanus (Ex Longomontano).

Columns: No. | Year | Month, Day, Hour, Min. | Observed longitude (Sign, Deg., Min., Sec.) | Computed longitude (Sign, Deg., Min., Sec.).

No.	Year	Mon. D. H. M.	Longit. obs. (Sig. G. M. S.)	Long. supp. (G. M. S.)
4	1580	Nov. 18 1 30	Gemini 6 27 30	6 27 30
5	1582	Dec. 28 4 0	Cancer 16 54 30	16 55 30
6	1585	Jan. 30 19 14	Leo 21 35 10	21 37 0
7	1587	Mar. 6 7 20	Virgo 25 42 0	25 42 10
8	1589	Apr. 14 36 0	Libra 4 23 0	4 16 30
9	1591	June 8 7 45	Sagittarius 26 42 0	26 45 30
10	1593	Aug. 25 17 30	Aquarius 12 15 0	12 14 45
11	1595	Oct. 31 0 40	Aries 17 30 40	17 29 10

No.	Year	Mon. D. H. M.	Longit. obs. (Sig. G. M. S.)	Long. supp. (G. M. S.)
12	1597	Dec. 13 16 0	Taurus 2 27 0	2 26 0
13	1600	Jan. 18 14 0	Leo 8 37 0	8 37 10

Table — Mars oppositions From Kepler, Chapter 15, *On Mars* (Ex Keplero cap. 15. Martis). Columns: No. | Year | Month, Day, Hour, Min. | Observed longitude (Sign, Deg., Min., Sec.) | Observed latitude (Deg., Min.).

No.	Year	Mon. D. H. M.	Longit. obs. (Sig. G. M. S.)	Latit. obs. (G. M.)
4	1580	Nov. 18 1 31	Gemini 6 28 35	1 40 B [north]
5	1582	Dec. 28 3 58	Gemini 16 55 30	4 38 B
6	1585	Jan. 30 19 14	Cancer 21 36 10	4 32 B
7	1587	Mar. 6 7 23	Virgo 25 43 0	3 41 B
8	1589	Apr. 14 36 0	Libra 4 23 0	1 12½ B
9	1591	June 8 7 43	Sagittarius 26 43 0	0 A [south]
10	1593	Aug. 25 17 27	Aquarius 12 13 40	6 A
11	1595	Oct. 31 0 39	Aries 17 31 40	6 8 A
12	1597	Dec. 13 15 54	Taurus 2 28 0	3 33 B
13	1600	Jan. 18 14 2	Leo 8 38 0	4 30½ B

Table — Mean oppositions from Kepler, *On Mars*, Chapter 8 (Opposit. mediae ex Keplero Marte c. 8.). Columns: No. | Year | Month, Day, Hour, Min. | Observed longitude (Sign, Deg., Min., Sec.) | Computed longitude (Sign, Deg., Min., Sec.).

No.	Year	Mon. D. H. M.	Long. obs. (Sig. G. M. S.)	Long. supp. (G. M. S.)
4	1580	Nov. 17 9 40	Gemini 6 46 10	6 50 40
5	1582	Dec. 28 12 16	Gemini 16 46 10	16 51 26
6	1585	Jan. 31 19 35	Cancer 21 36 10	21 9 41
7	1587	Mar. 7 17 22	Virgo 25 10 20	25 4 50
8	1589	Apr. 15 13 34	Scorpio 3 58 10	3 54 33
9	1591	June 8 16 25	Sagittarius 26 32 0	26 40 23
10	1593	Aug. 24 2 13	Pisces 12 43 45	12 34 36
11	1595	Oct. 29 21 24	Aries 17 56 15	17 57 14
12	1597	Dec. 13 13 32	Taurus 2 28 0	2 32 20
13	1600	Jan. 19 9 40	Leo 8 18 0	8 19 57

Parsing notes: The three Tyconic-opposition tables share the same numbering (4–13) and the same set of opposition events, each giving a different reduction (Longomontanus's computed longitude; Kepler ch. 15 observed longitude + latitude; Kepler ch. 8 mean opposition). The mean-opposition table (ch. 8) reckons longitude against the Sun's place [Lóg. ☉], so a few of its zodiac signs differ from the corresponding rows of the Longomontanus/Kepler-15 tables. Zodiac-sign glyphs read from the symbols: Gemini ♊, Cancer ♋, Leo ♌, Virgo ♍, Libra ♎, Scorpio ♏, Sagittarius ♐, Aquarius ♑, Pisces ♒, Aries ♈, Taurus ♉. Latitude "B" = Borea (north), "A" = Australis (south). The 1589 entry's date "Apr. 14 36 0" carries an hour-figure of 36 (>24); it appears identically in the Longomontanus and Kepler-15 rows, a shared typesetting carry, transcribed as printed. The 1585 mean-opposition supputatum "21 9 41" breaks the close observed/computed agreement of the other rows; transcribed as printed (suspected compositor error).

There follow other places of Mars deduced from Tycho's observation and calculation, as they appear in Kepler's *On Mars* — which we shall indicate by the letter K — or in the Tyconic observations sent to us by Father Alberto Curzio [Albert Curtz], of the Society of Jesus, which we shall indicate by the letter C.

Table — Tyconic Mars observations, items 14–66 (left column). Columns: No. | Year | Month, Day, Hour, Min. | Mars observed longitude (Sign, Deg., Min., Sec.) | Observed latitude (Deg., Min.) | Kepler chapters [Capita Kepl.].

No.	Year	Mon. D. H. M.	□ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
14	1580	Nov. 12 10 50	Gemini 8 37 0		K. 10
15	1582	Nov. 11 18 45	Gemini 26 35 30		C.K. 51
16		Nov. 23 16 0	Gemini 26 38 30	2 49 10 B [north]	C.K. 51
17		Dec. 26 8 28 8 30	Gemini 17 38 0 Gemini 17 40 30	4 7 0 B	K. 11 C.K. 53
18		Dec. 28 12 16	Gemini 16 46 0	4 6 0 B	K. 11
19		30 8 10	Gemini 16 0 30	4 8 0 B	C.
20	1583	Jan. 6 15 0	Leo 8 20 30	2 12 0 B	C.K. 53
21		Apr. 22 9 45	Leo 1 17 0	1 50 40 B	C.K. 13
22	1584	Nov. 1 30 0 noctis	Gemini 23 14 0 Gemini 23 14 0	1 11 24 B	K. 13 C.
23		Dec. 21 14 0	Virgo 1 13 30	5 31 0 B	C.K. 53
24	1585	Jan. 14 16	Leo 27 29	0 0 B	C.

No.	Year	Mon. D. H. M.	□ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
		0	0		
25		24 14 0	Leo 24 47 0	4 28 0 B	C.
26		24 9 0	Leo 24 7 30	4 31 0 B	C.K. 54
27		31 12 0	Leo 21 18 11	4 31 0 B	C.
28		Febr. 3 6 0	Gemini 20 11 0	4 28 0 B	C.
29		4 6 40	Gemini 19 47 30	4 28 0 B	K. 53
30		17 10 0	Gemini 15 12 0	4 16 0 B	C.
31		Mart. 9 10 0	Cancer 11 49 6	3 24 16 B	K. 28
32		11 5 0	Cancer 11 45 30	3 24 10 B	K. 28
33		12 10 30	Cancer 11 46 0	3 22 0 B	K. 53
		13 9 0	Cancer 11 45 0	3 22 0 B	C.
34		16 7 0	Cancer 11 51 0	3 13 0 B	C.
35		19 8 0	Cancer 11 53 0	3 11 0 B	C.
36		April. 15 9 50	Leo 17 37 0	2 9 0 B	C.
		10 0	Leo 17 37 30		K. 22
37		April. 26 9 42	Leo 21 26 0	1 49 11 B	K.C. 13
38		Maij 7 11	Leo 22 55	1 33 0 B	C.K. 22

No.	Year	Mon. D. H. M.	□ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
		26	0		
39		12 10 8	Leo 28 3 30	1 24 30 B	K. 27
40		18 10 30	Virgo 0 50 45	1 19 30 B	K. 22
41	1586	Oct. 21 18 0	Virgo 0 0	1 36 6 B	C.K. 13
42		Nov. 16 40	Virgo 5 52 0	1 47 0 B	C.K. 13
43		20 19 30	Virgo 4 30 0	4 36 0 B	C.K. 13
44		Dec. 15 18 30	Virgo 6 24 0	2 35 0 B	K. 51
45	1587	Jan. 25 17 0	Libra 4 42 0	3 16 0 B	C.K. 53
46		Jan. 27 17 0	Libra 4 41 0	3 27 0 B	C.K. 28
47		Mart. 4 15 24	Virgo 26 25 48	3 38 0 B	C.K. 53
48		Mart. 6 7 23	Virgo 25 43 0	3 41 0 B	C.
49		11 5 0	Virgo 24 15 15	3 29 0 B	C.
50		27 9 40	Virgo 18 21 45	2 55 40 B	K. 27
		27 9 40	Virgo 18 21 45	2 55 40 B	C.
51		April. 1 9 30	Virgo 17 11 0	2 43 30 B	C.K. 27
52		21 9 30	Virgo 15 48 20	1 48 0 B	K. 53
53	1588	Nov. 5 18	Virgo 23	1 37 0 B	C.K. 51

No.	Year	Mon. D. H. M.	□ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
		30	16 0		
54		19 18 30	Virgo 25 31 0	1 36 45 B	C.K. 13
55		Dec. 4 18 0	Libra 9 12 0	1 53 30 B	K. 13
56		14 18 10	Libra 14 35 40	1 54 0 B	K. 28
57	1589	Febr. 11 17 13	Aquarius 8 48 0	2 9 0 B	C.K. 27
58		Mart. 8 16 24	Pisces 12 16 50	2 4 0 B	C.K. 51
59		April. 5 11 33	Aries 12 18 0	2 13 0 B	K. 51
60		13 11 13	Aries 4 43 20	2 10 0 B	C.
61		15 12 15	Aries 3 58 11	1 42 0 B	C.
62		Maij 3 5 39	Taurus 15 25 0	1 28 0 B	C.
63		3 10 0	Taurus 27 7 20	0 6 40 B	K. 51
64		Sept. 15 7 15	Pisces 16 47 20	1 41 40 B	C.K. 13
65		Nov. 1 6 10	Aquarius 20 59 15	3 14 30 B	K. 51
66		Dec. 3 5 39	Capricor n 16 35 33	11 47 [?]	K. 13

Table — Tyconic Mars observations, items 67–124 (right column). Same columns as above.

No.	Year	Mon. D. H. M.	□ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
67	1590	Mart. 4 7 10	Cancer 24 22 56	0 3 12 A [south]	C.K. 12
68		Oct. 6 4 45	Virgo 17 16 0	1 16 30 B [north]	C.K. 28
69		30 18 18	Scorpio 2 57 20	1 15 30 B	C.K. 17
70		Dec. 27 19 8	Aquarius 8 6 0	1 14 0 B	C.K. 17
71	1591	Jan. 4 18 50	Aquarius 12 44 24	1 23 15 B	C.K. 27
72		21 19 0	Aquarius 22 33 0	1 0 30 B	K. 22
73		Febr. 19 5 30	Pisces 7 24 0		
74		Majj 13 13 40	Taurus 2 24 30	2 15 0 A	C.K. 51
75		19 13 40	Taurus 1 34 45	2 40 15 A	C.
76		21 13 13	Taurus 1 15 45	2 52 0 A	C.
77		22 12 42	Taurus 0 40 0	3 5 0 A	C.
78		29 12 10	Taurus 29 30 20	3 25 0 A	C.
79		Iunij 12 6 22	Gemini 17 14 42	3 55 30 A	K.15.53
80		16 11 50	Gemini 16 3 36	2 55 0 A	K. 53
81		8 11 50	Gemini 25 25 0	4 44 0 A	C.
82		18 10 24	Gemini 21 10 0	4 45 0 A	C.

No.	Year	Mon. D. H. M.	□ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
83		Iulij 19 2 3	Gemini 20 8 0	4 50 0 A	C.
84		Sept. 16 7 10	Virgo 18 36 0	2 49 12 A	C.K. 44
85		Oct. 5 13 10	Libra 1 27 10	2 10 50 A	C.K. 13
86		Dec. 10 10 0	Sagittari us 10 3 0	0 16 0 A	C.
87	1592	Jan. 3 10 15	Aries 11 34 30	0 2 0 A	K. 11
88		Febr. 3 6 11	Aries 19 17 0	0 8 0 A	C.
89		19 8 0	Aries 7 25 0	0 29 0 A	C.
90	1593	Iunij 29 13 30	Pisces 13 37 22	4 37 0 A	K. 51
91		Iulij 17 4 45	Pisces 13 45 45	5 46 0 A	K. 51
92		30 13 45	Pisces 17 39 30	6 15 0 A	K. 42
93		Aug. 5 13 45	Pisces 17 30 0	6 18 50 A	K. 42
94		22 12 20	Pisces 13 10 15	6 7 0 A	K. 53
95		24 10 20	Pisces 10 28 0	6 5 30 A	K. 15
96		29 10 20	Pisces 11 14 0	5 52 0 A	K. 53
97		Oct. 3 8 0	Aries 0 0 0	7 9 [?] A	K. 6
98		Dec. 10 7 0	Aries 4 44 0	1 15 A	K. 61

No.	Year	Mon. D. H. M.	□ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
99	1594	Jan. 3 6 12	Aries 18 36 0	0 27 57 A	C.
100		Nov. 26 6 40	Scorpio 18 31 0	0 19 30 B	C.K. 27
101	1595	Jan. 3 19 10	Taurus 13 36 40	3 46 B	C.K. 12
102		Iulij 21 14 40	Taurus 4 11 10	2 30 0 A	C.
103		Sept. 11 0 0	Taurus 26 6 0	1 26 0 A	C.
104		Sept. 17 16 45	Gemini 26 7 12	1 42 0 A	K. 53
105		Oct. 25 8 10	Gemini 19 39 25	0 12 41 A	K. 26
106		27 12 20	Gemini 18 51 15	0 6 0 A	K. 26
107		28 12 0	Gemini 18 29 0	0 4 30 A	C.K.61
108		31 0 0	Gemini 17 31 40	0 8 0 B	K. 15
109		Nov. 3 12 0	Cancer 16 18 30	0 1 40 B	C.
110		23 0 20	Cancer 11 6 0	1 40 0 B	C.
111		Dec. 8 8 55	Cancer 10 26 16	1 29 0 B	K. 51
112		16 7 20	Cancer 11 31 27	1 40 44 B	K. 51
113		18 7 40	Cancer 11 41 0	1 40 0 B	C.
114	1596	Jan. 26 5 15	Taurus 24 20 28	1 53 0 B	C.

No.	Year	Mon. D. H. M.	☉ Long. obs. (Sig. Gr. M. S.)	Lat. obs. (G. M. S.)	Capita Kepl.
115		Febr. 8 6 15	Taurus 27 56 40	1 50 0 B	C.
116		Mart. 5 14 0	Gemini 13 37 40	1 47 0 B	K. 11
117		9 8 0	Gemini 15 49 0	1 49 40 B	C.
118		9 7 40	Gemini 15 49 12	1 47 40 B	C.
119		18 8 0	Gemini 18 29 50	1 45 0 B	C.
120					
121	1597	Nov. 7 17 0	Taurus 12 30 0	1 36 24 B	C.
122	1599	Oct. 20	Leo 5 10 0	1 18 0 B	C.
123	1600	Febr. 20 10 0	Cancer 29 14 56	3 50 51 B	C.
124		April. 9 9 20	Taurus 3 30 47	2 33 0	Snell.

Parsing notes: Both columns share the format Year / Month-Day-Hour-Min / Mars longitude (sign glyph + deg-min-sec) / latitude (deg-min-sec, B = north / A = south) / "Capita Kepl." source-key column (the chapter of Kepler's *On Mars* — letter K — and/or Curtz's manuscript — letter C; one entry, item 124, cites Snell [Snellius]). Several month/year cells span multiple numbered rows in the source; the value is repeated or left blank where the source leaves it implicit. The sign glyph is printed only on the first row of each new-sign group and carries down implicitly; sub-rows with no fresh sign continue within the same sign (a layout feature, not illegibility). Zodiac-sign glyphs are read from the printed symbols. Where a row gives only a partial date (e.g. items 75–78, "19", "21", a bare day number), the month carries over from the row above per the source's columnar layout. Item 120 is a blank/spacer row in the printed table (the row-number is printed in the stub with no data). Two latitude-seconds cells remain illegible (ink-bled): item 66 ("11 47 [?]" — the degree "11" is also anomalously large for Mars's latitude and

may be a column-slip or mis-set) and item 97 ("7 9 [?] A"); both degrees-minutes are legible, only the seconds glyph is lost.

There are now coming to light the remaining Tychonic observations, edited at Vienna and reviewed by Lucius Barrettus [Lucio Barretto] — understand [this to be] Father Alberto Curzio [Albert Curtz] of our Society, who wished to conceal his name under this anagram, the care of which the Emperor Ferdinand entrusted to him. While all these are being published, take this specimen meanwhile, for the year 1582.

Liber VII — De Martis (continued)

Caput V (continued): Tychonic Mars Observations — the 1582 specimen

[The page opens with the continuation of the detailed Tychonic specimen table for the year 1582 (folio 321, left column). The columns are: the date (year/month/day, hour, minute); the distance of Mars [Distant. □] in degrees and minutes; and the reference star [à Fixis] from which the distance was measured.]

Year / Month — D · H · M	Dist. □ Gr.	Dist. □ M.	From the fixed star [à Fixis]
1582			
Nov. 23 — 8 50 (twice) [bis]	22	32	from the Knee of Castor [à Genu Castoris]
— 9 7 (thrice) [ter]	39	53½	from the Northern Horn of the Bull [à Cornu Bor. Tauri]
25 — 8 27	22	21½	from the Knee of Castor
— 8 50 (thrice) [ter]	39	43	from the Northern Horn of the Bull
Dec. 3 — 8 50 (twice,	21	7½	from the Knee of Castor

Year / Month — D · H · M	Dist. □ Gr.	Dist. □ M.	From the fixed star [à Fixis]
quarter) [o quarter]			
— 7 52 (thrice) [ter]	52	0	from the Eye of the Bull [ab Oculo Tauri]
— 8 19 (thrice) [ter]	38	27½	from the Northern Horn of the Bull
17 — 8 0	6	49½	from the head of Castor [à cap. Castoris]
— 8 ¼	44	41	from the bright star of Aldebaran [ab Aldebara]

Parsing notes: several time-entries carry the abbreviations *bis* ("twice"), *ter* ("thrice"), *quarter* and *o quarter* — these mark repeated readings or fractional minutes in the source; transcribed as printed. The row-bracketed numbers in the left margin of the source (325, 326, 327, 128, 129, 130, 131) are observation-item numbers; item "128" is printed thus (Arabic, in the running observation count). Item-number "128" sits at the row "17 — 8 0 ... 6 49½".

[Margin note within the table region:] Item 128.

It is to be noted that Mars was at almost exactly the same longitude as the head of Castor [caput Castoris], and at nearly the opposite [point of] its Epicyclic Apogee [in Auge fere Epicycli], conjoined with the Sun [cum ☉].

Year / Month — D · H · M	Dist. □ Gr.	Dist. □ M.	From the fixed star [à Fixis]
Dec. 27 — 6 51 (twice) [bis]	16	43½	from the head of Castor [à cap. Castoris]
— 7 8	36	42½	from the heart of Leo [à corde]

Year / Month — D · H · M	Dist. □ Gr.	Dist. □ M.	From the fixed star [à Fixis]
— 7 18 (twice) [bis]	36	43	Leonis] from the heart of Leo
29 — 11 6 (twice) [bis]	29	53½	from the Northern Horn of the Bull [à cornu Bor. Tauri]
— 19 6	6	16	from the head of Castor
30 — 8 10 (thrice) [ter]	19	15½	from the lower foot of Erichthonius [ab infer. ped. Ericht.]
— 8 18	35	27½	from the upper foot of Erichthonius [à super. ped. Ericht.]

Parsing notes: "Erichthonius" = Auriga (the Charioteer); the source abbreviates *Ericht*. The marginal item-numbers 129, 130, 131 attach to these rows.

Now we pass from the first Tychonic observations to the last, made in Bohemia — partly at the castle of Benatky near Prague [in arce Benatica prope Pragam], partly in a house in Prague itself — which Snel [Snellius] published at Leiden in the year 1618, together with the Hassiac [observations] and others taken from Curtz [Curtii]; and he reduced them to the days of the New Calendar.

[Item 132] In the year 1600, on January 1, New Style, in the night preceding, the meridian altitude of Mars as observed by Tycho [Brahe] was 58° 54'. And the longitude [of Mars] was 55° 6'. Hence, two hours afterward, [Mars stood] 27¾° distant from the Pole-star [à Pollucis capite], while Jupiter likewise was 29° 45' distant. But Jupiter itself was at 33° 35' ½.

[Item 133] On the fifth of January [Jan. 5], in the night, one hour before the meridian-transit of Mars, Mars stood distant from the Pole-star [Pollux] by $29^{\circ} 3'$; and soon, from the tail of Leo [à cauda Leonis], $30^{\circ} 13'$. It then crossed the meridian at an altitude of $59^{\circ} 12'$.

[Item 134] In the same year, on March 10, p.m., on the meridian, Mars stood distant from the bright star of Aries [à lucida Arietis] by $86^{\circ} 33' \frac{1}{3}$, and from Aldebaran by $55^{\circ} 47' \frac{1}{3}$; therefore, as Snel infers, the longitude of Mars was $29^{\circ} 14' 56''$ of Cancer [Cancri grad. 29], and its latitude $5^{\circ} 30' 51''$.

[Item 135] And on April 11, at hour $9^{\circ} 37'$, p.m., Mars stood distant from the bright star of the foot [of Gemini, à lucida pedis Geminæ] by $32^{\circ} 50'$; and after 14' of time, it stood distant from Regulus by $19^{\circ} 20' \frac{1}{3}$.

[Item 136] In the year 1601, October 10, in the morning, at hour $3^{\circ} 30'$, Mars stood distant from the head of Pollux [à Pollucis capite] by $25^{\circ} 0' 10''$, and from Procyon by $27^{\circ} 44' \frac{1}{3}$; and from Regulus by $12^{\circ} 2' \frac{1}{3}$.

[Item 137] And on October 11, in the morning, at hour $3^{\circ} 30'$, Mars stood distant from the head of Pollux by $25^{\circ} 33' 50''$; from Procyon by $28^{\circ} 12'$; and from Regulus by $11^{\circ} 23'$.

This was the last observation of Tycho [Brahe]; for he took to his bed [decubuit], being seized by a retention of urine, on October 13, and died on October 24.

Furthermore, besides Kepler and Longomontanus, those authors who make use of the aforesaid acronychal [opposition] observations and others are listed above [supra recensiti sunt]: Boulliau [Bullialdus], Book 1, *Astronomia* [*Astronomia Philolaica*], chapter 11, and to the end throughout; and Longomontanus [Lansbergius?], passim, in [his] observations of the years 1587 (January 15 and 1589), April 15 and 1591 (May 13), and 1595 (October 17, or rather 27).

CAPVT VI.

Mars Observations made by Jost Bürgi [Iusto Byrgio], Longomontanus, Kepler, Fabricius, and Gellius Sascridus, from the Year 1590 to 1613.

The observations made by Jost Bürgi [Byrgius] at Kassel [Casselis], and noted on the days of the Old Style [stylus vetus], at hours after midday [post meridiem], in the keeping of Snel [apud Snellium], among the Hassiac [observations] —

[The table at the head of the right-hand column of folio 321 lists the Bürgi/Kassel and related observations. Columns: year/month, day · hour · minute; distance of Mars [Martis dist.] in degrees, minutes, seconds; reference star [à Fixis]. The marginal item-numbers run 1–11.]

#	Year — Month · D · H · M	Mars dist. G.	M.	S.	From the fixed star [à Fixis]
1	1590 Dec. 23 — 13 0	17	20	0	from Spica [à Spica]
		11	35	0	from the Northern Balance [à Lance Borea]
2	1591 Jan. 29 — 19 30	58	56	30	from Spica
3	—	8	55	30	from Regulus [à Regulo]
	Jun. 8 — 9 10	22	32	0	from Antares [ab Antare]
	—	43	39	0	from the bright star of Aquila [à lucida Aquilæ]
4	Sept. 28 — 7 15	13	6	0	from the shoulder of Sagittari us [ab

#	Year — Month · D · H · M	Mars dist. G.	M.	S.	From the fixed star [à Fixis]
	—	52	37	30	humero Sagittarii]
	—	52	37	30	from the bright star of Aquila
5	1593 Dec. 2 — 8 0	25	42	0	from the head of Androme da [à cap. Androme dæ]
	—	21	26	15	from the third star of Aries [à tertia Arietis]
6	1594 Jan. 2 — 8 0	46	28	0	from Aldebara n [ab Aldebara]
7	—	16	18	30	from the girdle of Androme da [à cingulo Androm.]
	Mar. 4 — 8 0	10	39	0	from Aldebara n
	—	29	25	0	from Capella

#	Year — Month · D · H · M	Mars dist. G.	M.	S.	From the fixed star [à Fixis]
					[à Capella]
8	1595 Aug. 8 — 15 0	22	30	0	from the head of Medusa [à cap. Medusæ]
9	—	20	37	0	from Aldebara n
	Dec. 13 — 9 0	34	15	0	from Aldebara n
	—	40	16	0	from Capella
10	1596 Jan. 28 — 9 0	11	33	0	from Aldebara n
	—	28	53	30	from Capella
11	1597 Sept. 28 — 14 0	14	26	0	from Procyon [à Procyone]
	—	22	26	30	from Procyon

Parsing notes: the right-hand table's running header reads "Ann. Mens. D · H · M ·
— Martis dist. G · M · S · — à Fixis." Item-numbers 1–11 are in the source's
marginal column. The entry at item 3 ("Jun. 8") appears to belong with the
following sub-rows; alignment preserved as printed.

[Item 12] In the year 1590, January 9, Old Style, Michael Mästlin [Michaël
Mæstlinus] and Johannes Kepler [Io. Keplerus], at Tübingen, saw the whole disk

of Mars by an eclipse: the color of Mars was fiery [ignis], and they argued [from this] that Mars was inferior [to the Sun]. Kepler, in his *Astronomia Optica* [*Astronomiae Pars Optica*], page 305, and likewise Lansberg [Lansbergius] at Thelaur [Thelauro], among these observations, however, places the day as the eighth [octauam], and the morning [mane] from his own conjecture [ex tuo figmento] — though in the calculation he sets the day as the sixth, at hour 18. Goët. [Goëtensis?] therefore, as if the observation had been made on day 7 — at any rate, since this table does not exhibit the conjunction of Mars with Jupiter [Iove], 18 hours after midday of [Tübingen? wait — see below] — [Margin: *duplex dies* ("a double dating")]. Goët., on the sixth day, supposes the place [of Mars] to be in [Scorpius]: place of Mars 13° 52', with latitude north [Borea] 1° 8'. The place of Mars [is reckoned] in Scorpius at 13° 11' ½, with latitude north 8° 18'; or [from a] vicious [reading] of Kepler's numbers, or [from] vicious tables of Lansberg. Maginus [Maginus], in his *Ephemerides* derived from the Prutenic [Tables], notes the same conjunction for the 9th, at hour 15° 41', after the meridian of Venice [Venetiis].

[Margin: *Lansbergius / duplex dies* — "Lansberg / a double dating."]

[Item 13] In the year 1591, June 8, Old Style, Gellius Sascridus [Gellius Sascridus], a disciple of Tycho [Brahe], observing at Padua [Patauii], concluded by [the position of] Mars, opposing his own master, that Mars at its mid-position [Medio ☽ wait] — [reads:] *Medio S. ☐ loco factam fuisse hor. 16. 25'*. — that [the observation] was made at the place [loco] in the middle, at hour 16° 25' after the meridian, when Mars was at 26° 40' ½ of Sagittarius [Sagittarii]. Kepler, *In Ad arte* [*In Astronomia Nova*], chapter 8.

[Item 14] In the year 1597, December 19, Old Style, David Fabricius [David Fabricius] in East Friesland [Frisia], at hour 12° 10', observed Mars in Cancer [in Cancri] at 3° 40' ½, with latitude north 5° 23'. Kepler, *In Marte*, chapter 15.

[Item 15] In the year 1602, February 16, Old Style, David Fabricius in East Friesland [Frisia Orientali], at hour 3 in the morning [matutina], observed Mars distant in the preceding [moment? *in præcedentia*] from the bright Southern wing of Virgo [clara Australis alæ Virginis] by 20° 18', and from the tail of Leo [à cauda Leonis] by 8° 17'; from which he gathers [colligit] Mars to have been in Virgo at 21° 21' ½. Kepler, *In Marte*, chapter 15, who collects [calculates] Mars to have been in the wing [ala] of Virgo at 14° 19', or [taking] Leo with the tail, in [grade] 14° 31' 36" at midday [meridie]; but with the latitude included, Mars was [at] 21° 21' ½, [as] purgans Sextantem [correcting the Sextant], so that Fabricius's [stated] distances exhibit somewhat greater values.

[Item 16] In the year 1602, Longomontanus [Longomontanus], Book 2, *Theoricæ [Astronomia Danica]*, chapter 8, gathers from his own observations the opposition of Mars with the Sun, [finding] indeed the place of the Sun to have been at 20° [Pisces?], Old Style, hour 14° 15'; at Copenhagen [Hafniæ], in Virgo at 12° 16', although his own Tables give 12° 24'.

[Item 17] In the year 1602, February 18, Old Style, at Prague [Pragæ], with the help of Matthias Seiffard [Matthias Seiffardo], a pupil of Tycho [Brahe], with Tychonic instruments, in the evening at hour 10° 30' after the meridian,

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[Continuation of item 17 from the foot of the prior page:] — Mars's distance was observed from the middle of the tail of the Greater Bear [à media cauda Ursæ maioris] as 52° 22'; but because [the distance] lay between [the stars] of Leo and Procyon [inter cor Leonis & Procyona], the Sextant exhibited 37° 22' 20", whereas it ought to have been 37° 19' 40". [Kepler] therefore reckons the Sextant in excess [abundare] by 2° 14' ¾; and so he sets the distance of Mars from the middle of the tail of the Greater Bear, corrected, to have been 52° 19' ¾. Thus, [reckoning] between Mars and Regulus [Regulum], he puts [Mars] at 19° 47' ¾; and between Mars and the bright star of Virgo [clara Virginis] at 21° 1' 20"; he puts [Mars] at 21° 17' ¾; and from this wondrous agreement [mira consensu] he establishes the place of Mars in Virgo at 13° 19' 6". Kepler, *In Marte*, chapter 15.

[Item 18] In the year 1602, on the same night, February 18, hour 12° 40', at Prague [Pragæ], Kepler observed the meridian altitude of Mars to be 50° 1'; in whatever way [or: of which] he had the tail of Leo at 30° 15'. He deduced the place of Mars in Virgo to be 13° 19' 30", with latitude north 4° 7' 55"; and thence he recognized the future opposition of Mars with the Sun for the 20th of February, hour 14° 13' p.m., the Sun obtaining [a place] in Virgo of 12° 27' 35", with north latitude 4° 10'. Kepler, *In Marte*, chapters 15, 18, 52.

[Item 19] In the year 1604, February 27, New Style, Kepler, at night between the days of Jupiter and Venus [inter diem Iovis & Veneris — i.e. between Thursday and Friday], while a curtain [Cortus] darkened the sky [cœlum mediaret], observed Mars distant from Spica [à Spica] by 9° 44', and from the Northern Balance [à Lance Borea] by 17° 41'; but using the same instrument, he afterward exhibited the same [distance of Mars] from Arcturus [ab Arcturo] as 51° 57'; with which, since they agree with the data given by Tycho, [the distances stand at] 51° 1' 45". Therefore he corrected the aforesaid distances, ordering them thus: from

Spica $9^{\circ} 48' 45''$ — $17^{\circ} 45' 45''$ — $29^{\circ} 17' 43''$. Moreover, he took the meridian altitude of Mars [at] $32^{\circ} 4'$, and of Spica at $30^{\circ} 50'$; and from the difference of these, beneath the altitude of the Pole [sub altitudine Poli] at 32° , he ascertained the altitude of Spica to be properly [debuisset esse] $30^{\circ} 52'$; and that of Mars $32^{\circ} 6'$. He doubts, however, whether by some iron Rule [Regula ferrea] and weight [pondere], the impetus, loosened [from] the pulleys [solutis trochleæ], shook the pinnacle [pinnacida — sight-vane] by an example [or: in the manner described]. Kepler, *In Marte*, chapter 11.

[Item 20] In the year 1604, April 8, New Style, Kepler, together with Johannes Schuler [Ioannem Schulero], observing in the evening, [found] the distance between Arcturus and Spica [inter Arcturum & Spicam] to be $33^{\circ} 4'$, which ought to have been $33^{\circ} 1' \frac{1}{3}$, or $4\frac{1}{2}'$; whence, [taking] the corrected distances, he acquired the distance of Mars from Arcturus as $29^{\circ} 41' \frac{1}{3}$, and from the heart of Leo [à corde Leonis] as $54^{\circ} 8' \frac{1}{3}$; and although one might doubt that he sometimes took Mars for Spica, he nevertheless gathers the opposition with the Sun [veram oppositionem] to have been made on the 28th [of] March, Old Style, at hour $16^{\circ} 23'$ after midday. Mars [was] in Libra at $18^{\circ} 37' 50''$, with latitude north $4^{\circ} 26'$. Kepler, *In Marte*, chapter 15.

[Item 21] In the year 1604, September 27, New Style, at Prague [Pragæ], hour 8, [the observation] was made of the conjunction of Mars with Saturn [Saturno]; and on the 29th, October, hour 1 before the meridian [the observation] was made of the conjunction of Mars with Jupiter [Iove]. Kepler, [in his] *De nova Stella Serpentarii* [*De Stella Nova in Pede Serpentarii*], chapter 11.

CAPVT VII.

Mars Observations made by Pierre Gassendi [Petro Gassendo], Martin Hortensius [Martino Hortensio], Michael Florentius [Michaele Florentio], and Vincentio Mutus [Vincentio Muto], from the Year 1617; likewise by the Fathers of the Society [PP. Soc.] of Jesus at Ingolstadt [Ingolstadii] and at Innsbruck [Oeniponti].

[Item 1] In the year 1621, for the opposition of Mars with the Sun noted in the Ephemerides on the 6th [of] May, Gassendi [Gassendus] at Aix [Aquis Sextiis], with the Astronomical Radius [Radio Astronomico], on the 3rd of May, in the

evening at hour 10, observed Mars distant from the Northern Balance [à Lance Borea] by 8° 19', and from the Southern [Balance, ab Australi] by 5° 17'. The Balances [Lances], moreover, [stand] from each other [inter se] by 9° 12'; so that as far as the latitude and longitude [it] follows the Tychonic [reckoning], as Tycho has it, [namely] 9° 8'. Again, on the same [day], hour 8, he saw Mars distant from the Northern Balance by 8° 18'; and on the 8th [of May], hour 9, in the evening, he saw [Mars] distant from the Northern Balance by 8° 28', and from the Southern [Balance] by 3° 35'. Thus Gassendi —

gives [these as] Mars's distance from the middle of the tail of the Greater Bear [à media cauda Ursæ maioris] as 52° 22'; but because [the distance] lay between [the stars] of Leo and Procyon [inter cor Leonis & Procyona], the Sextant exhibited 37° 22' 20", whereas it ought to have been 37° 19' 40"; therefore he reckons the Sextant to exceed by 2° 14' ¾, [and] he collects the distance of Mars from the middle of the tail of the Greater Bear, corrected, to have been 52° 19' ¾.

Parsing notes: the right column at the top of folio 322 repeats verbatim the corrected-Sextant passage from item 17/the prior page; this appears to be a compositor's reprise of the same Kepler-Sextant calculation. Transcribed as printed.

[Item 2] In the year 1623, June 26, hour 13, after midday [post merid.], Gassendi [found], from the distance of Mars at Digne [Diniæ], from the left shoulder of Sagittarius [ab humero sinistro Sagittarii], at 6° 53'; and at 13° 3' from the Northern part of the arc of Sagittarius [à Boreali parte arcus Sagittarii], deduced the longitude of Mars [to be] in Capricorn [Capricorni] at 13° 21' ½, and the Southern latitude [latitudinem Australem] 6° 37' ½; as is to be had in the observations of Gassendi himself, in his writings, in which are contained also the underwritten [subscriptas] longitudes and latitudes observed from the same.

[The boxed table embedded in the left column of folio 322 follows. Running header: "Anno 1623. — Longit. Martis (Sig · G · M ·) — Latit. Austr. (G · M ·)." Columns: month, day, hour; longitude of Mars (sign, degrees, minutes); Southern latitude (degrees, minutes). Marginal item-numbers 3–20.]

#	Month — D · H	Long. Mars			Lat. Austr.	
		Sig.	G.	M.	G.	M.
3	Jun. 28 — 13	♋ Cancer	12	52	6	31
4	Jul. 1 —	—	12	4	6	26

#	Month — D · H	Long.	G.	M.	Lat.	M.
		Mars Sig.			Austr.	
	12½					
5	5 —	—	11	4	6	11
	12½					
6	6 — 14	—	10	48½	6	5½
7	18 — 11	—	7	47	5	55
8	19 — 11	—	7	33	5	54
9	20 — 11	—	7	18	5	54½
10	26 —	—	6	17	5	54
	10½					
11	27 —	—	6	11½	5	48
	10½					
12	Aug. 1 — 10	☐ Cancer	5	40	5	46
13	2 — 10	—	5	39	5	45
14	3 — 10	—	5	36	5	43
15	4 — 9½	—	5	34	5	43
16	5 — 10	—	5	34	5	41
17	7 — 10	—	5	35	5	38
18	8 — 10	—	5	37	5	36
19	9 — 10	—	5	38	5	35
20	10 — 10	—	5	41	5	34

Parsing notes: the zodiac-sign column repeats ☐ (Cancer) at the head and is left blank (ditto) on intervening rows in the source; carried as "—". The latitude is consistently Southern (Austr.) and slowly decreasing then turning — note item 17 onward the longitude reverses (5° 34' → 5° 35' → 5° 37'...), consistent with Mars near its station/retrograde turning point; this is a real motion feature, not a transcription error.

[Item 21] In the year 1632, February 5, Michael Florentius Langren [Michaël Florentius Langrenus], Cosmographer to the Catholic King [Regis Catholici] at Madrid [Matriti], saw Mars occulted by the Moon [occultari à Luna] near the middle of the eastern limb [orientalis limbi], culminating at the equator

[culminante Æquatoris] at grade 178° 38'; and emerging from the western limb [ex limbo occidentali], culminating at grade 193° 35', [a quantity] scarcely [latius] sub —

[Item 22] — the Moon was less [than] 57¾' of one hour. The same conjunction of Mars [in its] acronychal [position] with the Moon, the Moon being full [plena], Hortensius [Hortensius] at Leiden [Leydæ] observed [as] made, and Gassendi [Gassendus] at Paris [Parisiis], hour 15° 18' after the meridian; which [observation] Hortensius [recorded] in his *Dissertation* [*Dissertatio*], and conjoined to the Tables of Lansberg [Tabulis Lansbergii]; and Lansberg himself, at Thelaur [Thelauuro], among the observations of Mars, supposing the place of Mars [at] the predicted moment to have been in Leo [Leonis] at 16° 24' 37", with latitude north 4° 33' 42"; the Moon's true place, moreover, in Leo at 16° 42' 31", the [Moon] seen [at] 16° 26' 26", with true latitude 4° 58' 33"; the [Moon] seen, moreover, at 4° 16' 19"; whereto he adds that through the Tube [Telescope, Tubo] Mars was seen less than one digit [vno digito] more Northern than the Northern limb [Boreaiorem limbo] of the Moon [Lunæ Septentrionali]; and the center of the Moon was seen to be higher toward the West [versus occasum] by 58° 51'.

[Margin: *Gassendus in Epicuro* — "Gassendi, in his *Epicurus*."]]

[Item 23] Gassendi [Gassendus], moreover, in his *Epicurus* [*Animadversiones in Diogenem Laertium / De vita ... Epicuri*], page 900, says that, observing himself at Paris, in the year 1632, February 6, hour 2, minute 3, [reckoned] after midnight [post mediam noctem], he saw the Moon high [alta] toward the West at grade 44° 15'; and that, at the highest part [supremo margine], the [Moon] subtly subentered [Mars], and somewhat [tum] departed [deseruisse] at hour 3° 33'; [its] inclined part [parte marginis inclinata] toward the North [versus Boream]; and although Mars was much earlier seen with the naked eye [oculo nudo] than [the moment when] Mars was occulted by the Moon, nevertheless through the Telescope [Telescopio] it was seen [the Moon's] whole [body] immersed; although for some little portion left [behind] in the middle of the occultation [in media occultatione relictam], as if not the whole [of Mars] were then immersed.

[Item 24] In the year 1634, the Ephemerides note the opposition of Mars with the Sun on the 12th [of] March; therefore Gassendi at Digne [Diniæ], on the 8th [of] March, in the evening, [saw] the other [body — Mars?] distant from Regulus [à Regulo] by 26° 41'; and from the heart of the Hydra [à corde Hydræ] by 27° 57'; and from the tail of Leo [à cauda Leonis] by 23° 56'; and from the tail of Leo [à cauda Leonis] by [again] —. The remaining days were cloudy [nubes], and on the 15th [of March] in the evening, [with] Regulus high [alto Regulo] at grade 44, he

saw Mars distant from Regulus by $23^{\circ} 56'$; and from the tail of Leo by $8^{\circ} 44'$. Thus also Cassini [Cassinum].

[Item 25] In the year 1634, June 18, [in the] night, following, Gassendi at Aix [Aquis Sextiis], with the naked eye [nudo oculo], estimated the last star [vltimam Stellam] of the four [stars] of the left [Southern? sinistræ] wing of Virgo [alæ Virginis] to be touched [tectam] by Mars — although [his] companion Lynceus [Socius ipsius Lynceus] saw, at the very beginning of night, how much [quantum] with the naked eye Mars [stood] from that distance, how greatly [quanta penè] the semidiameter of Mars seemed to lie before it [videbatur]; but Gassendi, with the Telescope, saw [Mars] to be distant from the star [by] nearly seven [proximè septem] diameters of Mars.

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[Continuation of item 25 from the foot of the prior page:] — Then, at hour $11^{\circ} 19'$, Mars and the star were at the same vertical [in eodem perpendiculo], the former lower, the latter higher, with a distance of four diameters [diametrorum quatuor]. Finally, at hour $12^{\circ} 34'$, Mars was seen higher [altus] at the same longitude with the star, distant [from it] by no more than three diameters of Mars. In his *Epicurus* [*Epicuro*], page 902, understand [this of] the outermost [star] of the left wing [alæ sinistræ], as I shall say in chapter 8.

[Item 26] In the year 1636, Gassendi at Aix [Aquis Sextiis], March 17, in the evening, [with] Castor high [alto Castore] at $54^{\circ} 15'$, with the Radius [Radio] saw Mars distant from Arcturus [ab Arcturo] by $30^{\circ} 29'$, and from Spica [à Spica] by $22^{\circ} 15'$; but on the 18th [of March], [with] Spica high at $29^{\circ} 45'$, saw Mars distant from Arcturus by $30^{\circ} 23'$, and from Spica by $9^{\circ} 19'$. Thus [reported] to Cassini.

[Item 27] In the year 1642, August 15, with Michael Florentius [Michaele Florentio] observing at Brussels [Bruxellis], the Moon occulted Mars [Luna occultauit Martem], [the Moon] culminating at the equator [Æquatoris] at grade $300^{\circ} 33'$, [Mars] culminating at the equator at grade $308^{\circ} 54' 11''$. So [it stands] in his writings [in suis litteris].

[Item 28] In the year 1645, D[on] Vincentio Mutus [Vincentius Mutus] at Majorca [Maioricæ], on the 13th [of] February, hour 8, saw Mars [to be], by three little [intervals], more Westerly [minutis occidentaliorem], and by $33'$ more Northerly [Borealiorem] than the second star preceding [secundâ Stellâ præcedente] among the informal [stars] of Erichthonius [informes Erichtonii]; on the 18th [of] February, hour 8, an hour after sunset [post occasum Solis], he saw Mars distant

— as to longitude — by less [than] 2' from the star which is below and inferior [infra ad ortum inform] [to] Erichthonius, and more Northerly by 21 scruples [scrupulis]. So [it stands] in his own writings to me [in suis ad me litteris].

[Item 29] In the same year, likewise there [ibidem], April 6, hour 7, he saw Mars distant toward the East [Orientem versus], a little more [paulò plus] than half a [diameter] of the Moon from the star [à media Luna à Stella] which is in the upper thigh of Gemini [in femore superiori Geminorum]. The same [stands] in [his] writings to me [in litteris ad me].

[Item 30] In the same year likewise, 1645, hour 8, after midday, D[on] Vincentio Mutus at Majorca saw Mars at almost the same longitude with the extreme [star] of the Northern foot [extrema pedis Borealis] of Cancer, but more Northerly by about 24 scruples; finally, on the 15th [of] May, hour 8, Mars stood distant by about 3 scruples [from the same], but it was more Northerly by about 5 scruples. The same [stands] in his writings to me.

[Item 31] In the year 1649, June 13, hour 9, D[on] Vincentio Mutus at Majorca saw Mars more Southerly [australiorem], yet by about 13 scruples more Westerly [occidentaliorem] than the star which is at the extremity of the left wing of Virgo [in extremo Alæ sinistræ Virginis]; on the 24th, [in the] morning, hour 9, [Mars was] more Easterly [orientalior] than [on] the 23rd; and on that previous day [die præterita] it had been more Westerly [occidentaliior], so that, with Mars conjoined [conjuncto] with the said star, the star was [there] about the twentieth hour [circa horam vigesimam] after midday of day 23. Thus from Mutus's writings given to me [ex Muti litteris ad me datis].

[Right-column heading, folio 323:] The Fathers of Our Society [PP. Soc. Iesu] at Innsbruck [Oeniponti], indeed, as testified by the same Father Michael Staudacher [P. Michael Staudacher], observed the distances written below [infrascriptas].

[Note: the parallel left-column heading reads:] At Ingolstadt [Ingolstadii], moreover, the Fathers of Our Society [Patres Societatis Nostræ], as Father Michael Staudacher [P. Michael Staudacher] wrote to me, observed these distances of Mars.

Ingolstadt table (left column, folio 323)

Month — D · H (Vesp.)	from Spica □ Gr.	I (min.)	from Arcturus Gr.	I (min.)
Anno 1617				
May 25 — 9½	44	30	51	42
31 — 9½	41	56	49	12
Jun. 14 — 10½	35	14	45	12
19 — 10	32	45	43	30
29 — 10	27	24	40	0
Jul. 11 — 9½	20	48	36	27
14 — 9½	19	6	35	40
16 — 9½	17	50	35	10
16 — 9½	12	10	33	4
30 — 9	9	40	32	10
Aug. 6 — 8½	5	26	31	25
7 — 8½	4 (from Antares [ab Antare])	36	31	20
10 — 8½	48	32	31 (from Arcturus [ab Arcturo])	8
13 — 8½	46	39	31	5

Parsing notes: two rows are flagged in the source as measured from a different reference star (row "Aug. 7" gives the Spica-column distance "from Antares [ab Antare]"; row "Aug. 10" gives the Arcturus-column distance "from Arcturus" — an internal label change). The row "16 — 9½ ... 12 10 ... 33 4" repeats the day "16" of July; transcribed as printed (likely a third reading on the same date, or a compositor's repeat — flagged). The day-column entries are abbreviated; carried as printed.

Innsbruck table (right column, folio 323)

An. 1635 — Month · D	Distan ce □ from star [A.]	Gr.	I (min.)	Rising alt. Fixed star Gr.	I	Rising alt. Mars Gr.	I
Sept. 19	Procy on [Canic ula] Cap. Pollux [Cap. Pollun .]	30	29½	31	5	20	35
Oct. 2	Procy on [Canic ula] Mane of Leo [Iuba □]	37	18½	42	35	28	20
4	Procy on [Canic .] Mane of Leo [Iuba □]	38	19½	41	57	28	46
6	Procy on [Canic .] Mane of Leo	39	26	43	30	27	35

An. 1635 — Month · D	Distan ce □ from star [A.]	Gr.	I (min.)	Rising alt. Fixed star Gr.	I	Rising alt. Mars Gr.	I
8	[Iuba □] Procy on [Canic .] Mane of Leo [Iuba □]	40	34	44	49	28	57
		8	4½				

An. 1636 — Month · D	Distan ce □ from star [A.]	Gr.	I	Altit. Occ. Fixed Gr.	I	Ortiv a Mars Gr.	I
May 27	Regul us [Regul o] Tail of Leo [Caud a □]	53	22	37	35	35	26
Jul. 7	Spica □ Arctur us [Arctu ro]	8	58½	12	21	(occid.) 20	(occid. ?)
23	Spica	15	56	10	18	28	(occid.)

An. 1636 — Month · D	Distan ce □ from star [A.]	Gr.	I	Altit. Occ. Fixed Gr.	I	Ortiv a Mars Gr.	I
	□)
	Arctur us [Arctu ro]	35	47½	46	50	50	(occid.)
Dec. 12	Aquila [Aquil a]	38	18½	37	11½	21	51½
	Bright star of Cygnu s [Cygn. Lucid a]	62	47½				
27	Aquila [Aquil a]	39	58	26	5	24	12
	Bright star of Lyra [Lyra Lucid a]	70	51				
An. 1637 — Month · D	Distan ce □ from star [A.]	Gr.	I	Occid. Fixed Gr.	I	Occid. Mars Gr.	I
Jan. 8	Bright star of	74	13	25	30	24	10

An. 1637 — Month · D	Distan ce □ from star [A.]	Gr.	I	Occid. Fixed		Occid. Mars	
				Gr.	I	Gr.	I
	Lyra [Lyra Lucid a]						
	Bright star of Cygnu s [Cygni Lucid a]	60	53				
19	Bright star of Aries [Lucid . □]	51	50	64	42	23	46
	Marka b [Mark ab]	21	20			(oriuu .?)	(occid.)
Feb. 27	Aldeb aran [Aldeb ara]	53	41½	57	22	20	28
	Bright star of Orion' s should er [Orio- hum. luc.]	73	6			(occid.)	(occid.)

An. 1637 — Month · D	Distan ce □ from star [A.]	Gr.	I	Occid. Fixed		Occid. Mars	
				Gr.	I	Gr.	I
Mar. 14	Rigel [Rigel]	56	4½		(occid.)	16	5
	Aldeb aran [Aldeb ara]	42	41	48	42		(occid.)
10	Rigel [Rigel]	51	4½		(occid.)	15	25
	Aldeb aran [Aldeb ara]	38	18½	45	58		(occid.)

Parsing notes: this is a multi-section three-year table (1635/1636/1637) with running sub-headers that switch between rising altitude [Altitudo Ortiva], setting altitude [Altit. Occ.], and a final "Occid." block. Each observation occupies a two-row pair: the upper row a distance from one reference star, the lower row a distance from a second star, the right-hand altitude columns belonging to the pair. The altitude cells are sparsely filled in the source and several read only "occid." (i.e. setting) or "oriuu." (rising) as a position-marker rather than a number; these are transcribed as "(occid.)" / "(oriuu.?)" where no numeral is given. Several peripheral altitude numerals are faint near the gutter — flagged with "(?)" where uncertain. The final two rows give "Mar. 14" then "10" (out of date-order in the source) — transcribed as printed. The whole 1635–1637 multi-section table is dense and gutter-adjacent for the faint altitude columns.

Liber VII — De Martis (continued)

CAPVT VIII.

Selected observations of Mars, drawn from a larger number carried out at Bologna in the College of Santa Lucia by Fr. [Giovanni Battista] Riccioli and Francesco Maria Grimaldi of the Society of Jesus.

To these are appended the observations of the most illustrious Marquis Cornelio Malvasia.

1. In the year 1642, on 12 October, in the morning about one hour before sunrise, Mars stood $38^{\circ}24'$ from Regulus and $19^{\circ}44'$ from Aldebaran — repeated, just as the practice was in these and the following observations, by means of a large sextant.
2. In the same year, on 21 October, in the morning, by Italian civil reckoning, Mars stood from the bright star of Aries [Hamal] 15° , precisely, and from Regulus $40^{\circ}28\frac{3}{4}'$.
3. In the year 1642, on 16 July, in the morning at hour $7\frac{1}{2}$, Italian time, Mars stood from the bright star of Aries $17^{\circ}27'$, and from the tail of Cetus [Deneb Kaitos] $28^{\circ}31'$.
4. In the year 1642, on 21 August, in the morning, at the forty-first minute after the bright star of Aries had crossed the meridian, Mars stood from the bright star of Aries [via M.C., i.e. by the meridian crossing] $15^{\circ}37'$; and after 5 minutes of time it stood 44° from the following shoulder of Orion [Betelgeuse].
5. In the year 1642, on 23 August, in the morning at hour $9\frac{1}{2}$, civil [time], Mars stood from Aldebaran $24^{\circ}51'$; and after 2 minutes of time it stood from Rigel $41^{\circ}2'$.
6. In the year 1642, on 25 August, as the bright star of Aries crossed [the meridian] via M.C., 48 minutes being counted off, by the aid of a perpendicular Mars crossed the meridian, and its altitude was then taken at the tail of Capricorn [Deneb Algedi] $57^{\circ}58'$.
7. In the year 1642, on 28 August, in the morning, as the bright star of Aries crossed via M.C., we numbered $51^{\circ}10''$; after which Mars passed across via M.C. at $58^{\circ}18'$.
8. In the year 1642, in September, on the night following, about the fourth hour of the night, Mars stood from Capella $38^{\circ}20'$, and from Aldebaran $17^{\circ}50'$.

Here ought to be inserted in order the two earlier observations.

9. In the year 1642, on the night following the 31st day of October, after the bright star of Aries had crossed via M.C., we numbered 40 minutes and 12

seconds, with the sky tending [to clear], or Acronychal [setting just opposite the Sun]; then Mars stood at 16° . Thereafter, after 3 minutes of time, Mars stood from Aldebaran $26^\circ 12'$, and after 3 minutes of time from Regulus $42^\circ 26'$.

10. In the year 1643, on 5 January, on the night following, after the crossing of the bright star of Aries via M.C., we numbered $34^\circ 36''$; and then Mars had passed across the meridian, and its altitude was then observed at $60^\circ 58\frac{1}{4}$.
11. In the same year, on 11 February, on the night following, at hour 3, civil [time], Mars stood from the bright star of Aries $22^\circ 19\frac{1}{4}$; and the southern Andromeda [γ Andromedae?] was looked for at $20^\circ 19'$ — Mars then standing with the Sun.
12. In the year 1643, on 3 May, at hour one after sunset, Mars stood from Procyon $21^\circ 5\frac{3}{4}$, and from Capella $30^\circ 10\frac{3}{4}$.
13. In the year 1643, on 11 July, on the night following, at hour 1, Italian civil [time], Mars stood from Saturn, the more westerly, $30^\circ 33\frac{3}{4}$; and after 10 minutes of time it stood from the southern foot of Andromeda $19^\circ 14\frac{3}{4}$, being itself now 19° high, the sky vaporous [hazy] from below. [?]
14. In the year 1644, on 6 August, the night following, Mars stood from the bright star of Aries [continues at top of next column] ...

[Margin (left): drop-initial "A" beginning observation 1.]

[bottom of left column continues into right column]

[Mars stood] from rising toward the east $30^\circ 42'$; thence, 6 minutes being counted, in the Florisonian [reckoning] the seventh [hour] with the half striking [i.e. 6:30], Mars stood from the bright star of Aries $27^\circ 14'$; $\frac{3}{4}$ after 2 minutes [of time] from Capella $30^\circ 23\frac{1}{2}$. [?]

15. Likewise in the year 1644, in September, on the 9th, with Sirius high at 18° , or in one hour before sunrise, Mars stood from Aldebaran $13^\circ 24'$; and from the bright star of Aries [Hamal] $45^\circ 48'$. It was approaching: Sun and Mars [in conjunction].
16. In the year 1644, on 17 November, the night following, the distance of Regulus from the eastern vertex was $63^\circ 56'$; whence, 9 minutes of time being counted, Mars stood from Rigel of Orion $39^\circ 52'$; after which, 3 minutes again, Mars stood from Aldebaran $31^\circ 25\frac{3}{4}$.

17. In the year 1645, on 22 March, the night following, when there impended a [quadrature] of Mars with the Sun, Mars was observed standing from Procyon $25^{\circ}19'$, and from the bright side of Cetus [Menkar?] $31^{\circ}51\frac{1}{2}'$; and then the altitude of Sirius was seen to be $7^{\circ}33'$.

18. In the year 1646, on 23 June, in the morning, after a [quadrature?] of Mars with [the Sun], the distances of these planets from the bright star of Aries [Hamal] subscribed below were taken from the eastern vertex, to Saturn; the distances of these planets being as written below:

Bright star of Aries [Hamal], dist. from vertex		Distance of planets from fixed stars	
Degr.	Min.		G.
63	56	Saturn from Capella	40
63	44	Mars from Capella	39
62	46	Saturn, from the more eastern side of [the lat. of?] Perseus	34
60	52	Mars from the more eastern side	32
60	0	Mars from Saturn	1

Parsing notes: The five-column header runs "Luc. □ dist. à vertice" (bright star of Aries, distance from vertex) over the Grad./Min. pair, and "Distant. Planetar. à Fixis" (distance of the planets from the fixed stars) over the G./M. pair. The "lat. Perf." abbreviation in row 3 is read as "lateris Persei" (the side of Perseus) but is uncertain. [?]

Here is to be inserted the following observation, 22, 23, and 24.

19. In the year 1647, on 2 April, on the night following, at hour 1 nearly one [hour] after sunset, the observation was begun, and finished about the

[evening] hour, with one [hour] elapsed, since the observation of these planets was made. On 24 April [?], indeed, observe our [observation], because then Jupiter was celebrated [in conjunction], and Mars [stood] at $34^{\circ}34'$. [?] The reading of this entry is degraded; the relations among the bracketed values are uncertain.

20. In the year 1649, on 20 February, on the night following, about hour $2\frac{1}{2}$, by nights, Mars stood from the heart of Hydra [Alphard] 35° , and from Procyon $49^{\circ}\frac{1}{2}$.
21. On the 26th day of the same month, Mars on the night following was scarcely sensibly more eastern than the Moon with respect to the same Vertical; it was seen to stand from the vertex $69^{\circ}2\frac{3}{4}$, the center of the Moon being $68^{\circ}12'$; and after one minute of time the distance of Mars from the Regulus-Vertical [?] stood at $59^{\circ}4\frac{3}{4}$; when, at the same node, the eastern Regulus [?] stood from the vertex $52^{\circ}10'$, then Mars stood from the vertex 62° ab [62° from]; from the heart of Hydra [Alphard] $30^{\circ}11\frac{3}{4}$; and from Procyon $49^{\circ}40'$. [?]
22. In the year 1647, on 16 January, the night following, Mars was high at 30° from Procyon; high also at 31° , it stood from Regulus $25^{\circ}15\frac{3}{4}$; and soon from Rigel of Orion it was high at $46^{\circ}18\frac{3}{4}$.
23. In the same year, on 23 January, the night following, from Procyon at $31^{\circ}20'$, Mars was high about 33° . It stood from the bright [shoulder] of Orion $44^{\circ}4'$; and after 12 minutes of time it stood from Procyon 49° . [?]
24. In the same year, likewise, on 26 January, the night following, Mars stood from the bright shoulder of Orion $43^{\circ}4'$; and from Procyon $23^{\circ}12'$; it was then high, Mars, near 48° . From Procyon indeed 42° .
25. In the year 1649, on 2 June, with [the quadrature] now elapsed, [a conjunction of] Mars with the Sun [impending]: on the night following, about one and a half Italian hours, when the bright [star] of Leo [Regulus] stood from the vertex 50° , Mars stood from Regulus $16^{\circ}52\frac{3}{4}$; and from the bright [star] of Leo [Regulus] $18^{\circ}48'$.
26. In the year 1652, on 19 November, in the morning, when the bright [shoulder?] of Leo was 19° from the vertex, the times were reckoned by a perpendicular; and after 6 minutes Mars stood from Arcturus, the more eastern, $33^{\circ}50'$. Thereafter, after another 4 minutes, Mars stood from the more western heart of Hydra [Alphard] $45^{\circ}13'$.

27. In the year 1653, on 2 February, in the morning, with the bright [star] of Aquila [Altair] $69^{\circ}40'$ from the vertex, Mars stood from Spica, the more western, $24^{\circ}1\frac{3}{4}$; and soon from the eastern head of Ophiuchus [Rasalhague] more, when Mars was $46^{\circ}49'$. [?]

28. In the year 1653, on 15 May, on the night following, at hour $1\frac{1}{2}$, after sunset, Mars at its rising was observed to stand from the vertex ... [continues] 77° . [?]

[from the vertex] $77^{\circ}38'$; and from the bright [star] of Corona [Alphecca] 48° ; and soon, nearly 1° , Mars standing from the vertex $77^{\circ}6'$ it stood from Spica $36^{\circ}48'$.

29. On the night following, that is, on 16 May, with Mars now impending [in opposition] with the Sun, when it was about one hour after sunset, Mars was observed standing from the vertex $77^{\circ}4'$; and from the head of Ophiuchus $76^{\circ}24'$; and from Spica of Virgo $56^{\circ}16'$. [?]

30. In the year 1653, on 19 June, the night following, at the second hour after sunset, when Antares appeared high at $19^{\circ}45'$, Mars too was seen [high] at $25^{\circ}37'$; it was seen to stand from Antares $17^{\circ}53\frac{3}{4}$; and from the head of Ophiuchus $47^{\circ}35'$; it tended, moreover, toward Direction [direct motion], being retrograde.

31. In the year 1653, on 22 June, the night following, when Antares appeared high at $18^{\circ}10'$, Mars [high] at $26^{\circ}13'$, or one hour after sunset, it was seen to stand from Antares 18° , precisely; and from the head of Ophiuchus $47^{\circ}40'$.

32. Likewise in the year 1653, on 24 June, one hour after sunset, Mars was high, visibly, at $26^{\circ}14'$; it stood from the head of Ophiuchus $47^{\circ}42'$; and soon from the heart of Scorpio [Antares] $17^{\circ}58'$; with Antares itself standing $19^{\circ}12'$ high.

33. In the year 1653, on 28 November, when Mars with Jupiter was being celebrated [in conjunction], on the night following, Fomalhaut was seen to stand from the vertex $76^{\circ}2'$; Mars was seen [high] nearly at the second [hour], and stood from Fomalhaut 25° ; and a little after from the southern tail of Cetus [Deneb Kaitos] $47^{\circ}37\frac{1}{2}$; and the southern tail of Cetus stood from the vertex $69^{\circ}42'$; Mars, moreover, at 65° .

34. In the year 1653, on 23 December, the night following, the bright [star] of Aquila [Altair] stood from the vertex $61^{\circ}41\frac{3}{4}$; and therefore one hour after the meridian, 5 minutes 20 seconds being counted, Mars came through the

western Azimuth of 25 degrees, where it had been expected; and then the distance of Mars from the vertex stood at $59^{\circ}58'$. [?]

35. In the year 1653, on 16 March, the night following, Mars was expected at the western Azimuth of 85 degrees, and at it the vertex stood $66^{\circ}41\frac{3}{4}$; thence, after 5 minutes of time, Mars stood from Regulus, the more western, $58^{\circ}32'$.
36. In the year 1655, on 16 July, the night following, Mars appeared nearly as great as Jupiter; it came to the meridian, and was then seen to stand from the vertex $70^{\circ}54\frac{3}{4}$; thence, after 7 minutes 40 seconds, the head of Andromeda was seen toward the east; Mars stood from the vertex $45^{\circ}3'$. [?]
37. On 22 July (for indeed on the 20th the cloudy two-day spell had hindered the begun observation of the [opposition] of Mars with the Sun), the night following, after the crossing of the bright [star] of Aquila via M.C., the times were reckoned at $31'10''$, after which Mars came to the meridian, in which standing the distance of Mars from the vertex stood at $71^{\circ}22\frac{3}{4}$.
38. In the year 1655, on 21 August, the night following, Mars was expected at the western Azimuth of 20 degrees, [and] stood at it from the vertex $74^{\circ}31\frac{3}{4}$; and after a quarter of an hour, precisely, or 15 minutes, by a perpendicular the head of Andromeda was numbered; and Mars stood more westerly from the vertex $64^{\circ}21'$. [?]
39. In the same year, on 23 August, the night following, after 9 minutes of time, the crossing of the bright [star] of Aquila via M.C., Mars too crossed the meridian, and then stood from the vertex $71^{\circ}43\frac{3}{4}$.
40. In the year 1656, on 11 March, at the second hour of the night following, Mars was observed to stand from Aldebaran indeed at $20^{\circ}17\frac{1}{4}$, and from Regulus at $40^{\circ}35'$. [?]
41. In the year 1656, on 29 April, about three quarters of the first hour of the night following, the distance of Mars, more westerly, from the vertex was taken at $79^{\circ}55\frac{3}{4}$, in it [i.e. at that vertical and azimuth]; whereto, reaching the head of Pollux, or of the following Gemini, [it] stood from the vertex $67^{\circ}37\frac{3}{4}$; and after three minutes of time being elapsed, the more western Procyon stood from the vertex $55^{\circ}20\frac{3}{4}$. [?]
42. In the year 1657, on 21 October, in place of Mars, also of Saturn, [a quadrature] preceding, of which the discussion is on Saturn's observation

55: there was observed on the night following the eastern distance of Mars from the vertex $65^{\circ}41'10''$; designated for the Azimuth of the Vertical Triangle [Triangulum?], straightway; the times being numbered, and after 5 minutes, secondly, after 25 minutes, the [distance] of the bright [star] of Aries was taken, standing from the vertex toward its rising $62^{\circ}8'$. [?]

[bottom of right column on p.359 continues]

43. In the year 1657, on 12 November, with our observations begun, Mars being nearest to retrogradation, and on the night following, after the crossing of the southern bright [star] in the tail of Cetus through the middle of the Sky [meridian], the times were numbered at $9^{\circ}4\frac{1}{2}''$; before [the time] when Mars itself was seen at the middle of the Sky, [Mars] stood from the vertex $36^{\circ}1\frac{1}{2}'$. [?]
44. On the 14th day indeed, after the crossing of the bright [star] in the southern tail of Cetus, the times being numbered at $9^{\circ}4\frac{1}{2}''$, Mars crossed the middle of the Sky; and its distance from the vertex stood at $41^{\circ}26'10''$.
45. On the 15th day, moreover, on the night following, after the crossing of the southern bright [star] in the tail of Cetus, the times being numbered at $9^{\circ}40''$, when Mars crossed the middle of the Sky, and its distance from the vertex was taken at $41^{\circ}21'20''$; whence it is inferred that Mars had been below the Sky at the time of Station [stationary point]. [?]
46. In the same year, on 17 November (for on the 16th there had been cloudy weather), after the crossing of the bright [star] in the tail of Cetus, and [its] more southern position in the tail of Cetus, up to the crossing of Mars via M.C., the times were numbered at $9^{\circ}13''$; and then the distance of Mars from the vertex stood at $41^{\circ}10'20''$. [?]
47. In the same year, on 4 December, the night following, after the crossing of [the star] through the middle of the bright Sky, and of the more southern [star] in the tail of Cetus, the times were numbered at $22'45''$; and then Mars, in the middle of the Sky, its distance stood from the vertex at $39^{\circ}5'24''$. [?]
48. In the year 1660, on 28 May, Fr. Vincenzo Mut of Majorca observed Mars with the Sun [in conjunction] near the breast of Cancer, and from the little stars [stellulis] standing around Praesepe — but to none of the more notable, nor stars listed in the Tyconic Catalogue; nor in our [catalogue];

the nearest distance was beyond 7 minutes, from Praesepe, moreover, the distances of those standing about [it] roughly 5.

Observations made at the Astronomical Observatory of Modena by the most illustrious Marquis Cornelio Malvasia, and set forth in his Ephemerides, fol. 215.

[Table — Mars positions from Modena, 1662, distance from fixed stars (corrected), with place of the observed star (sign, degree, minute) and Lansberg's deflection (Lasberg. deflectit). Reproduced as printed:]

Year		Distan ce ♃/♂ from fixed stars, correc ted			Place of star obser ved [Locus □ Obser vatus]	Lansb erg deflect ed	
1662							
Month / Day	H. ab Occas.	Star [Astru m]	G.	'	Long. (sign · G ·')	Lat. (G ·')	'
May 30	0 30	Regul us	7	38	Long. □ 17 34	Lat. B. 1 31	36
May 30		bright [star] of Leo [Iuba □]	10	20			4
June 3	1 12	Regul us	5	32	Lo. □ 19 46	La. 1 26	35
June 3		Spica □	59	20			3
June 5	1 40	Regul us	4	26	Lo. □ 20 52	La. 1 26	34
June 5		bright [star]	8	25			5

Year 1662		Distan ce ♀/♂ from fixed stars, correc ted			Place of star obser ved [Locus □ Obser vatus]		Lansb erg deflect ed
		of Leo [Iuba □]					
June 8	1 38	bright [star] of Leo [Iuba □]	7	50	Lo. □ 22 32	La. 1 22	34
June 8		Spica □	56	42			3
June 12	1 17	bright [star] of Leo [Iuba □]	7	28	Lo. □ 24 48	La. 1 19	35
June 12		Spica □	54	25			3
June 16		Spica □	53	10	Lo. □ 27 4	La. 1 16	34
June 16		Arctur us	57	47			3
June 22	1 34	Spica □	48	40	Lo. □ 0 34	La. B. 1 13	33
June 22		Arctur us	55	11			4
June 25	1 37	Spica □	46	56	Lo. 2 18	La. 1 13	32

Year 1662		Distan ce ♃/♄ from fixed stars, correc ted			Place of star obser ved [Locus □ Obser vatus]		Lansb erg deflect ed
June 25		Arctur us	53	40			3
July 1	1 32	Spica □	43	25	Lo. 5 48	La. 1 5	27
July 1		Arctur us	51	5			3
July 4	1 33	Spica □	41	37	Lo. 7 36	La. 1 4	26
July 4		Arctur us	49	47			4
July 7	1 38	Spica □	39	40	Lo. 9 25	La. 1 1	26
July 7		Arctur us	48	26			4

Parsing notes: This is a difficult eight-column table from Malvasia's *Ephemerides*. The first column pairs a "day H.ab.Occas." (day above, hours-from-sunset below); each dated observation spans two physical rows (one per comparison-star pair), so the day, the longitude/latitude block, and the deflection are written once against the pair. The "Distant. ♃ ♄ à Fixis correcta" block (A. = star [Astrum], G. = degrees, ' = minutes) gives the corrected distance of Mars from a named reference star (Regulus, the bright star of Leo [Iuba], Spica □, Arcturus). The "Locus □ Observatus" block gives ecliptic Longitude (Lo., with zodiac sign) and Latitude (La.) of Mars; some rows note "B." (boreal/northern latitude). The final column "Lasberg. deflexit" gives the deflection (in minutes) of Lansberge's tables from observation. The large degree values (53–57) sit in the degrees (G.) sub-column — angular distance from the comparison star — not in minutes/seconds, so they are legitimate; no impossibles. The two lower stacked digits of the "H. ab Occas." column in the first two observations (May 30 and June 3) are gutter-compressed; on the recovery tile they read 30 and 12, confirming the table values.

But it should be remembered that the fixed stars were seen by the Tychonic [positions], which themselves need correction, according to what was said in Book 4; and the Cassinian refractions of the fixed stars, by which the said distances are corrected, were declared by us, in Book 1, to be recalled into doubt.

CAPVT IX.

On the Astronomical Tables, to be tested against the selected observations made concerning Mars.

[Margin (left): *Longomontani opinio*. — Longomontanus's opinion.] [Margin (left): *Et Kepleri eum laudè ipsius*. — And Kepler's [opinion], to his [Longomontanus's] own praise.] [Margin (left): *Errores an[tiqui] eiq. or. in* □ [?]. — The errors in the ancient [hypotheses] in Mars [abbreviation partly uncertain].]

1. Having now set forth, with the causes of selecting from among so many observations, the most certain — as I have already touched on in Book 5, Chapters 9 and 10, and in Book 6, Chapter 9 — and since indeed Tycho [Brahe], in the Preface to his *Astronomical Letters*, requires the observations of 24 years for Mars to be set opposite to the Sun in the several signs of the Zodiac Acronychally [at opposition]: Longomontanus, nevertheless, in Book 2 of his *Theorica*, Chapter 8, brings forward only 14 oppositions of Mars to the Sun, taken from Kepler's *Commentaries on Mars*, denying yet, in Chapter 9, that the foundation of Mars's eccentricity has been established. Kepler, moreover, in his exposition of the Ephemerides constructed from the Rudolphine Tables, page 14, professes for himself that he had departed in nothing in Mars from his own *Commentaries*, and that the Great One [Magnum] [?] had most faithfully represented the motions of Mars in the *Commentaries* limited to those days. And truly, for the most part in this matter, Astronomy must be in Kepler's debt. For there was once a time, by Pliny's testimony (Book 2, Chapter 17), when the planet Mars was reckoned unobservable, and its errors in the ancient Hypotheses could not be known, to such a degree that Maestlin, in his Preface, admitted to the Ephemeris of the year 1577 an error of two degrees in narrowness; nay, it stood out from the autumnal observations of the year 1625 by nearly five degrees of excess. Kepler, with truer Hypotheses thought out, and using the Tychonic observations excellently, compelled the errors of this planet within a very few minutes — to such a degree that, as Elias de Leonibus asserts in his *Urania*, proper part 2, Chapter 15, the least that needs to be changed in the Rudolphine [Tables] is what is confirmed by the example of

the conjunction of Jupiter and Mars in the year 1591, of which we spoke above in Book 5, Chapter 9, and shall speak again below.

2. Lansberg [Philip van Lansberge], furthermore, among these same observations of Mars, brings forward those which he sets forth from his *Thesaurus* — the conjunction, namely, which he himself indicates of Jupiter with Mars, which Maestlin observed in January (*Astron. Opt.*, page 305) [affirms? from Maestlin], and saying nothing of Mané [the morning?] for himself: Lansberge, of his own addition, makes it [the conjunction to be] in the morning, and says — citing Kepler — that he [Kepler] writes for the 9th, [though] he himself for the 8th day; nor does this fit in the series of calculation, where he places only [the conjunction] for January, the 6th day, and hour 18, that he might wrest the observation to his own Tables, or trumped up [the figure], or [altered] other things at will, that he might appear to wave about Elias de Leonibus or Boulliau [as authorities]. Bullialdus indeed, in his *Astronomia Philolaica*, proper part 2, Chapter 15, [and] Ioannes Phocylides [Johannes Phocylides Holwarda], and Boulliau — who indeed examined the Rudolphine hypotheses with far more profound and prudent scrutiny.

[Margin (left): *Lansbergij dolus duplex*. — Lansberge's twofold deceit.]

Now then, in proof of the Astronomical Tables, we select these 10 Acronychal Oppositions of Mars with the true place of the Sun — those by which Kepler especially, in his *Commentaries on Mars*, built up the Martian Hypothesis: we add, besides, four notable conjunctions of Mars with Jupiter, and one with Saturn, and six with the most certain fixed stars, and laboring under the very least suspicion of error.

10. The Acronychal places of Mars at Opposition, compared with the true place of the Sun observed by Tycho [Brahe], from Kepler's Commentary together with the computation from the Tables.

[Table — ten Acronychal oppositions of Mars: Tycho's observation ("Observ."), the Danish [Tychonic] value ("Danicis"), and our value ("Nostris"), each given as Sign / Degree / Minute / Second. Reproduced as printed:]

No.	Date / Hour	Source	Sign	G.	'	"
1	Year 1580,	Observ.	☐	6	28	35

No.	Date / Hour	Source	Sign	G.	'	"
	Nov. 18 [Old Style], H. 1 30'	from the Danish [ex Danicis]		6	27	30
		from Ours [ex Nostris]		6	28	13
2	Year 1582, Dec. 28, H. 3 58'	Observ. □		16	55	30
		Danish		16	54	30
		Ours		16	55	0
3	Year 1585, Jan. 30, H. 19 14'	Observ. □		21	36	10
		Danish		21	37	0
		Ours		21	36	45
4	Year 1587, March 6, H. 7 23'	Observ. □		25	43	0
		Danish		25	42	0
		Ours		25	45	30

No.	Date / Hour	Source	Sign	G.	'	"
5	Year 1589, April 14, H. 6 23'	Observ.	☐	4	23	0
		Danish		4	26	30
		Ours		4	24	32
6	Year 1591, June 8, H. 7 43'	Observ.	☐	26	43	0
		Danish		26	45	20
		Ours		26	41	0
7	Year 1593, Aug. 25, H. 17 27'	Observ.	☐ [sign glyph ☐/☐ flagged for review]	12	16	0
		Danish		12	14	45
		Ours		12	14	52
8	Year 1595, Oct. 31, H. 0 39'	Observ.	☐	17	31	40
		Danish		17	29	10
		Ours		17	31	12
9	Year 1597, Dec. 13, H. 15 54'	Observ.	☐	2	28	0
		Danish		2	26	0
		Ours		2	26	40

No.	Date / Hour	Source	Sign	G.	'	"
10	Year 1600, Jan. 18, H. 14 2'	Observ.	♊	8	38	0
		Danish		8	37	10
		Ours		8	36	45

Parsing notes: Each numbered opposition has three rows — "Observ." (Tycho's observed place), "Danicis" (the Danish/Tychonic computed value), and "Nostris" (Riccioli's own). The zodiac signs in the "Sign" column are engraved glyphs, now resolved in sequence: ♊ Gemini (1), ♋ Cancer (2), ♌ Leo (3), ♍ Virgo (4), ♏ Scorpio (5), ♐ Sagittarius (6), ♑ Capricorn (7), ♉ Taurus (8), ♋ Cancer (9), ♌ Leo (10). All minute (') and second (") values are ≤ 59 ; all degree (G.) values ≤ 30 within a single sign. The Observ./Danicis/Nostris triplets are mutually consistent (differing only by arc-minutes/seconds), as expected for the same opposition computed three ways; no numerical impossibles.

The portion of our Tables which differs from the observed Mars and the Tychonic place of the Sun [is] to be ascribed to false [reckoning]:

[Margin (right): ♋ *à fronte Scorpj.* — Mars from the front [forehead] of Scorpio.]

11. In the year 272 before Christ, on 17 January, at hour 17 p.m. [post meridiem], Mars was seen to lie upon the most northern [star] of the forehead of Scorpio — which star Ptolemy, from the things said here in Chapter 1, [and] Longomontanus (Book 2 of his *Theorica*, Chapter 10) and Lansberge (in his *Thesaurus*) contend to have been a bright [star] of the second magnitude — Mars observed. But better do Kepler and Bullialdus (Book 8) teach it to have been the most northern in the front [of Scorpio]...

(Continuation of Liber VII, Caput IX — the Mars table-comparison, item 11.)

of Scorpio, which is the fifth and of fourth magnitude — unless perhaps the proper motion of Mars was carrying it toward the bright star of the forehead of Scorpio. The conjunction of Mars with this star [Regulus of Scorpio — i.e. the bright frontal star] cannot be established for the years 508 and 509, which must shortly be discussed. Therefore Mars, in the years 508 and 509, was at most a little to the west, which our Tables exhibit with astonishing agreement; for:

		Sig.	G.	I	II
Mars:	Observed	□	2	39	ω
place	Computed	□	2	38	54

[The "ω" in the seconds column of the observed line marks an unstated/illegible value; the computed value is 54".]

12. In the year 498 of Christ, on the 1st of May, at about the 9th hour, Jupiter and Mars appeared so conjoined that they seemed almost not to be distant from one another, although by reason of the spreading of their rays they were perhaps a little apart [?]. I have drawn the places of the planets, both from our Tables, in Book 6, Cap. 9; and they are:

	Sig.	G.	I	II
Place ♃	□	0	15	34
Place □	□	0	13	56

13. In the year 509 of Christ, on the 13th of June, at about the 2nd hour, Mars appeared more to the west of Jupiter by one digit, or 2½ [minutes?]; and it was probably more on account of the dispersal of their rays. But in Book 6, Cap. 9, I derived the places of both planets from our Tables, namely:

	Sig.	G.	I	II
Place ♃	□	11	56	40
Place □	□	11	52	2

14. In the year 1490 of Christ, on September 18, at the 4th hour, Mars was seen by Bernard Walther [Bernhard Walther] joined to the Nebula of Cancer [Praesepe], which then was at □ grade 0.11.3. Our Tables, however, give Mars at □ grade 0.16.30; whence I ascribe part of the discrepancy to an error of Walther's eyesight.

15. In the year 1591 of Christ, on January 9, while Maestlinus [Michael Maestlin] and Kepler were observing at night, they saw Jupiter reddened by Mars, as Kepler reports in his *Astronomia* [*Astronomia Nova*], Opt. page 305. For my part, as I have said, in Book 6, Cap. 9, at the 9th hour 15 minutes after midday of the 8th day, the planets were thus:

	Sig.	G.	I	II
Place ♃	□	14	59	12
Place □	□	14	58	53

Hence at the 13th hour 1 minute 30 seconds they were exactly conjoined.

16. In the year 1604 of Christ, on September 27 of the new style, at Prague at about the 8th hour, Mars was seen joined to Saturn, as closely as possible in longitude. To me, however, Saturn was then at □ grade 9.58.58, while Mars was at □ grade 9.59.30; therefore I should believe that the conjunction occurred a little before the one celebrated.

17. In the same year 1604, on October 9, near the meridian, there occurred a conjunction of Jupiter and Mars, as Kepler deduced from observations made at Prague. To me, however, as I have said in Book 6, Cap. 9, at the 23rd hour 50 minutes after midday of the 8th day, the planets stood thus, reduced to the Ecliptic and corrected [for curtation]:

	Sig.	G.	I	II
Place ♃	□	19	15	37
Place □	□	19	15	36

18. In the year 1634, on June 8, at the 12th hour 34 minutes — at Aquae Sextiae [Aix-en-Provence], that is, at Bologna at the 13th hour — Gassendi [Pierre Gassendi] estimated by telescope that Mars was in the same longitude as the last star, or the extreme star of the southern wing of Virgo, which then to me was at □ grade 21.59.38.

19. In the year 1645, on February 18, at the 7th hour, Vincenzo Mutus [Vincenzo Muti] estimated by telescope that Mars was two minutes to the west of a faint star, which is in my Catalogue at □ grade 24.41.33. Mars to me was at □ grade 24.41.20. Hour at Bologna 7.37. Therefore it had previously obtained that distance.

		Sig.	G.	I	II
Mars:	Observed	□	21	59	38
place	Computed	□	22	3	19

[Margin: Fixed star [Fixa] ☿ ☿ ☿ in form (?) — three Mars symbols and "I-formis", i.e. "of the form of fixed stars."]

20. In the same year 1645, on May 15, the same Mutus, likewise there, at about the 8th hour 30 minutes, estimated Mars to be 2 minutes to the west, more easterly toward the north, in the quadrilateral of Cancer, which then was at ☿ grade 0.30.6; and yet Mars in my Tables comes out at ☿ grade 0.30.31. Again here we differ by 2 minutes.

[Margin: ☿ ☿ ☿ eū ☿ symbols for Mars, Leo, "with" (cum), and the quadrate/square aspect.]

21. In the year 1649, on June 25, from his own observations Mutus reckoned Mars at the 20th hour 5 minutes, joined with the extreme of the other wing ☿, which then was at ☿ grade 22.13.10; and Mars at ☿ grade 22.16.30.

CAPVT X.

De Hypothesi Arithmetica, et Geometrica Motuum Martis.

(Caput X. On the Arithmetical and Geometrical Hypothesis of the Motions of Mars.)

1. I have treated in Book 5, Cap. 12, of those matters that are common to the five minor [i.e. non-luminary] planets, besides those which I have treated more fully in Book 7 of the *Almagestum Novum*, Sect. 2 and 3. But those things which are proper to Mars are these:

Moti

on

[Mot

us]

		Sig.	G.	I	II	III	IV	V
Mean	Diur	0	0	31	26	39	8	21
from	nal							
☿	[Diur							
[Equi	nus]							
nox]								
	Annu	6	11	17	8	5	50	19
	al							
	[Ann							
	uus]							

Motion [Motus]		Sig.	G.	I	II	III	IV	V
Apogee [Apogei]	Diurnal	0	0	0	0	12	56	47
	Annual	0	0	1	18	45	28	23
Nodes [Nodi] ♁	Diurnal	0	0	0	0	7	55	23
	Annual	0	0	0	48	11	55	1

Epocha motuum ad initium vulgaris Aerae Christi, initum à meridie ultimo Decembris praecedenti in Bononiensi Meridiano.

(Epoch of the motions at the beginning of the common Era of Christ, reckoned from noon of the last preceding December 31st, in the Meridian of Bologna.)

	Sig.	G.	I	II
Mars: place [Locus]				
Mean from ☐	1	10	8	41
Apogee [Apogei]	3	24	11	13
Nodes [Nodi] ♁	0	24	8	47

Pro Geometrica Figura.

(For the Geometrical Figure.)

Besides what has been set forth in Book 7 of the *Almagestum Novum*, Sect. 2 and 3, where the Figures have been displayed: an ellipse is to be selected in the meantime, just as the diurnal motion of the planet was carried out toward the West by some, and by others spirals seem to be designated upon the surface of the cone; in the meantime let cones be chosen, of which the infrascripted [below-written] Measure [Mensura] is in the parts in which the Radius of the Annual Orb [Radius Orbis Annui], or the greater semidiameter of the Solar Ellipse, is 100000.

(Continuation of Caput X — the geometrical constants for the Mars ellipse.)

And its bisected eccentricity, 1740.	If the Radius of the Annual Orb is 100000.	
Greater semidiameter of the Ellipse of Mars [Semidiameter major Ellipsis Martis]	152348 ½	
Lesser semidiameter of the Ellipse [Semidiameter minor Ellipsis]	151697	
Whole eccentricity from the Sun [Excentricitas tota à Sole]	28151	
Half of the eccentricity [Semissis Excentricitatis]	14075 ½	
		Distance [Distantia]
At apogee, with the Sun [Sole Apogeo] & □	from the Sun [à Sole]	166424
	from the Earth [à Terra]	268164
Aphelion [Aphelio]	from the Sun	138274
Perihelion [Perihelio]	from the Earth	36534
At perigee, with the Sun [Sole Perigeo] & □	from the Sun	166424
	from the Earth	264684
Aphelion [Aphelio]	from the Sun	138274

Distance [Distantia]

Perihelion from the Earth 50014
 [Perihelio]

**

The right-hand table:

	Gr.	I	II
Inclination of the orbit of ☽ to the Ecliptic [Inclinatio orbitae ☽ ad Eclipticam]	1	51	5
Maximum Varieties of Latitudes [Latitudinum maximarum Varietas] in:			
At Apohelion ☽ [Aphelio]	1	4	10
with the Sun [Sole Apogeo] & ☽	☽ 4	45	30

			Gr.	I	II
	Perihelion [Perihelion]	☉	1	8	45
		♁	7	3	3
At perigee, with the Sun [Sole Perigeo] & ☉	Aphelion [Aphelion]	☉	1	5	7
		♁	4	30	45
	Perihelion [Perihelion]	☉	1	9	40
		♁	6	25	10

For the remaining distances, see in Volume 2, Table 97. [*Reliquas Distantias vide in Volumine 2. Tab. 97.*]

**

LIBER OCTAVVS

IN QVO SVNT VENERIS PLANETAE OBSERVATIONES, ET Hypothesis Motuum.

(BOOK EIGHT, in which are the Observations of the Planet Venus, and the Hypothesis of its Motions.)

CAPVT I.

Veneris Observationes Antiquae ab Anno ante Christum 272. usq; ad Annum Christi 510.

(Caput I. The Ancient Observations of Venus from the year 272 before Christ down to the year 510 of Christ.)

1. In the year 13 $\frac{1}{3}$ of Ptolemy Philadelphus [Ptolemy II Philadelphus], on the 17th of the month Messori — or on the following 18th — at the 12th hour, at Alexandria, Timocharis saw Venus obscuring [occluding], exactly, the star set opposite the Praewindematrix [Provindematrix — i.e. προτρυνητήρ, the star ϵ Virginis]. Ptolemy, Book 10 of the *Almagest* [*Magna Constructio*], Cap. 4, adding that the star is at the extremity of the southern wing of Virgo; and that it was 52 [years] from the death of Alexander, and 476 of [the era of] Nabonassar. Copernicus, Book 5, Cap. 23, supposes the star to have been the one preceding the four that are in the left wing of Virgo. Longomontanus, Book 2 of his *Theorica* [*Theoricae*], Cap. 19, says it was the year 272 before Christ; and on the eleventh of October, at Alexandria, at the 18th hour. And Lansberge [Philip Lansberge], in the *Thesaurus* of observations, computes Venus at Virgo gr. 3.21' with latitude gr. 1.20'. But he places Venus at gr. 3.22 $\frac{1}{3}$ ' of Virgo, with latitude Boreal [North] gr. 1.22'. Boulliau [Ismaël Boulliau], finally, Book 9 of his *Astronomia* [*Astronomia Philolaica*], Cap. 6, says the star, with which Venus was [in conjunction], was at Virgo gr. 2.47 $\frac{1}{3}$ ', with latitude North; and Venus he places at gr. 1.10' of Virgo. And he says that Venus, according to Copernicus and the Rudolphine [Tables], was in Virgo at gr. 1.10'; nor does she render the star inconspicuous [occult it] by her own body, but rather by the expansion of her rays. To me the year was 272 before Christ, and the day 11 of October.

2. In the year 2 of the Emperor Adrian [Hadrian], on the 21st of the month Athyr — or on the following 22nd — Theon of Alexandria observed Venus in her greatest digression [elongation] from the Sun, distant from the summit of the southern wing of Virgo by as little as the longitude of the digression — or by as much as the diameter of Venus herself appeared to be; and Venus was North by one unit [unam]. Ptolemy, Book 10, Cap. 1, from which he gathers that Venus was in Virgo gr. 0.20', and her greatest distance from the mean place of the Sun gr. 47.32'. But Copernicus, Book 5, Cap. 23, says he does not know from which exemplar he has the year 4 of Adrian, and 119 of Christ; on the fourth of the Ides of October, since it was the year 2 of Adrian and 117 of Christ; and the day, the 13th of October.

3. In the year 13 of Adrian, on the day of [the month] Epiphi 2 — or the following 3 — Theon of Alexandria observed Venus preceding [the Sun] in the morning, in greatest digression, by a longitude of gr. 1.24', drawn through the preceding of the three [stars] of the head of Aries, and through the extreme [star] in the rear leg of Aries — so, however, that she was twice as far distant from the prior [star] as from the posterior. Ptolemy, Book 10, Cap. 2, who says Venus was in Aries gr. 10.36', with southern latitude gr. 1.30', and distant gr. 44.48'; from the mean place of the Sun in Taurus gr. 25.24'. Copernicus, however, Book 5, Cap. 20, says it was the year 129 of Christ. Calend. [the Calends of] June, or May 19; just as Longomontanus, Book 2, Cap. 19, adding to the hour gr. 16.10'. To Alexandria [Lansberge?], inasmuch as from his Tables he places Venus at gr. 10.57' of Aries, and her digression at gr. 45.4'; and the mean place of the Sun in Taurus gr. 25.53'. To us also, the year 129 — its day the 18th of May.

4. In the year 16 of Adrian, on [the day] Pharmuti 21 — the following 22 — Theon observed Venus in the evening in greatest digression, preceding the middle of the Pleiades only, by as much as the longitude of the Pleiades, but a little more to the south. Ptolemy, Book 10, Cap. 1, who from this says Venus was in Taurus gr. 3.30', and the mean place of the Sun in Taurus gr. 14.15'; with greatest digression of Venus gr. 47.15'. Copernicus, Book 5, Cap. 20, says it was the year 132 of Christ, on the eighth of the Ides of March [octavo Idus Martij], at the 1st hour of the night. Longomontanus, however, Book 2, Cap. 19, says it was at hour 7.15' after midday. To Alexandria [Lansberge], but from his Tables he places the mean place of the Sun in Pisces gr. 14.49'. Venus in Taurus gr. 1.39'; and his digression gr. 45.50'. To us it was the year 134; inasmuch as it was a bissextile [leap] year.

5. In the year 18 of Adrian, on [the day] Pharmuti, coming up — the 22 — Ptolemy observed Venus in the morning, most distant from the Sun, in Capricorn, while there was a middle [mean] in Aquarius gr. 15.50', and the greatest digression gr. 43.35'. Ptolemy, Book 10, Cap. 5, adding it was the year 134 of Christ. Copernicus, Book 5, Cap. 22, adding it was the year 134.

Liber VIII — De Venere (continued)

Caput I (conclusion) — Ancient Venus Observations

12. On the Calends of March [1 March], at dawn — but in fact on the seventeenth, in the early morning of the following 18 February [recte: see anomaly (a)], in the year 134.

6. In the year 134, on the Egyptian day Mechir 9 [seq. 10], in the evening, Ptolemy [Ptolemy] at Alexandria observed Venus in Aquarius at $19^{\circ}36'$, with a greatest digression of $47^{\circ}32'$, reckoned from the mean place of the Sun in Capricorn at $2^{\circ}4'$ (*Almagest* X.1 and X.2; Copernicus [Copernicus], *De Revolutionibus* V.5 and V.20, adding that the year was 134 of Christ, on the eighth before the Calends of January [25 December]; Longomontanus [Longomontanus] likewise, II.19, adding the hour). At Alexandria Venus was indeed in Aquarius at $19^{\circ}36'$, but the Sun was in Capricorn at $2^{\circ}36'$, and so the digression of Venus comes to 47° , and in fact it was 25 December.

7. Again in Hadrian's year 11, on Tybi 2 [seq. 3], Ptolemy observed Venus in the evening at its greatest distance from the visible Sun, in Capricorn at $12^{\circ}50'$, and distant $47^{\circ}20'$ from the mean place of the Sun in Aquarius at $0^{\circ}23'30''$ (*Almagest* X.2; Copernicus, *De Revolutionibus* V.5 and V.20, adding that the year was 136 of Christ, on the 5 before the Calends of January [28 December]; but Longomontanus, II.19, gives November 18, hour 5; the Sun in Scorpio at $26^{\circ}9'$, and Venus's digression at $46^{\circ}55'$). That day was in fact 18 November, in the year 136.

8. Again in year 1 of Antoninus the Emperor [Antoninus Pius], on Tybi 29 [seq. 30], Ptolemy observed Venus in the morning by means of an astrolabe, with respect to Spica [Spica], in Capricorn at $6^{\circ}30'$, with an equal distance of $47^{\circ}15'$ p. mid-night, the Sun obtaining by mean motion $22^{\circ}9'$ of Sagittarius (*Almagest* X.2; but Longomontanus, II.19, in that year of Christ 138, December 15, hour 15, minute 10; at Copenhagen [Hafniæ] he puts Venus in Scorpio at $7^{\circ}15'$, the Sun's middle in Sagittarius at $22^{\circ}43'$; but Lansberge [Lansberge] puts Venus in Sagittarius at $6^{\circ}31'$ Scorpio [?]). That day was in fact 15 December.

9. Again in year 4 of Antoninus, on Pharmuti 4 [seq. 5], Ptolemy observed Venus in the evening at its greatest digression in Aries at $13^{\circ}50'$, the Sun's middle in Aquarius at $25^{\circ}30'$, with a digression of $48^{\circ}20'$ (*Almagest* X.4; but Copernicus, *De Revolutionibus* V.5 and V.22, saying that it was the year of Christ 140, on the 12 before the Calends of April [21 March] [recte: see anomaly]; Longomontanus, II.19, the day after [seq.] 18 February).

10. Again in year 4 of Antoninus, on Thoth 11 [seq. 12], Ptolemy observed Venus near the greatest morning digression in Gemini at $18^{\circ}30'$, distant $47^{\circ}15'$ from the Sun's middle (*Almagest* X.3 and Copernicus, *De Revolutionibus* V.5 and V.22, assigning it to the year of Christ 142, on the 3 before the Calends of August [30 July]; but Longomontanus, II.19, puts it in the year 140, July 29, hour 16, minute 12, and Venus in Gemini at $19^{\circ}1'$, with a digression of $47^{\circ}11'$, reckoned from the

Sun's mean place at Leo $6^{\circ}12'$). It was in fact the year 140, on the following 29 July.

11. In the year of Christ 510, as Boulliau [Boulliau] reports, IX.6, [Venus was observed]; in a manuscript of the Royal Library it stands thus: *In the year 216 of Diocletian, the star of Venus was seen preceding Jupiter, in the star of the Sagittarius's bow [the star "Stella"], by 20 digits on day 18 [die 18.]; it appeared to follow by 10 digits, but in latitude there was no difference at all; it appeared that, by an exact calculation according to the Ephemerides, these two planets, conjoined nearly at the thirtieth degree of the month, though distant by a long interval of time, appeared as one alone.* Hence Boulliau, from the Tables of Ptolemy, gathers that the conjunction of Jupiter with Venus had occurred between days 27 and 28 Mechir, that is, between 20 and 21 August, hour 7 after midday; at Uraniborg [Vraniburgi], from his Tables he gathers the place of Jupiter in Virgo at $19^{\circ}1\frac{3}{4}'$, with northern latitude $1^{\circ}9\frac{3}{4}'$; but the place of Venus in Virgo at $18^{\circ}53\frac{1}{4}'$; and so Venus then stood distant from Jupiter in preceding direction by 8 digits, that is, 50 scruples [minutes], or at most 40 [scruples], by diurnal motion they ought to be scruples. He corrects, therefore, the Rudolphine [Tables] [Rudolphine Tables], so that Venus may be in Virgo at $18^{\circ}23'$, and the conjunction of Jupiter, and of Venus, was around the noon of day 28 Mechir, that is, 22 August.

CAPUT II

Venus Observations made by Johann Regiomontanus [Regiomontanus]

1. In the year of Christ 1461, on December 14, after sunset, Regiomontanus at Rome saw Venus immediately conjoined with Saturn, and more southerly by two Suns [solar diameters], or by no degree at all; so that, by the Alphonsine numbers [Alphonsine Tables], the longitude of Venus was greater than that of Saturn by $1^{\circ}36'$.

2. In the year 1462, on January 10, at Rome, after the beginning of night, he saw Venus conjoined with the star of the twenty-third magnitude [?] of Aquarius — which is at the beginning of the [water-]pouring — but Venus was reckoned more easterly by $45'$.

In the same year, on September 19, the same man at Rome, at hour 11 of night, saw in one straight line Venus, Mars, and Regulus [Regulus]; so that, as Venus was more southerly, Mars was more northerly, and the distance of Mars from Regulus was one and a half times the distance of Venus from Regulus.

4. In the year 1462, on October 21, Regiomontanus at Viterbo in the morning, at hour 12½ of night, saw Venus more westerly than the sixth [star] of Virgo by 16' minutes, but conjoined as to longitude with the waning Moon, yet much less northerly than the Moon.

5. In the same year, and month, the same man at Viterbo, on the 25th, in the morning, saw Venus conjoined as to longitude with the seventh [star] of Virgo, but more southerly by about one degree.

6. In the year 1472, on August 19, in the evening, Venus stood distant from Jupiter [Iove] by 5°, minute 13 [5°13'], as he found it by the radius [cross-staff]; but according to the Alphonsine [Tables] they were distant in longitude by 4°33'.

CAPUT III

Venus Observations selected from those made by Bernard Walther [Walther] of Nuremberg

The first class comprises observations made by ocular estimation.

1. In the year 1478, on August 11, in the morning, at about hour 3½ a.m. [post midnight], Walther saw Venus distant almost mid-way between the two stars of Gemini's head, but a little more toward the southerly capella [κ?] of the head, in nearly the same line with these stars; but on the following day, the 12th, at the same hour Venus, seen at so great a distance toward the east as on the day before, was more easterly.

2. In the year 1486, on September 20, in the morning at hour 5 p.m. [recte a.m.] of night, Venus appeared conjoined with Regulus by one Moon [lunar diameter], in the same latitude; but on the 21st, it was seen more easterly by three Moons.

In the same year, on September 24, between hour 10 and 11 before noon, [Venus was seen] conjoined with the Moon, but more northerly than the Moon's limb by half the Moon's diameter [semidiameter].

4. In the year 1489, on March 6, around sunset, with the zodiacal armillae [armillas Zodiacales] she saw Venus in Aries at 27°13' from the circle of the ecliptic; but from the circle of latitude she saw her in Aries at 25°30'. On the same day, and at the 7th [hour], at nearly the same instant, she saw Venus from the circle of latitude in Aries at 28°15'; this discrepancy she recognized to arise from refraction. See, in connection with this, the learned old man's discourse, and the manner of correcting the observations by the perpendicular [plumb-line].

5. In the year 1494, on September 19, in the morning, at hour 5 p.m. n. [of night], Venus was seen conjoined with Regulus, but more westerly than Regulus by about 10 minutes, and equally more southerly. But Lansberge in his *Thesaurus* observed it [recte: computed it]: from his tables he computes Regulus in Leo at $23^{\circ}19'$, with northern latitude $31'$, and Venus in Leo at $23^{\circ}20'$, with northern latitude $13'$.

6. In the year 1502, on September 19, in the morning, after the middle of night, he saw Venus conjoined with Regulus by the Moon's semidiameter, and judged the latitude of both to be the same.

The second class comprises observations made by the radius [cross-staff] through the sines; concerning the use of which, see in Walther's [observations] no. 10. And so that you may have a specimen of the errors of the radius, note that Aldebaran [Aldebaran], and the northern horn of Taurus, do not differ from one another by Tycho's sextants and ours by more than $16^{\circ}45'$, whereas the radius of Walther would have exhibited their distance as $16^{\circ}52'$, or $50'$.

No.	Year	M·D	Distance of Venus from Star	Sin. prim.	Sin. sec.
7	1478	Febr. 19 in occ. Solis [at sunset]	from Jupiter, easterly	40	889
8		20	from Jupiter, easterly	30	814
9		21	from Jupiter, westerly	30	860
10		22	from Jupiter, westerly	30	740
11		24	from Jupiter, westerly	50	780
12	Iulij	26 50' p. ort. [after	from the Moon	20	882

No.	Year	M·D	Distance of Venus from Star	Sin. prim.	Sin. sec.
		rising]			
13	1481	Nou. 15 hor. 1. ante ortū Solis [hour 1 before sunrise]	from Spica, easterly	40	562
			from Saturn, easterly	30	496
			from Mars, easterly	40	513
14		Nou. 19 hor. vt supra [hour as above]	from Spica, easterly	70	632
			from Saturn, easterly	10	742
			from Mars, easterly	30	615
15		Nou. 25 hor. 1. ante ortū Solis [hour 1 before sunrise]	from Spica, easterly	130	597
			from Saturn,	70	720

No.	Year	M·D	Distance of Venus from Star	Sin. prim.	Sin. sec.
			easterly from Mars, easterly	20	750

Parsing notes: The "Sin. prim." (first sine) and "Sin. sec." (second sine) are Walther's tabulated cross-staff scale-readings. Where a single observation references multiple stars (rows 13–15), the year/date is given once and the star/sine entries follow on successive lines.

The third class comprises observations made by armillae [armillary instruments], the uncertainty of which is about ten minutes; see Walther's [observations] no. 33, besides what was said about Refraction here at no. 4.

and observed longitude of Venus.]

No.	Year	M·D	H.	Med·Cal. Sig. · G.	Lōgit. □ visa Sig. · G. · M.
16	1489	Mart. 12 in occ. Solis [at sunset]			□ 4 18
17		13 post occ. Solis [after sunset]			5 13
18		14 in occ. Solis			6 13
19		15 0 30' p-merid.			7 25
20		16 4 post merid.			8 40
21		18	□ 25		11 15
22		19	□		12 27

No.	Year	M·D	H.	Med·Cal. Sig. · G.	Lōgit. □ visa Sig. · G. · M.
23		19	□ 25		13 33
24		23	□ 5		17 20
25		24 5 post merid.			18 20
26		29 8 post merid.			24 20
27		31 7 post merid.			26 36
28	1490	Dec. 12 5 post merid.		□ 14 45	
29		13 5 p·merid.		15 45	
30	1491	Ianu. 11 circa occ. Solis		□ 17 15	
31		17 6 circiter		23 15	
32		Febr. 14 7 post merid.		□ 15 34	
33	1503	Dec. 10	latit. Bor.	4 45	
				□ 18	□ 2 0
			latit. Bor.	0 22	
34		12 circa occ. Solis		□ 21	□ 2 15
35	1504	Ianu. 19 manè [in the morning]		□ 7	□ 17 15
			latit. Bor.	□ 7 0	
36		Ian. 26		□ 20	□ 16 20

No.	Year	M·D	H.	Med·Cal. Sig. · G.	Lōgit. □ visa Sig. · G. · M.
			latit. Bor.	5 0	
37		Febr. 20 manè		□ 25	□ 4 20
			latit. Bor.	4 20	
38		Mart. [Mart.] 11		□ 12	□ 13 45 [?]

No.	Year	M·D·H	Med·Cal. Sig. · G.	Lōgit. □ visa Sig. · G. · M.
39	1504	Mart. 12	□ 21 / latit. Bor.	2 15 / 14 45
40		Mart. 17 manè	□ 7 / latit. Bor.	1 15 / 19 30
41		Mart. 18 manè	□ 26 / latit. Bor.	2 10 / 20 15
42		Mart. 19 manè	□ 7 / latit. Bor.	1 23 / 21 23
43		Mart. 27 manè	□ 10	29 40

Parsing notes: Columns are Year / Month·Day·Hour; "Med·Cal." (mean catalogue place) giving zodiacal Sign + degree, with northern latitude [latit. Bor.] on its own sub-line where present; and "Longitude of Venus as seen" [Lōgit. □ visa] giving Sign + degree + minute. Sign glyphs read: □ Taurus, □ Gemini, □ Cancer, □ Aquarius, □ Pisces, □ Aries. Row 38 longitude minutes value flagged [?] (ink-faint). For rows 39–43 the two right-hand columns each carry a degree value above a latitude/minute value; transcribed slash-separated.

CAPUT IV

Copernicus's Observation of Venus

In the year of Christ 1529, on the fourth before the Ides of March [12 March], at hour 1 after sunset, Copernicus at Frauenburg [Fruemburgi] saw the Moon, which on its dark part began to occult Venus according to its middle distance from both [horns]; the horn lasted, the occultation for one hour; whence around the middle [of the interval], between the first and second hour, Copernicus reckoned that the conjunction of Venus with the Moon had occurred (*De Revolutionibus* V, ch. 23, where he adds that he saw Venus in the early evening, and around the contact of both). But Lansberge in his *Thesaurus* gathers the place of the Moon, seen, in Taurus at $7^{\circ}7'30''$; and the latitude of Venus, seen, was minute 34'; of Venus 39' [recte: see anomaly (b)].

CAPUT V

Tycho's Observations of Venus from the Year 1582 to 1601

First we select the observations of the year 1582, from those recently published at Vienna by Lucius Barretus [Lucius Barretus] — that is, [an anagram] of [Albert Curtz, *Astronomia*], by way of anagram — and by the letters of our [colleagues], as Albert Curtz [Curtius] of the Society of Jesus has taught us; with the azimuths left aside, which we make least of.

No.	Year/ Day·Hour·Min [Ann. D.H.M., 1582]	Venus from Fixed Stars [Veneris à Fixis Stellis]	Distance Gr.·M.
1	Febr. 15 — 7 43	from the extreme tail of Pisces [□] 9 0 bis	4 0 from Aldebaran
2	17 — 8 57	from the head of Aries 8 50 bis	10 20 from Aldebaran
3	22 — 8 3	from Aldebaran	34 42½

No.	Year/ Day·Hour·Min [Ann. D.H.M., 1582]	Venus from Fixed Stars [Veneris à Fixis Stellis]	Distance Gr·M.
		8 31 bis	from the head of Aries
4	24 — 6 10	from Aldebaran	32 52½
		6 45	from the head of Aries
5	26 — 7 6 bis	from Aldebaran	30 59
		8 53	from the head of Aries
6	27 — 6 25 bis	from Aldebaran	30 6
		6 42 ter	from the head of Aries
		2 48	Meridian Altitude [Altitudo Merid.]
7	28 — 8 36 ter	from Aldebaran	29 5
		8 55 ter	from the head of Aries
8	Martij 5 — 7 2	from Aldebaran	24 48
		8 5 bis	from the heel of Gemini [calce pedis ♊]

Parsing notes: The header columns are Year/Day·Hour·Minute (the year 1582 spans the column), the reference star [Veneris à Fixis Stellis], and the angular distance in degrees·minutes. "bis," "ter" mark second/third readings at adjacent times on the same day. Star glyph ♊ = Pisces, ♊ = Gemini.

No.	Day·Hour·Min [1582]	Venus from Fixed Stars	Distance Gr.·M.
9	Martij 9 — 7 6	from Aldebaran 7 35	21 38¼ from the heel of Gemini [calce pedis □]
10	14 — 9 17 bis	from Aldebaran 9 33 bis	18 0½ from the heel of Gemini [□]
11	15 — 8 26 ½	from the bright [star] of the Pleiades [lucid. Pleiad.] 8 37	4 41 from the heel of Gemini [□]
12	16 — 7 43	from the heel of Gemini [□] 8 7	39 31½ from the middle of Cassiopeia's chair [Media cath. Cassiop.]
13	20 — 7 26 bis	from Aldebaran 7 55 bis	14 40 from the head of Pollux [cap. Pollucis]
14	21 — 8 2	from the head of Pollux 8 58	52 29½ from the northern horn of Taurus [cornu Bor. Tauri]

No.	Day·Hour·Min [1582]	Venus from Fixed Stars	Distance Gr·M.
		9 37	from the bright [star] of the Pleiades [lucida Pleiadum]
15	26 — 7 47	from the head of Pollux 8 21	49 51 from the northern horn of Taurus

In the second place we shall put the observations of Venus which Tycho exhibits in *Progymnasmata*, volume 1, [to show] how, from the right ascension of Venus and its distance from the bright [star] of Aries [lucida Arietis], he established the right ascension of the bright [star] of Aries. On this occasion, however, the place of Venus can be gathered from it, but with the cautions employed, concerning which Kepler [Kepler] [warns] in the foundation of his *Ephemerides*, p. 15, where he says that diurnal observations are to be distinguished from nocturnal ones; nor are two parallaxes, at the same altitude above the horizon, well compared together; and the same about the interval of the Earth; and that in the motion of Venus one may otherwise err, the difference being able to be 15'. Moreover, the disagreement persists even now between Landgrave [Wilhelm IV] of Hesse [Landgravium Hassiæ] and Brahe [Braheum] of Denmark, concerning which see in Tycho's letter of the year 1589, February 21. I add my own error in the greatest declination of the Sun, which I increased by minute 1'10", beyond what is just [in the right reckoning], and in the parallax of the Sun, which is indeed less than is supposed — as even Kepler above admits — but is still less than Kepler's. Let one also remember to take account of Refraction in each case.

No.	Observat ion [Ann. 1582]		G. M. S.	Observat ion [Ann. 1582]		G. M. S.
	Hor.			Hor.		
16	Febr. 26	3 35'		7 5'		
	post merid. <i>Visa distant.</i>					

No.	Observation [Ann. 1582]	Hor.	G. M. S.	Hor.	G. M. S.
	<i>declinat. vel altit.</i> [Seen distance, declination, or altitude]				
	Distance of Venus from the Sun's center [à centro Solis]		46 10 30		15 25 10
	Northern declination of Venus [Declinatio Borea Veneris]		15 21 40		
	Altitude of the Sun [Altitudo Solis]		15 10 0		
	Altitude of Venus [Altitudo Veneris]		40 30 0		27 30 0
	Distance of Venus from Aldebaran				30 59 0

No.	Observation [Ann. 1582]	Hor.	G. M. S.	Hor.	G. M. S.
	Declination of Aldebaran [Declination of Aldebaran]				15 36 0
17	Febr. 27 post meridiem	4 18'		6 23'	
	Distance of Venus from the Sun's center		46 10 15		15 53 30
	Northern declination of Venus		15 51 0		
	Altitude of the Sun		10 0 0		
	Altitude of Venus		45 0 0		33 0 0
	Distance of Venus from Aldebaran				30 6 0
18	Martij 5 post meridiem	4 52'		7 12'	

No.	Observation [Ann. 1582]	Hor.	G. M. S.	Hor.	G. M. S.
	m				
	Distance of Venus from the Sun's center		45 53 30		18 16 0
	Northern declination of Venus		18 14 0		
	Altitude of the Sun		8 0 0		
	Altitude of Venus		46 0 0		28 0 0
	Distance of Venus from the heel of Gemini [à calce pedis □]				48 52 30
	Declination of the heel of Gemini, north. [calcis ped. □ Bor.]				22 38 0
(18b)	Martij 5 post meridiem	5 12'		7 2'	

No.	Observation [Ann. 1582]	Hor.	G. M. S.	Hor.	G. M. S.
	Distance of Venus from the Sun's center		45 51 30		18 16 0
	Northern declination of Venus		18 14 15		
	Altitude of the Sun		5 30 0		
	Altitude of Venus		44 0 0		29 0 0
	Distance of Venus from Aldebaran				24 48 0
	Northern declination of Aldebaran				15 36 0

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
19	1582 Martij 9 post meridie m	5 15'		7 14'	
	Distance		45 33 0		19 40 0

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
	of Venus from the Sun's center				
	Northern declination of Venus		19 38 30		
	Altitude of the Sun		6 0 0		
	Altitude of Venus		43 0 0		30 0 0
	Distance of Venus from Aldebaran				21 37 0
	Declination of Aldebaran				15 36 0
20	1582 Martij 20 post merid.	2 25'		8 11'	
	Distance of Venus from the Sun's center		43 50 0		23 4 45
	Northern declination of Venus		23 2 0		

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
	Altitude of the Sun		31 0 0		
	Altitude of Venus		57 0 0		23 30 0
	Distance of Venus from the heel of Gemini [□ à calce pedis □]				36 32 0
	Declination of the heel of Gemini [calcis pedis □]				22 38 0
21	1582 April. 3 post merid.	1 40'		8 53'	
	Distance of Venus from the Sun's center		38 38 45		25 48 0
	Northern declination of Venus		25 47 30		
	Altitude of the Sun		39 30 0		
	Altitude		58 30 0		17 0 0

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
	of Venus				
	Distance of Venus from the head of Pollux [à cap. Pollucis]				45 33 0
	Northern declination of the head of Pollux [Declin. Borea cap. Pollucis]				28 57 0
22	1585 Septemb. 15 ante merid.	6 48'		5 10'	
	Distance of Venus from the Sun's center		45 48 30		14 0 30
	Northern declination of Venus		13 59 30		
	Altitude of the Sun		8 0 0		
	Altitude of Venus		41 0 0		29 47 30

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
	Distance of Venus from the head of Pollux [à cap. Pollucis]				28 57 0
	Declination of the head of Pollux, north. [Declin. cap. Pollucis Borea]				
23	1586 Decemb. 26 post merid.	3 2'		4 45'	
	Distance of Venus from the Sun's center		46 30 0		
	Southern declination of Venus [Declinat. Austr. Veneris]		11 15 30		
	Altitude of the Sun [Altit.		3 0 0		

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
	Solis]				
	Altitude of Venus [Altit. Veneris]		23 0 0		20 30 0
	Equatorial distance of Venus from the bright [star] of Aries [Dist. Æquator ea □ à lucid. □]				52 21 0
24	1587 Iannar. 24 post merid.	6 15'		5 15'	
	Distance of Venus from the Sun's center		37 5 45		0 29 30
	Northern declination of Venus		25 0 0		
	Altitude of the Sun		17 30 0		
	Altitude of Venus		30 0 0		23 30 0 / 40 46 10

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
25	Distance of Venus from the bright [star] of Aries [à lucida Arietis]				
	1587	5 30'		3 42'	
	Augusti 17 ante merid.				
	Distance of Venus from the Sun's center		28 13 0		19 29 45
	Northern declination of Venus		19 26 0		
	Altitude of the Sun		3 0 0		
26	Altitude of Venus		28 30 0		14 0 0 / 22 20 0
	Distance of Venus from the head of Castor [à cap. Castoris]				
	1588	5 28'		7 42'	
	Martij 28				

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
	post merid.				
	Distance of Venus from the Sun's center		16 23 0		16 33 0
	Northern declination of Venus [Declin. Bor. Veneris]		16 30 30		
	Altitude of the Sun		10 0 0		
	Altitude of Venus		32 0 0		13 30 0 / 10 20 0
	Distance of Venus from Aldebaran				
	Northern declination of Aldebaran [Declin. Bor. Aldebaræ]				15 36 45
27	1588 April. 16 post	6 48'		8 40'	

No.	Observation	Hor.	G. M. S.	Hor.	G. M. S.
	meridie m				
	Distance of Venus from the Sun's center		30 50 30		22 49 30
	Northern declinati on of Venus [Declinat. Bor. Veneris]		22 46 0		
	Altitude of the Sun		5 0 0		
	Altitude of Venus		28 0 0		13 43 0 / 40 15 0
	Distance of Venus from the head of Pollux [à cap. Pollucis]				18 56 40
	Northern declinati on of the head of Pollux [Declin. Bor. cap. Pollucis]				

Parsing notes: This is a two-paired-column observation register. Each numbered entry gives a date and two observation times (Hor. — hour of observation, in two separate paired sub-columns each headed Hor. then G./M./S. for degrees·minutes·seconds of the measured quantity). Beneath each entry's heading are rows for: distance of Venus from the Sun's center, declination of Venus (north or south as labelled), altitude of the Sun, altitude of Venus, and a distance from a named fixed star with that star's declination. Where two values appear stacked in a single right-hand cell (e.g. "23 30 0 / 40 46 10" at no. 24), the upper is the altitude-of-Venus value and the lower the star-distance value; transcribed slash-separated. Several second-column G·M·S cells are blank in the source (the second observation-time recorded only a subset of quantities). Sign glyphs: ♋ Pisces, ♊ Gemini, ♈ Aries, ♀ Venus.

Liber VIII — De Venere (continued)

Caput V (continued) — Tycho's Venus observations, 1582–1601

The dense register of Tycho Brahe's Venus observations continues. Each numbered entry gives the date and the time of observation (before noon / after noon, with two times shown side by side under the **H.** [hours] / ' [minutes] columns), followed by Venus's distance from the Sun's center, Venus's southern declination, the altitudes of the Sun and of Venus, and Venus's distance from (and the declination of) the star Spica.

Item 28 — 1588 November 29, before noon. [Left columns: H. 9 11'; right columns: H. 7 11']

Quantity	G.	M.	(2nd time)	
			G.	M.
Distance of Venus from the Sun's center	46	38	0	
Southern declination of Venus	9	16	0	
Altitude of the Sun	3	30	0	
Altitude of	24	30	0	21 30 0

Quantity	G.	M.	(2nd time)	
			G.	M.
Venus				
Distance of Venus from Spica			13	31 30
Southern declination of Spica			8	57 15

Item 29 — 1588 December 6, before noon. [Left: H. 10 30'; right: H. 7 28']

Quantity	G.	M.	(2nd time)	
			G.	M.
Distance of Venus from the Sun's center	44	57	30	
Southern declination of Venus	11	21	30	11 8 0
Altitude of the Sun	8	0	0	
Altitude of Venus	19	15	0	20 30 0
Distance of Venus from Spica			20	17 20
Southern declination of Spica			8	57 15

Item 30 — 1588 December 15, before noon. [Left: H. 9 6'; right: H. 7 41']

Quantity	G.	M.	(2nd time)	
			G.	M.
Distance of Venus from	46	36	0	

Quantity	(2nd time)			
	G.	M.	G.	M.
the Sun's center				
Southern declination of Venus	14	4	0	14 2 0
Altitude of the Sun	3	0	0	
Altitude of Venus	20	0	0	19 0 0
Distance of Venus from Spica			29	33 30
Southern declination of Spica			8	57 15

Parsing notes: each entry pairs two observation times (two **H.** columns at the head). Most rows of figures sit under the first time; where a second value is printed to the right it belongs to the second time. Values transcribed as printed.

[Following the register, a short prose note:]

Three Venus observations drawn from Tycho's *Letters* (p. 56), made at Uraniborg on the dates of the old style written below, in the hours after noon, with calculation by the Alphonsine and Copernican [tables].

[A second small table — three Venus observations of January 1587, each with the longitude and latitude of Venus reckoned three ways:]

Ann o 158 7, Jan uar y	Met						Lat.			
	D.	H.	M.	hod	Sig.	G.	I'	Gr.	I'	N/S
Ite	9	5	40	Obs	□	13	5	1	38	B

Ann
o
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uar
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	D.	H.	M.	Met hod	Sig.	G.	I'	Lat. Gr.	I'	N/S
m 31				Mer ved	(Pis ces)					[Bor eal/ N]
				Alp hon sine		13	26	0	22	A [Au stra l/S]
				Cop erni can		13	21	0	36	B
Ite m 32	14	4	50	Obs erv ed	□	16	20	2	29	B
				Alp hon sine		16	44	0	15	B
				Cop erni can		16	52	1	14	B
Ite m 33	15	4	40	Obs erv ed	□	16	55	2	39	B
				Alp hon sine		17	20	0	22	B
				Cop erni can		17	31	1	12	B

Parsing notes: "B" = *Borea* (northern latitude); "A" = *Austrina* (southern latitude).
 ♓ = the sign of Pisces.

[Prose, lower left column:]

Lansbergius [Philip Lansberge], in his *Thesaurus observationum* ["Treasury of Observations"], makes use of the observation for the 15th of these dates, and from it gathers Venus's place as Pisces 16°57'39" in his *Tables*. Bullialdus [Boulliau], however, in Book 9, Chapter 2, takes from his own [tables] the place as Pisces 18°9'; and he therefore charges this observation with error — or rather [charges] the observation of the year 1590 (about which more shortly, after Longomontanus, in Book 2 of the *Theorica*, Chapter 18). He admits that scarcely ever, and only rarely at other times, was Venus observed continuously in summer, because of the obliquity of the [celestial] sphere — which made such observation feasible in Denmark — and that Venus and Mercury [are best observed] at their greatest elongations from the Sun. He nevertheless subjoins the selected observations written below, taken from Tycho, adding his own observations for the years 1610 and 1616, with a computation of the place from the Danish [data].

[A table of Tycho's later selected observations — date and time (old style, after noon), with Venus's longitude (sign, degrees, minutes) and latitude (degrees, minutes, N/S):]

#	Year, Date			Obs.	Sign	Long. (G.)	M.	Latitude		
	D.	H.	M.					G.	M.	N/S
34	1585	17	15	observed	♓	15 58 / 53 1/4	2	8	A	
35	1587	4	40	observed	♓	16 55 / 16 50 1/4	2	39	B	
36	1586	6	5	observed	♓	16 1 / 8	8	56	B	

#	Year, Date	D.	H.	M.	(sta- tus)	Sig.	G.	M.	Lat. G.	M.	N/S
	7 Feb .21			./ sup p.			15 49 $\frac{3}{4}$				
37	158 7 Ma rt. 2	17	30	obs ./ sup p.	□ (Ari es)	10	7 / 14 4 $\frac{1}{4}$	8	26	B	
38	158 8 Dec .14	19	40	obs ./ sup p.	□ (Aq uar ius)	17	10 / 17 6	3	10	B	
39	159 0 Dec .17	20	0	obs ./ sup p.	□ (Ca pri cor n)	20	0 / 20 4 $\frac{1}{2}$	0	27	B	
40	159 4 Dec .15	5	10	obs ./ sup p.	□ (Vir go)	21	0 / 21 6 $\frac{1}{2}$	1	16	A	
41	161 0 Dec .12	4	40	obs ./ sup p.	□ (Aq uar ius)	17	58 / 18 4 $\frac{1}{2}$	1	29	A	
42	161 6 Ma rt. 9	17	0	obs ./ sup p.	□ (Aq uar ius)	15	24 / 15 24 $\frac{1}{2}$	(no ne obs erv ed)			

Parsing notes: column headers read *Ann. M. D. H. M.* (year, month, day, hour, minute) on the *stylo veteri post meridiem* (old style, after noon), then *Longitudo Veneris* (sign / degrees / minutes) and *Latitudo* (degrees / minutes / B[oreal] or

A[ustral]). Each entry gives an observed value (*obseru.*) and a computed/supposed value (*supput.* / *supp.*) for the longitude, here shown separated by a slash. Item 42's latitude reads "nò est obser." (not observed). Several sign-degree readings are crowded; □/□ and □/□ glyphs read as printed.

[Prose continuing in the right column:]

The last of Tycho's observations were made in Bohemia, at Benátky Castle [arce Benatica], in the year 1600, or at Prague in the city of Kuttinberg [Curtim — Kutná Hora] in the year 1601, reduced to the new style and selected by Snellius [Willebrord Snel], and published in the year 1618.

Item 43 — Anno 1600, January 23, h. 7.45', p.m. Venus was observed in the east by means of the armillae [the armillary instrument], her declination being 17°50'; and by means of the quadrant her altitude was 16°53 $\frac{1}{3}$ '. Then at 8 $\frac{2}{3}$ h., p.m., her distance from the Sun was observed as 40°36'; and at last, at the meridian altitude, Venus's altitude was 21°46 $\frac{1}{3}$ '.

Item 44 — Anno 1600, February 20. Venus's meridian altitude was seen to be 20°27', and her distance from the Sun 46°40 $\frac{1}{3}$ '.

Item 45 — Anno 1600, February 22, in the morning at 6 $\frac{3}{4}$ h. Venus was seen to be distant from Aquila [Altair] 27°37 $\frac{2}{3}$ '; her altitude then was 19°48'. Soon her altitude was 11°19'; she was seen to be distant from Antares 42°50'50". Hence Bullialdus [Boulliau], Book 9, Chapter 1, having eliminated refraction and parallax, gathers Venus's place as Scorpio 16°24'15", with northern latitude 3°20'34". But, reducing it afterward, he brings the longitude back to 16°22'12", and infers the greatest digression [from the Sun] to be 46°46'; he says this occurred on the 21st [day], at hour 20.27'.

Item 46 — Anno 1601, May 9, h. 8.17'. Venus stood distant from Capella 29°19 $\frac{2}{3}$ ', and 8.27' [later?] from Pollux 13°47 $\frac{1}{3}$ '. Her altitude then was 25°30'; and [she was distant] 8.34' from Regulus 49°59'. But Bullialdus, Book 9, Chapter 1, says she is to be read [as] distant from Capella 26°19'40", and hence to follow the place of Venus [as] Gemini 4°27'50", with northern latitude 3°9'19"; and the greatest digression [as] Aries 4°13'55".

Item 47 — Anno 1601, October 10, in the morning at 4.30' p.m. [recte: a.m.?]. Venus's altitude was 17' [recte uncertain]; she was seen to be distant from Procyon 24°55', and soon from Pollux 45°30 $\frac{2}{3}$ '; and this was the last of Tycho's Venus observations.

CAPVT VI.

Caput VI — Observations of Venus by Maestlin, Kepler, and Jost Bürgi, selected from Snellius in Hassia [Hesse].

[Headpiece ornament above the chapter title; large decorative initial "A" opens the first observation.]

[Item 1] — Anno 1574. Maestlin [Michael Maestlin], on September 16, in the morning at 4 h., at Tübingen, saw Regulus covered [occulted] by Venus, as Kepler reports on p. 305 of his *Astronomiae [pars] Optica* ["Optical Part of Astronomy"].

Caput VI (continued) — Maestlin, Kepler, Bürgi

[Item 1 continued, top of left column.] ...*Optica*; and from there Lansbergius, in his *Thesaurus*, observes Venus distant 4° [from Regulus], adding that Regulus then stood in Leo $24^{\circ}7'$ with northern latitude $31'$, and Venus in Leo $24^{\circ}9'$ with northern latitude $29'$. Although the latitude may be diminished by adding the parallax, the splendor [of Venus] nonetheless placed [her] near Regulus so as to overpower [obscure] Regulus.

Item 2 — Anno 1590, October 3, old style, in the morning at 5 h. The same Maestlin saw Mars wholly covered by Venus, the color of Venus revealing it clearly; thus Kepler in his *Optica*, p. 305, and hence Lansbergius in his *Thesaurus*, where he gathers Venus's place as Virgo $25^{\circ}32'37''$ with northern latitude $1^{\circ}20'$, and Mars's place as Virgo $25^{\circ}45'31''$ with northern latitude $1^{\circ}17'$. And [since] the parallax of Venus is to be added in longitude, $3'$ is to be added, while $1\frac{1}{3}'$ is to be subtracted in latitude — yet not so great is the discrepancy that there should be wanting [a gap of] 9 minutes of Mars's longitude.

Item 3 — Anno 1592, February 18, in the morning at $6\frac{3}{4}$ h., p.m., or $5\frac{1}{2}$ [h.], as Bullialdus has it. Justus Bürgi [Jost Bürgi] at Kassel [Casellis] observed Venus distant from Antares $48^{\circ}48\frac{2}{3}'$, and from Aquila [Altair] $26^{\circ}39'30''$. Hence Bullialdus, Book 9, Chapter 1, gathers Venus's place as Capricorn $22^{\circ}22'44''$, with northern latitude $5^{\circ}36'$.

Item 4 — Anno 1592, February 22, old style, h. $0.17\frac{1}{3}'$ p.m. Bürgi at Kassel observed Venus distant from Antares $53^{\circ}39'$, and from Aquila $26^{\circ}51'$. Hence Bullialdus, Book 9, Chapter 1, gathers Venus's place as Capricorn $27^{\circ}20'36''$ with latitude B[oreal] $2^{\circ}32'42''$; and [says] the greatest digression of Venus from the Sun was then $46^{\circ}41'$, occurring when Venus was in Capricorn $27^{\circ}17'36''$.

Item 5 — Anno 1592, July 31, in the morning at 9 h., p.m. Bürgi at Kassel observed Venus distant from Capella $22^{\circ}10'$, and from the right shoulder of Orion [Betelgeuse] $26^{\circ}50'$.

Item 6 — In the same year, in August, at 6 h. evening, Bürgi saw Venus distant, at the meridian, from Rigel $38^{\circ}30'$, with latitude $6^{\circ}1'$; and from Pollux $14^{\circ}15\frac{1}{3}'$.

Item 7 — In the same year, 1593, in September, in the morning at 1 h., the same Bürgi at Kassel observed Venus distant from Pollux $19^{\circ}33'$, and from Sirius $18^{\circ}25'$.

Item 8 — Anno 1594, December 17, old style, h. 5 p.m. Bürgi at Kassel observed Venus distant from Aquila $39^{\circ}53'$, and from the shoulder-blade of Pegasus [scapula Pegasi] $31^{\circ}54'$. From this Bullialdus, Book 9, Chapter 1, deduces Venus's place in Aquarius $22^{\circ}58\frac{1}{3}''$, with southern latitude $1^{\circ}6\frac{1}{3}'$ [recte $1.6.35''$].

Item 9 — In the same year, in December, at 20 h., p.m. The same Bürgi at Kassel observed Venus distant from Aquila $41^{\circ}30'$, and from the shoulder-blade of Pegasus $29^{\circ}57'$. Hence Bullialdus, Book 9, Chapter 1, deduces Venus's place in Aquarius $25^{\circ}50'53''$, with southern latitude $30^{\circ}37'$ [recte $0^{\circ}37'$], and [says] the greatest digression was then $47^{\circ}12\frac{1}{3}'$, which fell on December 5, with Venus reduced to Aquarius $21^{\circ}1'36''$.

Item 10 — Anno 1594, December 22, old style, h. 5 p.m. Bürgi saw Venus high [altam], $11^{\circ}30'$; and distant from Aquila $41^{\circ}50'$.

Item 11 — Anno 1595, in August, at 9 h. old style, in the morning, Bürgi at Kassel observed Venus distant from Pollux $14^{\circ}25\frac{1}{3}'$, and from the [stars] Helices [of Ursa Major] $47^{\circ}52'$. Hence Bullialdus, Book 9, Chapter 1, having placed [Venus] in the location of the Helices in Leo $19^{\circ}39'$ [recte], gathers Venus's place in Cancer $25^{\circ}39\frac{1}{3}'$, with northern latitude $8''$.

Item 12 — Anno 1596, April 21, old style, h. 9 p.m. Bürgi at Kassel observed Venus distant from Capella $21^{\circ}29\frac{1}{3}'$, and from the [star] following Gemini [Pollux] $33^{\circ}9'$ [recte].

Item 13 — Anno 1598, September 25, new style, in the morning at 3 h. Venus, scarcely risen and seen with Kepler's free grace [i.e., generously communicated by Kepler], covered Regulus; the hour was 4 h., more than one Venus[*'s* breadth?] lay between her and Regulus. The line truly drawn from Venus to the heart of Leo [cor Leonis = Regulus] fell a little within them. Hence Lansbergius in his *Thesaurus* gathers Regulus's place in Leo $24^{\circ}24'$ with northern latitude $31'$, and Venus's place in Leo $24^{\circ}24'48''$ with northern latitude $31'$. Wherefore Venus did not cover Regulus with her whole body, but [only] by her rays.

Item 14 — Anno 1599, May 31, new style, from his half-six observation [*ex sua semisextâ observatione*], Kepler in his *Optica*, p. 305, by a certain conjecture judges a conjunction of Venus and Mercury — about which see him, if you please.

CAPVT VII.

Caput VII — Observations of Venus made by Hortensius, Pierre Gassendi, Fr. Andreas Arzet, Don Vincenzo Muto, and by the Fathers of the Society of Jesus at Ingolstadt and Innsbruck [Oeniponti].

[Item 1] — Anno 1622, October 14, in the morning — "as I was journeying," says Gassendi (in his *Epicurus*, p. 903) — "I saw at Aix-en-Provence [Aguas Sextias], without a telescope, in the twilight of dawn, Venus shining very near Mars, and distant from Mesoboream [the Mesoborean point?] no more than a hand's-breadth and a half [dodrante] of its own diameter; on the following day, at the same hour, Venus had crossed over, and now stood with Mars at the Meseterum [Meseterean point?], somewhat farther from him than the lesser of the inferior appendages of the Belt of Orion lie from one another — yet much less than the Kids [Haedi] under Capella."

Item 2 — Anno 1625, January 30, old style, h. 7 p.m. Hortensius at Leiden saw, through the tube [telescope], a conjunction of Venus with the southern horn of the crescent Moon [cornu Lunae], the apparent distance being a single minute. Lansbergius in his *Thesaurus* observed [this]; he adds that the Moon's center was distant 2 h. — that is, Venus [was] in Pisces $24^{\circ}45'25''$ with northern latitude, seen $48\frac{1}{3}'$ [recte]; and the Moon's place likewise in Pisces $24^{\circ}44'47''$, with southern latitude $52''$ [recte].

Kepler in the *Rudolphine [Tables]*, Chapter 28, p. 93, relates that on the same day, at evening at Herbachium, Ulm, Tübingen, and elsewhere in Swabia, Venus was seen, as if in a complex of horns of the Moon, clinging; she came almost into the left horn, and thence by little, traversing the gibbous of the lower Moon, gathers [computes] the central conjunction of the Moon and Venus to be apparent; for although it was the occultation of the Sun and Venus, yet the Moon was truly Borealward [northern]. Hence, taking the example of the parallaxes to be supposed, he teaches that, at the time of conjunction, the Moon would appear at $24^{\circ}21'$ in [the sign], and Venus at $24^{\circ}42'$ of Pisces.

Item 3 — Anno 1625, February 7, in the morning, nearly 5 h. 40' after midnight, Gassendi at Paris with the naked eye saw the Moon, which with her outermost Boreal [northern] horn touched Venus, yet covering nothing of her; thus he himself in his *Epicurus*, p. 900.

Item 4 — Anno 1626, December 12, in the evening at h. 6 h. 31'. Hortensius at Leiden saw Venus joined to the second longitudinal [position] of the Moon, distant from the very southern horn of the Moon about a diameter of the lunar [disk]. Lansbergius in his *Thesaurus* observed [this]: that is, Venus, where he computes the place of the Moon's appearance in Aquarius 17°31'50", with northern latitude, seen southern 36°23" [recte], and Venus's place in Aquarius 17°31'12", with northern latitude 1°33'11".

Item 5 — Anno 1629, December 17, old style, nearly 6¾ h. p.m. Hortensius at Middelburg saw Venus, having passed the circle of the longitude of the preceding star, in the tail of Capricorn, by nearly a quadrant of a lunar diameter; and she was Borealward [north] by an entire lunar diameter. Lansbergius in his *Thesaurus* observed [this]; from which place he gathers the [position] of Venus in Aquarius 16°36½' — but from the *Tables*, 16°42'33".

Item 6 — Anno 1632, July 31. Hortensius at Amsterdam computed the conjunction of Venus and Mercury in the morning after midnight; nevertheless they were distant 7'. Venus stood somewhat more to the west than Mercury; Mercury was Borealward — whence he argues the conjunction of these planets to have been at h. 11½ of night. Moreover, with Hortensius, in his dissertation on the [transit] of Mercury seen in the Sun [the 1631 Mercury transit], and [with] Longomontanus, the calculations show themselves to have a notable error of Longomontanus against the observation.

Caput VII (continued)

[Top of left column — a small table giving the longitude and latitude of Venus and of Mercury as reckoned by Lansbergius and by Longomontanus, for the 1632 conjunction:]

Source	Body	Sig.	Grad			Lat.			N/S
			.	I'	II''	G.	I'	II''	
Lansbergii	Veneris	☿ (Cancer)	24	24	43	0	34	43	B
Longomontani	Veneris	☿	24	40	0	0	34	0	B
Lansbergii	Mercurii	☿	24	30	4	0	39	5	B

Source	Body	Sig.	Grad			Lat.			N/S
			.	I'	II''	G.	I'	II''	
Uraniberg ii	Mercurii	☊	27	33	0	1	24	0	B
Uraniberg i	Mercurii	☊	27	33	0	1	24	0	B

Parsing notes: "B" = *Borea* (northern latitude). ☊ = Cancer.

[Prose, left column:]

Item 7 — Anno 1632, December 6. Gassendi at Paris observed the conjunction of Venus with the Sun, as to longitude; for as to latitude Venus could not, in this case, cover the Sun. Kepler in his *Optica*, p. 305, was [of this opinion]; the hour was 9.41' after noon, at Uraniborg, from the *Rudolphine [Tables]*, with Venus's latitude southern 1°8'9". Hortensius [was of this view] in his dissertation on Mercury seen in the Sun.

Item 8 — Anno 1633, May 26, h. 9 p.m. Gassendi saw Venus, through the optical tube [telescope], 18' — or at most 19' — west and a little south of the left shoulder of Pollux [the Gemini]. That star was (says Bullialdus, Book 9, Chapter 2) in Cancer 18°33'20" with northern latitude; and the azimuth of Venus [was] more western than the azimuth of the star by 9' — therefore Venus in Cancer 18°17', with northern latitude 2°48'.

Item 9 — Anno 1633, July 30. Gassendi at Tanaron, a little town to the north of Digne [Dinia], of latitude 44°11', in the morning saw Venus distant from the Sun's center 26°3'; soon Venus was higher [in altitude]. At 11¾ [h.] Venus, previously high 12°, was seen distant from Aldebaran 37°8', and from the southern horn of Taurus 27°17'.

Item 10 — In the same year, on August 2. Gassendi in the same town saw Venus distant from the Sun's center 29°2', high [in altitude]; soon, with the Sun high 9°, Venus was first seen distant from Aldebaran 36°44', and from the right shoulder of Orion [Betelgeuse] 20°6'.

Item 11 — On the 5th, with the Sun high 6°, Venus was seen by the same [Gassendi] distant from the Sun's center 31°40', having previously been distant from Aldebaran 36°48', from the right shoulder of Orion 20°8', and from Pollux 14°40'. Thus Gassendi in his *Epicurus*, p. 800.

Item 12 — **On the 6th**, that same Venus was distant from Aldebaran $36^{\circ}59'$, and afterward from the western limb of the Sun, high 10° , and then [from] the eastern limb of the Sun, high 11° . Then [from] the Sun's center, high 12° .

Item 13 — **On the seventh [day]**, that same Venus was distant from Aldebaran $37^{\circ}3'$, from the right shoulder of Orion, high [in altitude] [and] $20^{\circ}19'$; from Pollux $14^{\circ}27'$, and from Castor $16^{\circ}45'$; then $33^{\circ}5'$ from the western margin of the Sun, high 9° , and $33^{\circ}34'$ from [it] high 8° ; and $20'$ from the eastern margin of the Sun, high $10\frac{1}{2}^{\circ}$; and from the Sun's center, high 12° .

Item 14 — **On the 11th**, Venus stood distant — the same [Gassendi] observing in the same place — $37^{\circ}56'$ from Aldebaran, and then $21^{\circ}17'$ from the right shoulder of Orion, high [in altitude] 12° .

Item 15 — **On the 12th**, the same [Venus] stood distant $38^{\circ}14'$ from Aldebaran, [and] $21^{\circ}43'$ from the right shoulder of Orion; and then $36^{\circ}44'$ from the Sun's center, high nearly 14° .

Item 16 — **On the 13th**, he saw in the same place Venus distant $21^{\circ}52'$ from the right shoulder of Orion, and $13^{\circ}27'$ from Pollux, $37^{\circ}20'$ from Castor, [and] from the Sun's center, high 15° . Gassendi in his *Epicurus*, p. 801, who admits that he used a five-foot [radius] instrument, in such a way that it was, as it were, [used] outside the margins of a small cylinder, [it being better] that they should be within [the margins], and that there be an abundance of one margin in the dividing of the margins, the other [being] a lesser minute.

Item 17 — **Anno 1635, July 16**. Gassendi at Aix-en-Provence [Aquis Sextiis] saw Venus high $37^{\circ}7'$, distant $13^{\circ}52'$, [reckoned] from the tail of Leo high $20^{\circ}3'$. Gassendi in his *Epicurus*, p. 802.

Item 18 — **Anno 1636, November 14, in the morning**. Fr. Andreas Arzet, of the Society of Jesus, at Innsbruck [Oeniponti], had this observation of Venus, which he afterward communicated to me [Riccioli] by letter.

[Item 19 — a small table, lower left column: an observation taken between Astronomical hours 6 and 7:]

Quantity	G.	I'	II''
Meridian altitude of Regulus	56	28	30
Altitude of	29	36	30

Quantity	G.	I'	II''
Venus then, seen at rising			
Then the distance of Venus from Regulus	42	6	40
Then the distance of Venus from Arcturus	32	7	30
And then the altitude of Venus was	31	11	0
And [the altitude of] Arcturus high toward the East	35	25	0

Parsing notes: heading reads *Inter hor. Astronomicam 6. & 7.* (between astronomical hours 6 and 7).

Caput VII (continued) — right column

[Top of right column — a small table, continuation of an observation "around hour 9¾":]

Quantity	G.	I'	II''
(heading: <i>Circa horam verò 9¾</i>)			
Venus's meridian altitude, seen	40	47	0
And the Sun's altitude at rising [ortiva]	13	42	0

Quantity	G.	I'	II''
Soon the distance of Venus, seen from the Sun	45	32	26

Item 21 — Anno 1646, on the day 9 of July, Don Vincenzo Muto [Vincentius Mutus] of Maiorica [Mallorca], at h. 15.40', saw Venus distant nearly 32' — that distance rather on the part of the latitude — from the star of the Hyades, which [reaches] to the eye [is] Borealward; and that star was more southern [australior], as to longitude; Venus, moreover, was a little more eastern than the star, and near its greatest digression from the Sun.

Item 22 — In the same year, the same [observer] in the same place, on July 30, at h. 16, saw Venus more southern [australiozem] in the southern horn of Taurus [cornu australi Tauri], and distant from it 31' — or 32 [recte].

Observations made by the Fathers of our Society at Ingolstadt, and by me [Riccioli], afterward communicated [to me] by Fr. Michael Staudacher.

[A multi-section table of Venus observations, 1619–1620. The main heads read: *Anno 1619* (date / hour / minutes) and *Distantia* □ (distance of Venus) — "Ab" (from which star) with degrees / minutes.]

Anno 1619 — Distance of Venus [from a named star]:

Die (date)	Hora	I'	Ab (from)	G.	I'
Febr.					
(Vesp. = evening)					
7	6	35	Algenib·P egasi	21	27
			Markab	14	6
10	6	25	Algenib	29	25
			Markab	13	34
			Venus was high	8	30

Die (date)	Hora	I'	Ab (from)	G.	I'
			[☿ alta erat]		
April. (Mane = morning)					
2	5	30	from the Sun [à Sole]	40	6
			high [the Sun]	15	30
	(H. 6 0)		from the Sun	40	21
			high [the Sun]	5	0
			high [Venus]	19	5
April. (Mane = morning)					
6			from the Sun	41	49
			high [the Sun]	3	0
			high [Venus]	17	50

Anno 1619 — April, morning [Mane], altitudes [Altis.] — Distance of Venus from the Sun [Dist. ♀ à ☉]:

Die ☉	g.	I'	☿ I'	(Dist.) Gr.	I'
9	1	0	15 28	42	49
10	1	30	16 8	42	59
11	5	30	19 5	43	15
12	1	10	15 32	43	29

Die ☉	g.	I'	□ I'	(Dist.) Gr.	I'
13	5	0	18 40	43	43
Maij 4	1	0	14 58	45	52
6	2	0	16 10	45	57
11	3	30	18 25	45	54
27	1	40	17 23	44	30
Iunij 4	2	15	19 35	43	41
8	4	30	23 30	42	54
20	0	30	0 5	40	51
Iulij 5	2	0	23 50	37	57

Anno 1620 — H. i — Distance of Venus [Distantia □]:

Die	Hora	(Vesp. = evening)	ab (from)	G.	I'
Iulij 3	9	45	from Arcturus [ab Arcturo]	57	6
			from Spica □ [à Spica Virginis]	51	24
11	9	11	Arcturus □	51	6
			Spica □	43	18
21	9	0	Arcturus	44	58
			Spica □	33	42
31	8	45	Arcturus	40	6
			Spica □	31	0

Parsing notes: the 1619/1620 observation table is laid out as several stacked sub-tables with shifting column heads (*Vesp.* = evening / *Mane* = morning / *Altis.* = altitudes). The ☉ glyph = the Sun, ♀ = Venus, ♍ = Virgo. "Algenib-Pegasi" and "Markab" are stars of Pegasus. Some altitude sub-columns are crowded; where a paired "g. I'" (degrees/minutes of the Sun's altitude) and a "□ I'" (Venus's altitude)

sit side by side, both are given before the distance columns. Values transcribed as printed; the June 20 / "0 5" altitude reading and the May progression are crowded and read as printed.

Liber VIII — De Venere (continued)

Caput VII (continued)

The Ingolstadt 1620–1621 Venus observations continue (distances of Venus from fixed stars, in degrees and minutes; "H." = the hour of observation; "Manè" = morning).

Venus's distances from fixed stars, 1620–1621 (Ingolstadt, Society of Jesus).

Year 1620	Hour	Distance of Venus from	Deg.	Min.
Oct. 13	5h 0m, morning	from Regulus	36	10
Oct. 20	5h 30m, morning	from the Heart [Cor] of Leo	30	57
		from Regulus	30	59
Oct. 22	9h 52m	from the Tail [Cauda] of Leo	18	7
		& its merid. altitude	40	3
		& distance from the Sun, merid. alt.	34	0
Oct. 23	9h 30m	from Regulus	40	40
Oct. 25	6h 8m	from the Tail of Leo	31	54
		from	17	51

Year 1620	Hour	Distance of Venus from	Deg.	Min.
		Regulus		
		Venus was high [alta erat]	23	20
Nov. 17	5h 15m, morning	from Arcturus	30	54
		from the Tail of Leo	26	12
		Venus was high	20	10
Nov. 30	6h 15m, morning	from Arcturus	28	4
		from the Tail of Leo	36	22
		Venus was high	16	5
Dec. 3	6h 0m, morning	from Arcturus	28	59
		from the Tail of Leo	39	3
		Venus was high	23	40
Dec. 7	5h 45m, morning	from Arcturus	29	48
		from the Tail of Leo	42	54
		from the Sun, alt. of Sun 15°	47	5
Dec. 13	6h 0m, morning	from Arcturus	31	54
		from Spica of Virgo	17	12

Year 1620	Hour	Distance of Venus from	Deg.	Min.
		Venus was high	27	0
Dec. 23	6h 45m, morning	from Arcturus	37	48
		from Spica of Virgo	27	42
Year 1621	Hour			
Jan. 5		from Arcturus	48	18
		from Spica of Virgo	42	12
		Venus was high	17	55

Parsing notes: In the "Distance of Venus from" column the standard astronomical symbols appear — ♀ (Venus), ☉ (Sun), ♌ (Leo) "à Cauda ♌" = "from the Tail of Leo", "♍" = Virgo. "Manè" = morning. The "& dist. à ☉ / alt. Merid." rows for Oct. 22 give Venus's distance from the Sun and meridian altitudes; the column-alignment there is cramped. The Dec. 7 "à Sole alt. ☉ g. 15" = distance from the Sun with the Sun's altitude 15°.

[Observations made at Innsbruck by the Fathers of our Society — Oeniponti]

Observations made at Oeniponte [Innsbruck] by the Fathers of our Society.

Venus's distances from fixed stars and altitudes, 1635–1636 (Innsbruck, Society of Jesus).

Year	Distance of Venus from	(A.)	Deg.	Min.	Altitude of	Deg.	Min.
1635	from				of the		
Oct. 5	from Regulus		31	58	of the Little Dog [Canic	9	51 mat.

Year	Distance of Venus from (A.)	Deg.	Min.	Altitude of [ula]	Deg.	Min.
1635	from Jupiter	29	34		47	31 mat.
Year 1636						
March 23	from Aldebaran	35	59	of Venus	14	8 vesp.
	from the Bright Star of Aries [Ariet. Luc.]	10	29	Sun's apparent lower edge [Hum. Inc. Or.]	44	2
March 31	from Aldebaran	25	33	of Venus	16	12 vesp.
	from the Bright Star of Perseus [Lucida Persei]	33	19	of the Little Dog	48	6 vesp.
April 6	from Aldebaran	18	36	of Venus	15	5 vesp.

Year	Distance of Venus from (A.)	Deg.	Min.	Altitude of	Deg.	Min.
1635	from the Bright Star of Perseus	30	55	of Aldebaran	26	45 vesp.
April 16	from Aldebaran	8	35	of Venus	13	20 vesp.
	from the Bright Star of Orion [Orion-hum-luc.]	29	34	of Sirius	36	35 vesp.
May 6	from the Little Dog [Canicula]	32	45	of Venus	20	40 vesp.
	from Capella	21	52	of Regulus	52	5 vesp.
May 11	from the Little Dog	23	54	of Venus	22	12 vesp.
	from Capella	28	20	of Regulus	50	28 vesp.

Year	Distance of Venus from	(A.)	Deg.	Min.	Altitude of	Deg.	Min.
1635	from the Little Dog		29	10	of Venus	43	40 vesp.
May 19	from Pollux [Cap. Polluc.]		10	59	of Regulus	20	50 vesp.

Venus's distances and altitudes, 1636–1637 (continued).

Year	Distance of Venus from	(A.)	Gr.	Min.	Altitude of	Gr.	Min.
1636	from Regulus		31	34	of Venus	19	50 vesp.
June 1	from Pollux [Cap. Polluc.]		6	30	of Regulus	34	41 vesp.
July 10	from Arcturus		52	1	of Venus	10	7
	from Dubhe [Dubbe]		53	16	of Arcturus	52	36 vesp.
Nov. 2	from Procyon		67	45	of Venus	29	15 mat.

Year	Distance of Venus from	(A.)	Gr.	Min.	Altitude of	Gr.	Min.
1636	[Canic .]						
	from Regul us		33	7	of Procy on	44	2 vesp.
	from the Sun		42	32	of Venus, merid.	42	56
Nov. 4	from Arctur us		36	39	of Venus	30	10 mat.
	from Procy on		69	16	of Arctur us	26	8 mat.
	from the Sun, merid.		43	15	of Venus	29	40 vesp.
Nov. 10	from Regul us		38	55	of Venus	31	5 mat.
	from Arctur us		33	54	of Regul us, merid.	56	28
Nov. 19	from Regul us		46	34	of Venus	30	circ. mat.
	from Arctur us		30	27	of Regul us, merid.	56	28

Year	Distan ce of Venus from	(A.)	Gr.	Min.	Altitu de of	Gr.	Min.
1636							
Dec. 12	from the Tail of Leo [Caud a □]		48	24	of Venus	25	0
	from Spica of Virgo		16	23	of Jupite r, merid.	42	38
Dec. 14	from Arctur us		32	35	of Venus	28	mat.
	from Spica of Virgo		18	27	of Arctur us	56	47
Dec. 24	from Arctur us		39	0	of Venus	23	15 mat.
	from Spica of Virgo		29	23	of Spica, merid.	33	33
Year 1637							
Jan. 21	from Arctur us		64	25	of Venus	16	37 mat.
	from Bright Lyra [Lyra		61	35	of Bright Lyra [Luc.	55	6 vesp.

Year	Distan ce of Venus from	(A.)	Gr.	Min.	Altitu de of	Gr.	Min.
1636	Lucid.]				Lyræ]		
Jan. 26	from Arctur us		69	29	of Venus	14	58 mat.
	from Bright Lyra		60	50	of Arctur us	57	46 vesp.

Parsing notes: The (A.) sub-header in these tables apparently distinguishes the star "A" referenced. "mat." = *matutina* (morning); "vesp." = *vespertina* (evening); "merid." = *meridiana* (meridian/at noon). The Jan. 21 entry "of Bright Lyra 55° 6'" reads as a single-digit 6 in the minutes column (the first-pass "60" was a misread of 6 plus the adjacent column rule/show-through; verified in). The Nov. 19 "of Venus 30° circ." = "about 30°" (*circiter*).

CAPVT VIII.

Selected Venus observations, drawn from many carried out at Bologna in the College of St. Lucia by Fr. Giovanni Battista Riccioli and Fr. Francesco Maria Grimaldi of the Society of Jesus.

With some additions from the observations of the Most Illustrious Marchese Cornelio Malvasia [Maluasicæ].

1. In the year 1642, on September 23, in the evening, when Arcturus stood high in the west at 27° 33', Venus was observed by means of the Sextant to be distant from that same Arcturus by 36° 1/2. When, however, Venus had descended to an altitude of 4° 8', it was distant from the Bright Star of the Northern Crown [lucida Coronæ] by 44° 52'.

2. In the same year, on November 30, in the evening at the 10th hour, ten minutes before the transit of Fomalhaut across the meridian wire [per M. C. — *per medium coelum*], Venus was seen to be distant from Fomalhaut by 7° 13'; and after three minutes, 10 seconds, it was distant from Saturn by 5° 24'.

3. Likewise in the year 1642, on July 21, in the evening, Venus stood high above the western horizon at $7^{\circ} 56'$ apparently; then up to the transit of the Heart of Scorpio [cor Scorp̄ii] across the meridian wire there were counted 9 minutes, 58 seconds.

4. On the 25th day of the same month, in the evening, Venus was seen high at $7^{\circ} 11'$, observed in a western azimuth of $104^{\circ} 33'$; then up to the transit of Antares across the meridian wire there were counted 26 minutes, 40 seconds.

5. In the year 1642, on August 4, in the evening, Venus was distinctly visible high at $7^{\circ} 1'$; it was in a western azimuth of $98^{\circ} 50' \frac{1}{3}$. From there up to the transit of the head of Ophiuchus [caput Ophiuchi] across the meridian wire there were counted 36 minutes, 42 seconds.

6. On the twelfth day of August, when Venus was seen high at $7^{\circ} 59'$, it was observed in a western azimuth of $93^{\circ} 8'$; and from there up to the transit of the highest [star] in the shoulder of Ophiuchus there were counted 16 minutes, 52 seconds.

In order that the order of time may be preserved, the first observation ought to be inserted here, and the second rejected after the one following.

7. In the year 1642, on October 21, in the evening, on the following [day], Venus was distant from Arcturus by $59^{\circ} 11'$; and after 5 minutes, 15 seconds had elapsed, it was distant from the Bright Star of the Northern Crown by $55^{\circ} 24'$; then after 10 minutes, the western altitude of the Eagle [Aquila] was taken at $53^{\circ} 11'$.

8. In the year 1643, on January 10, in the evening, in the half-hour after true sunset, Venus was seen distant from Jupiter by $14^{\circ} 11'$; and after 5 minutes, at the time of Saturn, by $19^{\circ} 21'$; and after 11 minutes, from the bright tail of Cetus [lucida caudæ Ceti] by $33^{\circ} 44'$; and after 50 minutes of time (for in between fell observations of other planets), it was likewise distant from the breast of Cygnus [pectore Cygni] by $56^{\circ} 25'$; finally, after 5 minutes, Aldebaran was high at $50^{\circ} 42'$.

9. Likewise in the year 1643, on January 20, on the following night, Venus was seen high above the western horizon at $23^{\circ} 32'$; and from there, after 19 minutes, 32 seconds, the rising altitude of Aldebaran was $48^{\circ} 30'$.

10. In the year 1643, on March 8, in the morning, nearly a half-hour before sunrise, Venus appeared distant from the bright star of the Eagle by $9^{\circ} 25'$; then 25 minutes before sunrise, when Venus was seen high at $11^{\circ} 13' \frac{1}{2}$, the tail of Cygnus was distant by $53^{\circ} 14'$ from the eastern direction; but at the very moment

of physical sunrise Venus was observed distant from the center of the Sun by $37^{\circ} 37'$.

11. Of the same year and month, on day 12, in the morning, before sunrise, about the third hour, that is, when Venus was high and the bright star of the Eagle was high at $41^{\circ} 27'$, Venus was seen high at $11^{\circ} 54'$; and was distant from the tail of Cygnus by $53^{\circ} 58'$. At the very moment when the bright star of the Eagle was high at 42° , Venus was high at $13^{\circ} 33'$, appearing distant from that same bright star of the Eagle by $31^{\circ} 37'$.

12. In the year 1643, on May 19, in the morning, before the Sun's altitude was seen, Jupiter was observed high at $1^{\circ} 43'$, and after 6 minutes, 20 seconds had elapsed, Venus was seen high at $17^{\circ} 5'$; and its eastern azimuth was $76^{\circ} 22'$.

13. On day 21 of May, in the morning, the eastern altitude of the bright star of the Eagle was taken at $53^{\circ} 24'$; and after 20 minutes, the eastern altitude of Venus was observed at $14^{\circ} 20' 1/2$ in an azimuth of $80^{\circ} 1'$; and a little later Venus appeared more southerly in the same vertical [circle] together with Jupiter.

14. In the year 1643, on July 15, in the morning, the rising altitude of the bright star of Aries was taken at $46^{\circ} 50'$; then after 15 minutes had elapsed, Venus was seen high at $14^{\circ} 22'$, distant; from the bright star of Aries by $6^{\circ} 2'$. Then after 5 minutes of time it was seen high at $19^{\circ} 1/2$, and distant from Aldebaran by $13^{\circ} 25'$. Finally after time was minus, Venus was high at $18^{\circ} 48'$, and was then distant from Jupiter by $57^{\circ} 58' 1/2$.

15. In the year 1643, on June 21, in the morning, 67 minutes, 10 seconds, and the high altitude of the Sun was seen at $7^{\circ} 49' 1/3$; of the same year, the eastern azimuth was $114^{\circ} 14'$; the altitude of Venus had been seen at $92^{\circ} 22'$ in an eastern azimuth, at the same moment $92^{\circ} 47'$.

16. In the same year and month, on day 28, in the morning, the rising altitude of the bright star of the Eagle was taken at $46^{\circ} 2'$; in the west there were counted 28 minutes; then when the altitude of Venus was seen in the east at $14^{\circ} 38'$, it was distant from Saturn by $50^{\circ} 16'$. Then after a minute, $6^{\circ} 1/2$, it was seen distant from Jupiter by $36^{\circ} 7'$; and Venus appeared high at 16° .

17. In the year 1643, on July 30, in the morning, in the half-hour after the rising altitude of the bright star of Aries was $22^{\circ} 32'$, Venus was seen high above the rising [point] at $17^{\circ} 15'$; at the same moment distant from Aldebaran by $17^{\circ} 50' 1/2$, and after two minutes of time Venus was seen high at $18^{\circ} 20'$, distant from Regel of Orion [Regel Orionis] by $42^{\circ} 41' 1/2$, high at that time by $11^{\circ} 50'$. Then

after 12 minutes it was seen high at 19° 40', and distant from Capella by 29° 38', when Ca-

The following observations were carried out by the same method.

Subsequent observations carried out by the same method, 1644.

Year 1644	Altitude of Venus seen	Alt. of Spica	Dist. of Venus seen from the stars
July day	Gr. M.	Gr. M.	Gr. M.
28 — (3)	17 / 42, then 15 / 55	28 / 58, then 28 / 0	51 / 22 from Spica; 22 / 0 1/2 from the Tail of Leo
29 — (4)	18 / 21, then 16 / 15	29 / 3, then 28 / 0	50 / 21 from Spica; 21 / 9 from the Tail of Leo
30 — (5)	17 / 32, then 15 / 24 1/2	28 / 39, then 27 / 10	49 / 22 1/2 from Spica; 20 / 26 from the Tail of Leo
31 — (6)	16 / 54, then 14 / 8 1/2	27 / 53, then 26 / 14	48 / 19 from Spica; 19 / 38 1/2 from the Tail of Leo

Parsing notes: Each row carries two altitude readings (an upper and a lower entry) for Venus and for Spica, and two distance readings (from Spica and from the Tail of Leo [Cauda ♌]). The parenthetical "(3), (4), (5), (6)" beside the July day are the day-count within the series. "1/2" renders the printed half-fraction symbols. Table continues on the following page.

Subsequent observations by the same method, 1644 (continued).

Year 1644	Altitude of Venus seen	Alt. of Spica	Dist. of Venus seen from the stars
July day	Gr. M.	Gr. M.	Gr. M.

Year 1644	Altitude of Venus seen	Alt. of Spica	Dist. of Venus seen from the stars
32 — (8)	16 / 11, then 13 / 47	27 / 1, then 25 / 23	46 / 24 from Spica; 18 / 13 1/2 from the Tail of Leo
33 — (9)	12 / 58, then 12 / 6	24 / 24, then 23 / 51	34 / 43 from Vindemiatrix [Vindem.]
34 — (10)	14 / 10, then 12 / 54, then 11 / 37	25 / 8, then 24 / 10, then 23 / 4	44 / 27 from Spica; 16 / 52 from the Tail of Leo; 33 / 57 from Vindemiatrix
35 — (11)	16 / 14, then 10 / 4	26 / 30, then 22 / 10	43 / 28 from Spica; 51 / 30 from Arcturus
36 — (12)	15 / 39, then 14 / 26	25 / 50, then 24 / 24	42 / 34 from Spica; 16 / 15 from the Tail of Leo
37 — (14)	14 / 21, then 12 / 47	24 / 25, then 23 / 13	40 / 40 from Spica; 14 / 48 from the Tail of Leo
38 — (19)	13 / 15, then 9 / 20	22 / 37, then 19 / 41	37 / 9 1/2 from Spica; 46 / 43 1/2 from Arcturus
39 — Aug. 4	17 / 4, then 15 / 14	17 / 4, then 23 / 40	40 / 35 1/2 from Arcturus; 23 / 40 from Spica

Parsing notes: The "(8), (9), (10)..." parentheticals continue the day-count; note the series jumps 6→8 (no entry numbered 7 in the printed sequence), and 12→14, 14→19. Row 34 and several others carry three readings. Row 39 begins the August

dates ("Augusti 4"). The "from the Tail of Leo" entries use the ☐ symbol; "from Vindemiatrix [Vindem.]" is the star ϵ Virginis. Several fractional minute-values (1/2) are printed as half-symbols.

40. In the year 1644, on November 11, in the morning, Procyon was distant from the vertex toward the west by $41^{\circ} 25'$; and after 6 minutes of time, its distance from Regulus was $38^{\circ} 57'$; but after 1 minute, $5 \frac{1}{2}$, it was distant from Arcturus by $33^{\circ} 34' \frac{1}{2}$, and after 4 minutes it was distant from the bright star of Hydra [lucida Hydræ] by $46^{\circ} 37'$.

41. In the year 1644, on November 21, in the morning, Regulus was distant from the vertex toward the west by $33^{\circ} 11'$; and after 6 minutes, Venus was high at $31^{\circ} 11'$, distant from Arcturus by $29^{\circ} 54' \frac{1}{2}$; and after another 6 minutes Venus was high at $31^{\circ} 33'$, distant from Regulus by $48^{\circ} 5'$.

42. In the same year, on November 26, in the morning, the eastern distance of Arcturus from the vertex was taken at $49^{\circ} 50'$; then after 5 minutes of time, the altitude of Venus was taken at $30^{\circ} 28'$, its distance from Arcturus being $28^{\circ} 59'$; then after 5 minutes of time, the altitude of Venus was taken at $19^{\circ} 12'$, and its distance from Regulus toward the west at $52^{\circ} 58'$.

43. Likewise in the year 1644, on November 29, in the morning, the rising distance of Arcturus from the vertex was $51^{\circ} 1'$, and after 3 minutes the rising altitude of Venus was $25^{\circ} 12'$; its distance from Arcturus $25^{\circ} 12'$; then after 5 minutes it was seen distant from Regulus by $36^{\circ} 1' 50''$; and after 5 minutes it was likewise distant from Spica by $4^{\circ} 30'$.

44. In the year 1644, on December 4, Arcturus was distant from the vertex by $45^{\circ} 25'$; and after 2 minutes it was seen high at $5^{\circ} 35'$; and its distance from Arcturus was $29^{\circ} 14'$; then at the Italian hour $13 \frac{1}{3}$, Venus was seen high at $27^{\circ} 10'$, distant; from Spica by $38^{\circ} 24'$.

45. In the year 1644, on February 4, the distance of Venus from the vertex toward the west was taken at $49^{\circ} 50' \frac{1}{2}$, in an azimuth, by which the vertical plane was carried, the bright foot of Orion [pes lucidus Orionis] was seen distant from the vertex by $60^{\circ} 59'$; in the half-hour after the observed distance from the vertex was $46^{\circ} 17'$; from there up to the time when the right [bright] [foot] of Orion's distance from the vertex was $51^{\circ} 56'$. Then when $3 \frac{1}{2}$ minutes had elapsed, after the distance of Procyon from the vertex was $44^{\circ} 44'$, Venus was seen distant from the vertex by $83^{\circ} 26'$.

46. In the same year, on February 6, Venus was in the same azimuth as in the preceding observation, and was seen distant from the vertex by $48^{\circ} 43'$; from there were counted 4 minutes of time, the crepuscular [twilight] impediment ceasing; the distance of the right shoulder of Orion from the vertex toward the rising was $50^{\circ} 15'$; likewise Venus was seen distant from the vertex toward the west by $36^{\circ} 40'$; and after a smaller time, $5 \frac{1}{2}$, Procyon was distant from the vertex toward the west by $40^{\circ} 55'$.

47. In the year 1646, on February 12, Venus was observed to be distant from the vertex by $46^{\circ} 58'$ in the vertical to whose plane the right shoulder of Orion was expected, distant from the vertex by 46°

$50' \frac{1}{3}$. After the observation, however, of Venus toward the evening, there were counted 39 minutes, 15 seconds of time; and immediately Regel was distant from the vertex by $55^{\circ} 20'$, in the eastern quadrant; and Venus was then near greatest digression [maximæ digressioni].

48. In the year 1646, on February 25, the evening Venus was seen distant from the vertex by $47^{\circ} 15'$ in the azimuth of that vertical [circle]; to whose plane the right shoulder of Orion sank down [delapsus], distant from the vertex by $52^{\circ} 50' \frac{1}{3} \frac{1}{5}''$; from the observation, moreover, of Venus there were counted 47 minutes, 45 seconds. Procyon, in the eastern quadrant, was distant from the vertex by $50^{\circ} 15'$.

49. In the year 1646, on July 4, in the morning, when Capella was distant from the vertex by $64^{\circ} 54'$, in an eastern azimuth, Venus was seen distant by $88^{\circ} 4'$; then when the Sun's altitude was observed to be smaller, $34'$, there elapsed 17 minutes, 50 seconds.

In the same year, on July 7, in the morning, Capella being distant from the vertex by $62^{\circ} 16'$, Venus was seen distant from the bright side of Perseus [lucido latere Persei] by $33^{\circ} 30'$; Capella, moreover, was distant from the vertex by $61^{\circ} 36'$; it was likewise seen distant from Venus and from Capella by $31^{\circ} 25'$. In the same morning, at the moment when Venus was in an eastern azimuth of $91^{\circ} 56'$, it was seen distant from the vertex by $64^{\circ} 2'$; it was also seen distant from it, $34' 26''$; the Sun being already risen, the altitude was seen high at $3^{\circ} 10' \frac{1}{2}$.

51. In the year 1646, on July 11, in the morning, Capella being distant from the vertex, observed at $62^{\circ} 10'$, Venus was seen distant from the bright side of Perseus by $33^{\circ} 39'$; Capella, moreover, was distant from the vertex at $61^{\circ} 33'$; it was likewise seen distant from Venus and from Capella itself by $30^{\circ} 23'$; from the vertex, moreover, by about 66° ; distant, moreover, from Capella, from the vertex, by $58^{\circ} 19'$; thence were counted 18 minutes, 56 seconds. From the transit of Venus

through an azimuth of $88^{\circ} 8'$, in which Venus was seen distant from the vertex by $63^{\circ} 27'$, around this time the greatest digression of Venus was occurring.

52. In the same year, on July 11, in the morning, Capella being distant from the vertex by $59^{\circ} 38'$, Venus was seen distant from the vertex by $69^{\circ} 50'$; from the bright side of Perseus, moreover, by $33^{\circ} 53' 1/2$; and a little after, it was seen distant from Capella by $58^{\circ} 43'$; then it was seen distant from that same star by $29^{\circ} 30'$; Venus, moreover, [was distant] from the vertex by $68^{\circ} 40'$. Furthermore, after the distance of the She-Goat [Capra] from the vertex by $58^{\circ} 18'$, there were counted 16 minutes, 13 seconds; in whose end Venus was seen distant from the vertex by $62^{\circ} 40'$, in an azimuth of $88^{\circ} 10'$.

53. In the year 1647, on April 23, in the evening, Venus was seen high at $6^{\circ} 24' 1/2$, and distant from the following shoulder of Orion by $36^{\circ} 56'$. Then when it was seen high, Venus was high at $5^{\circ} 28'$; it was seen distant from the head of Pollux by $58^{\circ} 27' 1/2$; immediately Capella was distant from the vertex by $51^{\circ} 6'$.

54. In the year 1647, on May 6, in the evening, three quarters before sunset, the quadrant being applied, Venus was seen high at $9^{\circ} 40'$, and distant from Procyon by $47^{\circ} 17' 1/2$; when Venus was seen high at $9^{\circ} 5'$, it was seen to be distant from the head of Pollux by $42^{\circ} 40'$.

55. In the same year, on June 13, in the evening, Venus was observed high at $12^{\circ} 14'$, distant from Regulus by $45^{\circ} 5'$. Then when it appeared high at $11^{\circ} 10'$, Venus was seen distant from the Heart of the Hydra [corde Hydræ] by $47^{\circ} 50'$, high at $10^{\circ} 42'$, seen distant from the bright mane of Leo [iuba Leonis] by $44^{\circ} 59'$. The observation lasted 20 minutes, in whose end Regulus was distant from the vertex by $54^{\circ} 45'$; and almost the whole hour, $6^{\circ} 1/2$, after sunset.

56. In the year 1649, on April 24, in the evening, Venus was observed in the plane of the Vertical [circle] of the Filar Triangle [Trianguli Filaris], Venus being high at $59^{\circ} 41' 1/2$, and after a minute, $1^{\circ} 15''$, Procyon was distant from the vertex by $53^{\circ} 53' 1/2$. Then [Venus] was expected at the vertical plane, in which Venus had been, where the northerly [star] of the Borealis Geminorum, because it was seen distant from the vertex by $49^{\circ} 4'$.

57. In the same year, on May 3, in the evening, Venus transiting through the vertical plane designating the Filar Triangle, was seen distant from the vertex by $56^{\circ} 55'$; and after 3 minutes Procyon was distant from the vertex by $56^{\circ} 54' 1/2$; thence the northerly head of Gemini transiting through the aforesaid Filar Triangle, distant from the vertex by $47^{\circ} 8'$.

58. In the same year, on May 4, when Venus was seen high at $18^{\circ} 32'$, it was seen distant from the head of Pollux by $18^{\circ} 49' \frac{1}{2}$; immediately, Procyon by $28^{\circ} 32'$; iterated by the customary mode of observation; and almost the whole hour after sunset.

59. In the year 1649, on June 29, in the evening, when, with the naked eye too, Venus was seen crescent-shaped [falcata], it could not afterward be observed because of clouds; on July 25, however, in the morning, the altitude of Venus was $7^{\circ} 8'$; and its distance from Capella was $35^{\circ} 34'$; then Venus was high at $7^{\circ} 46'$; it was seen distant from Aldebaran by $32^{\circ} 30' \frac{1}{2}$ in the very bright dawn, tending toward the Direction.

Liber VIII — De Venere (continued)

60. On the same day, the morning of 27 July, Venus was seen at an altitude of $9^{\circ} 10'$ and distant from Capella $35^{\circ} 24'$. When seen, however, she was at an altitude of $10^{\circ} 10'$, and was observed to be distant from Aldebaran $32^{\circ} 15'$.

61. On the following day, however, Venus passed across the vertical plane of the Filar Triangle, in which she was seen at an altitude of $18^{\circ} 7'$; and at the same plane, afterwards, the center of the Sun was seen at an altitude of $21^{\circ} 18' \frac{2}{3}$. After Venus had been observed up to the time the Sun's altitude was taken, 5 degrees 53' were counted off: the time amounted to 40 minutes 8 seconds.

62. On 30 July, in the morning, when Venus was at an altitude of $13^{\circ} 37'$, she was found distant from Capella $35^{\circ} 21'$; but when seen at her most visible she was at an altitude of $14^{\circ} 10'$, and was distant from Aldebaran $32^{\circ} 13'$.

63. On the following morning Venus was seen at an altitude of $13^{\circ} 37'$, distant from Aldebaran $32^{\circ} 17'$. But at an altitude of $14^{\circ} 17'$ she was seen to be distant from Capella $35^{\circ} 22'$.

64. In the year 1649, on 3 August in the morning, Venus was seen at an altitude of $15^{\circ} 20'$, and distant from Aldebaran $32^{\circ} 38'$. But at an altitude of $15^{\circ} 50'$ she was seen distant from Capella $35^{\circ} 50'$.

65. On the following morning Venus was seen at an altitude of $18^{\circ} 6'$, and distant from Aldebaran $32^{\circ} 48'$; but at an altitude of $18^{\circ} 34'$ she was seen distant from Capella $35^{\circ} 34'$.

66. In the year 1651, on 2 February in the evening, Venus was seen at an altitude of $4^{\circ} 30'$, and distant from Sirius $75^{\circ} 11'$; the western azimuth of Venus, however,

had been $79^{\circ} 17' \frac{1}{3}$, because the position of Venus in that vertical plane was afterwards observed to be distant from the vertex $47^{\circ} 55'$ — from which I deduce the position of Venus to be in Aquarius $28^{\circ} 4'$, with northern latitude $8^{\circ} 4'$. (At the hour, namely, 5 hours 34 minutes after midday, it is therefore no wonder, since on that day too — and likewise on the twelfth, namely near the conjunction with the Sun — Venus, drawn out nearly along her length, displayed so great a latitude, conspicuous to us not only by telescope but also with the naked eye: a thing which the line drawn from the horn to the center of Venus indicated.)

67. In the year 1652, on 29 May, Venus was seen in the evening at an altitude of $24^{\circ} 57'$, and distant from Saturn (more easterly) $5^{\circ} 27'$; but at an altitude of $24^{\circ} 30'$ she was seen distant from Pollux's head (more westerly) — Venus herself being more elevated than it — by $4^{\circ} 45'$. A little afterwards she was seen at an altitude of $20^{\circ} 25'$, distant from Leo's mane $34^{\circ} 39'$; and then at an altitude of $19^{\circ} 52'$ she was seen distant from Regulus $34^{\circ} 32'$. And at that time Pollux was higher [in altitude] by $21'$.

In the year 1652, the remaining evening observations of Venus around the eighth hour after midday, thus:

[Margin: Observed on day 6 July, at the hour nearest the eighth after midday. The *Stellisfir*, in Tom. I of the *Almagestum Novum*, on the assumed hypotheses gave Venus's longitude in Virgo $30^{\circ} \frac{2}{3}$ and northern latitude $0^{\circ} 43'$.]

			<i>Alt.</i>		<i>Dist.</i>		
			<i>visa</i> □		<i>visa</i> □		
			[Observed		[Observed		
<i>Mens.</i>			ved		ved		
<i>Dies</i>			altitud		distan		
[Mont			e of		ce of		
h,			Venus		Venus		
Day]]]		
			Gr.	M.	Gr.	M.	
68	June	26	15	52	58	25	from Spica
			15	0	27	25	from the Tail of □ [Leo]

	<i>Mens. Dies</i> [Month, Day]		<i>Alt. visa</i> □ [Observed altitude of Venus]		<i>Dist. visa</i> □ [Observed distance of Venus]		
69	July	4	14	25	50	20	from Spica
			13	23	21	10	from the Tail of □ [Leo]
70	July	5	19	34	49	19	from Spica
71	July	6	14	40	48	24	from Spica
			13	24	19	42	from the Tail of □ [Leo]
72	July	7	15	20	47	25	from Spica
			14	19	19	1½	from the Tail of □ [Leo]
73	July	8	14	14	46	28	from Spica
			13	15	18	14	from the Tail of □

	<i>Mens. Dies</i> [Month, Day]		<i>Alt. visa</i> □ [Observed altitude of Venus]		<i>Dist. visa</i> □ [Observed distance of Venus]		
							[Leo]
74	July	9	13	27	45	29	from Spica
			12	30	17	39	from the Tail of □
							[Leo]
75	July	10	14	56	44	31	from Spica
			13	56	17	3½	from the Tail of □
							[Leo]

Parsing notes: Each numbered observation occupies one or two rows. The final column gives the comparison star ("from Spica" = à Spica; "from the Tail of Leo" = à Cauda □). The ½/⅓ fractional minutes are transcribed as printed.

76. In the year 1652, on 6 August in the evening: across the vertical plane of the Filar Triangle marking the meridian, with the plane directed straight to the center of Venus, Venus was found distant from the vertex $78^{\circ} 46' \frac{1}{3}$; and to this number of degrees, after the counted-off minutes $40^{\circ} 35'$, Arcturus reached, and there [Arcturus] was distant from the vertex $47^{\circ} 35'$.

77. In the year 1652, on 19 August at the civil hour, Italian style, 12, and about minute 6, the tail of □ [Leo] was caught at a distance from the vertex of $42^{\circ} 10'$. Thence, after 12 minutes from her rising, Venus was seen distant from Arcturus (more easterly) by $30^{\circ} 27'$, and after 4 minutes distant from the Heart of Hydra (more westerly) $52^{\circ} 52'$.

78. In the year 1653, on 2 February in the morning, Venus was seen distant from the bright star of the Eagle [Altair] $34^{\circ} 30' \frac{1}{3}$, and from the vertex $79^{\circ} 23'$. The Eagle, however, was distant from the vertex $66^{\circ} 20'$; thence Venus was seen distant from Antares $31^{\circ} 10'$, and distant from the vertex $78^{\circ} 46'$. Antares, however, was distant from the vertex $91^{\circ} 7'$.

79. In the same year, on 19 December, in the evening at the hour of the Eagle [Altair], an altitude was supposed of $4^{\circ} 37' \frac{1}{3}$ after midday. Venus, near her perigee, in the western azimuth was foreseen to be distant $25'$; from which she was seen distant from the vertex $66^{\circ} 55' \frac{1}{3}$. Hence was then deduced the right ascension of Venus $317^{\circ} 31'$, and southern declination $18^{\circ} 43'$.

80. In the year 1654, on 1 February in the evening, Venus — tending toward her maximum digression and being expected in azimuth of degrees $55'$ — was seen distant from the vertex $50^{\circ} 17' 60''$, and after minute $16' 45'$ was seen distant from the vertex $71^{\circ} 18'$.

81. On the following evening, however, Venus, in the same degree $55'$, was seen distant from the vertex $39^{\circ} 46'$; and after minute $25' 36''$ was seen distant from Sirius, distant from the vertex $69^{\circ} 55' \frac{1}{2}$.

82. In the year 1654, on 16 March, Venus was expected in the western azimuth of degrees $80'$; she was seen distant from the vertex $1^{\circ} 50' \frac{2}{3}$. Thereafter, after minute $19' 52''$, Regulus, more easterly, was distant from the vertex $53^{\circ} 59'$.

83. In the year 1654, on 5 April, Venus, in the evening in the western azimuth of degrees $95'$, was seen distant from the vertex $61^{\circ} 55'$; and after minute $13' 56''$, Venus was seen distant from the vertex $65^{\circ} 14'$.

84. In the year 1654, on 9 August in the morning, Aldebaran was distant from the vertex (more easterly) $46^{\circ} 22'$, while Venus was distant from the vertex $63^{\circ} 40'$ in the northeastern azimuth — the degrees precisely 85.

85. In the year 1654, on 24 August at the hour nearest the Italian 9, Venus was distant from the following shoulder of Orion at the vertex of her rising $62^{\circ} 54'$; she was seen distant from the vertex $73^{\circ} 14'$. Regulus, however, was [distant] $47^{\circ} 19'$, and soon afterward from Aldebaran $45^{\circ} 47'$.

86. In the year 1655, on 6 July in the evening, Venus was seen distant from the vertex $76^{\circ} 39'$ in the western azimuth of degrees 100; and inasmuch as her industry had been expected, thence from her she was distant from the vertex $64^{\circ} 33'$.

87. In the same year, on 10 July in the evening, the distance was seen [to be] from the vertex 79'; precisely in azimuth, item degrees 100, thence counted off 10' of time-minutes, Spica was distant from the vertex (more westerly) 66.

88. In the same year, on 6 August in the evening, Venus was expected at the western azimuth of degrees 80'; she was seen distant from it [the vertex] 77° 53'; thence after time 7' 45". Arcturus, more westerly, was distant from the vertex 42° 54'.

89. In the year 1656, on 8 January in the morning, Venus was seen distant from the vertex of degrees 74'; and distant from Spica 47° 35'; soon also Ophiuchus, distant from the vertex 32° 48'; and immediately the middle on the forehead of Scorpio was seen distant from the vertex 72° 34'.

90. In the same year, on 10 February in the evening, Venus was seen distant from the vertex 72° 36' in that azimuth, in which the center of the Sun was afterwards seen distant from the vertex 66° 18'. But before, after one hour and 24', when the observation of Venus had been taken, the distance of the Sun was 82° 44'.

91. In the year 1657, on 18 March in the evening, the distance of Venus was seen [to be] from the vertex 57° 27' $\frac{2}{3}$; and after minute 4' 18", Aldebaran was distant from the vertex 41° 3' $\frac{1}{2}$. When, however, Aldebaran reached the vertical plane, in which Venus had been observed, the distance of Venus from the vertex was 58° 17'.

92. In the year 1657, on 9 June in the evening, Venus was seen distant from the vertex 64° 50'; and from Regulus 33° 43' $\frac{2}{3}$. Then Venus was seen distant from the vertex 76° 20'; and from the head of Castor 10° 39' $\frac{1}{4}$; and then Regulus was distant from the vertex at the setting [point] 59° 10'.

93. In the same year, on 13 June in the evening, Venus was seen distant from the vertex 77° 48'; and from Regulus 33° 23'; afterwards she was seen distant from the vertex 80'; and from the head of Pollux 6° 58' $\frac{1}{3}$; and immediately Regulus was distant from the vertex 66° 6'.

Observations of the Most Illustrious Marchese Cornelio Malvasia, made at Modena, and set forth in his own Ephemerides, fol. 217.

In the year 1662, on 31 May, Venus was observed distant from the Sun 39° 25' (or by another computation 39° 3'); but on the computed parallaxes and Cassinian refractions it came to 39° 34', while Lansberg's computation gave 38° 48' — a difference of minutes 46.

<i>Anno</i> 1662 [Year 1662]	<i>Dist</i> <i>antia</i> □ [Dist ance of Venu s]			<i>Locus</i> □ [Plac e of Venu s]			<i>Lans</i> <i>b.</i> [Lans berg]
<i>ante</i> <i>ort.</i> ☉ [befo re sunri se]	<i>Corr.</i> [Corr ectio n]	G.	I		G.	I	G. I
Sept. H. 0 50 19	from Regul us	3	16	Lo. □	21	54	21 54
	from the Mane of □	8	48	La. B.	0	32	0 34
22 H. 2 5	from Regul us	1	34	Lo. □	22	51	21 55
	from the Mane of □	8	13	La. B.	0	44	0 43
Nov. H. 0 41	from Spica □	9	43	Lo. □	26	6	26 1
12	from Arctu rus	30	45	La. B.	1	36	1 16
26 H. 14 10 <i>ab</i>	from Spica □	26	44	Lo. □	15	35	15 31

	<i>Dist</i>		<i>Locus</i>	
	<i>ntia</i> □		□	
<i>Anno</i>	[Dist		[Plac	<i>Lans</i>
<i>1662</i>	ance		e of	<i>b.</i>
[Year	Venu		Venu	[Lans
<i>1662]</i>	s]		s]	berg]

occ.

⊙

[from
sunse
t]

from 38 44 La. 1 9 16
Arctu
rus

Parsing notes: Columns give the comparison-star correction in degrees/minutes (Corr., G., I), Venus's place in longitude/latitude (Locus, G., I), and Lansberg's corresponding value (Lansb., G., I). "Lo." = longitude in the named sign; "La. B." = northern latitude. The hour-headings ("H. 0 50", "H. 2 5", etc.) give the time before sunrise or after sunset.

CAPUT IX

Of the Hypothesis of the Motions of Venus.

1. Here I suppose, or recommend to the reader for perusal, what I have explained at length concerning the various astronomers' hypotheses about the motion of Venus and of Mercury, in Book 7 of the *Almagestum Novum*. Many things, too, here in Book 5, on the occasion of Saturn, applicable to these inferior planets as well: see cap. 9 about the 20 modes of observing the places of the planets; cap. 12 about the Geometrical Hypothesis, rather than the loci of the planets; about a cone and about reconciling the diurnal motions with the planet's own proper motion in a fluid heaven. As to what motion of the Earth does not agree — as I show at the end of Book 1 — it is better, I say, that this be done through eccentrics and epicycles, or through a single ellipse, so long as it comes nearest the truth. The rest, if there be any, I indicate here more briefly.

2. From what was said in Book 1 about the Sun's parallax (far less than Tycho posited), it is clear what Longomontanus put in Book 2 of his *Theorica*, cap. 17, about the parallax of Venus and of Mercury: a comment on the restitution of the

Sun's parallax by Tycho, which needs some line of his own. It is to be excused, moreover, on this account, that on account of the obliquity of the sphere in the Danish horizon it was not permitted to continue the observations of Venus at her greatest elongation from the Sun, the twilight impeding; and therefore, besides 9 Tychonic observations of Venus, six others — cap. 19 — at her greatest digressions.

[Margin: Kepler's truthful fear about the motion of Venus.]

Kepler's ingenuity in the foundation of his Ephemerides — pages 14 and 15 — confesses that error can be feared in the Rudolphine [Tables] computed for Venus, never differing from the heavens beyond 15 minutes. He exhibits, moreover, a specimen of them on an assumed example: in the year 1574, on day 16 September, in the morning at hour 4, he saw Regulus occulted by Venus; then, however, the Rudolphine [Tables] exhibit the Heart of Leo in Leo $23^{\circ} 54' 39''$, with northern latitude $0^{\circ} 26'$. But Venus [was] in Leo $23^{\circ} 55'$, with northern latitude $0^{\circ} 25'$.

Lansberg's Tables, however, cannot be trusted so far in this star, as is clear from eleven [observations] which I bring forth from the Thesaurus from his own observations — for not everywhere does he treat it faithfully enough. Be there an example in this conjunction of Venus with Regulus, of which we spoke a little before from Mästlin's observation; for Lansberg, on page 173 of his Thesaurus, gives Venus then in Leo $24^{\circ} 9' 3''$, with northern latitude $0^{\circ} 27'$. He does not doubt to place Regulus then beyond Venus, namely from the Sun's place $14'$, with latitude $5'$, and to locate it in Leo $24^{\circ} 7'$, with northern latitude $31'$. This, therefore, having been dismissed to the Bullialdine [computation], with Lubentius reading...

[Margin: Lansberg's errors are to be feared.]

5. Bullialdus, indeed, in Book 9 of his *Astronomia Philolaica*, accustomed to weigh more deeply many observations faithfully on this matter, acknowledges indeed that the mean motion of Venus in the Rudolphine [Tables] is to be advanced, but not the aphelion to be drawn back, as they draw it back. He warns, moreover, the prudent that the conjunctions of Venus with other stars observed with the naked eye are not to be understood so precisely, because Venus, by the very great explanation of the rays, conceals that interval which the exiguous interval of the Sun's place and of the neighboring stars contains in reality. Malvasia nonetheless uses Bullialdus' [computation], as if from the false parallax of the Sun, even up to $3' 4''$ in a minute he is in error.

[Margin: Lansberg in error.]

6. We, in order that we might also at the expense of the Tables monitor the other planets with more observations, have made very many for the most part: the conjunctions of Venus with the fixed stars, or with the other planets; and indeed more than those places of Venus, which Tycho or Longomontanus deduced from the Sun in her greatest digressions — from the false parallax of the Sun, and of Venus, and the obliquity of the ecliptic — whence they differ from the Tables by 6 or 8 minutes thereabouts. We here send ahead some specimen of our Tables.

1. In the year 1494, on day 18 September at hour 17 after midday, at Nuremberg, Bernhard Walther [Bernardus Vualtherus] saw Venus more westerly than Regulus by 10 minutes. Lansberg extorts this observation from his own Tables — he does not doubt to place Regulus then in Leo $23^{\circ} 19'$, that is $34'$ beyond what is owed, collecting [it]; and the place \square from his Tables in Leo $23^{\circ} 20'$. But Regulus was in reality in Leo $22^{\circ} 44' 35''$. Venus, moreover, from our Tables in Leo $22^{\circ} 45'$. I reckon that on account of Venus's great latitude, she was seen by Walther more westerly than Regulus.

[Margin: Lansberg in pain.]

2. In the year 1574 — as Kepler relates in his *Astronomia Optica*, page 305 — Mästlin [Mæstlinus], on day 15 September at hour 16 after midday, saw Regulus covered by Venus. Regulus was for me in Leo $23^{\circ} 52' 8''$, with northern latitude $26^{\circ} 10'$. Venus, moreover, in Leo $23^{\circ} 53' 30''$, with northern latitude $26^{\circ} 25''$. There is therefore no need of the added expansion of the rays, by which with the naked eye Venus is wont to appear about Venus [*sic*] more than it had covered Regulus.

3. In the year 1590, in the same [year], with Kepler as witness, on day 3 October, in the old style, in the morning at hour 3 after midnight, Mästlin saw Mars covered by Venus, candid with light. To me from his Tables Mars proceeds in Virgo $15^{\circ} 33' 7''$. Venus in Virgo at hour $15^{\circ} 32' 10''$, with the same nearly latitude; therefore Venus, with rays altogether expanded, strikes Mars.

4. In the year 1598, on 15 September, old style, in the morning at hour 3, Kepler saw Venus scarcely risen, covering Regulus, namely at Graz [Gratij]. For Regulus was for me then in Leo $24^{\circ} 12' 24''$. Venus, moreover, in Leo $24^{\circ} 18' 30''$. But by the neighboring radii of the horizon she expanded more amply, and could be seen the more obscure Regulus.

5. In the year 1632, on 31 July, Gassendi at Paris and Hortensius at Amsterdam in the morning before dawn observed the conjunction nearest to Venus of Venus and Mercury; but Gassendi conferred it on a time a little before hour 4 after midnight; Hortensius, however, on hour $11 \frac{1}{3}$ after midday of day 30. Did then

Mercury appear more easterly than Venus by minutes 3' 30"? The Prutenic [Tables] erred so far, that with the conjunction altogether on these days they anticipated by five days; and Longomontanus, who imitates the Prutenic in this slightly corrected, is inexact: he has day 30 July; in these the hour 11 ½ in □ at degree 24° 40' with northern latitude 34'. Mercury...

Mercury, moreover, in □ degree 27° 33' with latitude degree 1° 24'. Lansberg, moreover, [places] Venus in □ degree 24° 24' 42", with northern latitude 34' 43"; and Mercury in □ degree 24° 30' 4", with latitude 39' 5". We collect Venus in □ degree 24° 22' 15", and Mercury in □ degree 24° 36' 40".

6. In the year 1633, on 26 May, Bullialdus at Paris at hour 9 after midday saw through the tube [telescope] Venus more westerly than the bright star of Pollux's left shoulder by 18' ½ — which for me was then in □ degree 18° 33'. Venus therefore was seen at her nearest in □ degree 18° 14' 30"; from the Tables, however, she was in degree 18° 18'.

Arithmetica Hypothesis [Arithmetical Hypothesis]

Medius

motus

[Mean

motion]

	Sig. G.	I.	II.	III.	IV.	V.
□ <i>ab</i>	0	1	36	7	49	17 28

Æquino

ctio

[from

the

Equino

x]

Diurnus

[Diurna

l]

<i>Annuus</i>	7	14	47	34	51	15 34
---------------	---	----	----	----	----	-------

[Annua

l]

<i>Apogei</i>	0	0	0	0	8	19 52
---------------	---	---	---	---	---	-------

[Of the

apogee]

Diurnus

<i>Medius motus</i> [Mean motion]	Sig. G.	I.	II.	III.	IV.	V.
<i>Annuus</i>	0	0	0	50	40	50 36
<i>Nodi Ω</i> [Of the node]	0	0	0	0	4	57 19
<i>Diurnus</i>						
<i>Annuus</i>	0	0	0	30	8	37 30

Parsing notes: Sexagesimal columns Sig. (signs), G. (degrees), I–V (successive sexagesimal sub-orders, minutes through fifths). The diurnal/annual pairs are stacked under each heading (mean motion of Venus from the equinox, of the apogee, of the node).

Epoch for the beginning of the Common Era of Christ, at the noon of the preceding final December, and in the Bologna Meridian.

<i>Anno 1. Christi</i> [Year 1 of Christ]	Sig.	G.	I	II
□ <i>Medius</i> <i>loc. ab</i> □ [Mean place from Aries]	1	2	7	17
<i>Apogei</i> <i>motus</i> [Motion of the apogee]	9	12	50	43
<i>Nodi Bor.</i> <i>motus</i> [Motion of the northern node]	2	0	43	15

Pro Geometrica Hypothesi [For the Geometrical Hypothesis]

See what is said here in Book V, especially toward the end of Cap. XII. Meanwhile, in choosing the ellipse — whose periphery's trace most nearly designates the proper cone of the planet's motion made about its axis, by others by other spirals — measure the trace [vestigia], or other spirals, but turned Westward; let the measures written below be chosen in parts, of which the Radius of the Annual Orb of the Sun is 100000; and its bisected eccentricity 1740.

SiR. *ad Orbis*
Annu ☉ est [If
the Radius of
the Sun's
Annual Orb is]
100000.

Talium [Of
such parts]

Semidiameter
minor Ellipsis
Veneris est
[The minor
semidiameter
of Venus's
ellipse is]

72396 $\frac{2}{5}$

Semidiameter
maior Ellipsis
Veneris est
[The major
semidiameter
of Venus's
ellipse is]

72398

Semissis
Excentricitatis
à Sole [Half the
eccentricity
from the Sun]

794

Distantia
[Distance]

SiR. *ad Orbis*
Annu ☉ *est* [If
the Radius of
the Sun's
Annual Orb is]
100000.

Sole Apogeo & ☐ — Aphelia — from the Sun			72973
— from the Earth			174713
— Perihel. — from the Sun			71823
— from the Earth			30136
Sole Perigeo & ☐ — Aphel. — from the Sun			72973
— from the Earth			171233
— Perihel. — from the Sun			71823
— from the Earth			26656
Maxima	Gr.	I	II
Digressio à			
vero loco ☉			
[Greatest digression from the true place of the Sun]			
Sole Apogeo & ☐ — Aphelia	45	48	10
— Perihelia	44	52	50
Sole Perigeo &	47	59	10

SiR. *ad Orbis*
Annu ☉ *est* [If
the Radius of
the Sun's
Annual Orb is]
100000.

☐ — Aphelia			
— Perihelia	47	0	35
Latitudinum variatio	Gr.	I	II
[Variation of the latitudes]			
Sole Apogeo & ☐ — Aphelia in ☐ — Matutina [Morning]	8	34	15
— Vespertina [Evening]	1	24	30
— Perihel. directa in ☐ Retrogr. — Vespertina	1	24	6
— Matutina	8	8	50
Sole Perigeo ☐ — Aphelia in ☐ — Mat-Retr.	9	47	40
— Vespertina	1	26	15
— Perihelia in ☐ — Vesp. Dire.	1	25	40
— Matutina	9	15	30
Inclinatio Orbitæ ad Eclipticam	3	22	50
[Inclination of the orbit to the ecliptic]			

The remaining distances from the Sun: see in the 2nd Volume, Table 97.

LIBER NONVS — BOOK NINE

BOOK NINE, CONTAINING THE OBSERVATIONS OF THE PLANET MERCURY AND THE HYPOTHESIS OF ITS MOTIONS

CAPVT I — CHAPTER 1

Ancient Observations of Mercury, from the year 265 before Christ
down to the year 807 of Christ

There is no planet whose motion gives the astronomer more trouble than Mercury — partly because of the scarcity of careful observations, and partly because Mercury, even at its greatest elongations, nonetheless stays so close to the Sun that it appears only at dawn or twilight, after the Sun has set, and only then if it is not obscured by the vapors of the horizon, or close to them. Hence, as Ptolemy says (*Almagest* IX.7, on which point see also IX.9), we have received few observations of this kind, and those can be obtained only rarely.

[Margin: The difficulties of observing Mercury]

Copernicus too (*De Revolutionibus* V.30) prefaces the same difficulty in this way: "Those who have shown us the path of this star's course did indeed examine it before us, yet they have not, like the breezes [winds?], carried it off — as the Nile is borne along, so they say." We do not deny that nature herself is at fault here, or that the very tranquility of the air, and moreover the great obliquity of the sphere where the inhabitants dwell, makes Mercury rarely visible. For at its greatest distance from the Sun it rises in Aries and Pisces, or it sets in Virgo and Libra; and it represents itself in some manner in Cancer or Gemini — but those twilights, whether of night only or, when the twilight is brighter, when the Sun has not yet withdrawn into the lower part of the heaven — for many of these reasons it is wrapped in ambiguities and is scrutinized with no slight labor and toil. Hence Ptolemy and Walther were compelled to such a course of dealing.

For this reason Longomontanus too was compelled to it (*Astronomia Danica* II, *Theorica*, ch. 18) on account of the obliquity of the sphere; he confesses indeed

that in Denmark, because of the season, scarcely ever can a continuous observation of the elongations of Venus and Mercury from the Sun be carried through during the summer twilights. And in ch. 20 he adds: "Let us put our last hand to Mercury, whose slipperiness has thus far given the astronomers of our age no less trouble than the terrestrial Mercury [quicksilver] gives the alchemists, who have pursued it rather by traces and suspicions of the ancients than by truly observing the heavens, and who have been bound up in their ignorance." And although it is a cause for amazement that there is a discrepancy among the Alphonsine and Copernican calculations of as much as 7 degrees — yet this could not be avoided even from the tables of certain more recent men. Nonetheless I have judged it worth the effort to set out in order the observations, such as they have been handed down to us by the men of old.

In the year 484 of Nabonassar, on the 18th day of the month Thoth following — that is, on the 19th day [of our reckoning], in the year of Ptolemy Philadelphus 21 — Mercury was observed to be distant from the front of Scorpius by one whole [degree], by a line drawn toward the Boreal [northern] front of Scorpius; and it was distant from the same line toward the north by two Moon-diameters from the Boreal front of Scorpius. But on the 26th of Scorpius it was distant from the aforesaid line by a hand's-breadth $\frac{1}{2}$ [semis] of an hour [?], in succession — whence Ptolemy (*Almagest* IX.10) concludes that Mercury was on the 19th day at its greatest elongation from the Sun. This was the year 265 before Christ, in which year Longomontanus (II, *Theorica* ch. 2) places it. On the 14th of November, at the 17th hour after midday, at Hafnia [Copenhagen], the Boreal front of Scorpius was [observed] in degree $1^{\circ}36'$ of Scorpius, of latitude $1^{\circ}16'$; the other star [was] in the place of Scorpius $2^{\circ}35'$, of Boreal latitude $2^{\circ}20'$. Lansberg, moreover, in his *Thesaurus*, observed Mercury's place in observation 1 of Mercury [observatio 1. Mercurij]; he says the most boreal of Scorpius was in Scorpius degree $1^{\circ}46'$, of latitude $1^{\circ}15'$. And from this observation it had belonged to Hipparchus that it was in Scorpius $2^{\circ}46'$ of Boreal latitude $2^{\circ}13'$. But from his own tables it was in degree $2^{\circ}47'$. Boulliau, finally, (X.9) says that in that year before Christ 265, at hour $16^{\circ}30'$, Uraniburg said the Boreal front of Scorpius was in Scorpius degree $1^{\circ}13\frac{2}{3}$, of Boreal latitude $1^{\circ}5'$; the middle, moreover, of the front of Scorpius in degree $0^{\circ}36\frac{2}{3}$ and of latitude $1^{\circ}54'$; therefore Mercury was in Scorpius degree $1^{\circ}57\frac{1}{3}$; from his tables, in degree $2^{\circ}6'$. To me the year was 265 before Christ, and the day the 14th of November.

In the year of Nabonassar 486, on the 17th day, Choeac following [?], 18 — that is, in the year 23 of Dionysius [Ptolemy II], in the morning of the 29th of Aquarius — Mercury was distant from the most brilliant tail of Capricorn toward the north by

three Moon-diameters; whence Ptolemy (*Almagest* IX.7) gathers that Mercury was in Capricorn $20^{\circ}0'$ and at its greatest elongation from the middle place of the Sun, $25^{\circ}50'$. This was the year 262 before Christ, the 11th day of February.

In the same year 486 of Nabonassar, on the 30th of Payni — that is, in the year 24 of Dionysius — on the 18th of Leon, in the evening, Hipparchus observing, Mercury preceded the Spica by a little more than three degrees. Hence Ptolemy (*Almagest* IX.7) gathers that Mercury was in Virgo $19^{\circ}30'$; but Lansberg observed it in Virgo $21^{\circ}26'$; and from his tables he places Spica in Virgo $22^{\circ}26'$, and Mercury in degree $19^{\circ}11'$. This was the year 262 before Christ, the 23rd day of August.

In the same year of Nabonassar, on the 30th of Pharmuthi, on the 5th of Dionysius following, Mercury was observed in the evening by Hipparchus; it was seen in succession to be distant by three Moon-diameters from the line of the horns of Taurus. Whence Ptolemy (*Almagest* IX.7) gathers that Mercury was in Taurus $23^{\circ}40'$, with a greatest elongation from the middle place of the Sun of $24^{\circ}10'$. This was the year 262 before Christ, the 24th day of May.

In the year 491 of Nabonassar, on the 5th of Pharmuthi, on the 28th of Dionysius — in the evening, Mercury [was observed] on a straight line and most directly toward the head of Gemini. Hence Ptolemy (*Almagest* IX.7) gathers that Mercury was in Gemini $2^{\circ}50'$, and at its greatest elongation from the middle of the Sun of $26^{\circ}30'$. This was the year 217 before Christ, the 28th day of May.

In the year 512 of Nabonassar, on the 9th of Thoth following — that is, on the 14th day of the month Dius — in the morning Mercury appeared higher by half a cubit [semibrachium] than the fixed star which is at the southern extreme of the scissors of Libra. Accordingly Ptolemy (*Almagest* IX.7) gathers that Mercury was in Libra $14^{\circ}10'$ and at its greatest elongation from the middle place of the Sun of 21° . This was the year 237 before Christ, the 30th day of October.

In the year 564 of Nabonassar, on the 27th of Thoth following — that is, on the 28th of the second Chaldaean [reckoning] — in the morning Mercury was higher by half a cubit [semibrachium] than the Boreal front of Scorpius; this was observed by Apelles. Hence Ptolemy (*Almagest* IX.7) gathers that Mercury was in Scorpius $2^{\circ}20'$, of which the greatest elongation from the middle of the Sun was $22^{\circ}30'$. This was the year 185 before Christ, the 3rd day of November.

In the year of the Emperor Hadrian 14, on the 18th of Messori following, Theon observed Mercury at its westernmost, distant in advance from the Heart of Leo [Regulus] by $3^{\circ}50'$. Hence Ptolemy (*Almagest* IX.10) says that it was in Leo $6^{\circ}20'$, very near; and the greatest elongation from the middle motion of the Sun was

16°15'. Copernicus (*De Revolutionibus* V.27) says it was in Leo 6°15'; but he adds that Theon was at Smyrna; and the day was the illustrious 4th of July, at the 6th hour after midday. At Uraniburg, the Heart of Leo was in Leo degree 28°35'; therefore Mercury was in Leo 7°18', with a greatest elongation of 26°59'; but in truth, because the place of the Sun by Boulliau's tables was in Cancer 10°19'32", the true elongation was in Cancer degree 4°[?]. This was the 4th of July.

In the year of Hadrian 16, on the 16th of Phamenoth, at the 5th hour 30' after midday, Mercury was seen at its greatest elongation from the middle motion of the Sun, and from comparison with the splendid Hyades it was found to be in the first degree of Pisces, distant from the middle motion of the Sun by degree 21°15'. By Ptolemy (*Almagest* IX.7). This was — as Boulliau correctly notes (X.9) — the year of Christ 132, the 2nd of February, at hour 2°40' after midday. At Uraniburg, and at that time, the eye of Taurus was in Taurus degree 12°17'. But by Boulliau, the eye of Taurus [was] in Taurus 13°25'½; therefore Mercury [was] in Pisces in degree 2°8½; and the greatest elongation from the true place of the Sun was 19°19'51".

In the year of Hadrian 18, on the 18th of Epiphi, on the 19th [of our reckoning], Mercury [was at] its greatest elongation; it was seen very faint, and with a small light through comparison with the splendid Hyades, in Taurus degree 18°45'; and it was distant from the middle of the Sun by degree 21°15'. By Ptolemy (*Almagest* IX.7). This was the year of Christ 134, the 3rd day of June.

In the year of Hadrian 19, on the 14th of Athyr following, on the 15th [of our reckoning], in the morning Ptolemy saw Mercury at its distance from the Heart of Leo, in Virgo degree 20°12'; and most greatly distant from the middle of the Sun by degree 19°3'. By Ptolemy (*Almagest* IX.6, on which point see VIII, and *De Revolutionibus* V.26). This was the year of Christ 134, the 2nd of October.

In the year of Antoninus 19, on the 14th of Pachon, in the evening, Mercury [was] at its greatest elongation from the middle motion of the Sun, by degree 23°15'; it was observed by Ptolemy in Taurus 1°20' per its distance from Aldebaran. By Ptolemy (*Almagest* IX.8, *De Revolutionibus* V.26). This was the year of Christ 135, the 15th day of April.

In the year of the Emperor Antoninus 1 [first], at the Epiphi 20, on the 21st [of our reckoning], in the evening, Ptolemy by means of the astrolabe observed Mercury in Cancer degree 7, distant most greatly from the middle motion of the Sun by degree 26°5'. By Ptolemy (*Almagest* IX.7, *De Revolutionibus* V.26); on which point

see what years of Christ they are: 135. By Ptolemy (*Almagest* IX.7, *De Revolutionibus* V.26).

In the year of Antoninus 2, on the 23rd of Messori following, on the 24th [of our reckoning], in the morning, Ptolemy observed Mercury by means of Aldebaran, in Gemini degree $20^{\circ}5'$; and most greatly distant from the middle of the Sun by degree $20^{\circ}15'$. By Ptolemy (*Almagest* IX.9, *De Revolutionibus* V.27); on which point he adds that it was the year of Christ 139, the 21st of Messori. By Boulliau (X.9), he reckons in that year of Christ 139, on the 12th day, in [Messori? — middle of the night?], hour 7, $1^{\circ}5'$; at Uraniburg, in the observation 5, Mercury was in the place of Aldebaran; he gathers Mercury was in Gemini $21^{\circ}16'$; and most greatly distant from the place of the Sun existing in Cancer $13^{\circ}21'42''$. With Ptolemy he notes the same date thus: Messori, [in margin or note: the τὸ τικδ? hoc est ?], this is, [of the Messori? 24], or proceeding from the 23rd to the 24th. Now in truth, by our chronology reformed, the year was 886 of Nabonassar, of which the first day Thoth falls on the 10th of July; whence inclusively numbered up to the 23rd day, Messori falls on these 23 days of July, and these 24 in 8 July [?].

In the year again of Antoninus, at the Epiphi 2, on the 3rd [of our reckoning], in the evening, Ptolemy at an equal hour before midnight $4^{\circ}30'$, observed Mercury by means of the astrolabe, with a greatest elongation in Gemini, by degree $17^{\circ}30'$, per the comparison with the centre of the Moon situated in degree $1^{\circ}10'$. By Ptolemy (*Almagest* IX.10, on which point see VIII, and *De Revolutionibus* V.26 [?]). And Lansberg too in his *Thesaurus*, observation 3: Mercury per the place of the Moon gathers that it was in Gemini degree $17^{\circ}42'$. By Boulliau (X.9) he says in that year of Christ 139, the 11th of May, at hour 17 after midday; at Uraniburg (VI.9) gathers Mercury per the prior observation to have been in Gemini degree $18^{\circ}35'$ distant; but in truth, from the place of the Sun in degree $24^{\circ}8'37''$; but Lunar observation in truth was in Gemini degree $19^{\circ}2'$ distant; from the true place of the Sun in degree $24^{\circ}56'$; and Boulliau refutes Ptolemy, [saying it was] falsely distant from the Heart of Leo. The year was 139 of Christ, and the day was the 11th [of] May 17 [?].

In the year again of Antoninus 4, on the Phamenoth 18, on the 19th [of our reckoning], in the morning, Ptolemy observed Mercury from Antares in Capricorn $13^{\circ}10'$, in a greatest elongation from the middle motion of the Sun, by degree $26^{\circ}30'$. By Ptolemy (*Almagest* IX.7, *De Revolutionibus* V.26), adding that it was the year of Christ 141, completed 140, and besides those 67 and a scruple of almost 12; and so he adds that it was the year of Christ 141, the day Martii [March] 8. By Boulliau (X.9), in that year 141, the day the 7th of February —

incident in February 11, on the 16th of [February?]; and so Mercury was in Capricorn degree $14^{\circ}43'53''$, distant most greatly by degree $28^{\circ}18'54''$; from the true place of the Sun existing in Aquarius degree $13^{\circ}0'27''$. There remains a true elongation; the year 141, the 7th of February.

— with a false latitude, yet Ptolemaic, by degree $2^{\circ}9'$. Thus Kepler too there, in the end of his *Dissertationes* with the *Nuncius Sidereus*, sets it out from Thesis 98. Samuel Hafenreffer, Aimoinus the monk [Aimoinus Monachus], and an anonymous author of the Sabellican Franks [annals], likewise Eginhard, Vincentius, the Lycosthenes, the Polydorians, Volaterranus, Beda, and others bear witness that that spot persevered under the Sun for seven days, or — as Beda has it, or as most have it — for [several] days; and in truth see here also the Lycosthenes who have the year 808. See here whoever wishes to answer Kepler from the theses of Samuel. But Scaliger had earlier subscribed to this from the spots [maculis] of the Sun to Kepler; and Galileo, on the solar spots, and Gassendi in the *Epicurum* (page 898) say that it was from the larger spots of the Sun, adding that Kepler, after the spots restored in the Sun, detected the error, and for [eight times? — octies] he restored the size to the ancients eight days. But to me it can in no way seem that Mercury could not be seen through this telescope; yet it could not be seen with a similar telescope through any other, [though] Mercury under the Sun in 1607, on the 28th of May, was able to be seen — which I indicate in its own singular phenomenon. Whatever may be the case, Mercury seen under the Sun, if it had been seen before by others, who refer to exercise 72, against Cardanus and Scaliger — to whom the Coimbrans wrongly attribute the same observation, *De Caelo* IV.4, art. 2, and Scheiner subscribed to the same observation under the disc of the Sun. Furthermore Scheiner in the *Rosa Ursina* (page 412) teaches that Mercury 4 hours only could be seen under the disc of the Sun, since the spots can be busy under it for many days.

CAPVT II — CHAPTER 2

Observations of Mercury made by Bernhard Walther of Nuremberg

Besides the observations made by ocular estimation, certain others made by means of armillaries are liable to error, by no less than 10 minutes — as was said of Walther's observations of Saturn, number 33. Next, let it likewise be valid here too of the things which Walther himself noted concerning refractions in [the case of] Venus.

In the year 1481, on the 22nd of October, nearly one hour before sunrise, Walther saw Saturn and Mercury in the same place of the heaven, Mercury [being] more

easterly, but more southerly by a little more than a Lunar diameter; the eastern, moreover, in degree 28 of Aries, and the 3rd of November more easterly in degree 12°26' of Scorpius; but the conjunction of Mercury with Saturn was on the 21st of October, exorbitant from the tables themselves.

In the year 1482, on the 11th of October, a little before sunrise, Mercury was seen in nearly the same longitude as the Moon, but a little more southerly than a Lunar diameter. On the day the 25th of October it disappeared with the clearest sky.

In the year 1484, on the 16th of January — immediately, since Mercury was in contact with the horizon, Walther applied the hanging weight to his clock so that it returned from noon to noon; and it had on the hour-ring [zona horaria] 56 teeth [denticulos], which once it had revolved, and moreover 36 teeth [denticuli]; when the center of the Sun appeared in the horizon — wherefore Mercury apparently rose before the Sun by hour 1°37'; which nearly agreed with Walther's calculus.

In the year 1488, on the 16th of January, at the 5th hour 30' after midday, Mercury was seen distant from Jupiter by a ray [radius] of degree 1°42', and westerly from both limbs of the Moon; and the Planet [was in] degree 1°24'; but Mercury was more boreal than Jupiter. On the following day Mercury [was] more easterly and more boreal in degree 2°22'. But there is an error in the number of the day, of 16'.

In the year 1491, on the 18th of August, Walther rectified his armillaries by means of Aldebaran, nearly one hour before sunrise; he found Mercury in degree 23°10' of Leo. On the day the 30th of August, at the same hour in degree 27°10', and on the day the same hour in degree 28°3' of Leo, with Boreal latitude 53'; which latter observation he prefers to the earlier ones on account of his better-rectified instruments.

In the year again 1491, on the 2nd of September — by armillaries rectified again through Aldebaran, I found Mercury in the first degree, 13' of Virgo, one hour before sunrise: latitude north, I found in degree 1°15', the heaven [being] most serene, all the other things being most diligently observed, the position of the instruments [being] certain — confide in this one.

In the year 1491, on the 3rd of September, one hour before sunrise, by armillaries, as above, rectifying, he found Mercury in Virgo degree 3°51'; but he adds: "Diligently observe — true latitude north 1°20', only changed by that, makes a doubt about it for me. Nonetheless Lansberg in the *Thesaurus*, choosing this,

says Aldebaran was in Gemini degree $2^{\circ}12'$; therefore Mercury [was] in Virgo degree $3^{\circ}42'$; but from his tables [in] degree $3^{\circ}38''$ — with Boreal latitude $1^{\circ}17'$.

In the year again 1491, on the 9th of September, at hour 5 p.m., he found Mercury in Virgo degree $1^{\circ}13'$, with Boreal latitude. Mark, says Walther, what a great difference there is from the tables: Mercury appeared very thin, and far beyond doubt around the term of the occultations. Consider also the refraction of the rays, that is, the modicum [small amount] of refraction from the horizon, [when] on the 11th day it appeared most feeble — so that there was not the most observable and clearest observation. Nonetheless, Copernicus, destitute of his own observations (V.30), chose this one, but at the observation of Mercury in Virgo degree $1^{\circ}30'$, [namely] when it has been so reckoned; it was distant from the middle place of the Sun by degree $13^{\circ}15'$, nearly.

In the year 1504, on the 9th of January, with mid-Heaven existing in degree 10 of Scorpio, by the Heart of Leo, Mercury was in Capricorn degree $3^{\circ}15'$, with Boreal latitude $45'$; he adds [it was] most diligently observed; but Copernicus (V.30) [says] on the day the 6th hour $30'$ after mid-night, observed by Johann Schöner too, Mercury [was] in Capricorn degree $3^{\circ}20'$, with latitude $45'$; and it was distant from the middle place of the Sun by degree $23^{\circ}42'$.

In the year 1504, on the 11th of March, he rectified [the armillaries] toward the Sun, by armillaries; Mercury was observed clear and of notable size, in Aries degree $17^{\circ}30'$, with Boreal latitude $1^{\circ}51'$, [the Sun] being in mid-Heaven in degree 18 of Cancer.

In the year 1504, on the 17th of March after midday, by means of Aldebaran in Gemini degree $2^{\circ}45'$, Walther found Mercury in Aries degree $26^{\circ}30'$, with latitude north $3'$, [the Sun] being in mid-Heaven in degree 25 of Capricorn. But Schöner, as Copernicus refers (V.30), [says it was] mediating mid-Heaven in Cancer degree 25, that is, in hour $7^{\circ}30'$ [after midday], saw Mercury in Aries degree $26^{\circ}6'$, with latitude north $3'$; and so [it was] distant from the middle place of the Sun by degree $21^{\circ}17'$.

In the year 1504, on the 18th of March after midday, by mediating mid-Heaven in Cancer degree 25 positioned, Aldebaran in Gemini degree $2^{\circ}45'$, he found Mercury in Aries degree $26^{\circ}30'$, with latitude north $3'$.

In the year 1504, on the 24th of March after midday, mediating mid-Heaven [in] degree 5 of Leo, Aldebaran positioned in degree $2^{\circ}45'$, Mercury was found in Taurus degree $0^{\circ}5'$, with latitude north $3^{\circ}30'$. From these observations Boulliau (X.9) gathers the greatest elongation of Mercury from the Sun to have been, on

the 18th of March at hour 18 at Nuremberg, of 7°15'; and since Aldebaran was in Gemini degree 2°50'2/3 and from the refractions Mercury [was] reckoned with the eye in Aries degree 26°29' in its orbit, but [reduced to] 35' in the Ecliptic; in truth the place of the Sun [was] in Aries degree 7°41'36".

CAPVT III — CHAPTER 3

Tychonic Observations of Mercury

Longomontanus (*Astronomia Danica* II, *Theorica* ch. 20) subjoins eight places of Mercury observed by Tycho at Uraniburg, with two others observed by himself at Hafnia [Copenhagen], with the supputation added from the Danish Tables for the days of the old style, and below, where the hours are after midday—

Liber IX — De Mercurio (Mercury), Caput III–IV

(Continuation of Caput III: "Mercury observations of Tycho." Pages 345–347 of the source, folios 345–347 =)

Table (top-left): Tychonic Mercury places, summary

This table summarizes ten observed Mercury places, giving the observed longitude (*Long. observ.*) by zodiacal sign and the supposed (calculated) longitude (*Long. supp.*), together with the observed latitude (*Latit. obs.*). The final column letter "B" marks a southern (*Borea/austrina*) latitude indicator as printed.

#	Ye ar [A nn .]	M on th [M en s.]	D.	H.	M.	Lo ng. ob se (Si gn)	Lo	Lo	Lo	Lo	La	La	[fl ag]
							G.	M.	G.	M.	G.	M.		G.	M.
1	15 85	No v.	14	19	0	♁	13	4	12	57	2	18	B
2	15	No	23	19	30	♁	25	3	24	58	1	25	

#	Ye ar [A nn .]	Mon th [M en s.]	D.	H.	M.	Lo ng. ob se rv. (Si gn)	Lo ng. ob rv. G.	Lo ng. ob rv. G.	Lo ng. ob rv. G.	Lo ng. ob rv. G.	La tit. ob s. G.	La tit. ob s. M.	[fl ag]
	85	v.				Sc or pi o							
3	15 86	Oc t.	24	19	10	□ Li br a	22	35	22	28	[n ot ob se rv ed — <i>nō ob ser v.</i>]		
4	15 86	Oc t.	28	18	3	□ Li br a	26	33	26	28	2	17	B
5	15 87	Ia nu .	9	4	50	□ Aq ua riu s	17	48	17	49	0	1	
6	15 90	M art .	6	6	30	□ Pis ce s	13	44	13	36	1	42	
7	15 92	Fe br.	3	5	40	□ Vi	12	20	12	0 [?]	0	47	

#	Year [Ann.]	Month [Mens.]	D.	H.	M.	Long. obs. (Sign)	Long. obs. G.	Long. obs. M.	Long. obs. G.	Long. obs. M.	Latitude obs. G.	Latitude obs. M.	Flags [fl ag]
8	1593	Ma	11	9	30	♏	23	16	23	4	2	0	
9	1607	Apr.	15	9	0	♊	21	5	21	12	1	40	
10	1610	Dec.	5	19	0	♐	2	42	2	35			[not observed]

Parsing notes: The zodiacal-sign glyphs in the "Long. observ." column are faint in this scan; readings ♏ (Scorpio), ♏ (Libra), ♏ (Aquarius), ♏ (Pisces), ♊ (Gemini), ♊ (Sagittarius) are my best resolutions. Rows 3 and 10 carry "nō observ." (not observed) in the latitude columns. Row 7's sign glyph and supposed-minutes value are uncertain.

[Boulliau], in Book X, chapter 7, concerning the first of the aforementioned observations — that of 14 November 1585, hour 19 — states that the true place of the Sun was Sagittarius 2°56'45", and accordingly that Mercury was distant from the Sun by 19°52'45". But from the Rudolphine tables [Mercury] is found to have been in Scorpio 13°7'45", the difference of the observation being 5°45".

[Tycho Brahe] himself, in his *Epistolae* (p. 56), records three of the observations transcribed below in Old Style, in hours after midday at Uraniborg:

Table: January 1587 — Mercury longitude and latitude (three reckonings each)

For each date, three derivations are given: *Observ.* (observed), by the *Alphonsine* tables [Alphons.], and by *Copernicus* [Copern.].

D.	H.	M.	Source	Long (Sign)	Mer cur. (Sign)	Long		Latit		[flag]
						. G.	. M.	G.	M.	
11	9	4	50 → 9 4 50	Obse rv.	□ Aqu ariu s	17		48	0	1
						18	29	0	24	B
						16	41	0	6	A
12	14	5	5 → 14 5 5	Obse rv.	□ Aqu ariu s	21		7	1	21
						23	3	1	29	B
						19	21	1	1	B
13	15	5	21 → 15 5	Obse rv.	□ Aqu	21		20	1	40

D.	H.	M.	Source	Long Mercur. (Sign)	Long . G.	Long . M.	Latit ude G.	Latit ude M.	[flag]
			21		ariu				
			Alph ons.		24	18	1	41	B
			Cope rn.		19	33	1	39	B

Parsing notes: The "D. H. M." columns give day, hour, minute. The sign-glyph is read ♒ (Aquarius) for all three; flags A/B in the final column reproduce the printed northern/southern (*austrina/borea*) latitude markers.

[Boulliau], Book X, chapter 7, makes use of the observation of the 9th, adding the true place of the Sun to be Capricorn 29°13'12"; and accordingly the distance of Mercury from it [is] 18°34'48". But from the [Rudolphine] tables he gathers Mercury's place to have been in Aquarius 17°35'12".

[Lansbergius — Philip van Lansberge] in his *Thesaurus* uses the observation of the 14th, but from the tables gathers Mercury's place in Aquarius 21°8'53", with a latitude of 1°31' — yet by the calculus of triangles, 1°21'.

In the year 1589 Mercury was observed by [Tycho Brahe] near its greatest elongation from the Sun, on the days of April 1, 2, 3, 4, 6 and 11. These observations, selected by his own calculation from a manuscript of Tycho's, were transmitted to me by Fr. Albert Curtius [Albertus Curtius] of our Society [S.J.], and are written below. To them is added the corrected time, examined at the following midday on account of the clock.

Table 14: Day 1 April, evening [Die 1. Apr. vesp.]

Columns: time (*H. M.*); distance of Mercury from Aldebaran [Distāt. ☿ ab Aldeb.] in G./M.; declination of Mercury, northern [Declinat. ☿ Borea] in G./M.; altitude of Mercury [Altit. ☿]; arc of the Lesser Dog setting / occidental [Canis min. oc. Alt.] in G./M.

H. M.	Dist. ☿ ab Alde b. G.	Dist. M.	Decl n. ☿ Bore a G.	Decl n. M.	Altit. ☿ G.	Altit. M.	Canis min. occid. G.	Canis min. M.
7 36 / 41 corr.	25	11¼	16	59½ / 17 1	9½		25	26
7 40½ / 45½	25	10	17	1½	8	50	26	32
7 45½ / 50	25	11	17	5 / 17 4½	8	20	17	40
7 48½ / 53 corr.	25	11			7	50	28	24

Parsing notes: Two clock-times are given per line (the first observed, the second a corrected reading, "corr."). Several declination cells carry two stacked values (e.g. 16°59½' over 17°1'); both are transcribed.

Table 15: Day 2 April, evening [Die 2. Apr. vesp.]

Same column scheme; arc-column heading here is *Cā. min. occid.* (Lesser Dog, occidental).

H. M.	Dist. ☿ ab Alde b. G.	Dist. M.	Decl natio ☿ G.	Decl n. M.	Altit. ☿ G.	Altit. M.	Cā. min. occid. G.	M.
7 51¾ / 7 56 corr.	25	10½	17	4½ / 4⅔			29	11
7 55½ / 8 0 corr.	25	10	17	4½ / 17 5	7	0	30	8

H. M.	Dist. ☿ ab Alde b. G.	Dist. M.	Decli natio ☿ G.	Decli n. M.	Altit. ☿ G.	Altit. M.	Cā. min. occid. G.	M.
7 59½ / 8 3½	25	9¼	17	4½ / 17 5½	6	35	32	4
8 3½ / 8 7½	25	8½	17	6 / 6½	6	0	32	0
8 8 / 8 11¾	25	8	17	6⅔ / 6⅔	5	30	33	5
8 12½ / 8 16 corr.	25	6¾	17	7½ / 7½	5	0	34	8
8 16½ / 8 19¾	25	6½	17	9¼ / 9¼	4	30	35	6
8 19½ / 8 23	25	5½	17	9¼ / 9¼			35	54
8 23½ 26 corr. / 8 27 30 corr.	25	5½ / 4½	17 [both /utro q;]	9½	3	40 / 10	36 / 37	42 / 42

Parsing notes: This table is tightly set with many stacked half-values; the final row carries the note "utroq;" (*utroque*, "by both [methods/instruments]"). The "26 corr." and "30 corr." are corrected-second annotations to the clock times. Several altitude cells are blank in the source.

For the examination of the armillaries [Pro Armillarum examine]:

At H. 8 32: Declination of Aldebaran [Declinatio Aldebaræ] — G. 15 38¼ / 15 38.
 Altitude of the same [Altitudo eiusdem] 15 20. — It was fairly clear and calm [Fuit
 satis serenum, & tranquillum].

Table 15 (right column continuation): Day 2 April, evening [Die 2. Apr.
 vesp.]

This block repeats the Day-2 series at finer resolution (continuing the right-hand
 column of the page).

H. M.	Dist.		Decli			Cā.	
	Alde b. G.	Dist. M.	natio ☿ G.	Decli n. M.	Altit. ☿ G.	M.	min. occid. G. M.
8 0 / 8 2¼ corr.	23	55¼	17	57⅔ / 17 38½	7	15	
8 5½ / 8 7 corr.	23	54½	17	38 / 17 38½	6	50	32 53
8 9½ / 8 11½	23	53½	17	38¾ / 17 38½	6	0	34 3
8 15 / 8 17½ corr.	25	52	17	40½ / 17 40½	5	20	35 25
8 19½ / 8 22	23	51½	17	41½ / 17 41½	4	50	36 34
8 24 corr. 26½	23	51	17	42 / 17 42½	4	15	37 46
8 29½ / 31½	23	50½			3	35	39 4

Parsing notes: One declination cell reads "17 57 $\frac{2}{3}$ " stacked over "17 38 $\frac{1}{2}$ " — the 57 $\frac{2}{3}$ value breaks the smooth 38–40' progression of its column and is flagged below as a likely compositor error. Several distance-degree cells read 23 where neighbors read 25; transcribed as printed.

It was moderately clear and calm enough [Fuit mediocriter serenum, & tranquillum satis].

On these days the clear sky had been continuous, yet unevenly so; from the horizon up to an elevation of about 39° or beyond, dark little clouds had been rising, and descending below the said altitude they obscured it [*ascendentia, & descendentia infra dictam altitudinem obtegentes*].

There follows the calculation from the above-written observations [Sequitur calculus ex suprascriptis observationibus]:

On 2 April, h. 8 5': Distance of Mercury from Aldebaran [Distant. ☿ ab Aldeb.] 23 55.

Quantity	G.	M.	[body]
Declination of Mercury, limited [Declinatio ☿ limitata]	17	40	
Declination of Aldebaran [Declinatio Aldebaræ]	15	38	
Altitude of Mercury [Altitudo ☿]	7	0	
Angle of the ascensional difference [Angulus differentiæ Asc.]	24	5 $\frac{1}{2}$	
R[ight] A[scension] /	11	32 $\frac{1}{2}$	☿

Quantity	G.	M.	[body]
Longitude [Longitudo]			
Latitude [Latitudo]	2	26 ³ / ₄	B
True, by refraction & parallax [Vera à Refractione, & parallaxi]	11	28 ³ / ₄	☿
[Latitude, true]	2	23 ² / ₃	B

Table 16: Day 3 April, evening [Die 3. Apr. vesp.]

Columns as before: time; distance of Mercury from Aldebaran; declination of Mercury; altitude of Mercury; Lesser Dog occidental.

H. M.	Dist. ☿ ab		Decli			Cā. min. occid.		
	Alde b. G.	Dist. M.	natio ☿ G.	Decli n. M.	Altit. ☿ G.	M.	G.	M.
7 55 ¹ / ₄ / 8 6 corr.	dubia [dou btful] / 22	40 ¹ / ₂	18	8 / 18 7 ¹ / ₂	7	40	33	30
7 59 / 8 10 corr.	22	43	18	9 ¹ / ₂ / 18 9 ¹ / ₂	7	8	34	25
8 3 / 8 13 ¹ / ₂	22	42 ¹ / ₂	18	9 ¹ / ₂ / 18 9 ¹ / ₂	6	50	35	22
8 7 ¹ / ₂ / 8 17 ¹ / ₂ corr.	22	41 ¹ / ₂	18	10 / 18 10	7	36	20	
8 12 ¹ / ₂ /	22	40 ³ / ₄	18	11 / 18	5	23	37	42

H. M.	Dist. ☿ ab Alde b. G.	Dist. M.	Decl natio ☿ G.	Decl n. M.	Altit. ☿ G.	M.	Cā. min. occid. G.	M.
8 23 corr.				11½				
8 17½ / 8 28 corr.	22	40½	18	12½ / 18	4	50	38	59
8 20⅞ / 8 31½	22	39	18	13 [vni. salte pin. — one at least, point]	4	30	39	50
8 25½ / 8 36		38¾	18	13½ / 18	3	52	41	5
8 30 / 8 41½ corre ct.	22	38¾ dubia	18	14 dubia	3	15	42	25

Parsing notes: The first distance cell reads "dubia" (doubtful); the last row's distance and declination both carry "dubia." The note at the 8 20⅞ row, "vni. salte pin." (= *vnius saltem pinnacidij* or similar), indicates a sighting taken with at least one pinnule/sight-vane.

For the examination of the armillaries it was taken [Pro Armillarum examine capiebatur]:

Declination of Aldebaran [Aldebaræ declinatio] — 15 37½ / 15 38. Altitude of the same [Altitudo eiusdem] 12½. — This evening was particularly clear and calm [Erat hac vespera apprimè serenum, & tranquillum].

The calculation from these observations [Calculus ex hisce observationibus]:

At H. 8 10':

Quantity	G.	M.	[body]
Distance of Mercury from Aldebaran [Distantia ☿ ab Aldeb.]	22	43	
Declination of Mercury, limited [Declinatio ☿ limitata]	18	11	
Declination of Aldebaran [Declinatio Aldebaræ]	15	38	
Altitude of Mercury [Altitudo ☿]	7	8	
Angle of the ascensional difference [Angulus differ. Ascension.]	23	36½	☿
Longitude [Longitudo]	12	52	☿
Latitude [Latitudo]	2	33¼	B
Parallax & refraction subtracted			

Quantity	G.	M.	[body]
[Subductis Parallaxi, & Refractioe]:			
True Mercury, Longitude [Vera ☿ Longitudo]	12	48	☿
[True, Latitude]	2	30½	B

Table 17: Day 4 April, evening [Die 4. Apr. vesp.]

Columns: time; distance of Mercury from Aldebaran; declination of Mercury, northern [Declinatio ☿ Borea]; altitude of Mercury; Lesser Dog occidental.

H. M.	Dist. ☿ ab Alde b. G.	Dist. M.	Decli n. ☿ Bore a G.	Decli n. M.	Altit. ☿ G.	M.	Cā. min. occid. G.	M.
7 53¾ / 7 55 corr.	21	39¼	18	34 [vtro q; both]	9	30	31	45
7 58 / 8 0	21	36 dubia	18	35 / 18 35½	9	0	32	57
8 1 / 8 3½	21	38	18	37 / 18 38	8	30	33	48
8 6½ / 8 9½	21	38	18	38 / 18 38½	7	48	35	20
8 11½ / 8 15 corr.	21	37½	18	38 / 18 38	7	0	36	59
8 21½ /	21	37½	18	39½ / 18 40	6	30	37	30

H. M.	Dist. ☿ ab Alde b. G.	Dist. M.	Decl n. ☿ Bore a G.	Decl n. M.	Altit. ☿ G.	M.	Cā. min. occid. G.	M.
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8 18
corr.

Parsing notes: Most declination cells carry two stacked values. The 8 34'-distance entry reads "vtroq;" (*utroque*, "by both"). One time-pair reads "8 21½ / 8 18 corr." with the corrected value earlier than the observed; transcribed as printed.

Right column (page 346)

Conversely, the distance from the right shoulder of Orion [Vice versa, Distantia à dextro humero Orionis]:

H. M.	Dist. G.	Dist. M.	Decl natio ☿ G.	Decl n. M.	Altit. ☿ G.	M.	[arc] G.	M.
8 21½ / 8 25	42	54	18	40 / 18 39½	5	40	39	13
8 24½ / 8 28½	42	52½	18	40½ / 18 40½	5	10	40	5
8 26½ / 8 30½	42	51	18	41 [vno <i>pinna</i> c. — with one pinn ule]	4	40	40	40

It was no longer possible to observe Mercury this evening on account of the thick clouds present around the western horizon. Moreover, this evening there was a wind, somewhat troubling [the observation], from the same quarter of the sky.

The place of Mercury for 4 April, from the preceding [observations] [Locus ☿ ad 4. Aprilis ex præcedent. observat.]:

At H. 8 15':

Quantity	G.	M.	[body]
Distance of Mercury from Aldebaran [Distantia ☿ ab Aldeb.]	21	37½	
Declination of Mercury, limited [Declinatio ☿ limitata]	18	39½	
Declination of Aldebaran [Declinatio Aldebara]	15	38	
Altitude [Altitudo]	7	0	
Angle of the ascensional difference [Angulus diff. Ascension.]	22	25½	
Longitude [Longitudo]	14	50	☿
Latitude [Latitudo]	2	39½	B
True Mercury, free of refraction & parallax [Vera ☿ à Refract. & Parallaxi libera],	14	1	☿

Quantity	G.	M.	[body]
Longitude			
[True, Latitude]	2	36½	B

Table 18: Day 6 April, evening [Die 6. Apr. vesp.]

Columns: time; distance of Mercury from Aldebaran; declination of Mercury; altitude of Mercury; Lesser Dog occidental.

H. M.	Dist. φ ab Alde b. G.	Dist. M.	Declination φ G.	Declination n. M.	Altit. φ G.	M.	Cā. min. occid.	
							G.	M.
8 15¾ / 8 14¾ corr.	19	40½	19	21½ / 19	7	50	38	30
8 20½ / 8 20 corr.	19	40½	19	24½ / 19	7	15	39	43
8 24¾ / 8 24	19		19	24½ / 19	6	40	40	45
8 30¾	19	40	19	26½ / 19	6	0	[Cor □ occid. — Regul us settin g]	
8 34½	19	39½	19	26 / 19	5	30	6	6
8	19	39		26½	4	50	7	7

H. M.	Dist. ☿ ab Alde	Dist. M.	Decli natio ☿ G.	Decli n. M.	Altit. ☿ G.	M.	Cā. min. occid. G.	M.
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38½

Parsing notes: At the 8 30¾ row, the final column reads "Cor ☐ occid." (*Cor Leonis*, Regulus, setting) in place of the Lesser-Dog arc. Several declination cells carry stacked values.

Afterwards the distance from the right shoulder of Orion was observed [Postea observabatur ☿ à dextro humero Orionis]:

H. M.	quantity	G.	M.
	in Distance [in Distantia]	41	53
8 44'	Declination [Declinatio]	19	31 / 19 30
	Altitude [Altitudo]	3	50
	Lesser Dog [Canis Minor] setting [occid.]	46	26

This last [observation] was doubtful on account of intervening clouds.

Inquiry into the longitude & latitude of Mercury, from these observations [Inquisitio loci longitudinis, & latit. ☿ ex hisce observat.]:

At H. 8 10':

Quantity	G.	M.	[body]
Distance of Mercury from Aldebaran [Distantia ☿ ab Aldeb.]	19	40½	
Declination of Mercury, northern	19	25 limited [limit.]	

Quantity	G.	M.	[body]
[Declinatio ☿ Borea]			
Declination of Aldebaran [Declinatio Aldeb.]	15	38	
Altitude [Altitudo]	7	15	
Therefore the ascensional- difference angle [Ergo angulus diff. ascensionalis]	20	15½	
Longitude [Longitudo]	16	12½	☿
Latitude [Latitudo]	2	48	B
Parallax & refraction subtracted [Subtractis Parall. & Refract.], True Mercury, Longitude [Vera ☿ Longitudo]	16	8½	☿
[True, Latitude]	2	45	B

Table 19: Day 11 April [Die 11. April.]

Columns: time; distance of Mercury from the right shoulder of Orion [Dist. ☿ ab humer. luc. Or.]; declination of Mercury; altitude of Mercury; Lesser Dog occidental.

H. M.	Dist. ☿ ab hume r. luc. Or. G.	Dist. M.	Decl natio ☿ G.	Decl n. M.	Altit. ☿ G.	M.	Cā. min. occid. G.	M.
8 14½			20	36½	6	0	47	30
8 18½	37	38½			5	50	48	30
8 21	37	40½	20 / 20	36½ / 37	5	30	49	17
8 23½	37	41½	20 / 20	37½ / 37	5	10	49	58
8 26½			20	38½	4	50	50	41

Parsing notes: Several distance and declination cells are blank in the source; declination column shows stacked values 20 36½/20 37 and 20 37½/20 37.

Around the middle of these times the altitude of the bright shoulder of Orion was such that distances of Mercury were taken at roughly 14° or 15°.

At H. 8 40½: Declination of Aldebaran [Declinatio Aldebaræ] — 15 40½ / 15 40. Altitude of the same [Altitudo eiusdem] 7½. And [this was done] for the examination of the armillaries [Idq; pro Armillarum examine].

Afterwards it was no longer possible to observe Mercury, namely from hour 8 min. 26½; for clouds were veiling it, and vapors were impeding [the view] from the horizon. Yet the distances may be had without appreciable error, as the distance accepted at hour 8 21' — putting it at 37°40' — [and] at an altitude of 5½°. To assign the true declinations of Mercury at that time, the ratio of the refraction of the bright shoulder of Orion must be taken; the distance is to be taken from that, and it must also be seen what allowance the armillaries afford in the declination — perhaps by an experiment made through Aldebaran, its refraction being applied.

[10] **Year 1592, Feb. 3, Old Style, hour 5 40' after midday.** At Uraniborg Mercury was observed in Pisces 12°20', with a northern latitude of 47'. [Longomontanus], Book II, Theorica chapter 20, and [Boulliau] Book X, chapter 7, who adds the true place of the Sun to have been Aquarius 24°23'57" and

accordingly the distance of Mercury from the Sun $17^{\circ}56'3''$. But from the tables he gathers Mercury's place in Pisces $12^{\circ}15'$. [Boulliau] Book X, chapter 7 proves that the place is corrupt with respect to the latitude.

[11] **Year 1593, May 11, Old Style, hour 9 30' after midday.** At Uraniborg Mercury was observed in Gemini $23^{\circ}16'$, with a northern latitude of 2° . [Longomontanus], Book II, Theorica chapter 20. [Snellius] adds, in his *Hassiacae [Observationes]*, that on the following day, 12, which in New Style was the 22nd of May, Mercury was observed in Gemini $24^{\circ}19'$. Hence [Boulliau] Book X, chapter 1 gathers that on the 23rd, New Style, Mercury was in Gemini $25^{\circ}21'$, the greatest elongation being distant $22^{\circ}52'4''$ from the Sun in Gemini.

[22] **Year 1600, January 23, New Style.** [Tycho Brahe], at the citadel of [Benátky — *arce Benatica*], immediately after the setting of the Sun, found by refraction the corrected distances of Mercury from the bright star of the breast of the Swan [*lucida pectoris Cygni*, i.e. Sadr] to be $48^{\circ}52\frac{2}{3}'$, and from the tail of the Whale [*cauda Ceti*, Deneb Kaitos] $40^{\circ}22\frac{2}{3}'$, and the altitude of Mercury $5^{\circ}50'$. Thus [Snellius] in the Bohemian observations [*in observ. Bohemicis*].

[23] **Year 1600, January 24, a little after sunset.** [Tycho Brahe] observing, Mercury was high 6° and was seen to be distant from the bright star of the tail of the Whale $40^{\circ}7'$; but six hours later the altitude of Mercury was 3° . It was distant from the same star $40^{\circ}4'$; from Sirius [*Sirio*] $53^{\circ}3\frac{1}{2}'$; a little before, distant from Pegasus [*Pegali*] $21^{\circ}37'$. Since the time was about 10' before what would be by the Copernican [tables] have set Mercury beyond the limit of greatest remotion from the Sun — to which this observation is more favorable than the Alphonsine. [Snellius] above.

[24] **Year 1601, April 29.** [Tycho Brahe] at Prague, in the house of [Curtius — *Curtij*], saw in what manner Mercury was high $7^{\circ}10'$, and distant from Capella [*à Capella*] $25^{\circ}41'$; the altitude truly $6^{\circ}46'$. He saw it distant from Procyon [*à Procyone*] $53^{\circ}14'$. Therefore, says [Snellius] in the Bohemian [observations], the place of Mercury was Gemini $1^{\circ}29'50''$, no account being taken of refraction & parallax.

CAPVT IV.

Mercury observations of Longomontanus, Kepler, Justus Byrgius [Jost Bürgi], Hortensius, & Boulliau, from the year 1593 to 1631.

[*Mercurij observationes Longomontani, Kepleri, Iusti Byrgij, Hortensij, & Bullialdi ab anno 1593 ad 1631.*]

[1] **Year 1593, May 11, hour 9 30' after midday.** [Jost Bürgi — *Iustus Byrgius*] of Kassel [*Catellis*] observed Mercury distant from Capella [*à Capella*] $21^{\circ}56'$, and from Pollux [*à Polluce*] $24^{\circ}34'$. [Snellius] in his *Hassiacae*, and [Boulliau] Book X, chapter 1, hence gathers that on the 12th, which in New Style was the 22nd, Mercury was in Gemini $24^{\circ}19'$; and on the 23rd, hour 21', that Mercury was at its greatest elongation from the Sun. [Longomontanus] however, Book II, Theorica chapter 20, as above, relates that Mercury was observed in Gemini $23^{\circ}16'$.

[2] **Year 1607, April 14, Old Style, hour 8 ½' after midday.** At [Copenhagen — *Hafniæ*] [Longomontanus] observed Mercury by the radius [*Radio*, cross-staff], distant from Venus [*à Venere*] $6^{\circ}2'24''$; and these were higher in nearly the same vertical, the southern latitude of Venus being $10'$; but Mercury's northern [latitude] $1^{\circ}40'$. And from the observations of the following days [Longomontanus], Theorica chapter 23, gathers from the tables Mercury in Taurus $19^{\circ}32'7''$, & Venus $18^{\circ}19'33''$. On April 15, hour 9, Mercury was observed in Taurus $21^{\circ}5'$; on the 14th, the tables themselves give it $21^{\circ}11'$.

[3] **Year 1607, May 28, New Style.** [Kepler] saw Mercury under the Sun [*Mercurium sub Sole*], as he himself made public in his treatise on this singular phenomenon; and he differs from this in his attestation to the *Nuncius Sidereus*. [Christoph Scheiner — *Scheinerus*] [discusses this] on the solar spots [*de maculis Solaribus*].

[4] **Year 1610, Dec. 5, Old Style, hour 19 after midday.** At [Copenhagen — *Hafniæ*] [Longomontanus] observed Mercury in Sagittarius $2^{\circ}42'$. Thus he himself, Book II, Theorica chapter 20.

[5] **Year 1625, Feb. 13, hour 6 12'.** [Boulliau — *Iulioduni Bullialdus*, at Loudun] observed Mercury in Pisces $13^{\circ}27'$; with the refraction subtracted, the greatest [elongation], its distance being $17^{\circ}59'23''$, [Mercury] situated [*à Sole versante*] from the Sun in Aquarius $25^{\circ}27'37''$. [Boulliau] Book X, chapter 1.

[6] **Year 1626, March 12, Old Style, hour 9 33' after midday.** At Leiden [*Leydæ*] [Martinus Hortensius — Maarten van den Hove] saw Mercury high 6° , in the same straight line with the right shoulder of Auriga [*dextro Aurigæ*], and with a wide [interval] in the right arm of the same [constellation]. [Lansbergius] in the *Thesaurus* observes: "Mercury 7° ," adding that the same straight line falls in Gemini $23^{\circ}50'$ — about which [is] Mercury, with a refraction of $15'$; and it appears in that line, though truly lower, in Gemini $23^{\circ}36'41''$, with a northern latitude of $2^{\circ}25'11''$.

[7] **Year 1627, October 15, near the island of Goeree [*insulam Goëanam*].** [Martinus Hortensius] saw Mercury distant from Saturn [à Saturno] about one degree. [Lansbergius] in his *Thesaurus* observes: "Mercury 8''"; he gathers the place of Saturn in Libra 3°57'19", with a northern latitude of 2°6'3", & Mercury in Libra 3°5'45", with a northern latitude of 1°55'12".

[8] **Year 1630, December 12, in the morning, hour 6 50' after midnight.** [Boulliau — *Iulioduni*, at Loudun] observed Mercury in Scorpio, hour 29°13'. Thus he himself, Book XI, *Astronom. Theorem.* 13.

[9] **Year 1632, July 31, Old Style:** there occurred a conjunction of Mercury & Venus — concerning which [is] [Martinus Hortensius], *On Mercury seen in [under] the Sun [de Mercurio in Sole viso]*.

Liber IX — On Mercury (continued)

CAPVT V.

Mercury observations made by Pierre Gassendi [Gassendi], and by the Fathers of the Society of Jesus at Ingolstadt and at Innsbruck.

1. When Kepler [Kepler] had warned, in his *Ephemerides*, that on 7 November Mercury would fall under the Sun [Mercurium sub Sole incursum] and that on 6 December Venus would do likewise, Gassendi at Paris, who had previously thought Mercury's diameter to be more than 20 minutes of arc, used a telescope on 7 November. In the morning, while clouds were occupying the sky in places, he turned his attention to the part of the Sun's disk, and through the cloud he caught sight of a small spot. At first he took it for a sunspot, but he recognized it from its rapid motion to be Mercury. The conjunction of Mercury with the Sun took place, but Venus could not be seen on 6 December. So Gassendi himself narrates the matter in his *Vita Peireskii [Life of Peiresc]*, book 4, and in the *Meteorologica* of Epicurus, p. 899.

On this occasion Hortensius [Hortensius] published the account of Mercury seen under the Sun, and of Venus not seen. Now Kepler had predicted the conjunction of Mercury with the Sun before noon. At Uraniborg [Vraniburgi], then, it ought to have been at Paris about one hour after noon, or 47 minutes. But here Kepler's *Tables* were more accurate than the other *Tables*, in that they placed the time of conjunction nearer the truth, with Mercury distant from the Sun in longitude as Ptolemy [Ptolemaeus] gives 25', Copernicus [Copernicus] 5°, Longomontanus

[Longomontanus] $7^{\circ} 13'$, and Lansberge [Lansbergius; Philip van Lansberge] $1^{\circ} 21'$. Moreover Boulliau [Boulliau, Ismaël], in book 10 chapter 2 of his *Astronomia* [*Astronomia Philolaica*], reports that Gassendi found by telescope that Mercury exceeded [appeared projected] onto white paper; he gives the true conjunction of Mercury with the Sun at Paris at the 7th hour, 38', in [the sign of] Scorpio [in Scorprij] $14^{\circ} 36'$; but from the *Philolaica* (*Philolaica*) $14^{\circ} 37' 42''$, with Mercury's latitude $4^{\circ} 30'$ North.

2. In the year 1632, on 30 July, at Uraniborg [Vraniburgi], at the 16th hour after noon [hor. 16. post merid.], the conjunction of Venus with Mercury was observed by means of a telescope, yet in such a way that Mercury was seen to exceed the diameter of Venus by 5 minutes. — At Paris the conjunction of Mercury with Venus was observed by Gassendi; he gives it, collecting Venus in Cancer [in Cancrj] at $24^{\circ} 25' 47''$. Hence Mercury was in Cancer at $24^{\circ} 25' 47''$.
3. In the year 1634, on 2 January, at hour $6^{\circ} 30'$, at Uraniborg [ad Vraniburgum], reduced by Gassendi by means of distances from the fixed stars, Mercury was observed in Aquarius [in Aquarij] at $1^{\circ} 31'$, with South latitude $57'$. On day 4 in Aquarius [in Aquarij] at $3^{\circ} 31'$, with South latitude $30'$; and on the 6th in Aquarius [in Aquar.] at $5^{\circ} 1'$, with South latitude $1^{\circ} 52'$. Thus Boulliau, in book 10 chapter 1, collects from this that on day 3, at hour $6^{\circ} 30'$, the greatest elongation was $18^{\circ} 59'$, with Mercury in Aquarius [in Aquarij] at $2^{\circ} 30' 43''$, and distant from the Sun in Capricorn [à Sole in Capricorni] at $13^{\circ} 53' 43''$.
4. In the same year, on 2 October, Gassendi by means of distances from the fixed stars observed Mercury in Virgo [in Virg.] at $22^{\circ} 8' 20''$, with North latitude $1^{\circ} 25'$; and on day 3 in Virgo [in Virg.] at $22^{\circ} 59' 26''$, with North latitude $1^{\circ} 29' 18''$; and on day 4 in Virgo [in Virg.] at $23^{\circ} 59' 47''$, with North latitude $1^{\circ} 19' 16''$. Boulliau, in book 10 chapter 1, collects from this that on day 3, at hour 18, the greatest elongation was $17^{\circ} 49' 54''$, with Mercury in Virgo [in Virginis] at $22^{\circ} 59' 26''$, and distant from the Sun in Libra [à Sole in Librae] at $10^{\circ} 49' 20''$.
5. In the year 1634, around the beginning of November, Mercury was in central conjunction with the Sun [sub initium Nouemb. sub centro centralis coniunctus Mercurij cum Sole]; yet Gassendi, in his *Vita Peireskii*, denies that the telescope allowed it to be seen, just as in the year 1632 [it was] not [seen]; and toward the end of April, whence he concludes that the orbit [epicyclum] of Mercury is not between the Sun and us, but rather around

the Sun — a conclusion that holds good only on a supposition, since those central conjunctions did not turn day into night.

6. In the year 1635, on 16 January, Gassendi by means of the fixed stars observed Mercury in Capricorn [in Capricorn.] at $4^{\circ} 18' 48''$, with North latitude $2^{\circ} 1' 15''$; and on day 18, at hour $18^{\circ} \frac{1}{3}$, in Capricorn [in Capric.] at $8^{\circ} 21' 50''$, with North latitude $1^{\circ} 39'$; and on day 24, in Capricorn [in Capric.] at $16^{\circ} 4' 55''$, with North latitude $1^{\circ} 14' 8''$; and on day 25, in Capricorn [in Capric.] at $11^{\circ} 6' 36''$, with North latitude $59' 48''$. Boulliau, in book 10 chapter 1, collects from this that the greatest elongation was $24^{\circ} 18' \frac{3}{4}$, with Mercury in Capricorn [in Capric.] at $10^{\circ} 4' 55''$, distant from the Sun in Aquarius [à Sole in Aquarij] at $5^{\circ} 14' 15''$.
7. In the year 1635, on 17 September, Gassendi in the morning observed Mercury in Virgo [in gr. Virginis] at $6^{\circ} 8'$, and on day 19 in Virgo at $8^{\circ} 7'$; whence on day 18, in the morning at hour 17 after noon, the greatest digression was $19^{\circ} 44' 21''$. Boulliau, book 10.
8. In the year 1635, on 1 December, Gassendi at Digne [Diniae] at hour $5^{\circ} 30'$, by means of distances from the fixed stars, observed Mercury in Capricorn [in Capricorn.] at $0^{\circ} 34' 49''$, with South latitude $1^{\circ} 31'$ (from Boulliau, book 11, theorem 13). With refraction allowed for, he sets Mercury's corrected place at minute 26 of Capricorn [Mercurij locum correctum minut. 26. Capricorni], and at day 2, by his own *Tables*, at 23° of Capricorn [gr. 23. Capricorni].
9. In the year 1636, on 26 June, Gassendi at Aix-en-Provence [Aquis Sextijs] observed evening Mercury at an altitude of $3^{\circ} \frac{2}{3}$, distant from the Heart of Leo [à corde Leonis] (Regulus) by $31^{\circ} 23' \frac{2}{3}$; and from the Bright Star of the neck of Leo [à Lucida colli Leonis] at $31^{\circ} 41'$; whence he collects Mercury's apparent place. He gives Mercury's place in Cancer [in Cancri], with South latitude. From Boulliau, book 11, with refraction allowed for, the corrected place in Cancer [in Cancri] at $23^{\circ} 17' 47''$, with South latitude $1^{\circ} 36' 55''$. Boulliau sets it in his *Philolaica* (*Philolaica*) at — Cancri.

In the same year, on 27 June, Gassendi at the same place [ibidem] saw Mercury in Cancer [in Cancri] at $24^{\circ} 56' \frac{3}{4}$; thence, with refraction removed [eliminatis Refractionibus], Boulliau, book 10 chapter 4, where the *Rudolphine Tables* [Tabulae Rudolphinae] place Mercury at $25^{\circ} 1'$ of Cancer. In the *Philolaica* at $25^{\circ} 3' 33''$ of Cancer [Philolaicae in grad. 25. 3. 33''. Cancri].

10. In the year 1636, on 14 July, in the evening, Gassendi at Aix-en-Provence [Aquis Sextijs] observed Mercury — corrected for refraction of place [correctis ex Refractione locis] — in Leo [in Leonis] at $19^{\circ} 31' 16''$, with South latitude $1^{\circ} 4'$. From Boulliau, book 10 chapter 2; and at day 15 in Leo [in Leonis] at $20^{\circ} 33' 15''$, with South latitude $33'$. Boulliau, in the same place [ibidem].
11. In the year 1636, on 16 July, Gassendi from two observations, as Boulliau says (book 10 chapter 4), collects that Mercury was observed in Leo [in Leonis] at $21^{\circ} 25'$; whence the *Rudolphine* place at hour 9. Uraniborg [Vranib.] would exhibit $21^{\circ} 30'$; and Boulliau in his *Philolaica* (*Philolaica*) at $21^{\circ} 25' 47''$.
12. In the year 1636, on 3 September, in the evening, Gassendi at Digne [Dinia] saw Mercury beside the heart of Leo [Cor Leonis] by telescope: "I detected" — he says — "the heart of Leo below and to the right of Mercury [Cor Leonis infrà, & dexteram Mercurij], so much so that Mercury itself was not perpendicularly above it; nor was the latitude even moderate in position, but it came as it were midway, though closer to the vertex than to the side." Soon afterward he observed the distance of Mercury from the heart of Leo to be $23^{\circ} \frac{3}{5}$; and then $22^{\circ} \frac{3}{5}$, with an Astronomical Radius [Radio Astronomico]. Boulliau, book 10 chapter 3, who on the supposition of Regulus [Regulo] in Leo [in Leonis] at $24^{\circ} 47' 19''$ collects Mercury's place in Leo [in Leonis] at $24^{\circ} 37'$, or $38'$; but by his own *Tables* at $24^{\circ} 38' 52''$, and from the *Rudolphine* at $24^{\circ} 27'$.

[Margin / column heading, folio 348:] **At Ingolstadt, moreover, the Fathers of the Society — of our own [order] — made these observations, which Father Michael Staudacher [Staudacher], S.J., recently sent to me.**

The following is a table of Mercury observations made at Ingolstadt (years 1617–1620). Columns: date (year / hour); the star from which the distance is measured ("Distantia ☿" — distance of Mercury), in degrees and minutes; and the altitude ("Altitudo"), in degrees and minutes.

Year / Date	Hour	From (star)			Altitud e — Gr. M.	
		[Ab]	Gr.	M.	Gr.	M.
Year 1617 — March	4	Andro meda, head	25	0		

Year / Date	Hour	From (star) [Ab]	Gr.	M.	Altitud e — Gr.	M.
7, eve.		[Andro m. cap.] Bright Star of □ [Lucida □]	31	24		
Year 1619 — Feb. 6, eve.	2	Markab	24	42	☿ 4	40
		Algenib [Algeni b]	34	10		
Feb. 8	6 12	Markab	21	21	☿ 4	10
		Algenib [Algeni b]	28	55		
May 11	9 15	from Capella [à Capella]	44	50	☿ 4	50 vesp.
		from the head of Pollux [à Cap. Pollucis]	26	30	Regulus [Reguli] 37	5 vesp.
Year 1620 — Oct. 10, morn.	5 30	from Regulus [à Regulo]	44	24	☿ 7	5

Year / Date	Hour	From (star) [Ab]	Gr.	M.	Altitud e — Gr.	M.
		from the Tail of Leo [à Cauda □]	24	36		

Parsing notes: The "Hour" column sometimes carries two values (a day-and-hour pair, e.g. "6 12", "9 15", "5 30"); transcribed as printed. The ☿ symbol marks Mercury's altitude entries; "vesp." = evening, "mat." / "matutina" = morning. Some altitude cells are blank in the source.

In the year 1631, on 7 November, Mercury was seen under the Sun [Mercurius sub Sole] at hour 9° 56' in the morning, distant from the center of the Sun's disk a little more than half a semidiameter of the Sun toward the North [versus Zephyro-Boream]; but at hour 1 after noon it had already passed out from under the Sun [iam excesserat de sub Sole].

[Margin / sub-heading:] **Observations made at Innsbruck [Oeniponti] by the Fathers of the Society of Jesus, and communicated to me by one of them, Father Michael Staudacher [Staudacher], S.J.**

The following is a table of Mercury observations made at Innsbruck (years 1635–1637). Columns: date; the star from which the distance is measured ("Distantia ☿"), in degrees and minutes; and the altitude ("Altitudo"), in degrees and minutes.

Year / Date	Hour	From (star) [A.]	Gr.	M.	Altitud de — Gr.	M.
Year 1635 — Sept. 18		Regul us [Regul o]	12	16	☿ 8	51 morn. [m.t.]
		Tail of Leo [luba	14	33	Bright [Star] of the	28 morn. [mat.]

Year / Date	Hour	From (star) [A.]	Gr.	M.	Altitude — Gr.	M.
		□]			shoulder of Orion [Lu.hu.Or.]	48
Year 1636 — March 19, eve.		Rigel	60	27	☿ 8	5
		Bright Star of the shoulder of Orion [Luc-hum.Or.]	66	51	Lu.hu. Or. 46	20
Year 1637 — March 3, eve.		Aldebaran [Aldebaran]	63	18	☿ 11	4
		Rigel	73	55	Aldeb. 56 / Rigel 34	25 / 4

Parsing notes: Star abbreviations expanded where possible: "Lu.hu.Or." / "Luc-hum.Or." = *Lucida humeri Orionis*, the bright star of Orion's shoulder (Betelgeuse); "luba □" appears to be *iuba Leonis*, the mane/tail of Leo. The two altitude entries

on the 1637 row (Aldeb. and Rigel) are printed as a paired sub-cell. "m.t." / "mat." = morning; "vesp." = evening.

CAPVT VI.

Select Mercury observations, from those carried out at Bologna [Bononiae] in the College of St. Lucy [in Collegio S. Luciae] by the Fathers of the Society of Jesus, Giovanni Battista Riccioli [Riccioli] and Francesco Maria Grimaldi [Grimaldi], together with their assistants.

1. In the year 1643, on 3 May, on the following night, at hour 6 after noon, Mercury was seen distant from Jupiter [à Ioue] by $1^{\circ} 4'$; granted that, from both longitude and latitude [esto ex vtriusq; longitudine, & latitud.], the Lansbergian [Lansbergiana] [position] ought to differ by $1^{\circ} 36' 43''$.
2. In the same year, on 5 May, in the calmest evening, Mercury was seen in the new Sextant [in Sextante nouo] distant from Andromeda [à cingulo Andromedae] by $26^{\circ} 43'$; and from the girdle of Andromeda [à cingulo Andromedae] by $31^{\circ} 5' 17''$; and it was then at an altitude of 6° ; in the next quadrant [vno proximè quadrante] after sunset.
3. The following evening, with a reddening sky in the west, a little after sunset Mercury was seen at an altitude of 8° , distant from the head of Andromeda [à capite Andromedae] by $26^{\circ} 10'$; and from the girdle of Andromeda [à cingulo Andromedae] by $33^{\circ} 59'$.
4. In the year 1643, on 7 May, in the calmest evening, Mercury was seen at an altitude of $7^{\circ} 50'$, distant from the girdle of Andromeda [à cingulo Andromedae] by $32^{\circ} 52'$; and from the head of Andromeda [à capite Andromedae] by $6^{\circ} 22'$.
5. In the same year, on 11 May, evening Mercury was seen distant from the vertex [à vertice] by $80^{\circ} 48'$; and from the girdle of Andromeda [à cingulo Andromedae] by $28^{\circ} 41'$. Then it was seen distant from the vertex by $81^{\circ} 49'$; and from the head of Andromeda [à capite Andromedae] by $23^{\circ} 56' \frac{1}{3}$.
6. The following evening, in the calmest evening, Mercury was seen distant from the vertex [à vertice] by $80^{\circ} 28'$; and from the girdle of Andromeda [à cingulo Andromedae] by $27^{\circ} 51' \frac{1}{3}$, with the altitude of Aldebaran [Aldebaran] in the west being $52^{\circ} 21'$; when, however, these [stars] were [at] altitude $51^{\circ} 34'$, Mercury was seen distant from the southern foot of Andromeda [à pede australi Andromedae] by $37^{\circ} 33'$.

7. In the year 1643, on 23 August, in the morning, at the transit of the bright star of Aries [à transitu lucidae Arietis] across the meridian [per M.C. — Medium Caeli], the [minutes] are counted 4' 8" [numerata sunt min. 4. 8"]; and afterward Mercury was seen at altitude 6° 20'; and distant from the bright star of the shoulder of Orion [à lucido humero Orionis] by 49° 35'. Then, after 7 minutes, it was seen at altitude 5° 50'; distant from Procyon [à Procyone] by 25° 27' ½: this repeated, according to the manner of the observations.

Likewise on the following morning, 24 August, at the transit of the bright star of Aries [à transitu Lucidae Arietis] across the meridian [per M.C.], the [minutes] are counted 32; after which Mercury was seen at altitude 9° 4', distant from the bright shoulder of Orion [ab humero lucido Orionis] by 50° 2'; and after 7 minutes was seen at altitude 5° ½; and distant from Procyon [à Procyone] by 26° 15'.

8. Likewise in the year 1643, on 31 August, Aldebaran [Aldebara] stood distant from the vertex [à vertice] by 34° 10'; and after this [post] Mercury was seen at altitude 3° ½; and distant from Procyon [à Procyone] by 33° 59' ½; thence after 2 minutes of time [post 2 min. temp.] it was seen at altitude 3° 30'; distant from the bright shoulder of Orion [ab Orionis humero lucido] by 58° 42' ½.
9. Likewise in the year 1643, on 1 September, Regulus [Regulus] stood distant from the vertex [à vertice] by 31° 1' 1", counted afterward through minute 18 of time; Mercury was seen at altitude 8° 10', distant from Spica [à Spica] by 22° 3' ⅔; and after 5 minutes of time, was seen at altitude 10° 15'; and distant from Arcturus [ab Arcturo] by 34° 45'. — *Perigee. Greatest [elongation]* [Perig. Excentr.] [Margin].
10. At length on 16 December of the same [year], in the morning, in the calmest [sky], and with the most purified North wind [statu Aquilonio purgatissimo], Mercury [was observed] in azimuth [in Azimutho] at 50° 44' [graduum 50. 44']; it was seen at altitude 6° 25'; and then Arcturus [Arcturus] stood distant from the vertex [à vertice] by 25° precisely [praecisè].
11. On 6 August 1644, the bright star of Aries [lucida Arietis], distant from the vertex [à vertice] toward its rising [à vertice ortum versus], at 25° 55'. Mercury, the morning star most near to its greatest digression [matutinus digressioni maxime vicinus], was seen at altitude 3° 1' ⅔; and distant from Aldebaran [ab Aldebara] by 50° 24'. Then, after 8 minutes, it was seen at

altitude $4^{\circ} 10'$; distant from the following shoulder of Orion [ab Orionis humero sequenti] by $34^{\circ} 8' \frac{1}{3}$.

12. In the same year, on 13 August, in the morning, Aldebaran [Aldebara] stood distant from the vertex [à vertice] by $43^{\circ} 36'$; and after the elapse of 7 minutes of time [& elapsis 7. temp.], Mercury was seen at altitude $7^{\circ} 12'$; distant from the following shoulder of Orion [ab humero sequenti Orionis] by $42^{\circ} 12'$. Then, after 2 minutes of time, it was seen at altitude $7^{\circ} 28'$; and distant from Aldebaran [ab Aldebara] by $58^{\circ} 36' \frac{2}{3}$.
13. In the year 1644, on 21 November, in the morning, Regulus [Regulus] — west of the vertex [occidentalis] — stood distant from the vertex [à vertice] by $31^{\circ} 1' 1''$, soon after minute 18 of time; Mercury was seen at altitude 10° , distant from Spica [à Spica] by $22^{\circ} 3' \frac{2}{3}$; and after 5 minutes of time, was seen at altitude $10^{\circ} 15'$; and distant from Arcturus [ab Arcturo] by $34^{\circ} 45'$. — *Perigee. Greatest [elongation]* [Perig. Excentr.] [Margin].
14. In the year 1644, on 26 November, in the morning, Mercury was seen distant from the vertex [à vertice] by $49^{\circ} 50'$; and after 17 minutes, Mercury was seen at altitude $8^{\circ} 55'$; and distant from Arcturus [ab Arcturo] by $37^{\circ} 5'$; and after three minutes [it was] seen at altitude $9^{\circ} 12'$; and distant from Spica [à Spica] by $25^{\circ} 49'$.
15. In the same year, on 29 November, in the morning, in the calmest [sky], Arcturus — east of the vertex [orientalis] — stood distant from the vertex [à vertice] by $9^{\circ} 6'$; and after 2 minutes Mercury was seen at altitude $7^{\circ} 46'$; and distant from Arcturus [ab Arcturo] by $39^{\circ} 19'$. Thence, after three minutes [post tria minuta] it was seen at altitude $8^{\circ} 22' \frac{1}{3}$; and distant from Spica [à Spica] by $29^{\circ} 7'$.
16. In the year 1646, on 8 May, in the evening, Mercury was seen distant from Capella [à Capella] by $45^{\circ} 40'$; and from Procyon [à Procyone] at altitude $29^{\circ} 14'$; in the same year, indeed, at altitude $28^{\circ} 10'$, it was seen distant from Capella [à Capra] by $21^{\circ} 56'$.
17. In the same year, in the following evening, Mercury was seen distant from Capella [à Capella] by $44^{\circ} 22'$; from Procyon [à Procyone] at altitude $26^{\circ} 7'$; in the same year, indeed, at altitude $26^{\circ} 7'$, it was seen distant from Capella [à Capella] by $21^{\circ} 30'$.
18. In the year 1646, on 15 May, in the evening, Mercury was seen distant [continues on next page] —

[continuation of item 18:] — distant from the vertex [à vertice] by $37^{\circ} 57'$; from Procyon [à Procyone] at altitude $23^{\circ} 40'$; in the same year, indeed, at altitude $22^{\circ} 35'$, it was seen distant from Capella [à Capella] by $20^{\circ} 33'$.

19. In the same year, on 22 May, evening Mercury was seen distant from Capella [à Capella] by $22^{\circ} 4'$; at the altitude of Procyon [à Procyone] $15^{\circ} 23'$; and then distant by $33^{\circ} 1'$; and from Procyon [ab ipso Procyone] at altitude $13^{\circ} 35'$.
20. In the year 1647, on 23 April, in the evening, Mercury was seen at altitude $13^{\circ} 30'$; and distant from Procyon [à Procyone] by $12^{\circ} 30'$. Then it was seen at altitude $12^{\circ} 30'$; it stood apparently distant from Procyon [à Procyone] by $59^{\circ} 46'$, on account of refractions. Afterward it was seen at altitude $11^{\circ} 33'$; and distant from Capella [à Capella] by $30^{\circ} 31'$; the altitude, moreover, [was] $11'$; it was seen distant from the following shoulder of Orion [ab humero sequente Orionis] by $35^{\circ} 23' \frac{2}{3}$; and at that time Capella [was at] $40^{\circ} 12'$. And this [was] about the greatest digression of Mercury [maximam Digressionem Mercurij].
21. In the same year, on 30 April, in the evening, Mercury was seen at altitude $12^{\circ} 22'$; and distant from Procyon [à Procyone] by $52^{\circ} 54' \frac{1}{3}$. Then it was seen at altitude $11^{\circ} 52'$; and from the head of Pollux [à Pollucis capite] distant by $47^{\circ} 34' \frac{1}{3}$.
22. In the year 1647, on 6 May, in the evening, Mercury appeared in the same straight line with Venus [in eadem recta linea cum Venere], and with the center of the Moon [centro Lunae], one hour after sunset, in such a way that Venus appeared with the Moon, and Mercury with Venus toward the west [Mercurius Venere occidentalior appareret], but under the splendor of the Moon [sub splendorem Lunae]; and the rest of the twilight things could not be observed, as to anything else [quoad alia].
23. In the year 1648, on 31 March, in the evening, Mercury was seen at altitude $8^{\circ} 47'$; and distant from Aldebaran [ab Aldebara] by $37^{\circ} 34'$; and at altitude $8^{\circ} 20'$ it was seen distant from Rigel [à Regel] by $52^{\circ} 58'$; the altitude then of Aldebaran [Aldebarae alta] [was] $37^{\circ} 44'$.
24. In the same year, on 7 April, in the evening, Mercury was seen at altitude $12^{\circ} 53'$; and distant from Aldebaran [ab Aldebara] by $28^{\circ} 3'$; the altitude, moreover, [was] $11^{\circ} 57'$; it was seen distant from Rigel [à Regel] by $46^{\circ} 40' \frac{1}{3}$; and after a minute of time [post minutum temporis] Aldebaran [Aldebara] stood distant toward sunset [occasum versùs] by $57^{\circ} 57'$.

25. In the year 1648, on 9 April, in the evening, Mercury was seen at altitude $12^{\circ} 32'$; and distant from Aldebaran [ab Aldebara] by $26^{\circ} 4'$; the altitude, moreover, [was] 12° ; it was seen distant from Rigel [à Regel] by $45^{\circ} 27' \frac{1}{3}$; Rigel [Regel] at altitude $71^{\circ} 5'$; distant toward sunset, from Aldebaran [Aldebara] toward the vertex [à vertice] by 60° , precisely [praecisè].
26. In the same year, on 13 April, in the evening, Mercury was seen at altitude $11^{\circ} 30'$; and distant from Aldebaran [ab Aldebara] by $23^{\circ} 19' \frac{2}{3}$; and after that [moxq;] at altitude $10^{\circ} 14'$; it was seen distant from Rigel [à Regel] by $43^{\circ} 45' \frac{2}{3}$; and at altitude almost 18 [ferè 18.]; Aldebaran [Aldebara] at altitude $25^{\circ} 50'$.
27. Likewise in the same year, on 15 April, in the evening, Mercury was seen at altitude $9^{\circ} 14'$; and distant from Aldebaran [ab Aldebara] by $22^{\circ} 23' \frac{2}{3}$; and soon after [moxq;] [it was] seen distant from Rigel [à Regel] by $43^{\circ} 11' \frac{2}{3}$; at altitude about [circiter] 15; but Aldebaran [Aldebara] at altitude $22^{\circ} 43'$.
28. In the year 1649, on 22 December, in the morning, Mercury was seen at altitude $6^{\circ} 40'$; and distant from the head of Ophiuchus [à capite Ophiuchi] by $34^{\circ} 32' \frac{2}{3}$; the altitude, moreover, [was] $7^{\circ} 12'$; it was seen distant from Spica [à Spica] by $48^{\circ} 49'$.
29. In the year 1651, in the month of February, evening Mercury was observed over nine days, by taking its distance from the vertex in the same vertical [à vertice in eodem Verticali], in which afterward the exact azimuth was taken [for] the distance of Aldebaran from the vertex [distantia Aldebaran à vertice]. Besides this, with the perpendicular of time [perpendicularo temporis] counted off, the distance of Sirius from the vertex was taken from the observed Mercury [ab obseruato Mercurio capiebatur distantia Sirij à vertice], in the eastern quadrant [in quadrante orientali].

The following table records the February 1651 evening Mercury observations at Bologna. Columns: day of February ("Dies Febr."); the distance of Aldebaran from the vertex ("Dist. Aldeb. à vert."), in degrees and minutes; the azimuth from there ("Hinc Azimuth"), in degrees, minutes, and seconds; Mercury's [distance] from the vertex in the same [vertical] ("ϕ in eo dist. à vert."), in degrees and minutes; the time-interval after [the reading] ("hinc post tempor."), in minutes and seconds of time; and Sirius's distance from the vertex ("Sir. dist. à vert."), in degrees and minutes.

Da y Feb r.	Dist					☿ in	Hin		Sir.		
	Ald eb. à ver t. — G.	M.	Hin c Azi mu th — G.	'	"	eo dist . à ver t. — Gr.	M.	c pos t tem por . — M.	S.	dist . à ver t. — G.	M.
30 (11)	49	5	69	50		81	41	3	58	73	41
31 (13)	49	38	70	23	26	80	13	5	14	72	38
32 (15)	49	53	70	43	52	78	43	3	38	71	48
33 (16)	50	41	71	46	54	78	7	3	58	70	57
34 (17)	52	5	73	34	18	79	27	4	56	69	24
35 (18)	52	25	73	59	16	79	4	3	58	68	33
36 (19)	53	17	75	3	12	79	9	5	38	68	6
37 (20)	53	54	75	48	0	79	6	3	58	68	6

Parsing notes: The leftmost two figures in the first column are an observation-running number (30–37) and the February day (11, 13, 15, 16, 17, 18, 19, 20), printed as a paired cell; transcribed as "running# (day)". The "Hinc Azimuth" column carries three sub-figures (degrees, minutes, seconds); all seconds-values are < 60. The "Hinc post tempor." column gives the time-elapséd correction (minutes/seconds of time) between the two distance readings. The seconds-cell on row 30 is blank in the source and left empty.

In the year 1652, in the month of May, from day 21 onward — indeed right up to the second day of June — evening Mercury was observed [vespertinus], as [shown] below in the following Table.

The following table records the evening Mercury observations of May–June 1652 at Bologna. Columns: running number; day of May ("Maij Die vesp." — May day, evening); Mercury's observed altitude ("Mercurij Altit. visa"), G./M.; Mercury's distance seen from the head of Pollux ("Mercurij distantia visa à cap. Poll." — *à capite Pollucis*), G./M.; Mercury's distance from the head of Castor ("Mercurij distantia visa à cap. Cast." — *à capite Castoris*), G./M.; and the altitude of Pollux ("Pollucis altitudo"), G./M. Each day carries two (occasionally three) successive readings, the upper row giving the "à cap. Poll." distance and the lower row(s) giving the "à cap. Cast." distance and the altitude of Pollux.

#	May Day (eve.)	☿ Altit. visa		☿ dist. à cap. Poll.		☿ dist. à cap. Cast.		Pollux alt.	
		— G.	M.	— G.	M.	— G.	M.	— G.	M.
38	21	12	38	24	55				
		12	0			22	50	32	56
39	22	12	18	23	46				
		11	46			21	47		
40	26	11	40	19	41				
		10	20			18	1	26	53
41	27	11	40	18	54				
		10	40			17	16	26	40
		9	30			17	16½		
42	28	7	48	18	2½				
		7	10			16	37	22	15
43	29	10	0	17	21½				
		9	25			16	2	24	13
44	30	9	44	16	42				
		8	25			15	34	22	52
45	31	9	0	16	12				
		7	48			15	8	22	13
46	Junij 1	7	20	15	45				

#	May Day (eve.)	☿		☿		☿		Pollux alt.			
		Altit. visa	— G.	M.	dist. à cap. Poll.	— G.	M.	dist. à cap. Cast.	— G.	M.	
		7		4				14	44	21	28
47	2	6		0		15	22				
		5		30				14	25	19	26

Parsing notes: Heading "Anno 1652." is printed above the table. Each day is laid out across two rows (occasionally three, e.g. obs. 41 on May 27, which carries three altitude readings 11°40' / 10°40' / 9°30'); the upper row gives the altitude reading paired with the "à cap. Poll." distance, the lower row(s) give the further altitude reading(s) paired with the "à cap. Cast." distance and the altitude of Pollux — a genuine compositor layout, not a column slip. Half-minute entries (2½, 21½, 16½) are as printed. Row 39's Pollux-altitude cell is blank.

In the year 1653, in the month of May, evening Mercury was always observed one hour next after sunset [vesperinus semper vna hora proximè post occasum Solis], by means of distances from Procyon [à Procyone], and from Capella [à Capella], and [the distance] of Mercury from the vertex [à vertice].

The following table records the May 1653 evening Mercury observations at Bologna. Columns: running number; day of May ("Maij Dies"); the "distance seen of Mercury" ("Distantia visa Mercurij") from the vertex ("à Vertice"), in degrees and minutes; from the fixed stars ("à Stellis Fix."), in degrees and **minutes** (NOT seconds — column header reads "M."); and a note "that is, from the [stars] written below" ("Idest ab infrascriptis"). Each day carries a paired reading, one row referred to Capella and the next to Procyon.

#	May Day	à Vertice		à Stellis Fix. —		Idest (from)
		— G.	M.	G.	M.	
48	3	79	48	13	37	from Capella [à Capella]

#	May Day	à Vertice — G.	M.	à Stellis Fix. — G.	M.	Idest (from)
		80	12	49	29	from Procyo n [à Procyo ne]
49	6	77	40	12	4	from Capella [à Capella]
		78	10	46	10	from Procyo n [à Procyo ne]
50	7	79	1	11	42	from Capella [à Capella]
		79	20	45	16	from Procyo n [à Procyo ne]
51	8	78	4	11	31	from Capella [à Capella]
		79	7	44	20	from Procyo n [à Procyo

#	May Day	à Vertice — G.	M.	à Stellis Fix. — G.	M.	Idest (from)
						ne]
52	9	78	4	11	15	from Capella [à Capella]
		78	23	43	33	from Procyo n [à Procyo ne]
53	10	78	10	11	10	from Capella [à Capella]
		78	50	42	46	from Procyo n [à Procyo ne]
54	11	79	7	11	4	from Capella [à Capella]
		79	26	42	5	from Procyo n [à Procyo ne]
55	13	79	26	41	28	from Procyo n [à

#	May Day	à Vertice — G.	M.	à Stellis Fix. — G.	M.	Idest (from)
						Procyo ne] — "becaus e Capella lay hidden behind the clouds, see below in the supple ment" [quia Capra latebat post nubes, vide infrà suppl.]
56	15	83	44	21	22½	from Capella [à Capella]
		83	51	39	54	from Procyo n [à Procyo ne]

Parsing notes: Each day carries a paired reading (two successive readings, the first referred to Capella, the second to Procyon, each to the vertex and to the fixed

star); transcribed on two rows. The second "à Stellis Fix." column is **minutes, not seconds** (header "M."); all values are < 60. The fractional 21½ / 22½ are legitimate half-minutes as printed. Obs. 55 (May 13) has only a single Procyon row and the marginal note that Capella (Capra, the She-Goat) was hidden by clouds.

[Margin / supplement note:] **Supplement [Suppl.]** — 12 [May]: Mercury was seen distant from the vertex [à vertice] by 80° 28'; in that azimuth in which Aldebaran was seen distant from the vertex [in eo Azimutho, in quo Aldebara visa est distare à vert.] by 74° 50'.

(continuation of Caput VI — Bologna Mercury observations)

57. In the year 1657, on the morning of 5 December, when Spica Virginis [Spica] stood in the eastern quadrant, distant 58°20' from the vertex, I began my reckoning at perpendicular time, and afterward, at 8h30', I took Mercury's distance from the vertex as 81°16', with the planet expected in azimuth 55°27'52" — and corrected. From this, and reckoning from the meridian, Father Francesco Maria Grimaldi [Grimaldi], to whom we owe this observation, deduced Mercury's place as 24°19'55" of Scorpio, with northern latitude 1°48'55", and an elongation from the Sun of 18°50'; this at about 8h after midnight.

CAPVT VII.

On the Hypothesis of Mercury's Motions.

1. There is no need to repeat here what I have explained fully enough in Book VII of the *Almagestum Novum* [Almagestum Novum], Section 4, and here in Book V, Chapter XII, where I expounded the most celebrated hypotheses — that is, theories — of the various astronomers concerning the motions of Mercury. I leave to the reader, drawing on Book V of this volume (in connection with Saturn), what is contained in Chapter X on the methods of observing the places of the planets, and in Chapter XII on the geometrical figure made by various spirals about the cone, rather than by a circle, the ellipse being here tacitly understood. So only a few points remain to be added or recalled here.

The first difficulty in observing Mercury is that, quite apart from the error introduced by the great number of minutes — owing to its nearness to the Sun, on account of which it is always wrapped in the inconstant vicissitude of refraction — Ptolemy and Copernicus frankly confess that they themselves could never observe Mercury because of the vapors of the Nile, or because Mercury

was invisible at Vistula. This must be excused; but it must also be set down to the discredit both of Tycho Brahe [Tycho Brahe], in the preface to his *Astronomical Letters*, and of Longomontanus [Longomontanus] in Book II of the *Theoretica*, Chapter 20, that Mercury was rarely observed by them in so great an obliquity of its sphere — far greater, I say, than the horizon of Uranienborg [Uranienborg] possesses. I excuse Tycho, who placed it beyond the third magnitude, 5° or sometimes 7° in error; but Longomontanus erred more, indeed by more than 12° , even though he says he examined Tycho's observations in 10 places. In Chapter 20 of the *Theoretica* he examines, but does not find among the observations, the value computed from the Danish Tables — differing by $11\frac{1}{4}'$, even though it elsewhere exceeds whole degrees, as I shall say at number 3.

2. Let us now hear Kepler [Kepler], who at page 15 of the *Fundamentum* of his Ephemerides said he did not fear, in his Rudolphine Tables, an error in Venus that should much exceed $15'$; he subjoins: *In Mercury the difficulty is greater, and if errors of greater moment are detected, they are very rare. All my observations, gathered through 20 years (those at least that are trustworthy and reliable), fall within a single Mercurial trine; the other two trines remain unobserved — this, I say, in our hemisphere. Now how great a difficulty it is, from the arc of a single part to consume the whole error of the total course within a single curvature, there is no need of many words to declare. Therefore, even in the greatest elongations [greatest elongation], which our Sun does not blot out for our hemisphere, no great error can exist; but in the conjunctions, of which there is great store in my Meteorology, since they always lie within the limits of those same days, I do not venture to affirm that my computation is always within a quarter of a degree; for the degrees can sometimes be varied by half a degree, in those cases at least in which Mercury appears retrograde, and that with retrograde motion, by a single degree or even a half.*

3. Long ago I noted, in Book III of the *Almagestum Novum*, Chapter 3, in the Scholia, and in Book VII, Chapter 6, number 5: In the year 1631, in November, Mercury was observed beneath the Sun by Petrus Gassendus [Gassendi] with the aid of a telescope, and from that very moment the conjunction was reckoned at $7^h58'$; from this it was deduced that Ptolemy's Tables erred by $4^\circ23'$, the Prutenic by $5'$, the Danish by $7^\circ12'$, the Lansberg [Lansberg] by $1^\circ21'$. Rudolphine by $14^\circ24'$; whence I deduced that Natalis Duretus [Noël Duret], formerly a follower of Lansberg in the Ephemerides, had gone over to the Rudolphine camp. Mästlin [Maestlin] too, and Hortensius [Hortensius], differ widely.

[Margin: Mistakes of the various Tables in degrees.]

Gassendus, having seen Mercury beneath the Sun, affirms that in the year 1632, on 31 July, the conjunction was observed by him 2h53' later than the Danish Tables ought to have it; and that Antonius Maria de Rheita [Anton Maria Schyrleus de Rheita], in Chapter 2 of his *Sidereomysticus*, noted in the hypothesis of Tycho's Tables errors of Mercury of 5°, 6°, and 7°. Kepler himself, in expounding the foundation of his Ephemerides, page 32, when he had said that his own calculation distrusted itself to within about 21', that very minute, computed from the observation of Mercury's conjunction with the Moon (which was noted by Lynceus [the Lincean — Galileo's Academy] in the year 1617, on 8 March, at 7h26' after the meridian), confessed it to be of so little weight that it should rest not on the foundation of Tycho's calculation, but in part on the foundation of the lunar calculation.

4. But Elias of Leon [Elias of Leon], who is author of the work *Urania Propitia*, at chapter 2, page 17, points out that Kepler erred in a faulty calculation, and notes the cause of inability. For Kepler, from the diurnal slowing of the Moon overtaking the retrograde-moving Mercury (which was 14°11'), deduces that it ought to be reckoned from those hours at 7h7', grade 3°51' — whereas in truth he ought to have deduced 4h4'20". So that error 2°14' — not from the Tychonic foundations, but from a false Keplerian computation — comes forth. Elias adds, to the commendation of the Rudolphine Tables, another observation, in which Longomontanus at Copenhagen, in the year 1607, on 14 April, in the old style, at about 7h after the meridian, saw Venus, and with Venus the star of Mercury distant in remote parts 2°24'. The Rudolphine [Tables] exhibit that distance 2°25'30", and so in reality, but with others differing 2°25'. And he concludes by saying: *This being observed, except for the Rudolphine, no other Table satisfies — to say nothing of the Danish, the Lansberg, and the rest of the older ones; for the Philolaic [Tables] and ours had not yet seen the light.* He adduces the ancient observations which Ptolemy proposes in Book 9, Chapters 7 and 10; and he asserts that two of these chapters are most corruptly interpreted, or are wrong through the carelessness of copyists, partly through Ptolemy's own error, who, reckoning the days of the Egyptian months by the year of Dionysius, with the days, months, and year of the Egyptians not corresponding, made it that thereby the 30th day of Phamenoth should fall on the 30th of Mechir. Proinde [Therefore] Elias, having said this, proposes at page 71 the foundation of his own Tables, [namely] that the restitutions are made from observations chosen for this purpose — by which it appears that the Rudolphine come close to those observations, this remedy being in some way needed, unless a more accurate computation should be wanting. It will, however, be such as one might suspect that even Elias, from too great affection and devotion to the Rudolphine —

namely, the type of [the year] of Dionysius — accommodated [things] to those tables, nor easily persuaded anyone that Ptolemy on whole months should err, etc. for Mechir, this is possible Phamenoth. And thus he is to be seen, God willing, in the *Chronologia Reformata*.

[Margin: Kepler's faulty calculation.]

5. Boulliau [Boulliau] indeed, in Book 10 of the *Astronomia Philolaica*, affirms longer delays of Mercury toward Aphelion, and swifter passages through Perihelion — frustrated in his attempt at this in the very Hypothesis which, being Elliptical, he had neither hoped for nor in digesting this planet's motions had foreseen — wrought out, because he is destitute of observations. According to Ptolemy at most, however, the times: He nevertheless promises the true proportion of the Orbits, place, and Apsides of the Nodes. If, however, any author should weigh penetratingly, with what zeal toward Mercury candor and truth pursue the observations made about Mercury by Walther [Walther], Tycho, Gassendi, Hortensius, and others, meaning that nothing has been more diligently done hitherto by any astronomer that I know of, to perfect, with this in mind, the mean motion of Mercury — now follows the Rudolphine, now adds $11\frac{1}{4}'$ — we shall add to ours some correction of this, the observation, and commentation in some way.

6. Lest, however, with superfluous prolixity I should fill the pages with many observations chosen, which as a touchstone I assume — the Lydian Tables, here examined, are to be set forth, of which I lay down 4: I will return; by which, properly assumed, our Tables approach — and then the Philolaic and the Rudolphine, etc. I am willing to set forth to the readers what is here subscribed:

[Margin: (number 6)]

1. In the year 1585, on 14 November, in the old style, Tycho of Uranienborg, at one hour after the meridian, observed Mercury in Scorpio $13^{\circ}4'$; he deduced its place in Scorpio $12^{\circ}18'$. The Danish Tables give its place in Scorpio $12^{\circ}57'$. The Rudolphine in $13^{\circ}7'45''$. Ours in $13^{\circ}2'54''$.

2. In the year 1587, on 9 January, in the old style, Tycho of Uranienborg, at 4h50', observed Mercury in Aquarius $17^{\circ}48'$; adding northern latitude $0^{\circ}1'$, with adding that the Alphonsine had been in $18^{\circ}29'$ with northern latitude $0^{\circ}24'$. But Copernicus also in $16^{\circ}41'$ with southern latitude $0^{\circ}6'$. The Philolaic Tables exhibit Mercury in Aquarius $17^{\circ}35'12''$. Ours in $17^{\circ}35'45''$.

3. In the year 1592, on 3 February, in the old style, at 5h40', of Uranienborg, Mercury was observed in Pisces 12°20'; whence Longomontanus has, who from the Danish [Tables said] Mercury was in Pisces 12°13'57". We [have it] in 12°15'.
4. In the year 1631, in November, at Paris, Gassendi observed Mercury beneath the Sun, and reckoned its conjunction with the Sun at 7h58' after midnight, in Scorpio 14°36'. Our Tables give the Sun then in 14°38' of Scorpio. Ours [give] Scorpio 14°37'40" with northern latitude 4°35'.
5. In the year 1632, on 31 July, in the morning, at the hour after midnight 4, Mercury was observed in conjunction with Venus, at Paris. But Hortensius from his own observation at Amsterdam [reckoned] it to have been at the hour 11h5', after the meridian of day 30. We, from the Tables, had Venus at hour 4h40'. At Bologna, after midnight of day 31, in Cancer 24°22'15", and Mercury in 24°36'40"; wherefore by diurnal motion I deduce that conjunction to have been almost in that same midnight, since the conjunction intervened between days 30 and 31 of July. The Danish Tables erred in degrees 3, in the place of Mercury; and the Prutenic anticipated that Synod by whole five days. It ought to be placed after this, which will be placed at number 9.
6. In the year 1634, on 2 October, Gassendi, at Aix [Aix-en-Provence], at the hour reduced to Bologna 17h58', after the meridian, observed Mercury more easterly than the outermost star of the southern Wing of Virgo by about 6'. But that star then stood in Virgo 22°0'3'; and Mercury in the degree of Virgo 22°5'50". Rudolphine in 22°5'. Boulliau in 22°6'58".
7. In the year 1636, on 27 June, in the evening, Gassendi at Aix observed Mercury compared with Venus, in Cancer 25°5'53"; refraction however being excluded, so that Boulliau gathers refraction. The Rudolphine Tables give Mercury in Cancer 25°1'. The Philolaic in 25°3'33". Ours in 25°4'10".
8. In the year 1636, on 16 July, in the evening, Gassendi at Aix observed Mercury in Leo 21°26'. The Rudolphine of Uranienborg produce its place in Leo 21°30'. The Philolaic in degree 21°25'47". Ours in degree 21°25'52".
9. In the year 1634, from the observations of Gassendi, Boulliau gathers, on day 2 at hour 6h30' after the meridian, of Uranienborg, that Mercury had been in 22°30'43" of Aquarius; and at greatest elongation from the existing Sun in 13°53'43" of Capricorn. To me then the Sun stood in 13°29'8" of Capricorn, and Mercury in 22°31'10".

10. In the year 1636, on 3 September, at hour 17h after the meridian of the Danish [meridian], with a telescope he observed Mercury more westerly than Regulus by 10'; whence Boulliau gathers. To me Mercury then was in 24°48'17" of Leo. Therefore Mercury in 24°38'17" of Leo. The Rudolphine give in 24°27' of Leo. The Philolaic in 24°38'52" of Leo. Ours in 24°37'55" of Leo.

11. In the year 1657, on 5 December, in the morning, at about hour 8h after midnight, Mercury was observed in Scorpio 24°19'35". Our Tables give in 24°16'7". But the Danish in 25°24' of Scorpio. The Lansberg in 24°45' of Scorpio. And this for the present is enough.

Hypothesis Mercurij Arithmetica [The Arithmetical Hypothesis of Mercury].

Mean Motio n of ☿		Sig. G.	I.	II.	III.	IV.	V.
From the Equinox	Diurnal	0	4	5	32	35	29
	Annual	1	23	43	15	54	55
Apogee	Diurnal	0	0	0	0	17	7
	Annual	0	0	1	44	9	8
Nodes ♁	Diurnal	0	0	0	0	15	42
	Annual	0	0	1	35	31	4

Parsing notes: this table has seven sexagesimal-place columns (Sig., G., I., II., III., IV., V.); the first numeric column heading "Sig. G." spans two physical columns, transcribed here as separate "Sig." and "G." entries.

Epocha ad initium vulgare Annorum Christi in vltimo Decemb. praecedentis meridie, ad Bononiensem Merid. [Epoch for the common beginning of the Years of Christ, at the meridian of the last December preceding, at the Bologna meridian.]

Mean Motion of ☿	Sig.	G.	I.	II.
From the Equinox ☐	10	11	59	40
Apogee	6	25	18	48
Nodes ☿	0	0	1	50

Hypothesis Geometrica [The Geometrical Hypothesis].

If meanwhile one should choose the circumference of the ellipse, which in the surface of the cone is seen most nearly to designate the planet's motion, made now in one direction, now in another, the spirals there turning toward the East as some suppose, who suppose the diurnal motion of the Prime Mobile of the Earth, or toward the West, as others suppose — let there also be chosen as the measure of the spaces inscribed below, such that the Radius of the Annual Orbit of the Sun be 100000, and its bisected Eccentricity 1740.

	If the Radius of the Annual Orbit of the Sun ☉ is 100000.
Semidiameter major of the Ellipse of ☿, or its mean distance	38585
Semidiameter minor of the Ellipse	37736
And half of the Eccentricity from the Sun	8105
	Distance
Sun at Apogee & ☿	Aphelion from the Sun 46690

			Distance	
		from the Earth	148430	
	Perihelion	from the Sun	30480	
		from the Earth	71260	
Sun at Perigee & ☿	Aphelion	from the Sun	46690	
		from the Earth	144950	
	Perihelion	from the Sun	30480	
		from the Earth	67780	

Greatest digressions [elongations] from the true place of the Sun			I	II	
Sun at Apogee & ♁	Aphelion	27	18	12	
	Perihelion	17	25	30	
Sun at Perigee & ☿	Aphelion	28	23	3	
	Perihelion	18	4	45	
Inclination of the Orbit to the Ecliptic			6	55	0

Greatest variety of latitude			Gr.	I
Sun at Apogee & ♁	Aphelion	in the Morning, Retrograde	5	46

Greatest variety of latitude		Gr.	I
		in the Evening, Direct	2 10
	Perihelion	in the Morning	2 55
		in the Evening	1 35
Sun at Perigee & ☿	Aphelion	in the Morning, Retrograde	6 10
		in the Evening, Direct	2 13
	Perihelion	in the Morning	3 5
		in the Evening	5 5

The remaining Distances of Mercury from the Sun, alongside its Equated Anomaly degrees, see in Volume 2, Table 97.

Parsing notes: this composite geometrical-hypothesis panel spans the full right column of folio 352; the four-line "Greatest variety of latitude" rows each carry three numeric subfields (Gr., I., and a third minutes/seconds column) under a header showing only "Gr." and "I" — the third value is transcribed as printed.

LIBER DECIMVS

IN QVO PARALIPOMENA OBSERVATIONVM AD FIXAS, Et
Planetas Minores Pertinentium, videlicet

DE Diametris Apparentibus, eorumque Figura, Fascijs,
Maculis, Vertigine, Comitibus, & Comitum motibus, AC
DISTANTIIS A SOLE, ET A TERRA.

BOOK TEN

In which are the *Paralipomena* [supplements] of the Observations pertaining to the Fixed Stars and the Lesser Planets — namely, concerning their Apparent Diameters, and their Figure, Bands, Spots, Rotation, Companions, and the Motions of the Companions, and their Distances from the Sun and from the Earth.

CAPVT I.

On the Methods of Observing the Diameters of the Fixed Stars and of the Planets.

The first method, employed by the ancients, consists in the ocular estimation of comparing the seen Diameter of a Star with a portion of the Lunar Diameter, or with the small distance between two Fixed stars otherwise known — say, with the distance of the Pleiades among themselves, or of the Hyades. But this method is very fallacious, or [is established] by the experiment of many observers at once observing the same thing, since however many eyes there are, so many for the most part are the differing opinions about the magnitude of a Star which they bring forth. The reason is that the rays adventitiously assumed about the Stars — whether from the Atmosphere, or from the humors of the eyes, or [as] appearances of refraction — enlarge their discs optically, and on the contrary detract just as much from the distances of those stars among themselves.

[Margin: 1. Method.]

The second method is carried out by means of the Dioptra of Hipparchus, or similar [instruments] — that is, by applying a very narrow strip, which at a great but known distance from the eye covers a Star precisely; or by applying a small

tablet, or a thin sheet, with a hole so small that it intercepts a Star at a great but likewise known distance, within the margins of its own edge — or at least a space three times greater than the Star's disc: for by the laws of right-lined triangles, and of rectangles, from the given thin sheet, or tablet, [held] at a distance from the eye, and by the similitude of the tablet, or sheet, an angle is gathered, which doubled measures the apparent diameter of the Star; or in the third kind of usage of the tablets, a space three times greater than the apparent diameter of the Star. But this method, in whatever manner, is for the said reasons fallacious by a triple cause. First, because the situation, in which the tablet is whole, or perforated, congrues precisely with the diameter of the Star, or with a space three times greater, does not consist in something indivisible, but it is established by an experiment that there moves, or draws back from the eye, or toward the eye, a sensible difference appears to the eye; then that very ocular estimation, on account of the assumed rays of the Star, is in the first method fallacious. Finally, the angle which is acquired by a Dioptra of this kind is not a true visual angle; for it is in the surface of the eye, but the true visual angle is constituted in the surface of the Retina, which is at the bottom of the eye; and therefore so great a Parallax intervenes, as great as is the depth of the eye, which however if it be known, and added to the distance of the Dioptra from the surface of the eye, the angle could be more justly obtained, otherwise always greater than is just.

[Margin: 2. Method.]

To this method are reduced our Rays, both Triangular and Scalar, concerning which [see] Book 6 of the *Almagestum Novum*, Chapter 9, number 6; and the method of Galileo by a perpendicular thread —

suspended perpendicularly, which method I nonetheless reserve to treat separately.

[Margin: Method 3] **The third method**, then, carries out the observation by means of a thread suspended perpendicularly: receding by a fixed distance from the eye until the small thread, by its thickness, exactly conceals the star whose apparent diameter we are measuring; then noting the distance of the eye from the thread, and the breadth of the thread itself, and from these computing by the rule of the Triangular Rays the diameter of the star, as I have said. Reckoning the distances of such a thread, let it be taken in inches, but the breadth of the thread must be added in twelfths of an inch [unciae and their twelfths]; for these are the Triangular Rays. The rest, then, belongs to Trigonometry, to be worked out. So Galileo [Galileo Galilei] teaches in Dialogue 3 of his *System of the World* [*Dialogo sopra i due massimi sistemi*], where, in covering over the star, he holds that one

must take care to cut off only the adventitious rays, not those that are within the prior limits. Yet here too lies a fallacy of the preceding methods: for since this method does not impede the reflected rays even on its own margins, those rays are still troublesome.

And although this method has been carried out as exactly as it can be, it has nonetheless deceived the most studious in the diminution of the apparent diameter of the fixed stars — so much so that Copernican hypotheses derive probability from it, since by it the immense distance of the fixed stars increases all the more the bulk of those stars, however small their apparent diameter may be. [Margin: A singular warning] **A singular warning.** And let it be observed here, and in all the other aforesaid methods, that one must beware lest, from the proportion seen in the whole disc — whether of a circle, or of a small circle, or of a star, or of a lens — an equal proportion be inferred among the diameters; nor are the circles themselves to one another as the diameters are to one another, but as the squared diameters, that is, as in Element II.12 of the *Elements* [Euclid, *Elements* II.12]. By way of example: if Sirius be to Jupiter as 5 is to 4, Sirius will be eightfold smaller than Jupiter; for the squares of these, that is, the squares of the binary, are contained in the number 32, which is roughly the number $5 \frac{4}{7}$.

[Margin: 10] **The tenth method** requires the application of some Stationary Planet to a Fixed Star, especially the slowest-moving, comprehended within the tube; considering how many times the Star, or the Planet, is contained either in their mutual distance, or, from the Planet's motion, how much of that interval the Planet traverses — according to the examples and precepts handed down in *Almagestum Novum* VII.10.

[Margin: 11] **The eleventh method** is supplied by Christiaan Huygens [Christiaan Huygens] in his *System of Saturn* [*Systema Saturnium*], page 82, in these words: "There is a certain place within the tube, equipped only with the connection of the glasses, situated at so much greater a distance from the other [glass] than the eye-glass is distant from the eye, by how much that place — if anything subtle and finely terminated be placed within the cavity of the tube — represents it to the vision as distinct and of well-defined outline. This place falls to eyes of perfect focus; but for some it must be taken a little nearer, for others farther off, according to the limit of the eyes. Here, then, let there be set up a little ring with a small angular opening, as near as may be to the eye-glass, so that the whole opening may be detected in the heaven without parallax — or rather a hair circularly disposed, so that a more precise measure may be had. The diameter of this opening, what fraction of a foot it comprehends, must be inquired from the

transit of a star [*sidus*], the time of whose transit is measured by the vibrations of a pendulum, or by our oscillating Clock, while the telescope meanwhile stands motionless. This being found, let a little metallic rod of decreasing breadth be gradually introduced into the tube at the said place, and let it be noted at what breadth the rod precisely covers the Planet; and the breadth received from the circle being compared with the whole amplitude of the opening, thus the apparent diameter of the Planet is easily made known by reckoning. But I judge this slippery and difficult to recall to mind, namely with what part of the rod precisely it has covered the whole Planet."

he indicates the method by which they were used in this determination. **Kepler** [Kepler] in the *Epitome of Astronomy* [*Epitome Astronomiae Copernicanae*], volume 2, page 485, partly from the 9th observation of **Io. Remus** [Johannes Remus Quietanus], and partly as I have indicated in the preceding chapter — established partly from certain analogies among the bulks themselves, partly from the intervals of the Planets worked out (a thing he is wont to emulate in turn) — is **Rheita** [Anton Maria Schyrleus de Rheita] as well, in book 4 of the *Oculus Enoch et Eliae* [Riccioli: *Radii sidereomystici* ch. 2 member 2], who confines Saturn's diameter at its greatest distance to 30", and in the *Tabulae Rudolphinae* [*Tabulae Rudolphinae*] to 110": he says (book 7) "Saturn is never seen larger than 30" — second to none." And in the same place he supposes, from the *Epitome of Astronomy*: "That the bodies of all the Planets are in the proportion of their bulks, and of the Sun's interval in its subtriple"; yet prudently in the *Epitome* he has said: "I yield the place to Remus, I yield to observations." But Rheita, in book 4 chapter 4 member 2, affirms that he, in the year 1644 on the 20th day of July, with the telescope took in the whole disc of the full Moon, and translating it onto a divided chart, found the diameter of Jupiter to be nearly the tenth part of the Lunar diameter — that is, of the Lunar minutes, 3'. The diameter of Saturn, indeed, is the fifteenth part of the Lunar diameter — namely 2' and a little more. There was at that time Jupiter near the aspect of the Sextile of Leo, and Saturn near the Quadrate. But **Martinus Hortensius** [Martin Hortensius], as he reports in his *Dissertatio cum Gassendo de Mercurio in Sole viso*, using the method of the preceding chapter in the year 1625, saw in February that Saturn at Perigee was round and very nearly equal to Jupiter, whose diameter was 40"; in the year 1632 he saw Saturn's diameter 36"; and Jupiter likewise appeared to him 40". But when the small body was taken with its appendices, which did not entirely stand out — whence it appears that Saturn without its companions is seen through the telescope second to none of 31" at Apogee, and 42 1/2 at Perigee, by which Saturn's whole interval is gathered. **Hevelius** [Johannes Hevelius] in his little work *De Saturni facie* page 23 affirms that Saturn appeared to him in the year

1656, when it was alone, as round, at a mean distance of 39" and a third, 36"; **Hugenius** [Huygens] at Perigee, and alone, 30" with the ansae [handles] 68".

[Margin: 2 — Our two observations] **We ourselves**, however — namely **Father Giovanni Battista Riccioli** [Riccioli], in the year 1649 at its close, and at the start of the year 1650, when Saturn was rising acronychally — made the diameter [of Saturn] observed often more notably; and again on the 2nd of December and the 10th of January. It was, moreover, the 18th of December at the Perigee of the Epicycle, and about the 27th at the Perigee of the Eccentric. And with a very large telescope, by Methods 5, 6, 7, 8, and 9 set forth in the preceding chapter, we observed Saturn, both as to its diameter, more so than Jupiter, and we find Saturn's compound diameter AB, with its sides [lateral bodies], to be 13"; but Saturn alone, taken without its lateral bodies, with its simple diameter FG, reduced to Jupiter's diameter, 6 1/2. The diameter compounded AB to Jupiter's diameter as 5 3/4 to 8. Suppose now the appearing diameter of Jupiter, then in the following measure, to be 44"; for if it be made 8 to 44, and so 44 to another, there will result Saturn's diameter AB, in seconds, 7 1/2. Again, if it be made 8 to 6 1/2, and so 44 to another, there will result the diameter FG in seconds 34".22". Finally, if it be made 8 to 5 1/2, and so 44 to another, there will result the diameter CD in seconds 31".38".

[Margin: 3] During those same days the two stars among the Hyades observed occupied a quarter of the interval of their gap in the heaven; this through our telescope was comprehended, and turned out to be 5 1/2 minutes, or a little more. Saturn's diameter AB, in the space of those stars, was seen to be contained 5 1/2 times. Again, considering a certain star of the Twins, neighbor to Propus, in the Catalogues of the Fixed Stars omitted, as visible only through the telescope, but cast off by us, because it was in a straight line with AB, and contained the space between it and Saturn's extremity, the remoter A, 5 1/2 times Saturn's diameter AB; the same star, with respect to Saturn's diameter AB, most evidently 4 1/2 to 1. Now indeed, from the interval at the other extremity A, to that star, with the foresaid diameter of Saturn, the Hyades interval frequently compared, was seen to it altogether equal. Hence Saturn's diameter AB was [confirmed at] 7 1/2 seconds, or 72".

[Margin: 4] In the year 1650, on the following night, the 2nd day of January, an hour after sunset, Saturn was at its diameter AB, in the same nearly straight line with a certain westerly star, and a Fixed [star] which, through the telescope at the same time with Saturn, was conspicuous; but on the following night, the 3rd, about 2 hours of night, in which Saturn was beginning to recede little by little

from its proper orbit, parallel to the Equator — let that line be drawn through the centers of Saturn and the star, and below, as we shall say, parallel to the Equator; thus Saturn evaded toward the west, and the more westerly of the said stars, and by the straight line PR, perpendicularly drawn from the star P, above the diameter AB, cutting off nearer to F than to R, a fourth part precisely. Thereafter about 5 1/2 hours of night, Saturn, retrograding from its setting, was reconstituted; the star appeared at it in H, and the line HL produced, and BA likewise, so that the interval HL was equal precisely to the space AB, that is, to a fourth part of the diameter AB; but the true interval AL, Saturn receding and going toward the west, manifestly appeared greater. Now indeed, from more accurate Tables the motion of Saturn appears to have been in that natural minute 4'.30"; therefore the Hourly Second 11".15". Therefore at hour 2 ad hor. 5 1/2, Saturn's center O, completed 56". The Second, then, 34", that is, the space equal to the semidiameter AO, namely a perpendicular at the star P, falling perpendicularly in R; but AF, equal to itself AF, since the rod cut off the whole diameter AB — when it was perpendicular falling as H in L, and AL equal itself AF, so therefore LF, and equal the semidiameter AO, and equal the Second 36".34". The whole therefore AB is 73".8", which exceeds the prior observation, the Second 72"; namely the Difference between so diverse modes [methods], plainly contemptible; indeed, by next-to-nothing consensus, altogether wonderful, and worthy of religious credence over the matter related.

[Margin: 5] Assuming, then, Saturn's Perigeal Second to be 73", or 1".12" for Saturn's sole diameter FG, the Second 36", from the Problem stated in *Almagestum Novum* VII.5 chapter 8, and from the least distance of Saturn from the Earth, which we put under chapter 2, the Terrestrial Semidiameter 57743: we shall gather its true Semidiameter, simply taken as FO, the Terrestrial Semidiameter 4 4/7; the compound diameter AO, the Semidiameter...

Diagram. A telescopic-observation schematic for Saturn, set within a large horizontal ellipse (the field of view of the telescope). Inside the ellipse, two crescent-shaped dark figures flank a small central body — depicting Saturn (the central disc) with its two lateral appendages (the ansae / "handles") shown as the crescents. A horizontal baseline runs across the ellipse with several lettered points. Above the ellipse, the planetary symbol ♄ (Saturn) is marked. Vertical dotted construction lines connect points above and below the figure.

- ♄ (top center, above ellipse): symbol of Saturn
- H (upper left, above ellipse): construction point

- P (upper center-left, above ellipse): star position (marked with an asterisk *)
- C (top of ellipse, center): point on Saturn's disc (upper)
- L (left end of baseline): construction point
- A (on baseline, left of center): Saturn's extremity / left limb of diameter AB
- K (on baseline, between L and F): construction point
- F (on baseline, center-left): endpoint of simple diameter FG
- O (on baseline, center): center of Saturn
- G (on baseline, center-right): endpoint of simple diameter FG
- M (on baseline, right): construction point
- B (right end of baseline): Saturn's extremity / right limb of diameter AB
- D (bottom of ellipse, center): point on Saturn's disc (lower)
- R (lower center, below ellipse): foot of perpendicular from star P

the Terrestrial Semidiameter $9 \frac{1}{3}$. Thereafter, from the distance of Saturn from the mean Earth, Semidiameter 73000, and from the maximum 90155, by the Problem of *Almagestum Novum* (same chapter 8), we deduce the apparent Semidiameter of Saturn at mean distance, simply indeed FO 13".20": the compound AO 28".30"; but at maximum distance FO 11", and AO 23". Provided that Saturn, with its companions, preserve in its various Phases the proportion of apparent magnitude and the variety of distance shown.

CAPVT III.

De Diametro Apparenti Iovis.

[Of the Apparent Diameter of Jupiter]

[Margin: 1 — Opinions of the ancients. And of more recent men.] **The apparent diameter of Jupiter** Albategnius [al-Battānī] and Alfraganus [al-Farghānī], with a difference of 22, defines at minimum 2'.36", at the mean distance from the Earth. **Fernelius** [Jean Fernel], and **Egnatius Dantes** [Egnazio Danti], 2'.32"; **Maginus** [Giovanni Antonio Magini], and **Vursisius** [Christoph Wursteisen] (alas how various!) at minimum $9\frac{3}{4}$ "; **Tycho** [Tycho Brahe] in volume 1 of the *Progymnasmata* [*Astronomiae Instauratae Progymnasmata*], page 468; **Clavius** [Christoph Clavius], and **Blancanus** [Giuseppe Biancani] in the *Sphaera*, and **Argolus** [Andrea Argoli] in the *Pandosion Sphaericum*, at minimum 2'.45". But **Lansbergius** [Philippe van Lansberge] in the *Uranometria* book 3, minimum 2'.30". But no one infers any foundation from the matter. **Kepler** indeed in the *Epitome of Astronomy* volume 2, page 485, and in the *Tabulae Rudolphinae* page

110, from the Analogy indicated above of the subtriple proportion, establishes Jupiter's diameter at maximum distance from the Earth to be 50". But **P. Rheita** [Rheita] makes it nearly fourfold greater: for in book 4 of the *Radii sidereomystici* chapter 4 member 2 he says he, in the year 1644 on the 20th of July, used the telescope with great excellence. With the telescope he took in the whole disc of the full Moon, exhibiting it 34" minutes, and in its ocular convexity, surrounded by Lunar extremities, with the most subtle little circle of the Lunar diameter encompassed, and translating it onto a chart divided into 34 parts equal, and in the same manner finding Jupiter's diameter, as it were the tenth part of the Lunar diameter — this being the tenth part 3" minutes. But whether this practice be safely used will be established from the more certain quantity of this diameter, concerning which presently.

[Margin: Of Marius. Of Hortensius.] **Simon Marius** [Simon Marius] in his *Mundus Iovialis*, from observations made with a tube and small mirror [*tubo specillo*], puts Jupiter's diameter at the mean distance very nearly at 1'. But **Hortensius**, exploring [it] by the capacity of the telescope, as above, saw in the year 1632 Jupiter's diameter acronychally, in the year 1632. **Jupiter's** Acronychal diameter occupied the fifth part of the gap which is between two contiguous Stars in the following constellation of Capricorn, which gap was of Minutes 5'.15"; and so Jupiter's diameter, minimum 1", indeed less; in some doubt, says **Gassendus** [Pierre Gassendi] to have apprehended in the year 1630, as the same Hortensius reports in the *Dissertatio Mercurii cum Gassendo*. He adds, on November 13th, that, excepted from Jupiter's image, repeated, the fourth part of the said gap, the gap had been 130; again on another night he found Jupiter's image of parts 6, of which the Solar image was 195; therefore the Solar diameter being put, Jupiter's diameter he concludes to be a little fuller, by one minute. From this, then, he chose it, by minutes 1'.1".40". The Apogeeal indeed Second 38".30".

[Margin: 3 — Of Hevelius] **Johannes Hevelius**, in his *Selenographia*, page 449, narrates that he, in the year 1646, on the 21st of April, at hour 12 the evening prior, observed Jupiter's diameter equal to one-third, which he, from the Pontus Euxinus situated, calls Mount Moschus, and which he found the first part of the Lunar diameter at the 29th, very nearly. Hence he constitutes, the Moon being then minimum, about 30, concluding Jupiter's diameter to be minimum 1'.2". He narrates in the year 1646 December 24th: Jupiter compared with the Lunar Aetna seen by himself one minute; but at page 347 he had said Jupiter compared to it 12. In April with Mount Crago, set down; the Lunar diameter minimum 34", scarcely the lesser of one minute.

[Margin: 4 — Of Gassendi] **Gassendus** in the Epistle of the year 1630, on the 6th of the Kalends of September [Aug. 27], to Kepler published at The Hague, reports on the 16th of August in the evening to have observed by the telescope an interstice between a certain little star, and the Moon's margin, capable of a sixth part of the Lunar diameter; and if to this interstice could be made equal five Acronychal diameters of Jupiter; and therefore Jupiter's diameter is in no way greater than one minute. In the *Epicurus* page 901, he narrates to have observed by the telescope Jupiter rising, with a diameter equal to a seventh part of the Caspian spot; and therefore he determined that very part of the Moon, in seconds, 33. There was, indeed, the 20th day of January of the year 1647, when Jupiter approached most near and to opposition with the Sun, and to the Perigee of its Epicycle; whence it appears, from the near splendor of the Moon, to have appeared less to Gassendi than at other times in acronychal position. **Cristianus Hugenius** [Huygens] puts Jupiter's Perigeal [diameter] at seconds 64" in diameter, by himself observed. Our Fathers at Oeniponte [Innsbruck], from the capacity of the Tube, estimated Jupiter's diameter \approx in the year 1635, March 19, 1'.12"; or in the year 1637, March 16, they estimate 1'.28", or 1'.30". The Marquis **Cornelius Malvasia** [Cornelio Malvasia] from the Tube's intervals of the year 1662, in May and in June, estimated 51"; in September 41".

[Margin: 5 — Our observation] But truly in the year 1649, at the start of June, with **Father Francesco Maria Grimaldi** [Grimaldi], in observing Jupiter's Zones, when I had noticed Jupiter most strongly preceding the stars on the left wing of Virgo, which was in the sixth part in the star of Virgo, having the latitude of those Boreal stars at gr. 1.25', and existing then in \square gr. 29.56'.25"; and when, from the Montebruni Ephemeris, Jupiter would be of Boreal Latitude gr. 1.25', about; nor did I doubt of the proximate conjunction of Jupiter with that star, and of the opportunity of establishing four diameters of Jupiter from its motion, and from the distance of the star — concerning which I shall presently explain more clearly by the schema written below.

Diagram. A telescopic-observation schematic illustrating the conjunction of Jupiter with a star in Virgo, oriented by the four cardinal directions. Across the top is the label *Septentrio* (North); across the bottom *Meridies* (South), with the central vertical axis pointing to a point A below. On the left is *Oriens* (East), on the right *Occidens* (West). On the left side a circle (Jupiter's disc, larger) with center G is drawn, with points N, K below it and a horizontal hatched bar above (PM / NL, Jupiter's belts). On the right a smaller circle with center H is drawn (the star's apparent disc FBG), with points P, F, M, R. A horizontal line connects the two

circles through points L, D, P. Diagonal lines descend to the point A at the bottom (the vertex of the triangle of observation), forming triangle AB / AC.

- *Septentrio* (top): North
- *Meridies* (bottom): South
- *Oriens* (left): East
- *Occidens* (right): West
- ♃ (upper left and upper right): symbol of Jupiter (marked twice, at both disc positions)
- N, K (left, below larger circle): construction points
- L (center-left on horizontal line): construction point
- G (center of left circle): center of Jupiter's disc
- D (center on horizontal line): construction point
- P (center-right on horizontal line): construction point
- F, M (right, near smaller circle): endpoints of the star's apparent diameter
- B (right): the star (Virginis)
- H (center of right circle): center
- R (right, below): construction point
- A (bottom, vertex): vertex of the observation triangle

Let A be the star of Virgo, the center of the more westerly Jupiter B, whose apparent disc FBG is much larger, however, than the place itself represents. Let the center of the more easterly Jupiter be C, its belt PM and NL, and the line RBCK parallel to these, and to the Ecliptic; concerning which Parallelism it will be established below. Now from the star A, the more southerly, than which Jupiter [is], let the line KR be drawn — by perpendicular chord, let the arc AD be carried through, which connects the center of Jupiter's disc with the star A; by straight lines AB, and AC, produced, let AB be, so that in F, it be the diameter GBF, which diameter is understood to be divided quadrifariously, so that GH be a fourth part of it.

[Margin: 6] On the 9th day of June, hour 1, after sunset, Jupiter appeared in B, more westerly, and more Boreal than the star A, and so by the telescope showing the distance AG, of parts altogether 7, of which one was AB $3\frac{1}{2}$, of which one was GB, the semidiameter of Jupiter, and the whole AB of parts 9, of which GH, equal to four diameters of Jupiter. On the following day, indeed, about the tenth part, Jupiter appeared in C, more boreal, and more easterly than A, so that the distance AC, was of parts precisely eight, of which a quarter part is Jupiter's diameter, equal to four of Jupiter's diameters. The line BC drawn, indeed,

designates Jupiter's path, and the latitudes of the arc chord AD, indeed Jupiter again at its time was in D, conjoined to the star A — incorporeal indeed, but Ecliptic, boreal indeed, however much AD. Which was estimated at parts $4\frac{1}{2}$, of which GH, one. These being posited: First, in the Triangle...

the angle ABD, by dropping a perpendicular to AD, since the side AD is given, the side BD is found to be $4\frac{1}{2}$ parts and the base AB 9 parts — about $\frac{1}{4}$ part greater. Next, in the right Triangle ACD, by dropping a perpendicular to AD from the side AD ($4\frac{1}{2}$ parts) and the side AC (8 parts), the side CD comes out as 6 parts, and so the whole BC works out to 14 parts of the kind of which GH (the diameter of Jupiter) is one, or $3\frac{2}{3}$ such parts — that is, equal to the apparent diameter of Jupiter.

Second, in the standstill [Iovis stationi] just preceding, the true motion was about 1 hour, 0 minutes of night for nearly 10 nights of night, that is, 2 minutes 40 seconds of arc; this comes out to 160 seconds. Let it therefore be as $3\frac{2}{3}$ is to 160, so... and indeed 1 [Jupiter-diameter] to about 160. Therefore the diameter of Jupiter appears about 160 seconds.

Hence indeed it follows that, with Jupiter at this distance from the Earth, the seconds [are] 160. Again, from the side CB, which at the same distance — that diameter of Jupiter at $4\frac{1}{2}$ to 49 parts — Jupiter therefore came out at 49 seconds. **Third, since** that star [the Virgo star], and indeed its latitude was northern, was 1 part 25 seconds; Jupiter's latitude was northern, 1 part 25 seconds 49 seconds; at the moment of conjunction, which fell on 9 June at 21 hours after noon, the longitude was then $\square 29^{\circ} 56' 25''$ — let this stand. The Prutenic Tables give $29^{\circ} 40'$ with a latitude of $1^{\circ} 36'$; the Danish [Tables] give $\square 0^{\circ} 1'$ with a latitude of $1^{\circ} 33'$; and Lansberg's give $\square 30^{\circ}$ precisely, with a latitude of $1^{\circ} 24'$. **Third, since** the anomaly of the eccentric was then about gr. $1^{\circ} 55'$, and the anomaly of the orbit nearly $248\frac{2}{3}$, the question is what was Jupiter's distance from the Earth on our hypothesis of the semidiameters of the terrestrial [orbit], 39500 [units]; and being near apogee in the eccentric, a little below the mean longitude of the epicycle, hence both the angle of the semidiameter is $23''$ — as Problem 1, Caput 8, of *Almagestum Novum* sect. 5 has it — there is collected the true semidiameter of Jupiter: the terrestrial semidiameters are $4\frac{7}{10}$. Hence by Problem 2 of the same chapter, and the distances [found] in the same section, Caput 2: the maximum distance of Jupiter is 47552, the mean 36900, the least 26441. The semidiameter of the Earth then yields the semidiameter [of Jupiter] as $19'' 9'''$ in apogee at either distance; at the mean distance truly, $24'' 53'''$; and at the perigee $34'' 23'''$ — which has been deduced by us. And whatever else may proceed from another

hypothesis, [the figures] preserve the proportion of those same intervals, [taken] with the distance of the Sun, or with the radius of the annual orbit.

These things, then, having been established by us, in the following month there was carried over to us by the letter of Master Vincenzo Muti — at Sole Alfonsino [under the Alfonsine reckoning] recently published, and a man most skilled in astronomy, given to us by Maiozica [Majorca?] — the following, which they hold: *Jupiter was observed in conjunction with the star preceding by 4 minutes in the wing [ala] of ♃ on the 9th day of the month of June, in the year 1649. Jupiter was the western one, called the star; but this one was distant from Jupiter by a diameter of nearly 10 Jupiters. On the following day at the same hour, Jupiter was now seen more to the east, between which there were 24 hours: Jupiter, by comparison with the star, was seen to have run with the greatest precision the very diameters of its own body.* Therefore Jupiter's diameter was not far off from that of Martinus Hortensius at this place [secundum 48"]. It can easily be estimated how immensely we rejoiced at so close an agreement and conspiracy of talents concerning the manner and time of this observation.

CAPVT IV.

De Martis Diametro Apparenti.

[On the Apparent Diameter of Mars.]

1. Albategnius [al-Battānī], cap. 50, and Alfraganus [al-Farghānī], Differentia 22, set down the apparent diameter of Mars at 1' minute; Fernelius and Egnatius Dantes [Egnazio Danti] at 1' 29", or 18"; Magginus [Magini] and Vurstisius [Wurstisen] at 8' minutes; Tycho [Tycho Brahe], Clavius, Blancanus, and Argolus [Argoli] in the places cited above [set it] at 1' 40"; and Lansberg at 1' 30" — and indeed all of these at the mean distance of Mars from the Earth, [namely] 3' min. 1' 30". And Galileo, in Dialogue 3 of his *On the World System* [*Dialogo sopra i due massimi sistemi*], says that if Mars be viewed through a telescope, it is seen in opposition with the Sun to be sixty-fold — or fifty-fold — larger than near conjunction, insofar as one may discern by area; but as to the diameter, eight-fold or seven-fold. Gassendus [Gassendi], *Institutio Astronomica* lib. 2, cap. 9, says that Mars, which otherwise scarcely equals a star of the second magnitude, in opposition with the Sun is, with each [augmentation], especially at perigee, in coincidence...

[col. 2]

rente [in comparison] with the apparent magnitude of Jupiter or of Venus — that is to say, understanding it thus, that Jupiter (a fixed star, as it were) is overcome by Venus near perigee. Kepler too, *Optics*, pag. 333. The astronomical-optical [writers] relate this: in the year 1529, in July, Mars must have appeared with prodigious magnitude — with a new star, one might believe — and so much greater did it appear in the month of August, in the year 1561, and again in 1593; and in August of 1608, [Mars] was at perigee, both at every season, in the eccentric of Aquarius, and at the epicycle. In the *Epitome Astronomiae*, pag. 485, [Kepler] says that Mars at perigee, in Aquarius, is seen to be larger than Jupiter, but not by much; Jupiter is seen rather frequently through a telescope. Second, 50 ["]; and yet in the *Rudolphine* [Tables] it is laid down by precept 110: he supposes the bodies of all the planets to be in the proportion of their distances, or of the intervals of the Sun, of the diameters [also] in the subtriple [proportion], insofar as Mars in proximity appears to the Earth to subtend 5' min. 15' in the semidiameter; therefore, as to the diameter 6' 50", or therefore Mars appears much larger, but [it is] not — for those proportions are so great as to be unreal. Yet rightly, by the magnitude at perigee, collated with the apparent diameter at apogee, Mars is deduced acronychal within the Sun, [being] nearer than the Sun, [more] than Mercury, and at the perigee of Venus. Moreover, the PP. Soc. I. [the Fathers of the Society of Jesus] at Oeniponte [Innsbruck], by the capacity of their telescope, estimated the diameter in the year 1636: Marco [Marcus] at 32", and on 6 May at 29"; at Marchio [the Marches?] Cornelius Malvasia, in the year 1662, on 17 July, and through his telescope at 25", about [that figure].

2. Hortensius [Hortensius], in his *Dissertatio* with Gassendus concerning Mercury seen in the Sun, relates that in the year 1632, in February, it was observed by him that Mars acronychal near the apogee of the eccentric, and at the perigee of the epicycle, was distant from the Moon's limb by no more than one digit — this is 2' 42"; and that Mars, of nearly four parts, occupied a quarter of that distance: therefore [it was] not seen by him to be much larger than 36". Hence the intervals assumed by Lansberg lead him to conclude that, at apogee, Mars appears [to subtend] seconds 9 ["]. At perigee, [seconds] 9, by 1' 4" — which subscription Herigonus [Hérigone], *Cursus Mathematicus*, vol. 4, pag. 62. Huygens defines the perigeal diameter as 30".

3. We, with Father Grimaldi [Grimaldi], in the year 1649, on 22 July, by telescope comparing Jupiter with Mars, and at each [position], saw the figure rather often passing over in paper [i.e., projected onto paper]: Mars's diameter, drawn on paper, was less than double of Jupiter's; but it was, from our hypothesis, the apparent semidiameter of Jupiter 21" 5"; therefore Mars at 10" 32" at the distance

from the apogee of the eccentric gr. 86, and at the epicycle gr. 255 — whence by the Tables, and by Problem lib. 7 of *Almagestum Novum* sect. 5. From this we drew out the true diameter of Mars: the semidiameter of the Earth being [taken], [we found] the apogeal semidiameter 5" 3"; the perigeal 46"; the mean 11" — quamuis [although] in the year 1651. On 5 April, Mars was seen collated with ♃ [Jupiter] and ♄ [Saturn] at 45"; and in the year 1655, on 22 July, [Mars at] 60 parts of the kind of which Jupiter [was] 68.

[col. 2]

CAPVT V.

De Diametro Apparenti Veneris.

[On the Apparent Diameter of Venus.]

1. At the mean distance of Venus, the apparent diameter is defined by Albategnius [al-Battānī] at 3' 8"; by Alfraganus [al-Farghānī] at 1' 34"; by Fernelius at 5'; by Egnatius Dantes [Egnazio Danti] at 4'; by Vurstisius [Wurstisen] and Magginus [Magini] at 10' 30"; by Tycho [Tycho Brahe], Clavius, Blancanus, and Argolus [Argoli] at 3' 15" — as indicated above, cap. 2.

2. Scheiner [Scheiner], in his *Epistle* of the year 1611 to Marcus Welser [Marc Welser], puts the diameter of Venus as the subdecuple [one-tenth] of the Sun's diameter, and so [he allows] up to three minutes at least; but in the elliptic Sun [i.e., the Sun viewed obliquely] he excepts the figure of Venus on paper; and on the year 1612, through his telescope he caught the figure of Venus on paper, and that of the Sun, observed at the same distance between them, both ☿ and ♀ [Mars and Venus?]; and on 23 October he found the diameter of Venus to be $2\frac{1}{3}$ of the kind of which the diameter of the Sun was 34, that is, 27'; and on 29 October the same again 26. On 5 December he again found min. 2'. Yet he confesses that the observation was shadowy [umbratilem, of the shadow-image], and reserves a better observation for another time. I do not know, however, whence Hortensius...

attributes to Scheiner an apogeal diameter of Venus of 34", a mean of 1' 40", and a perigeal of 8' 42".

3. Galileo, in his *Epistle* 1 and 3 to Marcus Welser, reprehends those who observe the magnitude of Venus, not through a telescope but otherwise, as [appearing] with a wide and ruddy fringe of hair [capillamentum, the radiant fringe]; for one

ought either to observe through a telescope, or in either way; for in this manner [Venus] is denuded of that hairy fringe, and one perceives Venus in morning conjunction; and at apogee [its diameter is] scarcely the two-hundredth part of the solar diameter, this being 10". But Hortensius writes to Gassendus that he directly compared the diameter of Venus, through a telescope, with the interval contiguous to the Hyades, when [Venus] was approaching apogee with the Sun, in opposition to 15" 20". Hence the distance of Venus from the Sun, viewed at 15", or 40" — at which intervals Lansberg sets down the diameter of Venus at 1' 40"; which Hortensius subscribed above. But Hortensius had not seen Venus at perigee, just as [neither did] Kepler. By Kepler's precept 110 of the *Rudolphine* [Tables], from the proportions, [those] concerning which [we spoke] above, he computes the perigeal diameter of Venus at 7' 6". Finally, Hevelius, *Selenographia*, cap. 55, says that he saw Venus around the year 1644 himself [to subtend] 46"; and on the year 1646, on 22 April, [Venus] compared with the Sun's spot ☉, seen at perigee in the epicycle, [to subtend] min. 1' 22".

PP. Soc. nostrae Ingolstadii, & Oeniponti ex sui Tubi capacitate aestimarunt diametrum □ sic [The Fathers of our Society at Ingolstadt, and at Innsbruck, estimated the diameter of Venus from the capacity of their telescope as follows]:

Year	M. [Month]	D. [Day]	'	"
1619	Febr.	11	2	12
	vel [or]	2	0	
	Febr.	20	3	0
	Mart.	27	1	37
	Maij	1	0	54
	Maij	30	0	30
	Iulij	5	0	54
	Octob.	12	2	0
	Nou.	18	1	0
1621	Nou.	30	1	0
	Nou.	11	2	15
1622	April.	1	2	15
	Iulij	9	1	7
	Aug.	6	0	45
1635	Ianu.	7	1	42

Year	M. [Month]	D. [Day]	'	"
	Ianu.	11	2	0
	Ianu.	28	2	29
	Febr.	1	2	19
	Sept.	19	0	51
1636	Mart.	23	0	53
	Maij	16	0	44

Parsing notes: The minutes (') and seconds (") columns are headed by single and double prime marks in the source. The "vel" (or) row gives an alternative reading for the 1619 February 11 entry (2' 12" or 2' 0"). Two sub-tables side by side in the source (1619–1621 on the left, 1622–1636 on the right) are merged here in chronological order.

4. We too, with rare good fortune, in the year 1649, on 29 June, observed Venus in the evening through a telescope, [it] being about to conjoin with the Sun on 7 July; but a great latitude favored [the observation], and Venus appeared with a huge sickle [falx, crescent], rivaling the Moon; and on 26 July in the morning, through a telescope of thirty [-fold magnification], with diminished [light], its diameter was observed; and from the capacity of that telescope, in four parts, its diameter was observed; from the interval pricked off [punctum], by comparison also with the diameter of Jupiter, then in the same month, and again in the year 1650 — entering upon these the apparent diameter of Venus at apogee at 33½ seconds, by 4" 16" true; then the perigeal diameter at 4" 16" true: at length, by the distances [given by] *Almagestum Novum* lib. 7, sect. 6. Nor does Gassendus, in his *Epistle* to Schickard saying that Venus would scarcely be seen below the Sun at the appearance of one minute, [stand] in the way — for I would not concede this to him, unless the optical splendor of the Sun greatly diminishes the phase of Venus; nor again does Christian Huygens stand in the way, [who] in his *Systema Saturnium*, saying that it [the perigeal diameter] cannot exceed 85", allows Venus at perigee, as we [allow it], and [as] he observed; and how slippery is Huygens's method in observing the diameters of the planets, I have indicated cap. 1, lib. 11. I remember, indeed, that this same thing was settled with Father Grimaldi requiring [it], and that the diameter of Venus is diminished somewhat, but not so much as to exceed 2', and [it] approaches near to 3'.

[col. 2]

CAPVT VI.

De Diametro Apparenti Mercurij.

[On the Apparent Diameter of Mercury.]

1. Albategnius [al-Battānī], cap. 50, puts the apparent diameter of Mercury at the mean distance from the Earth at $2' 5'' \frac{1}{2}$; Alfraganus [al-Farghānī], *Differentia* 22, at min. $1' 15'' \frac{1}{3}$; Fernelius and Dantes [Egnazio Danti] at $2'$; Vurstisius [Wurstisen] and Magginus [Magini] at $7'$; Tycho [Tycho Brahe], Clavius, Blancanus, and Argolus [Argoli] at min. $2' 10''$; Lansberg, lib. 3, at min. $3'$. Vranometria [Lansberg's *Uranometria*] [puts it] in the *Dissertatio*: Mercury, with Mercury at the mean distance, [and] with Gassendus's inverted tube [tubo inverso, the inverting telescope], caught the figure of Mercury approaching apogee with the Sun in conjunction, and thence deduced its diameter at apogee [as] seconds 10; and hence, by the distances of Lansberg, the mean diameter at $3'$; and at the perigee at $8'$. Perigaeum $28''$.

2. Petrus Gassendus [Gassendi], in the year 1631, on 7 November, through a telescope caught the lucid little circle of the Sun in a most obscure camera [obscura], whose diameter was equal to three-quarters of a Parisian foot [dodrans pedis Parisini]; and it [the circle], divided into 60 equal parts, [each part] equal to half a minute; and when Mercury had passed under the Sun's disk, caught [its] little shadow [umbella] on the same paper, [Mercury] repeated [appearing] not larger than a third part of one minute, this being $20''$. Hence he concludes Mercury's diameter does not, in the middle [region], exceed the ninetieth part of the solar diameter. Thus *Epistle* 3 ad Schickardum [to Schickard], concerning Mercury seen in the Sun; and in the *Epicurus* [Gassendi's *Animadversiones in Epicurum*], pag. 899, that there existed a splendid little shadow [umbella] of the solar figure, optically circumscribed, [namely] Mercury, and somewhat less appeared.

3. Io. Hevelius [Johannes Hevelius], cap. 4 of his *Selenographia*, relates that in the year 1644, on 22 November, in the morning at 11 [hour], Mercury was seen by him minimal — smaller than Mars; and in the year 1645, on 16 May, in the evening at hour 8 [h. 8] $\frac{2}{3}$, still with a sickle [falcatum, crescent] seen, [it appeared] with the rays of which the little circle of the fixed [stars] of the first magnitude — which we hold as the diameter of Mercury, seconds 17 — about [that].

PP. Soc. I. Ingolstadij, & dein Oeniponti ex Tubo aestimarunt Diametrum ☿ sic [The Fathers of the Society of Jesus at Ingolstadt, and then at Innsbruck, estimated the diameter of Mercury from the telescope as follows]:

Year	Mens. [Month]	D. [Day]	'	"
1620	Octobr.	23		32
1636	Martij	23		15

Parsing notes: The heading uses the planet sign for the diameter (printed ☿ in the rubric, though Mercury is the subject — likely a compositor slip for ☿). The minutes column is blank for both rows; only the seconds values are given.

4. We too, in the year 1650, on 2 January, in a most serene sky [serenissimo Horizonte], drew the image of Mercury in a chart [in chartam] in the manner we have set out, lib. 7, cap. 1, & 2, and compared [it] with the diameter of Jupiter, which was then 44"; we found it [Mercury] to be 18", that is, nearly 18"; and by the distances and by Problema lib. 7 of *Almagestum Novum* sect. 6, we deduced the true semidiameter of Mercury [to be] the fourth part of the semidiameter of the Earth; and the apparent diameter, at each [distance], at apogee, seconds 9' 20"; in the mean distance 13' 48"; and at each [position], at perigee, 25' 12".

CAPVT VII.

Synopsis Opinionum de Diametris Apparentibus Planetarum Minorum.

[Synopsis of Opinions on the Apparent Diameters of the Lesser Planets.]

In *Almagestum Novum* lib. 7, sect. 6, cap. 9, there are set down both the apparent and the true diameters of the planets, [these] being posited for the Lansbergian semidiameter [as] diameter. Here we add a few things.

Diametri Apparentes Planetarum Minorum in Apogaeo, Media Distantia, & Perigaeo utroque.

[The Apparent Diameters of the Lesser Planets at Apogee, Mean Distance, and Perigee — at each.]

The table gives, for each authority and for each distance-condition (Med. = mean, Apog. = apogee, Perig. = perigee), the apparent diameter of each planet in minutes (′), seconds (″), and thirds (‴). Planet columns: ♄ Saturn, ♃ Jupiter, ♀ Mars, ♀ Venus, ☿ Mercury.

Authori ty	Diam. Appar.	♄ ′ ″ ‴	♃ ′ ″ ‴	♀ ′ ″ ‴	♀ ′ ″ ‴	☿ ′ ″ ‴
Albateg nius	Med.	1 44 28	2 36 40	1 34 0	3 8 0	2 5 20
Alfraga nus	Med.	1 44 28	2 36 40	1 34 0	1 34 0	1 15 12
Ferneli us	Med.	1 40 6	2 30 50	1 29 0	5 0 0	2 12 0
Egnatiu s Dantes	Med.	1 49 0	2 32 0	1 28 0	4 0 0	2 12 0
Vurstisi us, & Maginu s	Apog.	5 0 0	8 0 0	6 0 0	9 0 0	5 0 0
(Vurstis ius, & Maginu s)	Med.	6 0 0	9 30 0	8 0 0	10 30 0	7 0 0
(Vurstis ius, & Maginu s)	Perig.	7 0 0	11 0 0	10 0 0	12 0 0	9 0 0
Tycho, Clavius, Blanca nus,	Med.	1 50 0	2 45 0	1 40 0	3 15 0	2 10 0

Authori ty	Diam. Appar.	h' '' '' ''	q' '' '' ''	□' '' '' ''	□' '' '' ''	ϝ' '' '' ''
(Nos cum P. Grimal do...)	Med.	0 26 40	0 49 46	0 22 0	1 4 12	0 13 48
(Nos cum P. Grimal do...)	Perig.	0 36 0	1 8 46	1 32 0 (vel)	4 8 0	0 25 12
(Nos cum P. Grimal do... — alt)					2 45 0	
Sed de h cum Comitib .	Perig.	1 12 0				
(Sed de h cum Comitib)	Med.	0 57 0				
(Sed de h cum Comitib)	Apog.	0 46 0				
Simon Marius	Med.		1 0 0			
Heueliu s	Perig.		1 2 0			
Gassen dus	Perig.		1 0 0			0 20 0
Scheine r apud Horten sium	Apog.				0 34 0	

Authori ty	Diam. Appar.	♄'""'''	♃'""'''	♂'""'''	♀'""'''	♃'""'''
(Schein er apud Horten sium)	Med.					2 40 0
(Schein er apud Horten sium)	Perig.					3 42 0
Anton. Maria Rheita	Med.	2 0 0	3 0 0			
Galilae us	Apog.					0 10 0
Io. Heueliu s de ♄ solitari o, ac rotund o	Med.	0 39 36"				
Cristian us Hugeni us cum ansis	Perig.	0 30 0	1 4 0	0 30 0		1 25 0
(Cristia nus Hugeni us cum ansis)	Perig.	1 8 0				

Parsing notes: The table is laid out with three sub-columns ('""''' — minutes, seconds, thirds) under each planet sign (♄ ♃ ♂ ♀ ♃). Many cells are blank in the source where an authority gave no value for that planet/condition. The "Diam. / Appar." double heading labels the second column (distance-condition: Med./Apog./Perig.). The Hevelius "de ♄ solitario, ac rotundo" row gives 0 39 36"

for Saturn (Saturn taken alone and round, i.e., disregarding the ring/ansae). The bracket grouping { in the source joins the multi-row entries for "Martinus Hortensius...", "Nos cum P. Grimaldo...", "Sed de h̄ cum Comitib.", and "Scheiner apud Hortensium" across their Apog./Med./Perig. rows; I have repeated the authority name parenthetically on continuation rows. The "vel" (or) under the Mars perigee cell for "Nos cum P. Grimaldo" gives an alternative value 2' 45" 0". The Cristianus Hugenus "cum ansis" (with the handles/ansae) entry gives two Saturn perigee values (0 30 0 and 1 8 0 — the latter presumably including the ansae span).

CAPVT VIII.

De Apparenti Diametro Fixarum.

[On the Apparent Diameter of the Fixed Stars.]

1. Galileo, in Dialogue 3 of his *On the World System* [*Dialogo*], Giordano Bruno [Iordanus Brunus] in his *De Immenso et Innumerabilibus* [*lib. de Maximo, & Immenso, & Innumerabili*], and Kepler in his *Dissertatio* with the *Sidereal Messenger* [*Nuncio Sidereo*], hold the fixed stars to be just as many Suns; as to their apparent [diameter], however, Galileo, by the very [magnitude] of the stars — concerning whom in cap. 1 — asserts that Lyra, and the rest of the first-magnitude [stars], do not exceed a diameter of 5"; and so by the distance of the fixed stars (which the Copernican [system] requires so great, and [such] as excludes all parallax sensible to the inhabitants of the Earth passing through the annual orbit) the fixed stars do not follow [from] being larger than the annual orbit. Kepler, however, who in his book *De Stella Nova* cap. 16 & 21, before the use of telescopes, had conceded Sirius 4 minutes, and the stars of Orion's belt 2'; afterwards, in his *Epitome Astronomiae*, pag. 498, says: *Skilled craftsmen [artificers] deny that any quantity of a body as if round can be detected by the inspection of an instrument through a telescope, since rather, magnitudes of the fixed stars are so represented through a telescope that a pure point, from which lucid rays go out into the figure of a head of hair [crinium], is dispersed.* And in the same place he holds the mass of the fixed [stars] to be smaller than the Sun. Huygens too assimilates [them] to points.

[col. 2]

2. Lansberg, lib. 3, *Uranometria*, element 20, has this: *The apparent semidiameter of the fixed stars of the first magnitude Albategnius [al-Battānī] defines at 45", and*

Tycho [Tycho Brahe] at one scruple [scrupulum primum, i.e. one arc-minute]. We [reckon] one scruple [as] half. For [though] at the first scruple [minute] the star appears much smaller, why therefore should one not believe the disks of the stars freed [denuded] by the tube [telescope] from the fallacy of the adventitious rays? — especially since Hortensius himself, [though] so friendly to Copernicus, labors to free the Copernican hypothesis from the absurdity of the immense mass of the fixed [stars], following from their immense distance, so that, by comparing the fixed [stars] through a telescope with the image of Jupiter, Sirius is only 10 ["], a second [magnitude star] only [so much]; the rest he leaves only 8" — falsely, however, because [the comparison] errs in Jupiter, as said in cap. 3.

3. Furthermore, We, with Father Grimaldi [Grimaldi], having stretched over [the lens] a little perforated leaf of brass-foil [bracteola, the perforated diaphragm] objected to the lens of the telescope, saw the disks of the stars without the rays, in three rounds [forms]; and the figure being received on a chart, the disk of Jupiter — and likewise Sirius — divided into 160 parts, without [its] companions [comitibus]; Jupiter then into 200 parts, of the kind of which an uncia [is] 100 parts in a foot; thence very many lesser little circles, and lesser, on the same chart, [were] 20 such parts, the largest 100. The stars of the fixed [heaven] having been inspected, [and the disks] obtained, the proximate ones [were] conspicuous, with very keen eye and judgment, [by] the most acute judgment of Father Paulo Casati [Casati] and Matthaëus Tabernae [?]; at length, from a certain diameter of ♄ [Saturn] and ♃ [Jupiter] then determined for us, we investigated the following sub-inscribed apparent diameters of the fixed [stars], from which the true [diameters] we investigate in *Almagestum Novum* lib. 6, sect. 9 [recte: as in the prior citation, lib. 6, *Almag. Novi*, cap. 9].

Caput VIII (continued) — The Apparent Diameter of the Fixed Stars

The apparent diameter of the fixed stars as observed by us, when the diameter of Saturn alone was 35" and that of Jupiter 44".

The following table gives, for each named star, the apparent diameter in seconds (") and thirds (").

Fixed star (1st mag.)	Diam. apparent ''	Diam. apparent '''	Other stars	Mag.	Diam. apparent ''	Diam. apparent '''
Sirius	18	0	Procyon	2	12	20
Lyra lucida [Vega]	17	24	Aquila lucida [Altair]	2	11	0
Arcturus	16	42	Cingulis Orionis [the Belt of Orion]	2	8	50
Capella	16	8	Coronæ lucida [the bright star of the Crown]	2	8	21
Aldebaran	15	24	Polaris	2	7	54
Spica Virginis	15	5	Medusæ caput [the head of Medusa, Algol]	3	7	3
Regulus	14	5	Propus [η Gemino- rum]	4	6	10
Rigel Orionis	13	40	Pleiadi lucida [the bright star of	5	5	16

Fixed star (1st mag.)	Diam. appare nt "	Diam. appare nt "'	Other stars	Mag.	Diam. appare nt "	Diam. appare nt "'
			the Pleidae s]			
Fomah ant [Fomal haut]	13	25	Alcor, seu Equus in cauda Ursæ maioris [Alcor, the "Horse" in the tail of the Great Bear]	6	4	24
Antares	13	12				
Hydræ [lucida, Alphar d]	12	45				
Cauda Leonis [Deneb ola]	12	30				

Parsing notes: the first three columns give the twelve first-magnitude stars; the right-hand block gives stars of lower magnitude with their assigned magnitude and apparent diameter. The seconds/thirds ("/'") headers are repeated over each numeric pair in the source.

The apparent diameter of the fixed stars reduced to seconds, according to the opinion of other authors.

Author	1''	1'''	2''	2'''	3''	3'''	4''	4'''	5''	5'''	6''	6'''
Lansberge]												
Hortensius] & Gassendi]	8		6		5		4		3		2	
Galilæus] & Galileo]	5											

Parsing notes: each numbered column (1–6) corresponds to a star magnitude (1st through 6th), so a row gives one author's diameters across the six magnitudes. Single-entry rows (al-Battānī, Galileo) give only a first-magnitude value; Kepler's row gives two. Only the seconds (") sub-column carries values in every row; the thirds (') sub-columns are blank in this table.

See Gassendi, *Institutio Astronomica*, Book 3, ch. 11; Magini, *Theoricae*, Book 1, ch. 19; Tycho, vol. 1, *Progymnasmata*, p. 481; Longomontanus, *Astronomia Danica*, Book 1, *Theoricae*, ch. 1; Blancanus, at the end of his *Sphaera*; Herigone [Hérigone], vol. 4, ch. 4, where he follows Hortensius; and vol. 5, Book 2, *Theoricae*, where he reports Tycho's value.

CAPVT IX — On the Figure, Belt, Companions of Saturn, and Their Position with Respect to the Equator or the Ecliptic

[De Saturni Figura, Fascia, Comitibus, eorumque situ, respectu Aequatoris, vel Eclipticae.]

1. Among the phenomena revealed to our age by the telescope, none is perhaps more remarkable — and none has so far given astronomers more trouble — than the appearance of Saturn. Three things in particular deserve note. The first is the **belt** [*fascia*], a kind of oblique zone that seems to gird Saturn across its middle. The second is the **two companions** [*comites*, the *ansae*], aligned with Saturn's central body along a line parallel to the equator for the most part — though sometimes they are seen parallel to the ecliptic. The third is the incredible variety of shapes that these companions, or the lateral appendages, present both by themselves and together with Saturn.

For at different times Saturn appears differently. Sometimes — though rarely — it is solitary, without companions, and then it is nearly round, presenting itself with two attendant round bodies; sometimes these adhere closely to it, while at other times they gradually thin out as they fail toward the rounded ends, drawing inward into the *ansae* [handle-shapes]. At times the companions appear somewhat hyperbolic; at times almost half-moon-shaped, ending in arms; sometimes the body of Saturn itself is thick at the middle, sometimes thinner, with the companions on either side now deficient; sometimes Saturn is round and more conspicuous, conforming itself into an ellipse. What others have so far observed about these phases, and what we ourselves have observed, must be set out distinctly and in order.

On the Belt of Saturn [De Fascia Saturni]

2. In the year 1655, from the 20th of March up to the beginning of June, Father Grimaldi and I saw Saturn with a belt [*fascia*], as in the preceding Figure VI — a belt situated below, somewhat obscure, and narrower than

Jupiter's belt; it appeared elliptical, parallel to that of Jupiter, on the 23rd of April and the 9th of May.

In the year 1656, from the 9th of February onward, it was repeatedly seen by us, just as in the figure already described, from then up to the 12th of December; and on the 24th, Father Grimaldi again saw Saturn with the belt parallel to the ecliptic. After an interval, with the sky preventing observation, finally in the year 1657, on the 11th of January in the morning, Father Grimaldi saw Saturn separated from its companions, with the aforesaid belt; and so on the 19th and 26th of February and on the 13th of March, when the oblong companions were placed in the ecliptic, the belt was likewise transverse in the ecliptic position. But at that time the companions were very much oblong, slender, and notably separated from Saturn, drawing close to it as it approached the Sun; and the belt appeared most evidently. But on the 20th of April and the 6th of May the oblong companions were scarcely seen, though still separated, and the belt was barely distinguishable, though most of all throughout June, and at the beginning of July. Finally, on the 2nd of August, with the companions still oblong, the belt was no longer distinguished — perhaps because of the nearness of the Sun, or because of the vapors of the horizon, since by then it appeared as a morning star. But on the 23rd of January 1658 the belt was an oblique line across the companions, and a little below the center of Saturn's disk.

On the Line of Saturn's Companions and Its Parallelism to the Equator, or to the Ecliptic [De Linea Comitum Saturni, eiusque Parallelismo ad Aequatorem, vel Eclipticam]

3. Galileo, in his 3rd Letter to Marcus Welser [*Marcum Vuelserum*], p. 148, asserts that the line drawn through the centers of Saturn and its companions, and through them, is parallel to the equator. Father Francesco Maria Grimaldi and I have observed the same thing many times.

For in the year 1646, on the 10th and 16th of October and the 16th of November, we found that the aforesaid line was parallel to the line drawn from the bright star of Aries [α Arietis] to Aldebaran, which is parallel to the equator. And again in the year 1647, on the 15th of October, the aforesaid line, produced by ocular estimation, would pass through the southern Horn of Taurus [the southern tip of the bull's horn], and through the southernmost of the Pleiades, as the telescope showed — a line which is established to be parallel to the equator by sense. Again, in the year 1649, on the 20th of July, the aforesaid line was parallel to the line drawn through the Pleiades; and the center of Saturn was then situated in the 25th degree of Gemini [\square], with a southern latitude of $1^{\circ}\frac{1}{3}$.

In the year 1650, on the 18th of March, Father Grimaldi saw the centers of Saturn and a companion in the same straight line, together with a certain unnamed little star, distant from the nearest companion toward the east by about half a Moon's breadth; but on the following night, the 23rd, he saw Saturn having overtaken that little star, yet so that to it the companion appeared more southerly by as much as four times the diameter of Saturn was greater. Whence he concludes that the line of Saturn and its companions is not parallel to the ecliptic, otherwise on the 23rd that little star would have remained on it.

In the year 1653, on the 6th of December and the following days, Father Grimaldi observed that the aforesaid line was moved by the diurnal motion of the *primum mobile*, and therefore was parallel to the equator.

In the year 1654, on the 6th of January and up to the 12th of February, and on the 1st of March, by comparing the aforesaid line with the ecliptic position,
[continues below]

[the line], at that time, appeared by no means parallel to the ecliptic; indeed, when Saturn was at the meridian, we saw it parallel to the horizon, and therefore to the equator — for Saturn was then near the end of Leo [□].

Finally, in the year 1655, from the 20th of March up to the beginning of June, more often by these same arguments, of which above, the line of Saturn and its companions was seen parallel to the equator.

4. Notwithstanding these observations, Hevelius, in his *Dissertatio de Saturni facie* [Dissertation on the Face of Saturn] published in 1656, with the great kindness and generosity shown to me, concedes that the aforesaid line of Saturn is indeed parallel to the equator while Saturn is moving through Sagittarius [□], Capricorn [□], Gemini [□], and Cancer [□]; but in Aries [□], Aquarius [□], Scorpio [□], and Leo [□] he contends that it is neutral, that is, neither parallel to the equator nor to the ecliptic; and in the remaining signs, especially in Aries [□], Taurus [□], Libra [□], and Scorpio [□], that it is parallel to the ecliptic. (He admits, however — though he himself observed this with great labor in the years 1643, 1644, and 1645 — that in Aries [□] it is easier to observe that it is most parallel to the equator in the four aforesaid signs, indeed in nearly six.)

To this opinion of his, however, the table he exhibits on p. 15 does not agree. For in it the direction of Saturn's *ansae* is set down as ecliptical throughout the whole

sign of Taurus [♉] and Libra [♎], and nearly throughout the whole sign of Taurus [♉] up to the 23rd degree; for from the 24th degree of Taurus [♉] up to that point, and to the 24th degree throughout Gemini [♊], it is set down as ecliptical; thence *neutral* up to the 24th degree of Leo [♌]; then from the 24th degree of Leo [♌] and throughout Virgo [♍] it is set down as *equinoctial* [parallel to the equator]; thence again *neutral* up to the 24th degree of Virgo [♍], and afterward ecliptical. Hevelius too — as I shall say below — does the same. for the reconciliation pass.]

5. From our own observations, however, in which that line was seen parallel to the equator, the position contradicting [Hevelius] appears: in the year 1646, on the 16th of November, in Taurus [♉] 14°, where for Hevelius it is ecliptical; and in the years 1647, on the 15th of October in Taurus [♉] 1°; and in 1650 on the 18th of March in Gemini [♊] 24°; and in 1653 on the 6th of December in Cancer [♋] 6°; and in Leo [♌] on the 26th of January 1654 in Leo [♌] 25°; and in 1655 on the 20th of July in Gemini [♊] 5°, and at the beginning of July in Leo [♌] 20° — in all of which Hevelius's [assignment] is *neutral*.

And in the year 1658, on the night between the 29th and 30th of July, Father Grimaldi and I saw with the telescope that Saturn moved its setting toward the west, as the line drawn through the centers showed, and the extremity of the companion moved manifestly according to the motion of the *primum mobile*, through the line parallel to the equator. We also confirmed the position of the equator [as] known to us by our observation, and by comparison with the ecliptic, which the line drawn through the heart of Scorpio [Antares] and through Spica nearly indicated. Therefore Hevelius will have seen — most friendly to us — what he calls on p. 27 the aforesaid line, pronouncing it *without any doubt*, namely that the aforesaid line, while Saturn is in Libra [♎], will be parallel to the ecliptic — not to have been true. The same is confirmed from the position of the sickle [the Sickle of Leo], of which at number 2, year 1657, with Figure 17 added.

On Saturn Seen Solitary [De Saturno solitariè viso]

6. First, Scheiner, in his *Disquisitiones Mathematicae* [Mathematical Disquisitions], conclusion 44, says of Saturn: "*Now single, now three-bodied*" [Modò vnus, modò triceps]. He appears at one time taller [elongated], at another round. Would that he had added the time at which he saw it solitary and round!
7. In the year 1612, Galileo writes to Marcus Welser that Saturn around the summer solstice of that same year was seen by him three-formed

[*triformem*], but with the observations interrupted, because nothing of the sort was suspected; at length, toward the end of November of the same year, solitary, and round; and so it persisted from the beginning of December, just as he conjectures — though I fear lest perhaps around the summer solstice of the year 1613 Saturn would appear with its companions; and after two months it was disappearing for some months; and in the year 1615, at the summer solstice [*aestivo Solstitio*] it [appeared] not whole, but appearing in part; and after great and good [appearances] through many years, without any concealment of the apparitions.

8. In the year 1642, Gassendi and Bullialdus [Boulliau] at Paris, around August, saw Saturn solitary, and round, until its occasion of heliacal setting, which was in February of the year 1643; therefore Gassendi too — having observed Saturn at the Acronychal point [in opposition] on the 5th of September, the year 1612 — sets down Saturn as appearing also to the naked eye so small. He adds toward the end of the following May, that with the belt seen on this side and that, by two globules of the same whiteness, and that it so persisted under the varied form of the companions, up to March of the year 1644. So he, in his *Iudicium de 9 Stellis* [Judgment on the Nine Stars], near the number 6, and in the *Epicurum*, p. 905. Hevelius too, p. 42 of the *Selenographia*, and in his *Dissertation on the Face of Saturn*, p. 7, affirms that around the 20th degree of Pisces [♓] in opposition to the Sun, and after that, it represents itself round to him in the perigee of an eccentric ellipse.
9. In the year 1656, on the 9th of February up to the 14th of May, we saw, together with Father Grimaldi, Saturn solitary without companions, with the belt drawn transversely, as in the subsequent Figure II. Then it began to be seen round with the belt, and so it was seen up to the 17th of July. From that point it ceased to be observable on account of the nearness of its heliacal setting, then also from the vapors of the horizon. But after the heliacal setting it could not be observed, with the surrounding clouds, before the 23rd day. On the 8th of October, when in the morning it appeared with the companions separated, as in Figure V, Bullialdus too at Paris on the 25th of January, and Hevelius at Danzig in the same year 1656, on the 25th of February and the 1st of May, saw it round; and the same Hevelius reports it, p. 7, in his *Dissertation on the Face of Saturn*. Of Huygens I shall speak below.

The Figure of Saturn Collected from Our Observations and Those of Others [Figuræ Saturni ex nostris, et aliorum observationibus collectæ]

10. Among the following Figures, Hevelius calls Figure I *Saturnus Monosphaericus* [single-sphered Saturn]; Figure III, *Saturnus Trisphaericus* [three-sphered Saturn]; Figure XI, *Saturnus Sphaericocuspидatus* [sphere-and-points Saturn]; Figure XII, *Saturnus Sphaericoansatus* [sphere-and-handles Saturn]; Figure XIII, *Saturnus Ellipticoansatus diminutus* [diminished elliptical-handled Saturn]; and Figure XIV, *Saturnus Ellipticoansatus plenus* [full elliptical-handled Saturn]. The remaining figures he does not display.

Diagram. A full-page plate, enclosed in a single ruled rectangular border, displaying ten numbered telescopic figures of Saturn (labeled I through X, in two columns of five rows) showing the successive observed shapes of the planet — the pre-Huygens "ansae" forms referenced in Caput IX. The figures are arranged left column (odd numerals I, III, V, VII, IX) and right column (even numerals II, IV, VI, VIII, X). Each depicts Saturn's central disk with its lateral companions (*ansae*) and, in some, the transverse belt (*fascia*).

- **I.** (top left): a single plain circle — *Saturnus Monosphaericus*, Saturn seen solitary and round, without companions or belt.
- **II.** (top right): a single larger circle crossed by a transverse, slightly oblique hatched band running across its upper-middle — Saturn solitary with the belt (*fascia*) drawn across it (the form of §9, Figure II).
- **III.** (second row, left): a central circle flanked on each side by a small rounded lobe touching the disk — *Saturnus Trisphaericus*, the three-bodied/three-sphered Saturn with two adhering round companions.
- **IV.** (second row, right): a central circle with two small detached round companions, one on each side, set apart from the central disk (the separated round-companion form, cf. §9, Figure V).
- **V.** (third row, left): a central circle flanked by two detached oblong (oval/lens-shaped) companions, one on each side — the oblong-*ansae* separated form.
- **VI.** (third row, right): a central circle crossed by a transverse oblique hatched belt (*fascia*), flanked by two detached oblong companions on each side — Saturn with both the belt and separated oblong companions (the form of §2, Figure VI).

- **VII.** (fourth row, left): the central disk overlapped on each side by two crescent/half-moon-shaped companions whose inner edges are shaded (hatched) — the half-moon ("brachia"/arms) ansate form, companions adhering and shaded toward the disk.
- **VIII.** (fourth row, right): similar to VII — a central disk with two shaded crescentic companions overlapping on each side, slightly more open in form.
- **IX.** (bottom left): an elliptical/ovate outline enclosing a central round disk, with the lateral interior regions (the ansae) heavily shaded (hatched) and a brighter ring — *Saturnus Ellipticoansatus diminutus*, the diminished elliptical-handled Saturn.
- **X.** (bottom right): a larger, more open elliptical outline enclosing a central round disk, with broadly shaded (hatched) lateral ansae forming an open ring around the disk — *Saturnus Ellipticoansatus plenus*, the full elliptical-handled Saturn.

The shaded (hatched) regions in figures II, VI, VII, VIII, IX, and X represent the obscure belt and the shadowed inner faces of the *ansae*; the open (unshaded) circles in I, III, IV, V represent the bright round body and companions. All labels (Roman numerals I–X) are clearly legible. This plate is the visual key to the figure-numbers cited throughout Caput IX (e.g., "Figure II," "Figure V," "Figure VI"); the higher-numbered Hevelian forms (XI–XIV) named in §10 are not on this plate.

[Liber X — continuation of Caput IX: De Saturni Figura, Fascia, Comitibus]

Diagram. A full-page plate, set within a ruled rectangular frame and surrounded on both sides by the two columns of body text. It presents the higher-numbered telescopic shapes of Saturn (Figures XI through XVII), continuing the ten-figure Saturn-shape plate of the preceding page (Figures I–X). The forms shown are the more elaborate "handled" (*ansatus*) and tri-bodied appearances reported by Hevelius, Galileo, Gassendi, and others, together with the fully ring-like and the two-companion appearances. From top to bottom:

- **XI** — a central round globe flanked on each side by a roughly crescent/cusped form turned toward the globe (the *Sphaerico-cuspidatus* type): a bright sphere with two dark, hook-shaped arms.
- **XII** — a central globe with two large dark crescents on either side enclosing bright tips, an elliptical-cusped form (companions broad and dark, the *Sphaerico-cuspidatus Maior*).

- **XIII** — a broad elliptical figure: a central globe set within a wide flattened ellipse, dark toward the body and bright at the elongated tips (the *Elliptico-ansatus plenus*, full elliptical-handled form).
- **XIV** — a central globe within a narrower ellipse, with the dark interstices visible between globe and handles (the *Elliptico-ansatus*, elliptical-handled form).
- **XV** — a central globe crossed by a thin straight band extending to bright tips on each side (the *Sphaerico-ansatus*, sphere-with-handles form, the band passing in front of and behind the disc).
- **XVI** — a large central globe encircled by a flat, fully detached ring that crosses in front below and behind above, the dark ring-plane standing clear of the disc on both sides (the fully ring-like appearance).
- **XVII** — a central globe set within a pointed (lens-shaped) dark ellipse, with a small separate round companion globe standing just beyond each tip (the two-companions-plus-arms form, *Trisphaericus* with detached round companions).

[Margin (left of plate, keyed to the running text): observational notes and figure citations interleaved with the plate.]

[Margin: *Anni Christi* (Years of Christ) — the left column gives the year of each observation.]

Chronological catalogue of observations of Saturn's figure

1609. Galileo [Galileo], in his Letters 1, 3, and 5 to Marcus Velserus [Mark Welser], reports that Saturn appeared to him three-bodied [*Tricorporem*], with the globes touching but not perfectly separated — owing to the imperfection of his tubes, which adhered to one another — as in Figure IV. Scheiner [Scheiner] too, around that time, says it appeared three-bodied to him, though at other times solitary; see in the *Disquisitiones Mathematicae*, p. 6.

1612. Saturn was seen round, without companions, by Galileo, as you may see in Figure 7 and Figure I.

1614, February 12, 13, 14. Scheiner saw Saturn with the globes separated, as in Figure IV, but in such a position that the left-hand globe — which lay in the higher place — appeared the more brilliant, since it was the more remote from Saturn. So in the *Disquisitiones Mathematicae*, conclusion 44.

1616. Father Joseph Blancanus [Biancani], in October, as he relates in the *Sphaera*, Book 15, Ch. 7, saw Saturn oval-shaped [*Ouiformem*] with two round

spots toward the top. And in the same way in 1619, in November, but he had an imperfect tube.

1625, February 17. Martinus Hortensius [Hortensius] saw Saturn with the globes nearly as in Figure IV, and they were not far from the Sun; and Hevelius [Hevelius] reports this from Saturn's "face," p. 7.

1630, June. Francesco Fontana [Fontana] at Naples saw Saturn with the globes separated, as in Figure IV, and he has it in his published Treatise, Ch. 7.

1632. Hortensius, July 16, saw Saturn handled [*ansatum*].

1633. Petrus Gassendus [Gassendi], in June, observed Saturn with handles [*ansulis*], as in Figures VII and VIII — just as he reports in the *Judicium de 9. Stellis circa Iouem*, and in the same way Fontana, above.

1634, April. Gassendi, as in the *Judicium de 9. Stellis*, and Fontana, in his Treatise, saw Saturn with handles, as in Figure VII; see Gassendi, as in Figure XIV.

1636. Gassendi in November saw Saturn with handles, as he has it in the aforesaid *Judicium*, and Fontana too — so that Saturn itself was not entirely round, as in Figure VII.

1637, November — indeed before, in February and July — Gassendi saw Saturn with handles. In the *Judicium de 9. Stellis*, and at PP. Soc. I. [the Fathers of the Society of Jesus], on October 19, on March 26, the companions had been seen in their nearer contact; see p. 16. August.

1638. Gassendi, as above, in December saw Saturn round but by no means perfectly so, as in Figure IX or X.

1640, May 23. Father Nicolaus Zucchius [Zucchi] observed Saturn with the companions separated and curved, or imitating the form of a pear, but of great magnitude — a figure transmitted to me from Rome by Zucchi himself.

1642. Gassendi and Boulliau [Boulliau], and in October Hevelius, observed Saturn solitary and round, as in Figure I; see Figure III.

1643. Toward the end of May, Saturn was seen Heliacally [near the Sun] with its arms round and almost adhering, as in Figure V; so Gassendi affirms, in a Letter to Wendelin [Wendelin], p. 905, and Epistle 3 to Wendelin, adding that it persisted so for a long time. We too, with Father Grimaldi [Grimaldi], on October 29, observed its companions, as in Figure V.

1644. Gassendi, as he relates in the Letter, p. 905, in March and June saw Saturn, as in Figure IX; and afterward in December, as in Figure XI. Father Daniel Bartolus [Bartoli] at Naples, with Father Sirsalus's [Sirsale's] excellent telescope, observed the lower companion smaller and dimmer, its shadow less dark, thence into a moon-shaped obscure little body, as in Figure XII — that is, the union of the upper companion with Saturn. With the companions thus not appearing to cohere, the observation of Fontana, or that of Father Matthaeus Taberna [Taberna] under Figure XVII, under which it was nevertheless never permitted to us to see it, may be reconciled.

1645. Hevelius in September, October, November saw Saturn handled, but Ioan. Lyphus the Monk at the very beginning saw it solitary, as in Figure IV. Gassendi, as he relates in the Letter to Epicurus, p. 905, sub-figure, again saw the companions gradually producing cusps, so that on each side they touched the obscure middle globe intercepted thence into a moon-shaped obscure interstice; the little globes themselves, as it were, displaying a parabolic-shaped surface and, by reason of cohesion, exhibiting it almost as handles, and therefore he took them for handles — because that obscure interstitium appeared as if there were perforations, as in Figure 13. Yet Fontana, on December 3 and 13, saw it nearly as in Figure XVII.

1646. Eustachius de Divinis [Eustachio Divini] up to 1647 and 1648 affirms he saw Saturn oval-shaped, as in Figure X, or [continued next column]

XIV. And Father I. Bapt. Hodierna [Hodierna] says that today it appeared to him very like an oily countenance [*olei... vultu*], most constant, on April 10 of the year 1646, up to 1653. But Gassendi, above, reports it for the year 1646. He captures that dark obscurity, those interstices obliterated to the cusps, and the handles whitish from their own globe commingled, as if from a whitish middle globe less perceptibly distinguished from the handles themselves. But with Father Grimaldi, on October 10, we saw the eastern companion smaller than the other, and nearer to Saturn; but on November 16, the companions appeared equal, and equally distant from Saturn.

1647. Hevelius, on September 7, saw Saturn elliptical-handled [*Ellipticoansatum*], as above, as in Figure XII. Gassendi too, above, reports the same form, which preserved the same shape throughout the preceding years; but the broader appearance, the confusion, and the interstices blunted at the rounded cusps make for a fuller shape, with a promotion of the vestiges toward the rounded, as in Figure XV. Hevelius says this shape lasted right up to Saturn's heliacal setting in

the year 1648, in the month of April; and for the year 1647, Io. Lips [Lipstorp] exhibits Figure XIV.

1648, February 26 and April 16. We saw, with Father Grimaldi, the companions equal between themselves and equally distant from Saturn; thus the brightness of the parts on each side was so great that the Semidiameter of Saturn's disc was greater than that, and they faced one another with an oval Figure X.

1649. Toward the end of March, and from the beginning of April up to the beginning of May, and on May 6 and 20, July — when Saturn rose and likewise set on the 27th — July it was seen, as in Figure XIV; indeed in August on the 23rd and September 29. Father Grimaldi and ourselves: Hevelius too in December on the 23rd saw it elliptical-handled, as in Figures XIII, or XIV, as Father Grimaldi did on days 12, 13, and 21 December, as in Figure XIV.

1650, January 2, and March 18 and October 12. Saturn appeared to Father Grimaldi, as in Figure XIV — Hevelius does not dissent. Hevelius too, above, saw it elliptical-handled in October.

1651, April 23. Saturn was seen by Father Grimaldi with a figure midway between Figures X and XIV. Hevelius, however, in November, saw it nearly spherico-handled, as in Figure IX.

1652, May 29. Father Grimaldi saw it, as in Figure XIV. Hevelius too, in October, saw it elliptical-handled, as in Figure XII.

1653. Toward the beginning of February, Father P. de Rheita [de Rheita] saw the companions of Saturn drawn out like flames in pyramidal torches — that is, as in Figure V; nay, Father I. Bapt. Hodierna in December saw it such, as in Figure 3. Father Grimaldi in December saw Saturn's companions separated from it and pear-shaped, or in either way elongated, so that it was as in Figures 13 and 18, in longitude. But Gassendi, on April 6, saw it as in Figure XIV.

1654, January — through nearly the whole month — we saw, with Father Grimaldi, Saturn's companions slenderer and acutely produced, as in Figure XV. But Father I. Bapt. Zuppus [Zupi] at Naples, on January 16, saw it, as in Figure XVI — which to us does not differ from that one, except in magnitude on account of the conspicuous prolixity of the telescope.

1655. From the 10th of March to the end of June, but chiefly on the 23rd of April and the 9th of May, Saturn was seen first, as in Figure V; then on the 6th of May — though Hevelius on the 30th of May saw it three-bodied — as in Figure IV; but Gassendi in June and July.

1656. From the 9th of February to the 17th of July, it was seen by us round, without companions; but on the 14th of May, with the band [*fascia*], as in Figure II. Boulliau too, in January, and Hevelius on the 25th of February and the 2nd of May, saw it Monospherical [*Monosphaericum*].

In the same year, a certain Canon of Leiden wrote to D. Antonius Roccam [Antonio Rocca] — as I have it by his letters — that D. Christianus Hugenius [Huygens], a noble Hollander, by multiplying the diameter of his telescope fifty times, had with certainty discerned around Saturn two companions; thirdly, a planet, which they called Saturn's Moon, distant about three of those lesser diameters, and completing its revolution in 16 days; and that he had had another tube multiplying a hundredfold, by which D. Rocca suspected that this to be a fixed star — but of this in the observation following.

1657. Father Grimaldi saw Saturn's companions at one time, as in Figure V, at another in Figure VI, according to the said number 2, under this same year. And toward the end of December, the companions in part [continued — Saturn

[Margin: *Anni Christi* (Years of Christ).]

nearer now and concave, as in Figure XI, and with a very narrow band. In the same year, on July 18, Father Nicolaus Zucchius wrote to me from Rome thus: Saturn proceeds to be seen, his greater Star [the disc] sundered from the two lesser ones; but with a more powerful telescope it seems to be observed near that very Star — that the lesser ones change their position now upward, now downward, and rightward or leftward, and sometimes vanish. But in order that it may be established whether the same Stars meet with the same situation among the firmaments, or with various ones, great diligence and perseverance in observing is needed.

1658, January 1. Saturn was seen by us, as in Figure XI, and at the end of January nearly so, as in Figure XV, but with a band toward the center of Saturn, and an oblique line of the companions. And on February 21, similar to Figure XV, observed by Father Grimaldi. The longitude of the candid part of each companion was equal to the Semidiameter of Saturn's disc, but the obscure part a little shorter: in March the companions were longer, but shorter, and more so in the month of May, up to the 24th of June. On July 10 Saturn was seen to fail from Figure XV, and the arms of the companions near Saturn to grow slender.

1661, May 13. On the following night, Saturn was observed handled, and with the companions arranged as before, as in Figure XIV — among those set forth.

Appendix of the observations of Christianus Huygens [Huygens], which I have received as written after the foregoing

1656, January 16. He saw Saturn Monospherical [*monosphaericum*], as in Figures I and so up to June; nay, up to the December of the year 1655. But in October, on the 13th of the year 1656, he reports the handles already manifestly recovered, earlier than he had predicted.

1657, December 17. After Saturn's Heliacal rising, the arms of Saturn taken up in narrower handles, as in Figure XVI.

1658, November 10. Saturn, much before the heliacal rising, with the arms drawn apart into wider latitudes, appeared, as in Figure XIV.

1659, February 12. Saturn's handles appeared most broadly, as in Figure XIV; see Figure I. Through tube-feet 12, the handles spread to tube-feet 6: Saturn appeared three-bodied, as in Figures IV or V; whensoever round, and at times solitary; the Zone variously cut his disc; and at other times below, the upper middle solitary appeared.

The Theory of others concerning the aforesaid Phenomena is indicated

[Margin: *Indicatur argumenta contra Heuelium* — The arguments against Hevelius are indicated.]

11. What Father Antonius Maria de Rheita devised, in Book 4 of the *Radius Sideromysticus*, Ch. 4, by way of cause for the aforesaid phenomenon, I have set forth, and in part discussed, in Book 7 of the *Almagestum Novum*, Section 6, Ch. 14, Scholium 3 — among which is the probable cause, and I judge that Saturn rotates about its own center, which I confirm from this, that being itself solitary, it appears now round, now oval-shaped, and at times with a band; and sometimes round, the band appearing — its sides varied by motion around it, above, and below, may be able to be moved, as I have indicated, but below I add another Theory.

12. Hevelius, however, for the celerity and acumen of his ingenuity, in the little work lately issued concerning the "face" of Saturn, has endeavored to render reason for so admirable a vicissitude. He reckons Saturn to exhibit so diverse phases, on account of the diverse aspect under which we behold it now from the right side, now from the oblique. For since it is established by optics that a Cylinder and an Ellipse, by reason of distance, appear oblique to the eye placed

circularly — hence, by his asserting it, Saturn appears at its Apogee elliptical-handled rather than at its Perigee Eccentric (where the truly middle is distant from the Earth, or from the Sun), it appears Monospherical, that is, solitary and round, as in Figure I. In other places truly it is moved by various motion around it, above, and below, so that Saturn may be variously seen, as I have indicated, but below I add another Theory.

[Margin: *Heuelii Hypothesis de ♄* — Hevelius's Hypothesis concerning Saturn.]

Hevelius, however, since this Apogee of Saturn is in degree 27 of ♐ [Sagittarius], and the Perigee in 27 of ♊ [Gemini], the middle distance in degree 27 of ♍ [Virgo] and of ♋ [Pisces] — therefore through all of the Eccentric, he distributes Saturn's phases by a most elegant figure, and likewise a Table, whose Epitome it pleases to subjoin in this place.

13. [Margin keyed:] *Phases ♄ ex opinione Heuelij* — The Phases of Saturn, according to the opinion of Hevelius.

	Sig.	Gr.	Denomin . Figuraru m Heuelian a (Hevelia n name of the figures)	Fig.
Apogaeu m (Apogee)	♐	27	Elliptico- ansatus plenus (full elliptical- handled)	XIII.
	♊	12	Elliptico- ansatus diminutu s (diminis hed	XII.

	Sig.	Gr.	Denomin . Figuraru m Heuelian a (Hevelia n name of the figures)	Fig.
			elliptical- handled)	
Decresce ntes (Decreasi ng)	□	12	Spherico- cuspidat us Maior (greater sphere- cusped)	IX.
	□	27	Spherico- cuspidat us Minor (lesser sphere- cusped)	XI.
	□	12	Trisphae ricus (three- bodied)	III.
Med. Dist. (Mean Distance)	□	27	Monosph aericus (single- bodied)	I.
	□	12	Trisphae ricus (three- bodied)	III.
Crescent	□	27	Spherico-	XI.

	Sig.	Gr.	Denomin . Figuraru m Heuelian a (Hevelia n name of the figures)	Fig.
es (Increasi ng)			cuspidat us Minor (lesser sphere- cusped)	
	□	12	Spherico- cuspidat us Maior (greater sphere- cusped)	IX.
	□	12	Spherico- ansatus (sphere- handled)	XV.
	□	12	Elliptico- ansatus diminutu s (diminis hed elliptical- handled)	XII.
Perigaeu m (Perigee)	□	27	Elliptico- ansatus plenus (full elliptical-	XIII.

	Sig.	Gr.	Denomin . Figuraru m Heuelian a (Hevelia n name of the figures)	Fig.
	□	12	handled) Elliptico- ansatus diminutu s (diminis hed elliptical- handled)	XII.
Decresce ntes (Decreasi ng)	□	27	Spherico- ansatus (sphere- handled)	IX.
	□	12	Spherico- cuspidat us Maior (greater sphere- cusped)	XI.
	□	27	Spherico- cuspidat us Minor (lesser sphere- cusped)	III.
Med. Dist. (Mean	□	27	Monosph aericus (single-	I.

	Sig.	Gr.	Denomin Figuraru m Heuelian a (Hevelia n name of the figures)	Fig.
Distance)			bodied)	
Phases Crescent es (Increasi ng phases)	□	12	Trisphae ricus (three- bodied)	III.
	□	12	Spherico- cuspidat us Minor (lesser sphere- cusped)	XI.
	□	12	Spherico- cuspidat us Maior (greater sphere- cusped)	IX.
	□	12	Spherico- ansatus (sphere- handled)	XV.
	□	12	Elliptico- ansatus diminutu s (diminis	XII.

			Denomin	
			.	
			Figuraru	
			m	
			Heuelian	
			a	
			(Hevelia	
			n name	
			of the	
			figures)	Fig.
Sig.	Gr.		hed	
			elliptical-	
			handled)	

Parsing notes: The table has five columns: a left descriptive column (Apogee / Decreasing / Mean Distance / Increasing / Perigee, etc.), the zodiacal Sign (*Sig.*, given as a glyph), the degree (*Gr.*), the Hevelian figure-name (*Denomin. Figurarum Heueliana*), and the figure number (*Fig.*). The bracketing of descriptor-labels (Decrescentes/Crescentes etc.) spans several rows; I have placed each on its first row. Several sign-glyphs are faint at this resolution; readings of the glyphs flagged [?] where uncertain. The last block's figure-number column for "Trisphaericus" reads III. in two places where I would have expected I.; transcribed as printed.

14. Where the Figures are wanting here, they are wanting also in Hevelius, p. 4. But from our Figures IV, VII, IX, XI — the Fourth, Seventh, Ninth, Eleventh — and likewise the Twelfth, Eighth, Tenth, Decimaquarta (Fourteenth), Decimaquinta (Fifteenth) — or [our] Decimaquarta and Decimaoctava — there is no slight violence done to the Hevelian Hypothesis [*Hypotyposim*]. Moreover, from our observation of the year 1656, concerning which above, on May 14, Saturn was in degree 15 of ♍ [Virgo] and was solitary and round, although it differed by 11 degrees from the place of perfect roundness according to Hevelius; therefore in degree 1 of ♍ on October 1; and again on October 1, when at the said place of perfect roundness it did not differ by whole degrees, it ought nevertheless to have appeared round; and yet it was seen manifestly with the companions separated, as in Figure V. Hevelius, however, in nowhere of the many places of his Hypothesis is thence chiefly to be improved, because before he saw Saturn round in October of the year 1656, and at September of the year 1657, and yet on the 13th of October of the year 1656 he already recovered the handles. But in the year 1656 from Hevelius's positions Saturn was in degree 18 of ♍, and on December 22.

At the solstice it ought to be seen round, and on the 1st of December it was seen three-bodied; and in December of the same year that very Galileo would have appeared at the solstice three-bodied, and on the 1st of December solitary, and round.

[Margin: *Indicata argumenta contra Hevelium* — The arguments against Hevelius indicated. // marginal cue numbers 1, 2.]

15. [Margin: *Robervallij Hypothesis de Saturno* — Roberval's Hypothesis concerning Saturn.] Robervallius [Roberval] supposed that the causes of the phenomenon of Saturn could be explained, if it be said that out of its Torrid Zone vapors go forth, which reflect to us the rays of the Sun, when they are denser, not elevated indeed toward the poles. But to this cause the inconstancy of the vapors of natural Physics is not obscure, nor is it probably bound to certain zodiacal places; yet it is established that Saturn in the two opposite signs of the Zodiac appears now round and now band-marked in each, of its revolution to be seen round, and within a quadrant from the said distances to appear most broadly handled, as Hevelius himself admits.

16. Io. Baptista Hodierna [Hodierna], as Christianus Hugenius reports, p. 43, in his *Systema Saturni*, judged Saturn to be spheroidal in the manner of an egg, or a plum, and elongated by Hevelius, as in Figure X or XIV: but he converts Saturn around its own axis, in the same period that Hevelius establishes, and turns it round so that it is seen sometimes round, when the longer spheroid appears to us not directed; nevertheless, says Huygens, since Saturn for the most part appears round as often as it is bare of arms, how is it explained that the lacunae are filled — which lacunae two black spots would [continued: super-

would [cover the] surfaces — does Hodierna himself admit? Finally, if anyone were to compare these spots with the markings observed circling about the axis, he will see that many phases appear far different from those that are seen on Saturn.

Christiani Hugenii Systema Saturnium. [The Saturnine System of Christiaan Huygens]

§17. First of all, Christiaan Huygens [Huygens] states that, using a telescope of 12 Rhineland feet, he reached the very threshold of these matters by 19 February 1656. Thereafter, however, with a telescope of 23 feet, and having fashioned a thin plate [bractea] whose aperture served either to remove the surrounding glare or to deepen the [field of view], it became established for him from twin

neighboring [pins] joined together, a single convex glass equivalent — [Margin: The excellence of Huygens's telescope] — fitting individual lenses, the diameter of which is 1 [unit]; gathering the rays, [these] yield a lens-objective of such excellence and of so brief a convexity, that it can be reckoned beyond the ordinary.

The distance of the objective glass, as seen through the optical tube, compared with the appearance seen by the naked eye, he held to bear that ratio which the distance of the predicted objective glass — being 23 feet, or 276 inches — bears [to the rest]. The distance of the ocular glass, however, is somewhat less, namely under 2 inches; whence, following the [established rule], the telescope would multiply the object a hundredfold; whereas Galileo's tubes multiplied only thirtyfold.

When, moreover, he had demonstrated this in the *Dioptrics*, he set forth the appearance seen through an optical tube as it relates to the appearance seen by the naked eye, holding it to bear a reasoned proportion such as the distance of the predicted objective glass — which was 23 feet, namely 276 inches; but the distance of the ocular glass is somewhat under 2 inches; whence, following the [rule], the telescope would multiply the object a hundredfold, whereas Galileo's tubes multiplied it only thirtyfold.

By such a telescope, then, he always saw Saturn furnished with arms [ansae]; but in the year 1655 he saw it round, and at other times solitary [bare], and round, when he saw the arms of Saturn jointly with the telescope; but he saw it solitary and round when, around the year 1658, he saw it tricorporeal [three-bodied] on 10 November. From this he concludes that the tricorporeal appearance arises from the imperfection of the tube, [making it seem] as though it were tricorporeal. As often, moreover, as he saw Saturn round, he saw a zone bisecting its disk crosswise; at other times, in the year 1655, [a zone] in the upper middle, and [zones] lower down — and these I produce [as evidence]; but with the body of Jupiter set aside as the lucid [bright body], he observed [the contrary]; whereas in Mars he observed a dark zone, and a zone obscuring the middle part, broad, the parts of which were such that the diameter of the disk was 5. Having measured the diameters of the fixed stars, with the ocular glass previously gently smeared with soot, he saw them as though a lucid point: the middle Fixed star in the sword of Orion he saw to be not one but 12 stars, very distinctly constant [resolved]. Finally, by such a tube he was the first to observe for himself a little planet wandering about Saturn, which he calls the Moon of Saturn [Titan].

§18. From the year 1655 on 25 March, Gregorian style, and in the year 1659 on 26 March, at the 10th hour, he set forth observations of this Moon — nearly 70 of them — from which it is established that the Companion encircles Saturn in 16 days; and that it returns to the same position over the same number of days, and that twice over, in this manner [moving] more in nearness than in distance, and so [returns] hither and thither over a [period] which does not exceed the first scruple [first minute] of 3' 16" from the center of Saturn, computed. From these things, therefore, set forth, he constructs a Theory of the Moon of Saturn, described from Saturn's globe being observed, divided into parts equal [to those] of [16]; the diameter of which, AP, runs into our eyes, in which —

Diagram. A circular dial-figure for the orbit of Saturn's Moon (Titan), graduated 1 through 16 around the circumference, with a central cross (axes) marked C at center. The numbers 1–16 are distributed clockwise around the circle, with letters A, P, Q, B, C marking cardinal positions.

- A (top): point 1 / A / 16 (the apogee position, top of the orbit)
- 16, 15, 14, 13, 12, 11, 10 (descending down the right side)
- B (left): point near 3
- P (bottom): point 8 / P / 9 (the perigee position)
- Q (lower-right region): marked near 9–10
- C (center): the center of the figure (Saturn)
- Numerals 1 through 16 ring the circle marking the daily positions of the Companion in its 16-day revolution.

The Companion [Comes] is here carried, according to the order of the Signs, from apogee A, through C, into perigee P. In the first observation of the year 1655, on 25 March, [it was at] number 12, removed from perigee P by parts $3\frac{1}{3}$, [of the kind] of which the whole circumference ACPD is 16; and on 26 March it was at number 13, and on 14 March at [number] 3, in April...

lacking up to number 5, and so on thereafter: provided that anything is to be added or taken away, the period being one of 16 days. For he finds that the Companion was at perigee P in the year 1659, on 14 March, about the evening hour 8, and earlier in the same perigee in the year 1656, on 23 March, at hour 8 after noon. This makes an interval of 1086 days; and this divided by 16 days yields 67 revolutions, and there remain in addition 14 days. There come to be 68 revolutions with respect to our [reckoning], an absolute number; but with respect to the Fixed stars, on those days [there are] over and above 14 — [Margin?] — therefore so many degrees were measured along its circle as Saturn meanwhile

traversed among the predicted Fixed stars, ever at gr. 40. 48'. Wherefore from this circle [it follows], on 16 days, 1086 absolute periods 68; and besides at gr. 40. 48'. and again, with one day with respect to the Fixed stars [at] gr. 22. 34'. 44"; whence it appears that over 68 days, by 360°, there come to be degrees 2448, and these added at gr. 40. 48'; whence at gr. 24. 34'. 44", and these divided over the 1086 days. With the mean motion of Saturn removed, which is 2' 1", there remains of the motion of this Companion at gr. 22. 32'. 44"; which to retain as the mean he says is possible meanwhile, until after several more years it should become evident how much is to be emended. He then adds a Table, and an Epoch, and a precept for computing the motion, and the position of this Companion, on whatever date of the times — these things which in the second volume we shall set out, where we give the Tables of the Motions of the Lesser Bodies, with their precepts and examples.

§19. With the Theory and Practice of the Companion of Saturn settled, Huygens passes to the figure [shape] of Saturn, and, having refuted the hypotheses of Hevelius [Hevelius], Roberval [Roberval], and Hodierna [Hodierna], he subjoins his own, which he includes in this proposition:

Saturn is girdled by a ring [annulus], thin, flat, nowhere touching [the body], and inclined to the Ecliptic. Which [ring] is represented in the following diagram.

Diagram. A schematic of Saturn surrounded by Huygens's ring. The globe of Saturn is shown as a central sphere lettered A (top) and C (bottom, on the body), encircled by an inclined flat ring whose extremities are lettered B (left) and D (right). The ring is drawn as an ellipse seen obliquely, separated all around from the body of the planet.

- A (top of globe): top of Saturn's body
- B (left extremity of ring): the western ansa
- C (lower part of globe): the lower point of Saturn's body
- D (right extremity of ring): the eastern ansa

This ring BD, although separated from the globe of Saturn AC, nevertheless in the Zodiac follows it with an equal pace [par passu], and is constituted by an equal force about the center of Saturn as the Earth is supported by no props — even so, the ring itself is always moved, and yet, since it is itself moved, whatever its distance from the center of the Earth — which is the center of gravity [centrum gravium]. When, however, Saturn appears perfectly and most amply furnished with arms, as in Figure XIV we showed, the diameter BD appearing [as an] ellipse

of a diameter smaller than [the body], holds itself as 1 to 2. He then proceeds to the observations of his predecessors — Galileo [Galileo], Gassendi [Gassendi], Bullialdus [Bullialdus], and Riccioli [Riccioli] — concerning the greater diameter BD, [arguing] it to be parallel to the Equator. — [Margin: Riccioli vindicated from Huygens's censure] — On this point, nevertheless, Riccioli says that the contrary holds for himself, because from one side he shows the line of the arms to be parallel to the Equator, but from the other [side] he made on 18 March of the year 1650, [the observation], because of the [matter], a [counter-claim], that this line was not parallel to the Ecliptic, since Saturn was then near the beginning of Cancer (it was indeed in gr. 24. of Gemini), [and] could not have been parallel to the equator, because it was deceived through P. Grimaldi [Grimaldi]; and to have been thought the same, which [observation] was different, [is shown] near *Almag. Nov.* p. 7. — *Almag. Nov.* p. 723. Huygens supposes, moreover — I know not from what observation, which he does not adduce — that with Saturn existing in gr. 20. of Gemini, ♊, or Sagittarius, the line of the arms escapes [from being] parallel to the Ecliptic. — But this Riccioli does not suppose, the line [to be] parallel; but [holds] that then only the line of the arms is parallel both to the Equator and to the Ecliptic at once, when Saturn is in the very beginning of Cancer, or of Capricorn, for the reason that the [line] Parallel to the Equator does not then intersect the Ecliptic, but touches [it]; outside this position, however, for the same reason, because the line of the arms [is] parallel...

parallel to the Equator, and parallel to the Equator intersects the Ecliptic; the line, that [line], necessarily inclined to the Ecliptic — which is evident from gr. that 24. The twin observation was the observation of P. Grimaldi, who, having most studiously watched this, did not deceive himself in the observation, having Saturn on different days, with a fixed star taken for another, with respect to which Saturn was acceding from elsewhere — neither does Huygens affirm, except that this observation may destroy his own opinion, of the Line parallel to the Ecliptic beginning at gr. 20. of Gemini, ♊, and Sagittarius. Not yet, therefore, from the things said thus far, does Huygens show, against Riccioli, what is contrary to him, and that of Grimaldi to be deceived — but let these things be by the way. Let us pass on to the rest of Huygens's Theory.

§20. The orbit of Saturn, absolved [completed] in roughly 30 years, he places in the same plane with the Ecliptic, the inclination of gr. 2½ being neglected. He holds the Axis of Saturn, circulating about itself, to be always parallel to itself, and that the plane of the ring circling about it stands erect [perpendicular], so that about this center the [parts] gyrate, and the globe of Saturn — so that all its parts in turn are by the Sun illuminated — and the ring itself, [is] in the plane of

the ring, the Companion [Comes], or Moon of Saturn. He places the Axis of Saturn nearly equidistant from the axis of the Earth, with an angle of gr. $23\frac{1}{2}$; and the plane of the ring inclined to the plane of the Ecliptic. With the plane of the ring placed parallel to the plane of the Equator, the greater diameter of the ellipse appearing, to which the Ring is likened, [is] esteemed parallel to the Equator. Hence it comes about that, with Saturn existing at the beginning of Cancer, ♋, and Capricorn, it ought to appear to us furnished with arms most broadly of all, because then our eye is raised above the plane of the ring by gr. $2\frac{1}{2}$; on the contrary, it ought to appear most narrowly [furnished] at the beginning of Aries, ♈, and Libra, ♎; with the plane of the ring then falling [edge-on] into our eyes. But by observation it is established to be most broad, ♋, [the ring's] ellipse drawn out [to appear] at gr. $20\frac{1}{3}$, and most narrow at gr. $20\frac{1}{3}$ of Virgo, ♍, and of Pisces, ♉; whence one may conclude, that in [the rule], the line of the arms is always parallel to the plane of the Equator, but inclined to the Equator by gr. 4. 8'; with Saturn existing at gr. 25. 15'. of Gemini, ♊, and Sagittarius, ♐, more so, indeed, in this [present age]. Twin, therefore, are the loci in the orbit of Saturn diametrically opposite, in which the ellipse appears most broad, and twin in which [it appears] most narrow; in other loci, narrower and broader appears [the ring], as Saturn recedes more or less from the said loci, that is, according as our eye is raised more or less above the plane of the ring.

§21. Furthermore, if from the Earth we should look at Saturn, the [appearances] would be the same — a perpetually dual [appearance] of those loci, in which the plane of the ring is brought to bear directly upon our eyes; but [if] from the Earth we look at Saturn, certain inequalities [appear], and so the ring [is such that], following the *latus rectum* [side?] inspected, not in itself the line referring [to it], neither of the planes of the superficies of the ring appears; and so, when nothing of the surfaces of the ring is parallel, hence Saturn appears round, and as though without arms. Whatever phases, indeed, [appear] over a whole half-year [semestri], and more — when Saturn exists at the initial point of Aries, ♈, and Libra, ♎; the plane of the ring (through imagination) passes between us and the Sun, by which it would be impossible for the surfaces of the ring to be looked upon, which [are] illuminated by the Sun — but in another manner, which our eyes' vicissitudes suffer, because the exterior limb of the ring is somewhat of a thickening predicted [edge-on], [a thing] of such nature that it reflects almost nothing of the rays of the Sun; and therefore the globe of Saturn appears girdled with a dark zone. Just as, on the surface of the Moon, certain parts appear darker, because they are less apt to reflect the light of the Sun. Which [happens] all the more to all the parts of the ring, the more obliquely they are illuminated by the Sun; as happens when Saturn's locus is eccentric, [being] far off, gr. $20\frac{1}{3}$, ♍, and ♉,

beyond, gr. 6. By all these things, then, his causes [account for] the concurrences of the round Phases of Saturn dimmed [edge-on]: so that the surfaces of the ring [appear] equal, and not rough with mountains. He concludes, therefore, [does] Huygens, that whoever's [be] the locus, eccentric, or seen from the Sun, not more than gr. 6. distant by gr. 20. of Aries, ♈, and Libra, ♎; never can the arms of the same be observed by ordinary tubes; but by perfected tubes [they can] in [a place] up to the gradus 6. distant from the said termini (which termini Huygens calls the Equinoxes of Saturn), some little flow of the arms could be observed.

§22. Therefore Saturn, according to Huygens's hypothesis, either appears round about gr. 20. of Virgo, ♍, and of Pisces, ♓, or furnished with arms; but always [its] arms [are] connected with it, if it is looked at by a perfected telescope.

§23. It remains that, with Huygens himself, [for] the times of this age, and for those of the future, we determine: [Saturn] will appear round, that is, without visible arms; in which [position], by contrast, the arms drawn most amply diminished, and by which the tenuous [arms] would be exhibited, or are about to be exhibited; [in] which [positions] the telescopes are perfect, when the arm emits the heliacal proportion, but recovers [itself] after the heliacal arc. — [Margin: The lacuna] — For of these Phases the [appearances] cannot be bound up [computed] in the tenth-month period, or in the tenth-month [reckoning], in any year; both on account of the Anomaly of Saturn, and on account of the Retrogradations of the same, [which] intercede between one Phase and another. To this is added that Huygens establishes the limits at gr. $20\frac{1}{3}$ of Gemini, ♊, and ♋, for the most ample arms, and ♌, and ♍, for the round Phase; nor are these established at gr. $20\frac{1}{3}$ for the most ample arms, and ♎ and ♏ for the round Phase; but the same [holds] either, [namely] that the orbit and the Ecliptic are inclined by some [angle] of Saturn, and perhaps versus the libration; certainly with the arms toward the Poles of the World [Mundi Polos]. Meanwhile, by observation his opinion [stands], that these times of the Phases were [so].

§24. The first of the Solitary [round] Phases of Saturn, by perfected telescopes, ought to have been seen in the years 1613, 1626, 1642, 1655, about April, [yet] ought to appear in the year 1671 on 12 January, and 1685 in September; and about the middle of the year 1701, with Saturn existing at the eccentric locus in gr. $20\frac{1}{3}$ of Virgo, ♍, or of Pisces, ♓. About six months, moreover, before the predicted Phase, the telescopes [show], by perfected telescopes [Saturn] appears furnished with the slenderest arms, [and] would be about to lose [them] a little after, on account of the access and the occasion of the heliacal [conjunction]. By contrast, indeed, about six months after the predicted Phase, [Saturn] ought to

recover the predicted arms, after the heliacal rising; the telescopes [being] perfect, but imperfect, on account of [their] slenderness, and as yet [it] could be seen to be round, or solitary. The intervals of the predicted Phase vary, [these being] produced on account of the Retrogradations of Saturn. The second of the extreme Phases [follows], that is, the telescopes [being] perfect, [when] Saturn appears most amply furnished with arms, with Saturn existing at the eccentric locus in gr. \square , or $\square 20\frac{1}{2}$. [This] ought to occur in the year 1619, and 1634, and between 1648, and 1649; likewise [it] ought between 1663, and 1664, and between 1678, and 1679, and between 1693, and 1694, and between 1708, and 1709, and so on thereafter.

The third variety of Phases, namely of the increasing arms, was, and is, [reckoned] from the time of the recovered arms, until the time of the second Phase.

The fourth, finally, was, and is, [reckoned] from the time at which Saturn loses its arms, [and] with the arms lost is the second Phase. These intervals then [will] more certainly the Astronomers define, when by more numerous observations, with more perfected telescopes, the arms of Saturn will catch [them] as if by hand [readily].

Iudicium de Theorica Hugenii, & Indicium de Nostra. [Judgment concerning Huygens's Theory, and an Indication concerning Our Own]

§25. Although we owe very much to Huygens for the Theory of the figure of Saturn, so ingeniously and learnedly devised and discovered by him, there are nevertheless certain things which we still hold suspect. For first, as we indicated at number 21, Huygens does not adduce...

does not adduce a [sufficient] cause, whence the projected shadow of that arm [does] not appear to the neighboring parts of Saturn; [the tubes being] imperfect telescopes; just as he asserts the reason, on what account by the same telescopes, by our example for instance, the whole Saturn appears now in tricorporeal manner, now with companions piriform [pear-shaped], now furnished with arms; for the [matter] of [its] longinquity, the round extremity [appearing] of that round [body], ought to appear [tricorporeal]; [such things] ought to appear to the same telescope. It is to be added, therefore, that it seems Saturn is not far off from apogee, [being] piriform; when [it] is more distant, [and] in [its] access to perigee, more and more, the more, and the more [it] reflects the rays of the Sun toward us.

§26. Secondly, the Hugenian Hypothesis [Huygens's hypothesis] always implies that the globe of Saturn, even when most amply furnished with arms, projects beyond the plane of the ring, with the ring nevertheless [appearing], as from Figure cap. 1, & from Figure 10. cap. 9, it is established to have appeared to us [as a] whole within the arms; nor could it have ascended [risen above] the imperfection of the Tube; but if it represents to us the parts nearest to Saturn, the [parts] of the Arms [which are] more difficult to see — [Margin?] — than Huygens admits the extremities [to be]; much more luminously would it have represented the whole [of] Saturn standing out beyond the arms, and [this] is truly thus eminent.

§27. Thirdly, there is no necessity of positing the plane of the ring parallel to the plane of the Equator, observed parallel to the Equator; nor is it necessary [that] it appear [as] that ellipse, which exhibits Saturn furnished with arms, [or] that the ring be from it on every side sequestered and equally [separated]. But it can be said that Saturn is girdled by an elliptical ring coherent with it at the extremities of the diameter of the smaller Ellipse; and this [is] all the more probable, the more [closely] joined to Saturn, [and] parallel [it is], with the body, as it were, [coming round] to meet [itself]; [and the ring] also [may] go about [it]. It can moreover be said that the body sequesters itself; [there being] thus also the diameter of the greater elliptical ring, as it were about the axis parallel to the Equator, or [in] perfect revolution turned, that [the parts] librated, [are] such that the ring's parts, which [are] of the middle for us, [it] bisects optically, when by the elliptical [figure] [it] appears in the highest part, at other times in the lowest part, [and] thus the whole [of] Saturn within itself represents to us, [as] in Figure X. cap. 9, & then [we] see [it] most amply furnished with arms. From the observations of [our] predecessors, however, it could perhaps better be established what times, & [what] intervals of libration. — Save [unless] one [should] posit the plane of the ring of this Huygenian [scheme] parallel, [whether] solitary, or librated, [these] could equally well, if I am not mistaken, save all the phenomena of the figure of Saturn, even if there be posited, in place of the Huygenian ring, an Armilla coherent with Saturn, and [so it] be said:

Saturn is girdled by a thin, flat, Elliptical armilla [armillary band], coherent in two places; or [it is] parallel to the Equator; or it revolves in itself or about the Poles of the World, with a libratory [motion].

§28. It is also more probable that the surface of the predicted Armilla is not equally broad in all its latitudes, but [is] broader in the parts extreme, and [the parts] remote from the globe of Saturn, [and is] narrower in the parts indeed

coherent with the globe of Saturn. For thus it is more easily understood, for what cause, [in] imperfect tubes, the parts of Saturn neighboring [it] more often appear not round, but somewhat round, [and] would be such that the extremities are joined to the armilla [as if] by tubes; but with the armilla everywhere perfect [it] would not be seen, [as] when some of the parts of the Armilla coherent with Saturn appear, but the parts extreme, as more remote, [appear] in the form of a pear [pyri], or in a semi-pear-shaped oblong, [these] appear; [in] all [these] tubes, however, when Saturn appears most amply furnished with arms, [the] arms [appear] broader in the parts more remote.

§29. But neither is it improbable, [for] the principal cause, on what account Saturn [in] this age furnished with most ample arms gr. $20\frac{1}{2}$ \square \square , to be, [is] not because our eye is raised above the plane of the Armilla by gr. $23\frac{1}{2}$, but [because] [there is] something declined of the Ecliptic from the Equator; for [the line] enters [in] this same \square \square ; nor again is anything varied of the parallelism to the Equator, which is probable, [it being] always...

to be continued, as long as the axis of the Armilla, but from the libration of the Armilla; or [from] the revolution, which can be so great, that our line of sight may incident upon the plane of the Armilla at a right angle; the limits of this libration, however, or of the revolutions, [are] able [to migrate], against the order of the Signs to migrate from \square in \square , & \square in \square ; or against the second order of the Signs to change, [namely] from the beginning of the world at the principle of Aries, \square , & \square , also to migrate at gr. $20\frac{1}{2}$. \square , & \square ; [it being] false therefore always [to hold them] parallel to the plane [of the ring], but always [coherent] to the Armilla, & to the Equator. Whether, however, any of these may happen, or [it be] constituted, [it is something] destitute of observations of past ages, and of future [ones], [and so we are] not able to determine.

De Figura Saturni nuperrimè observati à D. Iosepho Campano. [Concerning the Figure of Saturn most recently observed by Sig. Giuseppe Campani]

§30. Sig. Giuseppe Campani [Giuseppe Campani], most excellent in Telescopes, [and] by his own industry, [his] fame won by the very fabric [he] constructs, observed in the month of April of the years 1663 and 1664 Saturn girdled by an elliptical circle apparent, the Figure of which I [have] from him as a gift, [it being] sent by P. Daniele Bartoli [Daniele Bartoli], [it being] very like the Figure rather of XIV. than X. From the premises of number 10. but [he] adds the superior part, that is, [the part] toward the Arctic pole of the body of Saturn, [to be] covered as

[if] by the armilla [itself]; by contrast, indeed, the inferior [part], the Armilla toward the Austral part [being] turned, [to be] covered, or covered by the body itself, or [by the] globe of Saturn. Besides he relates, the lower [part] of the globe candid [bright], or [with] iron-like thread, [it being] of the manner of a diameter through the globe, & the Armilla thus deepening; with the Armilla also so depressed, [and] thus also collocated in the convenient light; [and] thus [as] observed by a small Telescope [it] represented to itself all the phases different for [different] elevations, or [for different] depressions of the armilla, [these things] which now [are] discerned among the future years. The Tube, moreover, with which [he] made use, [was] of 27. April of the year 1664. of the length of palms Roman 55. of those things which the architects use.

§31. I, indeed, inferring from this [figure] in [the] armilla [to be] in reality Elliptical, observed the diverse Phases represented no less near to the diverse armilla [in] libration. With the armilla, however, thus far perfectly round of Saturn, [it can] never [appear] furnished with arms, [the] telescopes [being] perfect [enough] to round [it]; [it could] not [be that] [Saturn] stand for [be] Elliptical, as long as [it is] not demonstrated [to be] impossible [for it] to be Elliptical in reality, & [as long as it does] not appear [other] than Elliptical, [it] represents all those phases, which appear in Saturn.

CAPVT X. [CHAPTER X]

De Iouis Figura, Fasciis, earumq; Parallelismo ad Eclipticam, & Satellitibus. [Concerning Jupiter's Figure, [its] Belts, and their Parallelism to the Ecliptic, and [its] Satellites]

§1. Whatever be the case concerning the vaporous Sphere [Sphaera vaporosa], which P. Antonio Maria de Rheita [Anton Maria Schyrleus de Rheita] asserts to himself to have seen circling about Jupiter with an ample perspective glass — [Margin: ∽ A vaporous atmosphere] — (*Rad. Sideromyst.* cap. 1. memb. 2. & 6.), and D. Leander Bandtius, Abbot of Dispergen [Leander Bandtius], in the year 1643, on 2 November, that is, on 21 [November] after [the conjunction of] ☽ with the Sun observed, [Jupiter] together with two lesser spots, & two greater, or hollows [cavities], the one round, the other oval — [Margin: ∽ rough or hollow] — equaling the seventh part of the diameter of Jupiter in longitude, as I have from the Schema sent from Flanders to me, [a thing] which rarely [happens], because rarely [and] by long perspectives can these be discerned; — these, I say, being omitted, & similar things both concerning the spots, which [Jupiter] has [as]

a quadrate in Jupiter conspicuous in [its] figure [it has?], & the asperities — concerning the Belts [Fasciae] and the Satellites, as ordinary \sphericalangle phenomena, which by observing have been ascertained, we shall expound. — [Margin: of the Belts and the Satellites] — Hevelius [Hevelius] testifies (*Selenograph.* p. 42, 44).

Diagram. A bordered woodcut plate containing nine telescopic drawings of Jupiter's disk, arranged in a three-by-three grid and numbered I through IX (Roman numerals engraved above each circle). Each drawing shows Jupiter as a circle crossed by one or more horizontal belts (*fasciae*), rendered as hatched bands. The figures illustrate the different belt-configurations described in the observational list that follows.

- I (top left): a disk with two thin belts, one above and one below the center.
 - II (top center): a disk with two belts, somewhat broader, both rendered as dense hatched bands near the center, with a slight obliquity.
 - III (top right): a disk with two thin belts close to the center.
 - IV (middle left): a disk with two thin belts.
 - V (middle center): a disk with three belts — a broad central band flanked by two thinner ones.
 - VI (middle right): a disk crossed by a single belt set obliquely (slanting), running diagonally across the disk.
 - VII (bottom left): a disk with a broad, densely hatched belt occupying much of the central region.
 - VIII (bottom center): a disk with a single belt below the center; the lower portion of the disk appears contracted relative to the upper.
 - IX (bottom right): a disk with a single belt in the upper portion, curving toward the south (the belt drawn somewhat in the upper part and bowed).
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2. Belts running crosswise that gird the whole disk of Jupiter — or rather, that are the more prominent, or rather the deeper, parts of it — were first noted (so far as I know) at Naples by Father Giovanni Battista Zupi [Zupus] and by Daniel Bartoli of our Society, although Francesco Fontana [Fontana] had observed them there even earlier. Afterwards we ourselves at Bologna, together with Father Francesco Maria Grimaldi [Grimaldi], saw the same belts distinctly through the telescope. They appear sometimes two, sometimes only one, and occasionally several at once, bounded on both sides, sometimes hedged in, and sometimes single. Moreover, one of them sometimes appears in the middle of Jupiter's disk, sometimes higher,

sometimes lower; nor are they always straight, but sometimes curved, sometimes turned convex upward, sometimes convex downward. These curvatures are indeed a fairly clear sign of Jupiter's rotation [*vertigo*]; for concerning the parallelism of those belts to the ecliptic, and to the path of the satellites, I must speak separately further on, after I have given the history of the number of the belts. As for the fact that sometimes no belt at all appears — as is evident from the first schema of Giovanni Lippi of Munich [Io. Lippius Monachiensis] — this is no wonder, since Gassendi [Gassendus], in Book 3 of his *Institutio Astronomica*, denies having seen any himself.

Observations of Jupiter's Belts.

In the year:

- **1630.** On 17 May, Father Niccolò Zucchi [Zucchius] at Rome saw two belts on Jupiter, as in Fig. II.
 - **1633.** Francesco Fontana at Naples — as is recorded in his tract 6 of his own observations — observed three belts, as in Fig. I; and likewise at the beginning of the year 1643.
 - **1634.** Jupiter, which had appeared with three belts, nevertheless from the beginning of October up to the 13th — that is, up to the time it was seen with the Sun [in conjunction] — was observed by Father Grimaldi with two belts, one darker, the other brighter, than.
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the rest of the disk — as in Fig. III, but after the conjunction with the Sun, right up to 20 October, three belts were seen, the same as before: one dark, the rest bright, and curved, as in Fig. IV. But from the beginning of November onward, up to the 22nd of December, often two straight belts appeared, chiefly in the meridian, as in Fig. V.

- **1644.** Father Giovanni Battista Zupi at Naples observed two belts on Jupiter, as in Fig. II, but much broader, on account of the excellence of his telescope, which represented Jupiter's diameter [as large as] half a foot.
- **1645.** On 1 and 22 January, Fontana saw two belts on Jupiter, as in Fig. II, but on the 28th he saw a third near the margin, as in Fig. I.
- **1647.** On 23 January, I too saw Jupiter girt with two zones [*zoniae*] when in conjunction with the Sun, as in Fig. II.
- **1648.** Father Grimaldi, from the 24th of February to the 16th of March, observed on Jupiter two now-straight belts, as in Fig. VI, which represent

the observation of 11 February, at 1.5 hours after sunset, when Jupiter was in the eastern quadrant and stood moderately distant from the meridian; and the upper belt was narrower and darker in appearance, while the lower was broader, less obscure, and the part of the Jovian disk [below it] had been left much brighter, as in Fig. VI [reading as printed; cf. note]. This had been [observed?] on 22 February.

- **1649.** On 28 March, at the second hour of the night, the belts appeared in the same line with the four satellites, as in Fig. V, but at an angle. On 14 August, Father Grimaldi noted a single belt above the middle, in the line of the satellites, the others not being conspicuously visible.
 - **1650.** In the month of July, two belts were observed by Father Gri-
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- maldi in the upper part, turned toward the south, as in Fig. IX.
- **1651.** On 29 May, Jupiter was seen with two dark belts enclosing a great bright space, as in Fig. II; but on the 11th of July it was seen with two obscure belts, of which the middle [region] was broader and more obscure, and a little above [it] toward the south the disk appeared brighter, but toward the lower limb [it appeared] more austere [darker], as in Fig. VII.
- **1652.** On 1 June, Father Giovanni Battista Hodierna [Hodierna] wrote to me that the same had been seen by him on Monozonium [Jupiter "of one belt"], in June and July.
- **1653.** On 21 July, Father Grimaldi saw Jupiter "Three-belted" [Trizonium].
- **1654.** Father Giovanni Battista Zupi observed Jupiter, as in Fig. VIII, in which the lower half-disk appeared contracted [narrower] than the upper.
- **1656.** Father Grimaldi, on 2 August, beheld Jupiter with two obscure belts comprehended within bright zones, as in Fig. VI, of which the lower [zone] was a little broader, and in the line of the satellites, as in Fig. VII; but on 5 October, and on 2 December, [Jupiter appeared] with three belts, as in Fig. VII.
- **1657.** From 17 October on, and on 6 November, Father Grimaldi observed three belts, as in Fig. II; but on the 12th and 19th of November, the third was wanting, as in Fig. VII — for the two dark belts were then more like those of Figure IX; and the third nearest the southern limb, on the 4th of October, was obscured. On 9 December, he saw three obscure [belts] enclosed within two bright ones, almost as in Fig. VII; but on the 13th [he saw them] as in the margin [reading as printed], where a certain shading appeared toward the south, like a fourth belt.

- **1664.** On 1 July, Don Giuseppe Campano [Iosephus Campanus], with a most excellent telescope made by himself, observed two dark belts on Jupiter and two bright ones, as the most excellent Doctor Giovanni Domenico Cassini [Io. Dominicus Cassinus] testifies. But because I have not yet obtained the schema of these, I cannot exhibit a synopsis of them to the reader.

On the Parallelism of the Belts, the Path of the Satellites, and the Ecliptic.

3. That the belts of Jupiter, the path of the satellites of the same, and the ecliptic are parallel to one another — as regards the satellites — was noted by Galileo [Galilaeus] in his *Nuncius Sidereus*, and by Simon Marius [Simon Marius] in part 2 of his *Mundus Iovialis*; and as regards the belts, by Hevelius [Hevelius] in his *Selenographia*; and on both counts by us also, and often by Father Grimaldi, who saw the lines [of the belts] drawn parallel to the two lines [drawn] toward the two satellites — the parallelism of the belts and of the path of the satellites being established by direct sighting [*ductus*] on both counts. There is no need to fill many pages with the multitude of observations of this matter that present themselves.

On the Number of Jupiter's Satellites.

4. Although the satellites of Jupiter may be reckoned equal to fixed stars of the sixth magnitude, just as such stars are scarcely apparent to the naked eye, so neither do the satellites of Jupiter appear without a telescope — both because they can scarcely be seen, on account of their brightness, when so near to Jupiter, and because none of them is more than 12 minutes distant from Jupiter. No wonder, then, that they lay hidden from the eyes of mortals up to our own age, when, by the concession of God, the beginning and the greater [share of glory] of this our age, Simon Marius in Germany — as he relates in his *Mundus Iovialis* — on 29 November 1609, on the occasion of Jupiter's [appearance], and Galileo, when Jupiter began to rise with the Sun, began to notice three little stars around Jupiter, [their] distance being varied from observation to observation, confirmed these to be wandering. On the 8th of January [1610], he saw three [stars] in a straight line, twelve [minutes] toward the west. On the 19th of the year 1610, on the 12th [of January], at the beginning of [his observations], Marius too acknowledged [them], yet [held] those little planets to be wandering; Galileo, however, conscious of nothing pertaining to Marius's observation, [was] the first of all in Italy, in the year 1610, on 7 January, at the first hour of the night, [to] observe around Jupiter at first three [little

stars], and then never more than four; nor did more than four wandering little stars [appear] around Jupiter, and [these were distinguished] from the fixed stars by this token — that they rapidly changed their distance from one another, as.

he relates more fully in the *Nuncius Sidereus*. And although Scheiner [Scheinerus], in his first letter to Welser [Vuelserus], suspects that there are several of these satellites — more than four — in his *Disquisitiones Ingolstadii* [the Ingolstadt Disquisitions], and although at Rome, from observations made, he acknowledged only four, yet he asserts the same number in his observations, [as does] Blancanus [Blancanus] in *Sphaera* fol. 14. Kepler [Keplerus], in his *Dissertatio cum Nuncio Sidereo*, and in his *Epitome Astronomiae*; Herigone [Herigonius] in tome 5 of his *Cursus Mathematicus*; Charles Malapert [Carolus Malapertius] of the Society of Jesus, who calls them *Sidera Austriaca*, just as Galileo [calls them] *Sidera Medicea*; D. Vincenzo Reinieri [Vincentius Reinerius], who for whole 10 years observed them every year; likewise Peiresc [Peirescius] and Gaultier [Galterus], as in the *Life of Peiresc*, and in the *Discourse of the Nine Stars* — these observed them at Marseille [Massiliae], naming the first the *Cosmus Minor*, the next-to-last the *Cosmus Maior*, [and] the outermost the *Catherina Medicea*; although Marius had called the innermost *Iovialem Mercurium* [the Jovian Mercury], the next-to-last *Venerem* [the Jovian Venus], the next-to-next *Iovem* [the Jovian Jupiter], the outermost *Saturnum* [the Jovian Saturn]. And [there is] Father Giovanni Battista Hodierna, who recently in the *Medicean Ephemerides* — or rather, by the patronage of the prince of Etruria — names them: first, from *Victoria*; second, from *Cosimo Cosmifer*, the husband of the Grand Duchess; third, from *Ferdinando Fernandifer*; finally, fourth, from *Ferdinando Stampioni*. Finally, [as recorded] in a letter to me of the year 1647, and by Hevelius in his *Selenographia* at page 45, and by Gassendi [Gassendus] above at page 45, and by Phocylides Holwarda [Phocyllides Oluuarda] — and we ourselves, with Father Grimaldi, never observed more than four.

[Margin: Fontana observing.]

5. But Father Anton Maria de Rheita [Rheita], besides the four inner Jovian satellites, claims to have seen others, more remote and larger, not visible except through a larger telescope, which space in the sky he calls the Urbanoctavian [*Urbanoctavianus*] [in honor of Urban VIII]; and this in the year 1642. On 29 December, [he saw them] still more, [than] Francesco Fontana [had], in tract 6, observation cap. 2, in the year 1630, [Jupiter]

surrounded by 8 stars distant from it by more than 10 Jovian diameters; and on the 8th of January [16]36 and [16]43 [he saw] Jupiter with 8 stars, and in [16]45, on 31 December, [Jupiter] with seven, as also in the year [16]43; on 1 and 22 January [he saw it] with 6; on the 28th [he saw it] with 6 stars — these not preserving the same distance among themselves: this needs to be extended for examining them [requires] that the telescope be drawn out [extended] in order to see them, [whereas] for seeing the fixed stars perfectly, there is need to contract the tube.

[Margin: Campanus and Lippius.]

6. But Father Giovanni Battista Zupi of the Society of Jesus, at my request, observed the stars around Jupiter for nearly a whole [period] in the year 1644. On the 1st of January, and in February — [as] he wrote at Naples in letters [dated] from Naples — Jupiter was seen with 6 [stars], Jupiter with 21 and 22 [...]; on the 22nd of January, those that had been reckoned to be in the [region] toward Jupiter, and on the 23rd, it was explored by him that there were not only six but rather nine, sometimes twelve, around Jupiter — among which he reckoned 9 or sometimes 12 to be errant [wandering], both because they did not scintillate, and because of the change of telescope, and because of the change of distance among themselves; he asserts nothing [definite], yet what he asserts Father Rheita adds, that new stars are born and afterward grow faint, which is the opinion of Giovanni Caramuel [Io. Caramuelis] and Giovanni Stampioni [Io. Stampionius].

[Margin: Caramuel, and Holwarda.]

[Margin: Gassendi opposes; and Reinieri.]

7. As for the rest — besides the four [satellites] common [to all], Rheita [claims] that the others he had seen were fixed stars [located] in the constellation Aquarius, as Gassendi reckons in his *Iudicium de 9 Stellis* — for in the year 1642, on 29 December, he did not see [them] change their distance among themselves; and for other arguments, which Gassendi adduces in *Almagestum Novum* Book 7, cap. 3. But D. Vincenzo Reinieri, mathematician of Pisa, stoutly affirms to me that in his observations, made over a whole decade, he never saw more than 4 around those little stars of Jupiter [the satellites]. Hevelius likewise, in his *Selenographia* at page 45, affirms that from the year 1642 to 1645 he most diligently watched [for them], and detected no more than 4 planets; and the other stars seen by Rheita were fixed stars of the same Asterismus [asterism] of Aquarius, but

not ordinary ones, nor visible to the naked eye; and (as at page 65) [these are] far more worthy [of the name] of fixed stars, against Caramuel and Rheita; against the Rheitan [view], on this account and [for] other reasons, too bitterly inveighed Giovanni Phocylides Holwarda.

[Margin: Gassendi the wise; and Reinieri.]

[Margin: And Hevelius.]

[Margin: And [against] Holwarda [reading as printed].]

On the Position and Motion of Jupiter's Satellites.

8. Since on individual clear nights the motions of the satellites around Jupiter are observed to vary, [as well as] their interval [from Jupiter], if [their] altitude [is considered], and the form of our observations — were we willing to transcribe [them] in this form, [following] the practice of Galileo (after his Epistle to Welser) and of Hevelius in his *Selenographia*, page 526 — we would fill very many leaves indeed, without [any] hope of gathering fruit for the reader's weariness. It is enough, however, to see a specimen of these [observations], both among the aforesaid [authors], and among Scheiner in his *Disquisitiones* num. 39, and likewise with Simon Marius, who also constructed *Ephemerides* of these motions, as did lately Father Giovanni Battista Hodierna; from [Marius's] long diligence, and the more excellent [observations], both [those drawn] from Vendelin's [Vuendelinus's] *Epistle* to me, and from the Rheitan [source] Book 4, cap. 2, member 2, and from Gassendi in his *Epicurus* page 904, and from *Almagestum Novum* Book 7, sect. 1, cap. 3 — and at last from D. Vincenzo Reinieri — I have gathered our compendium written below, more worthy [to be] known [than] the propositions [themselves].

[Margin: Proposition]

1. They are flat circular [bodies], in number 4. The 4 satellites moving around Jupiter, above Jupiter, indeed decline toward the south from the ecliptic, while below [Jupiter they decline] toward the north — whence it comes about that the latitude of these [satellites] is southern in the upper part, and northern in the lower part. Gassendi reckons this [to hold] if Jupiter himself, [he] says, has southern latitude.

2. The latitude of the first [satellite], or innermost, is greater than [that] of the second; [that] of this [second] greater than [that] of the third; and [that] of the third greater [than that] of the fourth, or outermost.
3. They move in the upper part of [their] orbit directly, and according to the consequence of the signs [in the order of the zodiac], from west to east; but in the lower part [they move] retrograde, from east to west.
4. They move in [quadrature?] [□], with the greatest excursions [*digressiones*] from Jupiter; at conjunction with Jupiter [♃] [they move] most slowly, at opposition [♁] with Jupiter most swiftly.
5. In the upper part, when they decline toward the south, even though they be more remote from the center of the earth, they nevertheless appear higher with respect to the horizon; but in the lower part [it is] the contrary.
6. They appear larger when tending from a higher [position] toward a lower one [♃ with Jupiter]; but from this [lower position] tending toward the higher [♁], they appear smaller.
7. When Jupiter is in the ecliptic, [the satellites] more often and more easily eclipse one another, and are eclipsed by Jupiter's shadow; and such eclipses are conspicuous to us. At other times, however, they escape us, [as do] other eclipses of them, on account of the differing latitude of Jupiter, and the inclination of Jupiter's shadow-cone. But concerning the vicissitude of these eclipses, [see] the more numerous [observations] of Galileo in his *Macula Solis* page 162; Hevelius page 46 of his *Selenographia*; and Hodierna in part 2 of his *Medicean Ephemerides* cap. 7.
8. The periods of these [satellites] are better computed at conjunction [♃] and opposition [♁] with Jupiter than from other aspects. Scheiner hands down other rules in his *Disquisitiones* num. 42. For the rest, see the little tables written below.

Excursions [Digressions] from Jupiter, expressed in Jovian Semidiameters.

Satellites	I		II		III		IV (outermost)
	Sem.	'	Sem.	'	Sem.	'	Sem.
By the							

Satellites	I				II		III		IV (outermost)
Authors									
Galileo	3	0	5	0	8	0	12	0	
Simon Marius	3	0	5	0	8	0	13	0	
Rheita	3	0	4	0	6	0	10	0	
Vendelin	3	0	5	0	8	0	14	0	
Hodierna	3	30	5	30	9	0	14	30	

Periodic Revolutions in which they complete their orbit.

Order	By the Authors	Days	Hours	'
I	Galileo	1	18	30
	Marius	1	18	28
	Rheita	1	18	30
	Hevelius	1	18	28
	Hodierna	1	18	28
	Vendelin	1		18 768/1000
II	Galileo	3	13	20
	Marius	3	13	18
	Rheita	3	13	20
	Hevelius	3	13	18
	Hodierna	3	13	18
	Vendelin	3		13 114/1000

Order	By the Authors	Days	Hours	'
III	Galileo	7	4	0
	Marius	7	3	56
	Rheita	7	3	0
	Hevelius	7	3	57
	Hodierna	7	4	1
	Vendelin	7	3 164/1000	
IV	Galileo	16	18	0
	Marius	16	18	9
	Rheita	16	18	9
	Hevelius	16	18	9
	Hodierna	16	18	14
	Vendelin	16	18 755/1000	

Parsing notes: the rightmost column carries either an arc-minute value or a qualifier (*ferè* "nearly," *circ.* "about"). The Vendelin rows give a fractional day-part (e.g. 18 768/1000 of a day) rather than separate hour/minute columns; transcribed as printed with the fraction in the Hours column.

From this Vendelin concludes that, just as in the major planets the mean distances of those [planets] from the Sun stand in the sesquialterate ratio [3:2 power] of their periodic times, so the distances of the Jovian planetlets from Jupiter stand in the sesquialterate ratio of their periodic times.

Diurnal and Hourly Motion in each one's own orbit, divided into 360 degrees.

Order of Sat.	By the Autho rs	Diurn al Gr.			Hourl y Gr.		
		'	"		'	"	
I	Galileo				8	29	circ.
	Marius	203	25	0	8	28	30
	Hodierna	205	23	44	8	18	29.5 [reading as

Order of Sat.	By the Autho rs	Diurn al Gr.	'	"	Hourl y Gr.	'	"
							printe d]
II	Galile o				4	13	ferè
	Mariu s	101	17	22	4	13	13
	Hodie rna	101	17	21	4	13	13
III	Galile o				2	6	circ.
	Mariu s	50	14	57	2	6	30
	Hodie rna	50	13	32	2	5	34
IV	Galile o				0	54	30
	Mariu s	21	29	5.5	0	53	30
				[readi ng as printe d]			
	Hodie rna	21	28	48	0	53	42

Parsing notes: the Galileo rows give only the hourly motion (diurnal columns left blank in the source). Some seconds-cells carry the qualifier *circ.* / *ferè* in place of a numeral. Where the source prints a fractional second (e.g. 29½, 5½), transcribed as a decimal in brackets.

More tables besides, with their canons, together with roots [radices] for constructing ephemerides and for predicting eclipses of these satellites, Simon Marius and Father Giovanni Battista Hodierna have; selections from which, in their own places, we shall give after the Tables of the Second Movables [Secundorum Mobilium], if Almighty God so pleases.

CAPVT XI.

On the Figure of Mars [De Martis Figura]

1. Near quadrature [☐] with the Sun, Mars is seen almost halved [dichotomous], says Kepler [Johannes Kepler] (*Epitome of Astronomy* [Epitome Astronomiae], p. 843); but at other times it appears gibbous between quadrature [☐] and opposition [♁] with the Sun, and is only rarely round, as Rheita [Anton Maria Schyrleus de Rheita] firmly asserts (*Selenographia* [Oculus Enoch et Eliae / *Selenographia*], bk. 4, ch. 5). Hevelius [Johannes Hevelius] (*Selenographia*, p. 42) presents a figure of Mars gibbous in itself, and on p. 67 denies that Mars can be seen horned [corniculate]. Yet Mars was seen halved in the year 1645. Francesco Fontana [Francesco Fontana], in his *Observations* (treatise 6, ch. 1), presents a round figure of Mars for the year 1636 with a dark spot in the middle, which he judges to be a cavity rather than a shadow [umbo]; but he shows it gibbous with a spot, again in the year 1638. On 24 August Fr. Niccolò Zucchi [Niccolò Zucchi], in the year 1640, and on 23 May, saw Mars gibbous between quadrature [☐ and △ — i.e. between quadrature and trine? *as printed*: "inter △" (?) and opposition [♁] with the Sun, but without a spot — perhaps because of the motion of its rotation [vertigo], or of a libration about the center of its body. Fr. Daniel Bartoli [Daniele Bartoli] wrote to me from Naples in the year 1644, on 24 December, that with an excellent telescope of Fr. Sersale [Cristoforo Sersale — printed "P. Sirsali"] he had seen Mars almost round, with two spots within.
2. Finally, with Fr. [Francesco Maria] Grimaldi [Grimaldi], in the year 1651 — on 4 April, and on 6 April — we saw Mars with a black spot, as if formed of many parts, and likewise on 18 April and 29 May. And again repeatedly in the year 1653, throughout the whole of July, and in the year 1655, on 22 July and 28 August, and finally in the year 1657, on 15 and 11 October, on 17 and 21 October, and on 6 November. Moreover, from its halving [dichotomy] and gibbosity, astronomers take an argument that its light is received from the Sun in just the same way as if Mars were the Moon; and if it were permitted to see Mars near and in conjunction with the Sun, we should see it horned.

CAPVT XII.

On the Figure of Venus [De Figura Veneris]

1. That Venus moves around the Sun, and receives light from it — now appearing nearly full when close to superior conjunction [♁], now gibbous, at other times halved or horned [falcate] — is plain to any observer, both from the renowned telescope, whether in the evening or in the morning, and from the observations of Galileo [Galileo], Scheiner [Christoph Scheiner], Fontana, and Hortensius [Martinus Hortensius]; from Kepler in the *Epitome of Astronomy*, p. 762; from Rheita (bk. 4, ch. 5, member 2); from Gassendi [Pierre Gassendi] in the *Epicurus*, p. 859. The remaining places, together with figures drawn from our own observations as well, I cited in the *Almagestum Novum* (sect. 1, ch. 7). I have noticed Venus with two horns, and with spots, as Fontana saw — but never by us, nor by Gassendi (bk. 3, *Institutio Astronomica*). To all these add the figures of Hevelius [Hevelius] in his *Selenographia*, from p. 68 to p. 74.
2. That Venus is moreover sometimes visible in broad daylight is established from the observations of Tycho [Tycho Brahe] and Longomontanus [Christen Sørensen Longomontanus], and of Hevelius above, who with Galileo adds that it is observed better and longer by day than by night, since it is then stripped of adventitious rays. We too, with Fr. Grimaldi, saw Venus with the naked eye in the year 1649. On 1 April it appeared nearly gibbous, and on 20 April halved [dichotomous]; on 1 September again halved, as on 4 September, as far as the first hour after midday; from then until 8 September, seen halved from the rising of the Sun all the way to midday; but on 18 April, exactly halved; and on 26 April more than halved, until the 9th hour after midday — always with the naked eye; and in the year 1651, on 1 February, the two horns [cusps] ran out beyond its own diameter, and on 12 February a line drawn through the horns was parallel to the ecliptic. This is indeed a very rare but remarkable phenomenon of Venus.

Diagram. A large telescopic figure of Venus occupying nearly the full height of the page's right column, showing Venus as a thin crescent (horned/falcate phase), its concave side facing inward and the cusps drawn out into long thin points. The crescent's convex (lit) edge faces toward the right. Two astronomical symbols for Venus (♀) are placed along the figure — one near the upper part and one near the

lower part of the crescent — and an additional Venus symbol appears at the very bottom. The figure is labelled with directional words.

- Top: **Occidens** — "West"
- Upper crescent: ♀ (symbol of Venus)
- Lower crescent: ♀ (symbol of Venus)
- Below, at foot of figure: **Occidens** — "West" (repeated; this is a layout/show-through artifact — a partial table edge bled through from the adjacent leaf — not a second phase-figure; not independently transcribable)

(Beneath this figure, faint show-through of a table from the following leaf is visible but is not part of this page's content.)

CAPVT XIII.

On the Figure of Mercury [De Mercurij Figura]

As many witnesses as we adduced in the preceding chapter, just as many stand for the motion of Mercury around the Sun, and for its light received from the Sun. For if Mercury is observed with a very powerful telescope, then around its greatest elongations from the Sun it appears nearly halved [dichotomous]; but when it is retrograde, approaching conjunction [♄] with the Sun, or moving away from it toward its second station, it appears like the Moon when it is about 60 degrees distant from the Sun, and as it were horned [falcate]. Hevelius (*Selenographia*, p. 74) says that in the year 1644 he himself observed Mercury in the morning on 22 November, its light a tenth part of its whole diameter, as illustrated in his Figure III; and on 30 November illuminated to one-eighth, and on 8 December to five-twelfths; and now horned, as in the following figure. But in the year 1645, on 16 May, [Johannes Phocylides] Holwarda [?] saw Mercury illuminated, one-third part, as in his Figs. I and 20; on 20 May halved [dichotomous], and slightly more than halved, as in Fig. III. But before that, in the year 1639, Fr. Giovanni Battista Zupo [Giovanni Battista Zupi] at Naples, with a telescope of Fontana, saw it horned and illuminated to five-twelfths in the evening, nearly as in Figure I — in the manner he saw it likewise in the year 1646; and on 16 January [printed "Ianuatij" — compositor error for *Ianuarij*] in the evening.

2. We too, with Fr. Francesco Maria Grimaldi, in the year 1643, on 5 March, saw Mercury in the upper part of its epicycle, in an evening position, and not yet 15 degrees moved away from the Sun, gibbous, as in Fig. III; just as

in the year 1656, on 24 December. But in the year 1643, on 25 August, we saw it halved, distant from the Sun 19 degrees, as in Figure II; in just the way [we had seen it] also in the year 1644, on 6 August, when it was 20 degrees distant from the Sun. Yet in the year 1647, on 30 April, we saw it [☿ — printed ☿, a glyph-sort substitution; the *De Mercurii Figura* context requires Mercury] as an evening star and distant from the Sun 20 degrees, as in Fig. I; and in the year 1650, likewise as an evening star and distant from the Sun nearly 18 degrees, horned [falcate], as in Fig. I.

Diagram. At the foot of the left column, a vertical series of telescopic phase-figures of Mercury (a stacked column of small disk-figures showing successive phases — gibbous, halved, and horned), each annotated with the date of observation and a phase symbol (☿ for Mercury, with the lit fraction shaded). The figures are interleaved with an engraved decorative woodcut of cherub-heads, scrollwork, and a radiant IHS-type emblem behind them. Readable labels:

- **Vespertinus** — "Evening [star]" (heading the upper figures)
- **1639 Maij 23. 1646 Iun. 26.** — "1639, 23 May; 1646, 26 June"
- **1647 April. 30.** — "1647, 30 April"
- **Matutinus** — "Morning [star]" (heading a middle figure)
- **1643 Aug. 25. 1644 Aug. 6.** — "1643, 25 August; 1644, 6 August"
- **Vespertinus** — "Evening [star]"
- **1643 Martij 5.** — "1643, 5 March"

(Each label sits beside a small ☿ phase-disk with the illuminated portion shaded; the disks themselves are partly overrun by the decorative engraving and the page's central woodcut emblem. The date line atop the "Matutinus" middle figure is overlapped by the decorative central emblem show-through and cannot be read with confidence [?].)

CAPVT XIV.

On the Rotation of the Planets About Their Own Center [De Vertigine Planetarum circa suum centrum]

This rotation [vertigo] was asserted by Vuakerius [Wackher / Johann Matthäus Wacker von Wackenfels] [?] in the *Dissertatio cum Nuncio Sidereo* of Kepler; by Kepler himself in the same place, and in the *Epitome of Astronomy*, p. 549; and by Huygens [Christiaan Huygens] in his *Systema Saturnium* it is seen as probable,

from the varied situation of the belts [fasciae] and of the spots, concerning which see above under Saturn [♄], Jupiter [♃], Mars [♂], and the Moon [☾] — though perhaps these phenomena might be attributed to libration. Moreover, Fr. Anton Maria de Rheita affirms that this rotation of theirs was observed by him, from their setting toward their rising, and that its period is monthly — and he promises observations to be carried out [editae] on this matter.

If a rotation [vertigo] is chosen, this advantage emerges: namely, that all the parts of the surface succeed one another in turn, which is not the case for the Moon. As for the rotation of the Sun [☉] about its own center, it falls within 27, 28, or 29 days — as Scheiner, Galileo, and Bullialdus [Ismaël Boulliau] asserted from the apparent motion of the spots; or it is divinely [reckoned] according to Kepler, or is to be seen as a yearly one according to Rheita — concerning which we said much in *Almagestum Novum* bk. 3, ch. 4, and bk. 4, sect. 4, ch. 12. So many things are these, that they cannot here be reduced into a compendium without the loss of much erudition.

Diagram. A second stacked column of telescopic phase-figures, this one for **Mars** [♂] (the Mars symbol ♀ appears beside each disk), showing successive observed phases (round-with-spot, gibbous, and halved), each dated. The disks are again overlaid on the decorative cherub-and-scrollwork engraving and the central radiant emblem. Readable labels:

- **Vespertinus** — "Evening [star]"
- **1639 Maij 23. 1646 Iun. 26.** — "1639, 23 May; 1646, 26 June" [?]
- **1647 April. 30.** — "1647, 30 April"
- **Matutinus** — "Morning [star]"
- **1643 Aug. 25. 1644 Aug. 6.** — "1643, 25 August; 1644, 6 August"
- **Vespertinus** — "Evening [star]"
- **1643 Martij 5.** — "1643, 5 March"

(Note: the date-labels in this lower stack repeat the same dates as the Mercury stack above; the engraving is dense and the symbols ♂/♀ are hard to separate from the decorative work — labels flagged where the planet-symbol/date pairing is uncertain.)

CAPVT XV.

On the Distances of the Planets from the Earth and from the Sun, and on [the Distances] of the Fixed Stars [De Planetarum Distantijs à Terra, & à Sole, vbi & de Fixarum]

In the Prolegomena of this volume, Article 4, I taught that the distance of the Sun from the Earth is neither greater than 30,000 terrestrial semidiameters nor less than 6,430. Within these limits I proposed two other probable hypotheses: one nearly that of Posidonius [Possidonius] and Wendelen [Govaert Wendelen], the other that of Christiaan Huygens, twofold, as I set it out in bk. 1, chs. 13 and 14, and ch. 17. But in bk. 3, ch. 9, *On the Distances of the Moon* [Lunae distantiae], and in bk. 5, chs. 6, 7, 8, and 9, I reckoned the greatest distances, and the least, of the five lesser planets from the Sun — but in parts of which the radius of the Sun's annual orb [Radius Orbis Annui Solis] is 100,000, just as I set out the species of [these] parts in Volume 2, Table 97. To these I shall add their distances from the Sun at every degree of anomaly [Anomalialia], or at every five degrees together with their greatest and least distance from the Earth. Here indeed we set down only the greatest distances, and the least, not solely with respect to the parts of the radius of the Sun's annual orb, but also in semidiameters of the Earth — and that according to the four hypotheses of the Sun's distance from the Earth indicated above, the rest being rejected (along with the others that we set out above, or as fictitious within the aforesaid limits, or as easily, indeed evidently, false, as we showed in their place). We shall always suppose the distances of the planets from the Sun according to our own hypothesis; but whenever those [distances] are to be combined with the said distances of the Sun from the Earth, we shall take these [latter] from the four said hypotheses.

For example: when we say that the greatest distance of Mercury [☿] from the Earth, according to Wendelen, is 21,754 terrestrial semidiameters — it is to be understood as taken, and as compounded of two elements: namely from Wendelen, in that the radius of the Sun's annual orb is, in terrestrial semidiameters, 14,656; and on the other hand, that the greatest distance of Mercury from the Sun, which for us is 148,430 [printed "148430" — the worn final glyph is a 0; a sort-oddity for 148430], is of such parts as that the Radius of the Orb is 100,000. For 14,656 multiplied by 148,430 [printed "148430"], and the sum divided by 100,000, yields terrestrial semidiameters 21,754; and so of the rest.

[End of Caput XV / Liber X / Tomus I — tables and colophon]

The following two tables give the distances of the planets from the Earth and from the Sun. The first table (left column of folio 374) expresses distances in parts of which the radius of the Sun's annual orb is 100,000; the second (right column of folio 374, continued) expresses each planet's distance from the Earth in terrestrial semidiameters, according to the four hypotheses (Summa = Maximum; Vuendel. = Wendelen; Nobis = "by us / ours"; vel Infima = "or Least").

Table 1 — Distances of the Planets from the Earth and from the Sun, in parts of which the Radius of the Sun's Annual Orb is 100,000

Heading (verbatim): *In partibus Qualium Radius Orbis Annui Solis est 100000.*

Distances of the Planets from the Earth [Distantia Planetarum à Terra], from our own Hypothesis [Ex Nostra Hypothesi]

Planet	Minimum [Minima]	Mean [Media]	Maximum [Maxima]
☉ Sun [Solis]	98260	100000	101740
☿ Mercury [Merc.]	67780	—	148430
♀ Venus [Veneris]	26656	—	174715
♂ Mars [Martis]	36534	—	268164
♃ Jupiter [Iouis]	395418	—	649629
♄ Saturn [Saturni]	797563	—	1111033

Distances of the Planets from the Sun [Distantia Planetarum à Sole]

Planet	Minimum	Mean	Maximum
☿ Mercury	30480	38585	46690
♀ Venus	71825	72598	72973
♂ Mars	138274	152348	166424
♃ Jupiter	497134	522511	547889

Planet	Minimum	Mean	Maximum
♄ Saturn	899103	954198	1009293

Distance from the Earth in Terrestrial Semidiameters [Distantia à Terra in Semidiametris Terræ]

☉ Sun à Terra	(value)
Summa [Maximum]	28974 / 29487 / 30000
Vuendel. [Wendelen]	14407 / 14656 / 14905
Nobis [Ours]	7175 / 7300 / 7427
vel Infima [or Least]	6438 / 6552 / 6661

Parsing notes: the Sun's "Distance from Earth in terrestrial semidiameters" sub-block presents three columns of values (corresponding to minimum / mean / maximum) for each of the four hypotheses; I have rendered them slash-separated within each hypothesis row since the column headers are not repeated in this sub-block. The "Mean" column for the upper *Distantia à Terra* block (Mercury through Saturn) is left blank in the source. The Mars-from-Sun "Media" value reads 152348; the column is monotone Minima < Media < Maxima.

Table 2 — Distances from the Earth in Terrestrial Semidiameters, per the four hypotheses (right column of folio 374)

For each of the five lesser planets, the source gives a four-row block: **Summa** (maximum), **Vuendel.** (Wendelen), **Nobis** (ours), **vel Infima** (or least). Three numeric columns appear per row (corresponding to minimum / mean / maximum distance from the Earth). Transcribed left-to-right as printed:

Planet (à Terra)	Hypothesis	col. 1	col. 2	col. 3
☿ Mercury	Summa	19986	31446	42906
	Vuendel.	9934	15844	21754
	Nobis	4948	7690	10435
	vel Infima	4441	7083	9725
♀ Venus	Summa	7860	29689	51518
	Vuendel.	3904	14656	25406
	Nobis	1946	7350	12754
	vel Infima	1745	6596	11447
♂ Mars	Summa	10773	44923	79074

Planet (à Terra)	Hypothesis	col. 1	col. 2	col. 3
	Vuendel.	5354	22328	39302
	Nobis	2670	11120	19576
	vel Infima	2394	9982	17570
♃ Jupiter	Summa	116595	154075	191556
	Vuendel.	57952	76580	95208
	Nobis	28864	37266	45669
	vel Infima	25907	34235	42564
♄ Saturn	Summa	235110	281360	327610
	Vuendel.	116862	139847	162833
	Nobis	58207	69656	81105
	vel Infima	52263	62529	72795

Parsing notes: the three numeric columns per block are unlabelled in this right-hand panel but correspond (by analogy with Table 1 and with the planet's minimum / mean / maximum geometry) to least / mean / greatest distance from the Earth. Wendelen's row for Venus (col. 2 = 14656) and Mercury (implied) reproduces the Sun-distance radius figure 14,656, consistent with the worked example in the prose. Values transcribed as printed; both p. 374 distance tables further verified cell-by-cell — these are part-counts of 100000 (and Earth-semidiameter counts), not sexagesimal, so the >59 rule does not apply; none breaks an obvious monotone progression, so no impossibles flagged. (Jupiter Summa col. 2 reads 154075 — faint middle digits, moderately confident.)

Closing couplet (set beneath Table 2, verbatim):

Hic modus Errorum est; hi certi denique fines, Quos vltra citraq; nequit consistere verum.

"This is the measure of the errors; these, in the end, are the fixed limits, beyond which and short of which the truth cannot stand." (An adaptation of Horace, *Satires* I.1.106–107: *est modus in rebus, sunt certi denique fines, / quos vltra citraque nequit consistere rectum.*)

Laus Deo, Beatissimæq; Virgini.

"Praise be to God, and to the Most Blessed Virgin." (Colophon closing Liber X and Tomus I.)

Tomus II — Title Page

ASTRONOMIAE REFORMATAE [REFORMED ASTRONOMY]

TOMUS II. [VOLUME II]

The first part of which contains the precepts for the use of the tables; the latter part contains the 102 astronomical New-Almagest tables themselves.

[Display block, verbatim:]

- ASTRONOMIAE REFORMATAE TOMUS II.
- CUIUS PARS PRIOR PRAECEPTA PRO USU TABULARUM.
- Posterior Tabulas ipsas Astronomicas CII. Novalmagesticas continet.
- *AUCTORE* [By the author]
- P. IOANNE BAPTISTA RICCILOLO [Fr. Giovanni Battista Riccioli]
- SOCIETATIS IESU. [of the Society of Jesus]
- FERRARIENSI. [of Ferrara]

BONONIAE, MDCLXV. [Bologna, 1665]

Ex Typographia Haeredis Victorij Benatij. [From the printing house of the Heir of Vittorio Benacci] *SUPERIORUM PERMISSU*. [By permission of superiors]

INDEX OF THE PRECEPTS Set Forth in This Volume

[Display heading, verbatim:]

- INDEX PRAECEPTORUM Quae in hoc Volumine traduntur.
- [INDEX OF THE PRECEPTS Which are set forth in this Volume.]

This index lists the numbered precepts of Part I (the precepts for the use of the tables), each with its title and the page on which it is found. The page begins with the first part-heading.

I. Part Pertaining to Time [I. Pars ad Tempus pertinens]

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
1	To express the divided parts of Time, or of a Circle, applied to it, and their value [Assis partes Tempori, aut Circulo applicatas, earumque valorem exprimere]	1
2	To know Hours, Degrees, or the parts of a Circle resolved into the tenth scruple, and their quantity [Horae, Gradus, aut Circuli in Scrupula usque decima resoluti quantitatem noscere]	1
3	To convert equal Hours, and their scruples, into scruples of a Day [Horas aequales, earumque scrupula in Diei scrupula convertere]	1
4	To convert scruples of a Day into equal Hours, and their	1

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
5	<p>scruples [Diei scrupula convertere in Horas aequales, earumque scrupula]</p> <p>To resolve the Days of the Julian Months into Days reckoned from the beginning of the Common Year, and of the Bissextile [Leap] Year [Dies Mensium Iulianorum resolvere in Dies collectos ab initio Anni Communis, ac Bissextilis]</p>	1
6	<p>For given Days of the Julian Year, to assign their Month, and the day of the Month [Diebus Anni Iuliani collectis, assignare suum Mensem, Mensisque diem]</p>	1
7	<p>To reduce the Days of the Egyptian Months into Days reckoned from the Beginning of the Year [Dies Mensium Anni Aegyptii, reducere in Dies collectos ab Initio Anni]</p>	1
8	<p>For given Days of the</p>	1[?]

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
	Egyptian Year, to assign their Egyptian Month, and the day, and the Months [Diebus Anni Aegyptii collectis, assignare suum Mensem Aegyptium, diemque, Mensis]	
9	Given a Day of the Month in a Julian Year, in which an Egyptian Year began, to find what day of the Julian Month it falls on, and with which Day of any other Egyptian Month it coincides [Dato Die Mensis in Anno Iuliano, quo Annus Aegyptius incoepit; invenire quotus dies Mensis Iuliani, coincidat cum quovis alio die Mensis Aegyptii]	2
10	To convert the parts of the Equator into Hours, and Scruples, both of the Primum Mobile, and of the Solar day [Partes Aequatoris convertere in Horas, & Scrupula, tum	2

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
11	<p>primi Mobilis, tum diei Solaris]</p> <p>To convert Hours, and their Scruples, whether of the Primum Mobile, or Solar, into parts of the Equator [Horas, & earum Scrupula, sive primi Mobilis, sive diei Solaris, convertere in partes Aequatoris]</p>	2
12	<p>To change the equal Hours of one kind into hours of a different kind, or [hours] reckoned from a different beginning of the day [Horas Aequales unius speciei commutare in horas diversae speciei, seu a diverso diei initio numeratas]</p>	2
13	<p>To convert Temporal Hours into equal hours [Horas Temporales convertere in horas aequales]</p>	3
14	<p>To find the Semidiurnal and Seminocturnal quantity by two</p>	3

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
	chief methods, refractions set aside [Semidiurnam, & Seminocurnam quantitatem, duobus praecipuis modis invenire, secluis Refractionibus]	
15	To determine the longest Day of the Year in the frigid Zones, refractions set aside [Diem Anni longissimam in Zonis frigidis determinare, secluis Refractionibus]	3
16	Apparent Time into Mean [Time], or Equal, and this in turn into Apparent, to change by Tables both perpetual and temporary [Tempus Apparens in Medium, seu Aequale, & hoc vicissim in Apparens commutare per Tabellas tam perpetuas, quam Temporarias]	[?]
17	Of the Equation of Natural, or Civil, Days [Aequationis	3

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
[17]	Dierum Naturalium, seu Civilium] Time given under the Meridian of Bologna to transfer to another place on Earth, or from those [places] to the Meridian of Bologna; and likewise to learn the Altitude of the Pole of such places [Tempus datum sub Meridiano Bononiensi transferre ad alia Terrae loca, vel ab illis ad Meridianum Bononiensem: unaque addiscere talium Locorum Altitudinem Poli]	3
18	To distinguish Bissextile [Leap] Years from non- Bissextiles in the form of the Julian Year reckoned backward before the Epoch of Christ, and after [Annos Bissextiles discernere a non Bissextilibus in forma Anni Iuliani retrosum pati ante	4

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
	Epocham Christi, & post]	
19	The same to distinguish in the Years of Christ, but in the form of the Gregorian Year, and the excess of the Gregorian Year above the Julian days [Idem discernere in Annis Christi, sed in forma Anni Gregoriani, & excessum dierum Gregoriani Anni supra dies Iulianos]	4
20	To find the Cycle of the Sun before and after Christ [Cyclum Solis reperire ante, & post Christum]	4[?]
21	To find the Weekday [Feria] of a given day in a Julian Year [Feriam datae diei in Anno Iuliano reperire]	5
22	To find the Weekday in an Arabic Year of the Hegira, by means of the Arabic Cycle [Feriam in Anno Arabico Hegirae reperire, beneficio Cycli Arabici]	5

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
23	To add the reckoned Days of the Years, and of the Months of different nations, and the concurrence of the Months of those same [nations] [Dies collectos Annorum, ac Mensium diversarum nationum, & concursum Mensium earundem addiscere]	6
24	To convert the Years before or after the Epoch of Christ into Years of the Julian Period [Annos ante, vel post Epocham Christi commutare in Annos Periodi Iulianae]	6
25	To turn the Years of the Julian Period into Years before or after the Epoch of Christ [Iulianae Periodi Annos vertere in Annos ante, vel post Epocham Christi]	6
26	To convert the years of the Epoch of the World, according to	6

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
	the opinion of the Greek Fathers of Constantinople, into Years before or after the Epoch of Christ [Mundi Epochae annos iuxta opinionem PP. Graecorum Constantinopol. convertere in Annos ante, vel post Epocham Christi]	
27	To convert the Years before or after the Epoch of Christ into the aforesaid Years of the Epoch of the World [Annos ante, aut post Epocham Christi, convertere in praedictos Mundi Epochae Annos]	6
28	To convert the Years of the Olympiads into Years before or after the Epoch of Christ [Olympiadum Annos convertere in Annos ante, vel post Christi Epocham]	6[?]
29	To convert the Years before or after the Epoch of Christ into Years of the Olympiads [Annos	6

Precept no. [Praecept. ordo]	Precept	Page [Pagina]
	ante, vel post Epocham Christi, convertere in Annos Olympiadum]	
30	To convert the Years of the founding of the City of Rome into Years before or after the Epoch of Christ [Urbis Romae conditae Annos convertere in Annos ante, aut post Christi Epocham]	6
31	To convert the Years before or after the Epoch of Christ into Years of the founding of the City [Annos ante, vel post Epocham Christi, convertere in Annos Urbis conditae]	7
32	To reduce the Years of Nabonassar into Years... [Nabonassari Annos redigere in Annos...] [table continues into next column/page]	7

Parsing notes: The page is laid out in two columns, each split into three sub-columns (Precept number | Precept title | Page). The left column runs precepts 1–16, the right column precepts 17–32. There appear to be two entries numbered "17" — one for the time-transfer precept (under the Bologna meridian) and one for the equation of natural/civil days; the index numbering in this region is

ambiguous in the scan and may reflect a compositor's misalignment of the page-number rules against the entries. Several page-number cells in the left column are faint or partly obscured by show-through and are flagged [?]. The page numbers shown are mostly low single digits (1–7), consistent with the opening precepts of Part I.

[Index Praeceptorum, continued — the index of precepts for using the tables (*Index Praeceptorum*), running on from precept 32 of the prior batch. Each page is a two-column index; columns give the precept's order-number, its title, and the page reference. Transcribed below in reading order, left column then right column of each opening.]

Index Praeceptorum (continued)

[left column]

Order	Precept	Page
	...years before, or after, the Epoch of Christ.	7
33	To find the beginning of a Year of Nabonassar, given the corresponding Julian year, month, and day.	7
34	To know with which month-day of the Julian reckoning any given day of an Egyptian month coincides, in years before or after Christ.	7
35	To reduce years before or after Christ into Years of Nabonassar.	7
36	To assign the day of	8

Order	Precept	Page
37	<p>a given Julian year, before or after Christ, that is congruent with a day in the Egyptian Nabonassar year.</p> <p>To convert the Years of Alexander the Great, or also of Dhū'l-Qarnayn [Dhulkarnaym], into years before or after Christ, and conversely those into these.</p>	8
38	<p>To turn the Years of Alexander the Great into Years of Nabonassar, and these conversely into those.</p>	8
39	<p>To convert the Arabic [Hegira] years, months, and days into Years of Christ, with their months and days.</p>	9
40	<p>Christian years not exceeding 622, to commute into Years of the Hegira, with their days, into days, etc.</p>	9
41	<p>To commute the Persian [Yazdegerd] years and days into Years of Christ.</p>	9

Order	Precept	Page
42	To convert the Years of Christ, and their days, into Years and days of Yazdegerd.	10

Monitum pro reliquis Epochis [a Notice concerning the remaining Epochs]. —

| 43 | Finally, to accommodate Time to the use of the Astronomical Tables of this Volume. | 10 |

Praecepta pro Tabulis II. Partis [Precepts for the Tables of Part II].

| 44 | To inquire the Declination of the Sun, or of a given point of the Ecliptic. | 11 | | 45 | To find the angles which the Ecliptic and the Meridian, or any given Circle of declination, make. | 11 | | 46 | To seek the Right Ascension of the Sun, or of a given point of the Ecliptic. | 11 | | 47 | Given the Altitude of the Pole and the declination of any Star, or of a point in the Ecliptic — or, alternatively, its declination from the Ecliptic — to find the Ascensional Difference. | 11 | | 48 | To form the Right Ascension of any given Star or point of the Heaven, together with the Ascensional Difference, into Oblique Ascension. | 11 | | 49 | Given the Altitude of the Pole, a point of the Ecliptic, or the Sun situated in it, to find the Oblique Ascension by the Table of Oblique Ascensions. | 11 | | 50 | Given the Apparent Time after Noon, the place of the Sun, and the Altitude of the Pole, to investigate the Horoscope, or... | |

[right column]

Order	Precept	Page
	...the Ascendant degree of the Ecliptic, and at the same time the Nonagesimal numbered from the Ascendant.	11
51	Given the Ascendant point of the Ecliptic, and the Altitude of the Pole, to find the angle of the Ecliptic	12

Order	Precept	Page
	and the Horizon, or the Altitude of the Nonagesimal.	
52	To resolve a sign of the Zodiac, or the degrees of any Circle, into degrees collected from the beginning of the circle.	12
53	The degrees of the Zodiac diametrically opposite, and, the Ascendant being given, to find the Descendant at once.	12
54	Given the latitude of any Star not exceeding 9 degrees, and its longitude, to find by the Table contrived for this purpose its Declination and Right Ascension.	12

Praecepta pro Tabulis Parte III. [Precepts for the Tables, Part III].

| 55 | To find the true place of the Sun in the Ecliptic for a given time after the Epoch of Christ, and its Equated Anomaly. | 13 | | 56 | To find the place of the Sun for a given time before the Epoch of Christ, and its Equated Anomaly. | 13 | | 57 | To find the Parallaxes of the Sun in the circle of Altitude. | 13 | | 58 | To investigate the Distance of the Sun from the centre of the Earth, and also of the Moon — but in syzygies [in copulis] — together with the Horizontal Parallax, and the Hourly motion of each Luminary. | 13 | | 59 | To determine the apparent Semidiameters of the Sun, and also of the Moon in syzygies, and of the terrestrial Shadow. | 14 | | 60 | To obtain the Refraction of the Sun, Moon, and Fixed Stars, and to discern their True and Apparent Altitude. | 14 | | 61 | To find the True

place of the Moon in its own proper Orbit, for a given time before or after the Epoch of Christ, together with its Anomaly on the day of New or Full Moon. | 14 | | 62 | To find the true place of the Northern Node of the Moon, and the maximum Latitude of the Moon. | 14 | | 63 | To obtain the True Latitude of the Moon, or the motion of its own Argument, or motion of Latitude. | 15 | | 64 | To reduce the Moon's place from the Orbit to the Ecliptic. | 15 | | 65 | To determine the True place of the Moon outside the syzygies. | 15 | | 66 | To inquire the Hourly motion of the Moon from the Sun on the days of Full Moon, and of New Moon. | 15 | | 67 | To inquire the Verification of the New Moon and of the Full Moon. | 16 | | 68 | The intervals of the Moon, and of the Earth, and ec-... | |

[left column]

Order	Precept	Page
69	...centricity outside the syzygies, to find. [continued from precept 68: ...and eccentricity]	16
69	To inquire the Distance of the Moon from the Earth precisely, outside the syzygies.	16
70	To acquire the apparent Semidiameter of the Moon, and also the horizontal Parallax, outside the syzygies.	16
71	To investigate the Parallaxes of the Moon in the circle of true, or apparent, Altitude.	16
72	Given the Year, and the Month, the New Moon, and the Full Moon, to investigate	16

Order	Precept	Page
	the Mean by Epacts.	
73	Given the hour of the mean Full Moon, thence to know the true Time.	17
74	To foreknow whether on a given day there has been, or will be, a New Moon or a Full Moon that is Ecliptic [i.e. an eclipse].	17
75	To inquire the Ecliptic digits, or the quantity of the Lunar diameter to be obscured.	17
76	To determine the Duration of a Lunar Eclipse, its delay in darkness if it be total, and — with the delay — to define the Eclipse, its beginning, end, etc.	17

Monita pro subtiliori Calculo Eclipsis Lunaris [Notices toward a finer Calculation of a Lunar Eclipse]. —

| 77 | To determine the True Latitude of the Moon at the beginning, end, of the Eclipse. | 18 | | 78 | To delineate the Type of the Lunar eclipse. | 19 | | 79 | To reduce the Equal Time of an Eclipse to the apparent. | 19 | | 80 | To survey the regions of the Earth's globe in which the Eclipse will be visible, and in which it will not be. | 19 | | 81 | To find on which Meridian the Moon will be at the middle of the Eclipse, and to which regions it will then be vertical. | 19 |

De Eclipsibus Solis [On Eclipses of the Sun].

| 82 | The order to be observed in the Calculation of a Solar Eclipse, to foreknow with an example repeated hither from those given above. | 20 | | 83 | To find the Altitude of the Nonagesimal in the Orbit of the Moon. | 20 | | 84 | To find the Horizontal Parallax of the Moon from the Sun. | 21 | | 85 | To obtain the Parallax of the Moon in Longitude. | 21 | | 86 | To obtain the Parallax of the Moon in Latitude. | 21 | | 87 | To define the Parallax of the Moon's longitude for one hour or another, before or after the true New Moon. | 22 | | 88 | To define the apparent motion of the Moon for one hour or another. | 22 | | 89 | To determine the Moment of the apparent New Moon. | 22 | | 90 | To investigate the parallax of the Moon's longitude at the moment of the apparent New Moon, for hours before or after. | 22 | | 91 | The Latitude of the Moon at the time of the New... | |

[right column]

Order	Precept	Page
92	...Moon, both apparent, both true, both seen, to find. [continued from precept 91]	23
92	To find the Digits, or quantity of the Solar Eclipse.	23
93	To determine the Beginning, End, and Duration of the Solar Eclipse.	23
94	To define the Latitude of the Moon seen at the beginning, end, of the Solar Eclipse.	24
95	To delineate the Type of the Solar Eclipse, with an Epilogue of the whole calculation thus far.	24

De Eclipsibus Horizontalibus [On Horizontal Eclipses].

| 96 | To discern the moment of time at which the Sun rises, or sets. | 25 | | 97 |
The true places of the Luminaries at the moment of the Sun's Rising or Setting. |
25 | | 98 | To define the Parallax of the Moon in longitude and latitude at the
moment of the Sun's Rising, Setting. | 25 | | 99 | To investigate the Distance of
the centres of the Sun and of the Moon, apparent, at the hour of the Sun's Rising
or Setting. | 26 | | 100 | To inquire the Ecliptic digits, at the moment of the Sun's
Rising or Setting of the Luminaries. | 26 | | 101 | To determine the Semidiameter
of the Disc of the Earth as visible from the Moon. | 26 | | 102 | To find the
Altitude of the Nonagesimal in that region to which the central Solar Eclipse will
appear. | 26 | | 103 | To inquire the Altitude of the Pole of the aforesaid Region. |
26 | | 104 | To compute Eclipses of the Southern Quarter [Region]. | 26 | | 105 |
To determine the central Ecliptic digits of a Solar Eclipse. | 26 | | 106 | To find
the Time during which the Lunar Shadow lingers above the Earth. | 27 | | 107 |
To find the Altitude of the Nonagesimal in those Regions, to which the beginning
of the Solar Eclipse first, or the end last, appears. | 27 | | 108 | To find the
Altitude of the Pole in the two aforesaid Regions. | 27 | | 109 | To determine the
regions themselves, their Longitude having been found. | 28 | | 110 | To find the
Time, from when the Solar Eclipse first becomes total at the rising Sun, and so on
up to the middle of the true and seen central Synod, and thence up to the moment
at which the central Solar Eclipse is last at the setting Sun. | 28 | | 111 | To find
the Altitude of the Nonagesimal for the Regions of the Phases in the manner just
stated. | 28 | | 112 | To find the Altitude of the Pole for those same Regions. | 29 |
| 113 | To find the regions themselves, by means of the Longitude. | 29 | | 114 |
To find the Region, in which at the Nonage-... | |

[left column]

Order of Precept	Precept	Page
	...simal there is a True and Seen central Synod. [continued from precept 114]	29
115	To find the Regions of the Earth, over which the Shadow of the Moon is borne, during the whole	30

Order of Precept	Precept	Page
	time of the Solar Eclipse.	

Praecepta pro usu V. Partis Tabularum [Precepts for the use of Part V of the Tables].

| 116 | To compute the place of Saturn in its Orbit according to longitude. | 30 | |
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PRECEPTS

For the Use of the Astronomical Tables Contained in This Volume

*(Praecepta Pro usu Tabularum Astronomicarum, Quae in hoc Volumine continentur
— p. 417, marked "1")*

Precept 1. On the Parts of the *As* Applied to the Circle and to Time

[Margin: Pag. 1.]

If, in some author, a part (an aliquot fraction) of a circle, or of a degree, or of a day, or of an hour, is expressed by the parts of the *as* [the Roman unit divided into twelfths] or of the *libra* — and you wish to know its meaning and value — Table 1 will teach you.

For example: a *dodrans* of the *libra* [three-quarters of a pound] is worth 9 ounces; a *dodrans* of a circle is worth 270 degrees; a *dodrans* of a degree is worth 45 minutes; a *dodrans* of a day is worth 18 hours; and so forth.

Precept 2. On Resolution into Minutes (*Scrupula*)

[Margin: Pag. 1.]

In Table 2 you have both an hour, a degree, and a circle resolved into minutes-of-minutes, the resolution being carried down as far as tenths of a minute.

For example: if an hour is to be resolved into sixth-order minutes, you have, in the first part of Table 2, opposite the numerator 6, [the figure] 466560000000; and so for the rest.

Precept 3. To Convert Given Hours and Their Minutes into Minutes of a Day

[Margin: Pag. 1.]

Since, among certain astronomers, the day is divided not into 24 hours but — though rarely — into 60 first minutes, and these into 60 seconds, and so on, therefore in Table 3 — when you seek hours given under their own titles in the leftmost column, together with their minutes — by proceeding rightward from those hours opposite, you will find, under their own titles at the head of the table, the minutes of a day corresponding to the [given] hours and minutes of the hours.

For example: let hours 5 and 25 minutes of an equal hour be given. First, in the leftmost column find hours 5, and opposite them, under the heading of first minutes of the day, which answer to the hours, you will find first minute-of-a-day 12 and second 30. Then for the 25 minutes of the hour, under the second part at the head — which answers to the first minutes, or minutes, of the hour — you will find first minute-of-a-day 1, second 2, and third 30. Therefore, by composing everything together, hours 5 equal to 25 minutes [of an hour] amount to first minutes of one day 13, 32, 30.

Precept 4. To Convert the Given Minutes of a Day into Equal Hours and Minutes of an Hour

[Margin: Pag. 1.]

Table 4 will accomplish this: by seeking everything under the appropriate titles at the head, and composing the numbers found.

For example: let there be given of a day first minutes 25 and second 20. For opposite first minutes 25, in the leftmost column, you will find under the title of hours, hours 10; and opposite the second minutes 20, in the second part at the head, which answers to the second minutes, [you will find] 8. Therefore, of a day, first minutes 25 and second 20 are worth equal hours 10 and hourly minute 8.

Precept 5. What Day of Any Julian Month Is Given, Counting from the Beginning of the Year

[Margin: Pag. 2.]

In Table 5, second column, if the year is common, but in the first column if it is bissextile [a leap year], seek the day in question, and opposite it in its rightmost column, under the month given, you will find the number of days of the year.

For example: let April 26 be given. In the common year 1650 — for opposite the number 26 in the second column, under April at the head, answers the day of the year 116. But if the year were bissextile, say 1652, then opposite the number 26 in the first column answers day 117.

Precept 6. Given the Number of the Days of the Julian Year, to Find of Which Month It Is, and Which Day of That Month It Is

[Margin: Pag. 2.]

In Table 5, in the columns you seek the number of days of the year, and at the head of that column you will see the month; while opposite the same number, in the leftmost column second-from-the-second if the year is common, but the first if it is bissextile, you will find the number of the day of the month sought. And if the year is bissextile, you ought to use that number in the same column.

For example: let it be the common year 1650, and the 116th day of the year. Opposite this 116, in the sixth column, under April you will find day 26. But if it were a bissextile year, say 1652, the number 116 in the first column would answer to April 25.

The other example: given the bissextile year 121 — for you will see this number, both at the end of the sixth column and at the beginning of the seventh; but as for the second column under April, opposite, under the first column, [it] will answer April 30.

Precept 7. What Day of Any Egyptian Month Is the Given Day, if it is to be Reckoned from the Beginning of the Year

[Margin: Pag. 2.]

The Egyptian year consists of 12 months, each of which is of 30 days; in absolute terms, however, of 360 days. To these are added at the end five more days, which they call the *intercalares*, and in Greek the ἐπαγόμενα [Greek: epagomenai, "the added-on days"], apart from the further quarter-day of the [actual] intercalation. Therefore, in Table 6, in the first and leftmost column, seek the given number of days, and opposite it, in the upper part of the columns, you will have the month named, [and] the day of the month collected, numbered from the beginning of the year.

For example 1: let the 23rd day of the month Athyr be given; you will find day 83 of the year.

For example 2: let the 3rd day of the *intercalares*, or of the Epagomena, be given — for the third day of the first part of the column, under the title Epagomena, answers to the 363rd day of the year.

Precept 8. Given the Number of the Days of the Egyptian Year, to Find of Which Month It Is and Which [Day]

[Margin: Pag. 2.]

In the same Table 6, seek the given number of days in some other manner, for it will answer in the title to the month indeed sought, but in the first column to the day of that month.

For example: given the number of days 83 — because it is in the fourth column, the month Athyr answers to it at the head, and in the first column day 23 of the same month.

[Margin: A] (*signature mark at foot of page*)

Praeceptum 9. Given the day of the Julian year on which an Egyptian year begins, to find out which day of the Egyptian year corresponds to it, and the date of which Egyptian month is wanted.

Astronomers begin the first day of the month Thoth at midday. Therefore, first reduce the given Julian day, on which the first day of Thoth falls, to a day-number by Precept 5. Second, reduce the given day of the Egyptian month by Precept 7 to a day-number of the Egyptian year, and add this number to the number of days that the first day of Thoth makes. From these two added together you will obtain the sum — provided it does not exceed 365 days, or 366 if it is a leap year. Then, with the units discarded, look for that sum in the columns of Table 6: it will correspond on the face of the table to the Julian year-month, and, opposite it in the first column, you will have, if the year is a leap year, in the second column — or if it is a common year, in the third column — the day of the desired Julian month.

[Margin: Pag. 2.]

Example 1. Suppose the Egyptian year begins on 20 February of a common Julian year, that is, by Precept 5, on day 51 of the Julian year. But suppose the given day of the Egyptian year is the 23rd day of the month Athyr, which by Precept 7 is day 83 of the Egyptian year. Adding these together — 51 and 83 — the sum is 134, from which, with the units discarded, there remains 13. Look for this 13 in Table 6: it corresponds on the face of the table to May, and opposite it in the second column [is] 13 May. Therefore, in that year, the 23rd day of Athyr coincides with 13 May.

[Margin: Pag. 2.]

Example 2. Suppose the Egyptian year begins on 20 March of a leap Julian year, that is, by Precept 5, on day 80 of that year. But suppose the given day of the Egyptian year is the 23rd day of the month Athyr, which by Precept 7 is day 83 of the Egyptian year. Adding these — 80 and 83 — makes the sum 163. With the units discarded, look for this in Table 6, column 8: it corresponds, in the first column, to the month June; and to the left of it, in the first column under the title 10, you will find day 23. But [since] day 23 of Athyr coincides with 10 June, beginning this day at midday. — That the sum of the days of either year does not exceed 365 in a common year, or 366 in a leap year: if that sum exceeds [it], it is a sign that the year in which the Egyptian year began was a leap year, and that the residue is to be sought by Precept 6 [as] the day, and the month of the Julian year, according as the year following it — in which the Egyptian year began — was a common year, or a leap year.

[Margin: Pag. 2.]

Example. Suppose the Egyptian year begins on day 25 of November of a leap year [belonging to] the Julian epoch 1684. By Precept 5 this day comes out to be day 330, [and] it is established that day 23 of Athyr is, as said above, by Precept 7, day 83 of the Egyptian year. Adding 330 and 83 together makes the sum 413, exceeding 366 — of the leap year — by 47. To this 47 I add a unit, and the residue 46 [by] Precept 6 in Table 6, [look for] that month February; and opposite it in column 2 — since indeed the year following 1685 is a common year — you find day 15 of February. Therefore day 23 of Athyr begins on day 15 of February of the Christian year 1685.

[Margin: Pag. 2.]

Praeceptum 10. To convert the parts of the equator into hours of the Primum Mobile, and the scruples of the hours; and conversely, to convert such hours into parts of the equator.

[Margin: Pag. 3.]

For this precept Tables 7 and 8 are sufficient. It is enough to inspect the headings on the face of those [tables] that correspond to the given degrees, or to the time, and to their scruples; for under those headings, proceeding from right [to] left from the number opposite, what is sought is found in one or several entries, as need requires.

[Margin: Pag. 3.]

Example 1. Suppose there be given 25 degrees, 35 minutes, and 15 seconds of the equator. For in Table 8, in the first column, under the supreme heading that corresponds to the degrees, you have 1 hour and 40'. Next in 4, [in] column 4, are 35 minutes, to which in the fifth and sixth [columns], under the second heading of the series, [there] correspond minutes of hours 2' and 20". Finally in the first column are 15 seconds, to which in the second and third [columns], but under the lowest heading of the series corresponding to seconds, you have 1". The sum therefore will be gathered thus:

Equator	Hour	I	II
Grad. 25	1	40'	0
Minut. 35		2	20
Secund. 15		0	1
Summa	1	42'	21"

[Margin: Pag. 3.]

Example 2. Suppose, conversely, there be given of the Primum Mobile 1 hour, 42' 21". From Table 7, in entry 1, you will gather the sum of the parts of the equator in this manner:

Primi Mobil.	Grad.	I	II
Hora 1	15	0	0
Min. 42	10	30	0

Primi Mobil.	Grad.	I	II
Sec. 21	0	5	15
Summa	25	35	15

Praecept. 11. To convert the time of a solar day into parts of the equator, and conversely the parts of the equator into the time of a solar day.

[Margin: Pag. 3.]

Since the day, which the Sun makes for us by its diurnal revolution, is somewhat longer than [the day] which the Primum Mobile makes — or (what comes to the same with an imperceptible difference) which any diurnal fixed star makes by its revolution from the same to the same meridian, or horizon — because in the meantime the Sun, by its mean motion, traverses about one degree in the ecliptic toward the east; so that, before the Sun is carried round to the same meridian, or horizon, [there are] over and above 360 [degrees] of the equator about one degree more of the equator that has to pass through: therefore, if it pleases [you] to subtilize this, to convert the time of a solar day into parts of the equator by Table 7, or [to convert] the parts of the equator into solar hours by Table 8, the Equation must be applied that is adjoined in those tables for the hours of the solar day, and [for] the scruples.

[Margin: Pag. 3.]

Example 1. Of 25° 35' 15" of the equator there were found to be contained 1 hour 42' 21" of the Primum Mobile; the correction, or Equation to be subtracted, [is] thus:

	II	III
Aequator.	16	0
Gradus 25		
Minut. 35	1	0
Sec. 15	0	59
Summa	17	59

Therefore, to the said parts there correspond, of the solar day only, Hor. 1. 42'. 3". 1".

[Margin: Pag. 3.]

Example 2. Of the same Precept 10, in which 1 hour 42' 21" of the Primum Mobile agree with 25° 35' 15' of the equator, the Equation for the hours of the solar day [is to be added].

		I	II	III	IV
Hora 1.	2	28	0	0	
Solaris					
Minut. 42	1	44	0	0	
Sec. 21	0	0	0	52	
Summa	4	12	0	52	
add.					

Therefore, of the solar day, the hours 1. 42'. 21". agree with the equator [at] Gr. 25. 39'. 27". 0''' . 52'''.

Praecept. 12. To convert equal hours of one kind, or denomination, into equal hours of a different kind, the half-day being given, or the half-night quantity.

[Margin: Pag. 4.]

Have recourse to Table 9, and carry out everything as is prescribed in it.

Example. Let the half-day time of hours of the equa-

tor be 7. & 30'. and let the given Hour be computed 5. 30'. from the midday Astronomical Hour, and let that be converted into the Italian Solar Hour. For subtract 5. 30'. from hours 23. 60'.: in semidiurnal time there remain hours 16. 30'. to which, when 7. 60'. is added, [it] of course coincides Italian[-style] with the Meridian; but if you add the Astronomical hours 5. 30'. that hour [is] Italian 22. but of the Sun, where indeed in Civil Clocks the day was continued through the half-hour, then [it] was struck not [at] hour but [at] hour 21½.

Praecept. 13. Given the quantity of the artificial day, to convert its Temporal Hours, and their scruples, into equal hours, and the scruples of these.

I call the artificial day the time of delay [Moram] of the Sun above the horizon. Among the Hebrews of old, and the Romans, [and] many nations it was divided into 12 equal hours, indeed [equal] among themselves of the same day, but not at

all equal to the hours of other days; therefore, [if you wish] to resolve them into the second scruple, [there are] 43200 [of them], that they might make use of as their division. Then resolve both the given artificial Day, which is in hourly second scruples, and the temporal [hour]; multiply one by the other: the sum issuing thence [the] hourly scruple of the second [order], and divide by 43200: it will give the second [scruple] of the equal Hours, [and] to which divide afterwards by sixty, [the] partition gathers the hours themselves, and the scruples of those.

[Margin: Pag. 4.]

Example. Let it be that the artificial day [is] of Hours 15. 30'. this in the seconds 55800". and let the Temporal Hours be 4. 20'. this of their seconds 15600", having been multiplied indeed [these] by those 55800. makes the sum 870480000". which, divided by 43200, there remain the second [scruples] 20150". and these divided by 60. there remain 335'. [the] minute, & 50'. then divided 335'. by 60. there remain the equal hours 5. min. 35'. & moreover the aforesaid 50". to which there are equal Temporal Hours 4. & 20'. The reason why, if to the Temporal Hours there should adhere some scruple, the twelfth proportional part is to be sought. And this twelfth part is to be added to the integral Temporal Hours above, and that very thing is repeated.

[Margin: Pag. 4.]

Example. Let the quantity of the artificial Day be of equal hours, as in the first Example 15. & 30'. and let the given Temporal Hours be 4. 20'. but [if] to that there should be added the twelfth part of an hour, that is 1. 17'. 30", which is the fourth assumed of Hours 5. 10". [the] minute the third part [is] a third, if the Hours [be] 1. 17'. 30". take the third part, namely 25'. & 50". & added to Hours 5. 10". there are made up equal Hours 5. 35'. 50". equivalent to the temporal hours 4. 20'.

Praecept. 14. On the finding of the Half-day, and the Half-night Time, the Pole-Altitude being given, and the place of the Sun in the Ecliptic.

It is plain from the Semidiurnal Time that, when Hours 11. & 60'. are subtracted, the Seminocturnal [Time] remains; and from the Seminocturnal [Time] when likewise Hours 11. & 60'. are subtracted, the Semidiurnal [Time] is had, and [when] doubled, the Diurnal [Time], etc.

[Margin: Pag. 5.]

Moreover, the Semidiurnal, or Seminocturnal, time is acquired in two ways with the greatest ease.

[Margin: Pag. 5.]

The first is by Table 11. in whose extreme left-hand columns are the signs of the place of the Sun with their three degrees, [the columns] to be numbered downward; but on the right are the signs with their degrees, to be numbered upward, and opposite them, under the Northerly Pole-Altitude, the Semidiurnal time is found, if the Sun is in the northerly signs; the Seminocturnal [time], if [it is] in the southerly [signs]. But if the place be beyond the Equator, that is, [if] the Pole-Altitude be Australesque, [there is] the time [found] of the Seminocturnal in the northerly signs, [and] of the Semidiurnal in the southerly [signs]. But where the Table is empty, [it is] a sign that the semidiurnal [time] exceeds hours 12.

[Margin: Pag. 5.]

Example. For a Pole-Altitude of 44 Degrees, the Sun being in Taurus 18°. Having found indeed in the left-hand column \square deg. 18. & thence proceeding downward to the right, [it] is found under the Pole-Altitude 44. Hours 7. 10'. this therefore is the Semidiurnal northerly time; but the seminocturnal [time] for the southerly peoples.

But if the Sun is at degree 12. of Aquarius, who are noted in the right margin, [there] correspond [to] this under the Pole-Altit. 44. Hours 7. 10'. which is the Seminocturnal northerly time, but [the] seminocturnal [time] [for] the southerly peoples.

But if the Sun is at degree 12. of Aquarius, who are noted in the right margin, [there] correspond [to] this under the Pole-Altit. 44. Hours item 7. 10'. which is the Seminocturnal southerly time for the peoples, but [the] Semidiurnal [time] [for] the northerly [peoples].

II. MODVS [Second Method]

[Margin: Pag. 19.]

Otherwise thus. Given the place of the Sun, seek its Declination in Table 26, [and] [Margin: Pag. 21.] indeed [seek] the same in the left margin, on the face of the table noted under the Pole-Altitude, or as said before, [seek] the Declination on the face, & under the Pole-Altitude in the left side, [and] seek the Difference of Ascensions [Differentiam Ascensionalem]. This indeed add to degrees 90. if the Sun is in the northerly signs, [Margin: Pag. 7.] & the Place likewise Conspicuous

Northerly, or take away if [it is] in the Australian [signs], & you will have the Arc of the Semidiurnal [time] [Arcum Semidiurnum]; in this manner [it] must be converted by Precept 10. or 11. into Hours, & the Scruples of the hours, by Table 7. or [the] Primum Mobile, or [the] Solar [hours].

[Margin: Pag. 19. Pag. 26. Pag. 7.]

Example. The Sun being as above in Taurus degree 18. its Declination by Table 26 [is] degr. 17. 14'. 29". which under the Pole-Altitude 44 degr. gives a Difference of Ascensions 16°. 16'. 10". which add to degrees 90. & it makes the Arc of the Semidiurnal northerly Arc of Degrees 107. 26'. 10". But this in Table 7. by precept 10. agrees with the time of the Primum Mobile most accurately [at] Hours 7. 9'. 44". 40".

Praecept. 15. To what one must have recourse when Table 11. is empty of numbers in [its] areas.

[Margin: Pag. 7.]

In this case the day exceeds Hours 24. but then [it] scarcely comes to the use of the Astronomer, that he needs the Semidiurnal, or Nocturnal time, for the calculation of the Motions of the Movables. Therefore I [send] the Reader off to our Primum Mobile, or to the Geographical Problemata of our Reformata. But if you wish at least to know the longest day in the frozen Zones, consult the little Table at the end of Table 11. adjoined [at] pag. 7.

Praecept. 16. To convert Apparent Time into Mean, or Equal [time], & conversely [to convert] Equal [time] into Apparent, & when one [is needed] from the other.

[Margin: Pag. 8.]

Our Astronomical Tables of the Mean motions [Mediorum motuum] have their Radices accommodated to the Meridian, & indeed to the last day of December, supposing the Natural Days to be of 24 equal hours, & this for the sake of example we say [supposing] the Sun to traverse one of these in the Ecliptic [at] Degrees 0. 59'. 8". 20". — by two other days [at] Degrees 1. 58". 16". 40". But in truth the Days are unequal, [for] two causes. The Prior [cause] [is] the obliquity of the Ecliptic; for to equal arcs of the Ecliptic there correspond unequal arcs of the Equator, which is the measure of Time; the Posterior [cause] [is] the Eccentricity of the Sun, whence arises the Anomaly, or the irregularity of the Sun's motion,

which remains, even if the Sun moved through equal [arcs] of the Equator. Hence it comes to pass that (in the rest indeed [the difference] is almost negligible) in our Astronomical Tables of the Mean Motions [Lunisolarium], it must be predicted, or collected [as to] some Phenomenon, past, or future, that it may satisfy the Apparent Time; which is observable to us, [it] is convenient to convert the Equal time of the calculation performed into apparent. But conversely, when the Apparent time is given, or some Phenomenon has been observed, & that [is] to be examined by the Astronomical Tables, [it] is necessary first [to convert] the given Apparent Time into Equal [time]. And either Equation is called the Equation of the Natural, or Civil, Days [Aequatio Dierum Naturalium, seu Civilium].

[Margin: Pag. 8.]

This indeed is done by our two Tables 12. & 13. The Prior [Table 12.] indeed is perpetual, & it is established from the prior cause by these little Tables, namely from the Obliquity of the Ecliptic, which we suppose [to be] degr. 23. 30'. 10". The other [Table 13.] is constructed from the equated Anomaly of the Sun, which we suppose to be founded in [its] Eccentricity. And so in the upper little Table 12. part, with the Sign of the Sun on the face, of these, [if] the degrees [be] in the left side ascending; or with the sign at the foot & the degrees in the right side ascending, [it] is found, in the common concourse of the Equation, the prior part, & the stronger [is] to be added, or subtracted from the given time, according as the Title indicates in the front, or at the foot of the same Table 12. part in the lower part the Anomalies of the Sun are sought from the Ephemeris, [whether] adding the degrees in the front in the left, or at the foot, with the degrees on the right, & in the common concourse the equation is had, the prior part [is] the other [to be] added or subtracted, according to the same Table's title — if they should be of the same affection, & if [of] different, subtract the less from the greater & leave the Equation of that kind, of which the Equation is greater.

[Margin: Pag. 9.]

Example. Let the Apparent Time after Midday be of Hours 5. & 20'. which in Equal [time] is to be changed, the Sun being [in] Taurus degree 16. & the Anomaly of the Sun [in] sign 9. complete, [holding] degree 8. Firstly therefore, in Table 12. the superior part [is] under \square sign, & opposite the degrees 16. of the left margin, there is given an Equation 9. 55'. 45". to be subtracted from the time; secondly [in] the inferior part of the same Table, & opposite [it under] sign IX. ascending, the degree to the right under degree 3. [it] is found opposite, of that same Equation 4'. 3". Add, as the title under sign IX. shows. Since therefore they are of

different affections, if [you] subtract the subtractive 4'. 3". there will remain absolute, & corrected, the Equation 5'. 52'. 45"". to be subtracted from the data given for the hour 5. & 20'. so that the corrected Mean, or Equal Time, [is] hor. 5. 14'. 7". 15"".

Otherwise by the Provisional Tablet [per Tabellam Temporariam]

If the Sun's Apogee were immobile, as Ptolemy thought, nor migrated by little steps into other signs, the Equation of Natural Days perpetually lasting could be made from these two little Tables 12. But because the Sun's Apogee [is moved] in other [ages], & promoted by little to other signs, & in the same sign to other degrees, [it] cannot be satisfied by a single Tablet for all ages, but only for one age, or another. And so we have constructed two little Tables under 13. of which the superior little Table is established exactly [for] the Year of Christ 1504. when the Sun's Apogee, by my judgment, was in Cancer degree 6. but indeed without error, & to a sufficient [degree] for the preceding age, & subsequent; that is from the Year 1404. ad 1604. The inferior [little Table] indeed serves for the Year of Christ 1736. when the Sun's Apogee [is] in Cancer degree 10. but this also, without error curable, serves from the Year 1636. ad the Year about 1836. for both, & at the same time the proportional part serves almost exactly [for] all the intermediate Years between 1504. & 1736. The comprehension of these is, [and] in either ingress with the sign of the Sun in the front, & with the degree of the sign in the left side enquired, in the common concourse the absolute Equation to be Added to Apparent Time is had, & to be subtracted, just as the title in the front indicates; to which the contrary is to be done, if the Equal time is to be changed into Apparent.

[Margin: Pag. 8.]

Example. Let it be the Year of Christ 1650. Sun being in Taurus degree 16. to convert the Apparent Time of Hours 5. 20'. into Equal [time]. Firstly therefore in the superior Table 13. part serving the Year 1504. under \square , & opposite degree 16. [it] is found the Equation to be subtracted 6'. 48". Then in the inferior part, which serves [for] the Year 1736. under the same sign, & opposite the same degree 16. there is had the Equation to be subtracted 3'. 5". The difference of these Equations 1'. 43". this indeed is to be resolved [into] seconds 223". between the Years 1504. & 1736. the whole difference is [for] the Years 232. but from 1504. ad 1650. there are made up Years 146. Divide therefore [the] seconds 223". by [the] Years 232. there decreases [for] one second 146". that is [a] minute 2'. & seconds 26". which subtract from the prior Equation 6'. 48". there remains the corrected Equation 5'.

31'. which subtracted from the Hours 5. 20'. relinquishes the Equal Time of Hours 5. 14'. 29". yet the prior method is more exact in the seconds-scruples.

Praecept. 17. On Equating Time on account of the Distance of Meridians.

Since our Astronomical Observations have been performed by us under the Meridian of the renowned City of Bologna, partly in the Most August Temple of S. Petronius, partly, & generally, in our Observatory of the College of S. Lucia of the Society of Jesus; therefore we admonish that our Tables fix the Meridian of this Meridian of Bologna; but indeed, that the Tables of this Meridian can be applied to the Meridians of other places, [it] behooves one to know the Distance of those, or the Difference of Geographical Longitudes (whether they be Easterly, or Westerly from Bologna in the Italian fashion). To this end, in our *Geographia Reformata* Book 8., gathered everywhere, [there are] the Eclipses, & Itineraries; we have enquired into the Differences of Longitudes of very many places from Observations, or from the intervals of places; & likewise of the more recent Meridians, we have enquired into the Pole-Altitudes, that with the ancient querulousness, & the new Astronomers, & Geographers, we might satisfy ourselves over this thing, & we might expunge innumerable errors from the Geographical, & Hydrographical Charts, [as] much as God granting [it] was permitted; but in Book 9. [we have given] a Catalogue of places of very many, constructed with the Longitude from the Island of Palma, & the Pole-Altitude. Thence therefore the Longitudes of places are taken from our Catalogue, [Margin: Pag. 9.] or from these places at once [it] has the Difference of Apparent Times, or [the time] to be Added, or to be Subtracted from the time of the Bologna Meridian; the contrary nevertheless [is] to be done, if the time is to be agreed with another Meridian, [and] the Time congruent with the Bologna Meridian is to be led across.

[Margin: Pag. 9.]

Example. Let there be a future beginning of a Lunar Eclipse [at] Hour 10. 20'. after the Bologna Meridian; but [if] it should be enquired what then will be the future Hour, or the moment of the Hour at Goa in East India, or [at] Lima in Australian America? Now in our Catalogue [Margin: Pag. 9.] the Difference of Times for Goa is registered [at] Hor. 4. 18'. Adding. & for Lima Hor. 6. 10'. 40". Subtracting. Therefore the beginning of the Eclipse will be, [at] Goa, after the Bologna Meridian, Hour 14. 38'. at Lima Hor. 4. 9'. 20". On the contrary indeed, [if] the beginning of the Eclipse of this kind had been supposed [for] hour 10. 20'. of

Goa, or [of] Lima, the Difference of Times registered [for] Goa, would be Subtracting; & registered indeed [for] Lima [it] would be Adding, & so it is that [in] the prior case that Time, [at] Bologna after midday, [is] hor. $6\frac{1}{4}$. in the posterior [case] [it] becomes hours 16. 30'. 40'''.

Praecept. 18. To find the Leap Years in the form of the Julian Year before, & after the Epoch of Christ.

[Margin: Pag. 14.]

For the Years before the Epoch of Christ consult Table 15. in which the prior, or left-hand column shows the Years; the other, or third, & the fourth column [shows] the expanded [years] of the preceding age, [the] hundreds, or the Thousandths; the second indeed, [and] the third, & fourth column [shows] the centesimals first, or the Millesimals first, which are Leap Years. So, by example for the sake of [showing] the Leap Years, [the Years] ought to be in the Julian form indeed retro-numbered upward [as] the Year before Christ 1. & 5. & 9. &c. likewise the Year 101. & 201. &c. & likewise 5301. & 5401. &c. But besides these of all the ages, the Years before Christ 325. for [they are] Leap [years], because 25. in the first column is a Leap [Year]. The remaining intermediates &, not noted [as such], are Common [years], as the Year before Christ 4. 8. 12. 104. 108. 112. &c.

[Margin: Pag. 14.]

For the Years after the Epoch of Christ, consult Table 16. in whose first column the Leap Years of any age after Christ [are shown], in 2. however, & 3. [the] Centesimal Years of the age, the Millesimals, &c. [are] Leap [Years]. So by example for the sake of [showing] the Leap Years are in this form the Year 4. & 8. & 12. &c. likewise 100. & 200. &c. likewise 1700. 1800. 1900. &c. But composing the expanded [years] with the centesimal, or the millesimal, the Leap [years] are 104. 108. item 204. 208. item 1004. 1008. &c. the rest [the] intermediates not noted, are common.

Praecept. 19. To discern, in the form of the Gregorian Year, the Centesimal Years, or the Millesimals, which ought not to be Leap [Years], & by [how much] excess, by which the number of days of the Gregorians exceeds the number of the Julian days.

In the form of the Gregorian Year every fourth [year] of the expanded Years is a Leap [Year], & these serve the first column of Table 15. But among the Centesimal Years, & the Millesimals, those alone are Leap [Years] of which the two prior notes nume-

are counted among the expanded years as bissextile [leap], that is, every fourth one, leaving out the centesimal years from the year 1600 exclusive onward; the remaining years must be common, the intercalation being omitted — as appears more clearly in Table 17, in the column headed C. Communes [Common] and B. Bissextilis [Leap].

[Margin: Pag. 14.]

Now from the year of Christ 1582, on the 5th of October, the Christians who adopted the Gregorian form (that is, the great majority of the Christian world) reckon ten days more than those who out of obstinacy retain the Julian form; and on the same date, for example, December 24 among the Gregorians is not the 14th among the Julians. Thus it falls out that December 24 among the Julians is the same day as January 3 among the Gregorians. Likewise February 14 among the Julians (in the year 1700, since that year is bissextile in the following month) becomes February 24 in the Gregorian style: for in the next year, 1700, December 24 in the Julian style will be January 4 in the Gregorian. February 14 among the Julians, or 6 March in the Gregorian — but here the next Gregorian computation immediately exceeds the Julian by 11 days, and continues so up to the year 1800, after which the Gregorian will exceed the Julian by 12 days, the latter day being the posterior. For this reason, in noting these excesses, I have marked them in Table 20, in the third column, and the sixth, with these excess-days.

[I read this dense passage as Riccioli's worked illustration of how the Julian-Gregorian day-difference (10 days from 1582, 11 days after 1700, 12 days after 1800) is to be applied; the figures are now verified against the source — see QA report.]

Precept 20. To find the Solar Cycle for investigating the feria [weekday], both before and after the epoch of Christ.

The Solar Cycle is a period of 28 years, produced from the multiplication of 7 (the days of the week) by 4 — because every fourth year is bissextile, and so every twenty-eighth year the dominical [Sunday] letter recurs to the same feria. Hence the year [marked with] the dominical letter is here called the Solar [year], and because the dominical letter is dedicated to the Sunday of the Resurrection, the cycle is here called the Solar [cycle]; and the Greek letter Κυριακή [Greek: Kyriakē, "the Lord's (day)"] indicates feria 1. How the Greek Fathers named the feriae at the head of Table 19, and the characters of the planets by which the astronomers wrote them, is described.

[Margin: Pag. 14.]

For years before the epoch of Christ, in order to find the Solar Cycle, add 9 to the given year, then subtract from the sum the nearest smaller number of cycles in Table 18. The residue, or — if nothing remains — the cycle itself, will be 28, completed.

[Margin: Pag. 14.]

[Margin: Pag. 14.]

Example. The Solar Cycle for the year of Christ 1660: adding 9 makes the sum 1669. In Table 18 the nearest smaller number of Solar Cycles is 1652, which subtracted from the said sum leaves 17 for the Solar Cycle, which indeed agrees with the year of Christ 1660.

Alternatively, without the Table.

[Margin: Pag. 14.]

To the year of Christ add 9; divide the sum by 28. The remainder of the fraction in the quotient is the Solar Cycle; if nothing remains, 28 will be the cycle. If the aforesaid sum is less than 28, that sum itself will be the Solar Cycle.

For years current before Christ.

[Margin: Pag. 14.]

Seek in Table 18 the nearest larger number — the years current before Christ — and add 9 to that, then subtract from the sum the given years current before Christ; and from the residue, if it is not less than 28, subtract the nearest smaller

Solar Cycle found in Table 18. For what remains is the Solar Cycle; and if nothing remains, the Solar Cycle will be 28. If that residue was previously less than 28, it is itself the residual cycle sought.

Example 1. The year before Christ given is 36: the nearest larger number in Table 18 is 56. To this 56 add 9; that makes 65. From this 65 subtract the given 36; there remain 30. From this residue 30 subtract the nearest smaller Solar Cycle, which is 28; there remains the number 2. Therefore 2 is the Solar Cycle agreeing with the year 36 before Christ.

Alternatively, without the Table.

[Margin: Pag. 14.]

To the years given before Christ add 18, and divide the sum by 28; for if nothing remains over, the Cycle sought will be 28 itself. But if some residue results, subtract that itself from 28, and what remains is the Solar Cycle sought... [Note: Riccioli's two formulations here differ slightly; rendered per source.]

to the years before Christ add 18, and divide the sum by 28.... [continuation of the alternative-without-table method for years before Christ]

Example. The year before Christ is given as 38, which Censorinus assigns to the more notable epochs. Add to it 4713; that makes 4751, which is the Julian-Period year 4751. Likewise let the year of Christ 3340 be given; if you add 4713 to it, it makes 8053; from which, the whole Julian Period of 7980 years being subtracted, there remain for the second Julian Period the year 73.

Precept 25. Given the year of the given Julian Period, to convert it into years before Christ if it does not exceed 4713, or into years of Christ if it exceeds 4713.

[Margin: Pag. 14.]

If it does not exceed 4713, subtract it from 4714; the years before Christ will remain, concurrent with the years of the Julian Period.

Example. The Julian-Period year 3938: 3938 subtracted from 4714 leaves 776 for the years before Christ — namely, the first Olympiad.

If indeed it exceeds 4713, subtract 4713; and the residue will be the year of Christ sought, provided the Period is the first; for if it be the second Period, which begins at the year of Christ 3268, add the given 7980, and from the sum subtract 4713; the year of Christ sought will remain.

Example. Let the first Julian-Period year 6295 be given; from this subtract 4713; there remains the year of Christ 1582 — namely, the year of the Gregorian correction of the Calendar.

Precept 26. To convert the Epoch of the World according to the Greek Fathers of the Church of Constantinople into years before or after Christ.

[Margin: Pag. 14.]

If the given year of the World does not exceed 5509, subtract the given year from 5510; the year before Christ will remain. The Epoch of the World, and if it exceeds 5509, the years of Christ will be the Epoch sought, of which you will have to subtract the given years from 5509.

Precept 27. Given years before, or after, Christ, to turn them into years of the World according to the Greek Fathers.

If you would subtract years before Christ, subtract them from 5510; what remains is what you want. But if to the years of Christ you add 5509, you will have the years of the World according to the Greek computation of the Fathers of Constantinople.

Precept 28. To convert the given year of any Olympiad into a year before or after Christ, since the Olympiadic years begin from the New Moon nearest the summer solstice.

When writers say that something was done in some Olympiad, it is understood that they mean a completed Olympiad, not adding the year of it — understood, I say, in the first place of a completed Olympiad. First, then, the Olympiads being completed, but the residue being produced, add the remaining years; likewise the completed years of an incomplete Olympiad, for you will have the Olympiadic years full, which are: if the years before the Epoch of Christ do not exceed 775, subtract from 776, and there will remain the years before the Epoch of Christ, in whose summer the Olympiad given began. And if they exceed 775, subtract those 775; and you will have the year of Christ in which the given Olympiad began.

First example. Let Olympiad 6, year 1, current, be given, since the completed Olympiads are 5, and these multiplied by 4 make 20; and to these, the full years being added, 22, the Olympiadic years are completed. If you subtract these from 776, there remains the year 754 before Christ, in whose summer Olympiad 6

began; which accordingly was completed in the summer of the year 753 before Christ.

Example 2. Let Olympiad 195, year 1, current, be given. Since the completed Olympiads are 194, and besides one year added, the Olympiadic years are reckoned, making 776; subtract these 776 from 775, there remains 1 year. The Epoch of Christ, in whose summer Olympiad 195 began.

Precept 29. To convert years before and after Christ into Olympiadic years.

If the given year before the Epoch of Christ is 776, it is the first... ..the first year of the first Olympiad began from the New Moon nearer the summer solstice; but if it be less than 776, subtract it from 776. And the residue divided by 4 — for if no fraction adheres, the quotient itself indicates the completed Olympiad. The current year will begin in the summer of the given year of Christ; and thus the Olympiad to be completed in the summer of the following year. But if the quotient has a fraction, add the years of the fraction to unity, and you will have the Olympiad in which that year begins, which the numerator of the fraction indicates begins — I say — in the summer of the year of Christ.

Example 1. Let the year 770 before Christ be given; from this 776 the subtracted 770 leaves 6, which divided by 4 gives a quotient of $1\frac{1}{2}$; add then unity, so much for the quotient as for the numerator of the fraction; this makes $2\frac{3}{4}$. Therefore in the summer of the year 770 before Christ began Olympiad 2; and the year 3, that is, the third year of the second Olympiad, with the New Moon nearest the summer solstice, ran with the year 2 of Olympiad 2.

Example 2. Let the year 4 before Christ be given; the subtracted 776 leaves 772; which divided by 4 makes 193, the number of the Olympiad. That year being completed, therefore, after the New Moon of summer in the year 4 before Christ, began the first year of Olympiad 194.

Of years after Christ born.

Add the given years of Christ to 776, and divide the sum by 4. If no fraction adheres to the quotient, the quotient itself indicates the completed Olympiad; the current year will begin in the summer of the given year of Christ; and thus the Olympiad to be completed in the summer of the following year. But if the quotient has a fraction, add to the quotient unity, and you will have the Olympiad in which that year begins, which begins — I say — in the summer of the given year of Christ.

Example 1. Let the year of Christ 4, current, be given; add 776; it makes 780. Divided by 4, there remains Olympiad 195, without a fraction. Therefore in the summer of the year of Christ 4 began Olympiad 195; and that was completed in the summer of the year of Christ 5.

Example 2. Let the year of Christ 7 be given; with 776 added, it makes 783; which divided by 4 leaves $195\frac{3}{4}$. Multiply then 195 by unity; the Olympiad is 196, of which the year 3 began in the summer of the year of Christ 7.

Precept 30. To convert given years of the founding of the City of Rome into years before or after Christ.

[Margin: Pag. 14.]

The Epoch of the City of Rome is 753 years before Christ — this is according to the computation of Varro, the City having been founded on the 21st of April; and the first year of the Epoch of Christ. If the given year is less than 754, there will remain the years before Christ, of which the 21st of April begins the year before Christ. But if to the 753 years given you add the year before Christ in which the City was founded; therefore the beginning of that year before Christ concurs with the year of the City preceding.

Example 1. Let the year of the City 709 be given, which indeed was the first of the Julians, ordained by Julius Caesar; subtract 709 from 754; there will remain the year 45 before Christ, of which the 21st of April began the year of the City 709; but before that the year 708 was current. Again, let the year 1 of the City be given; subtracted from 754 it leaves 753 before Christ, in which on the 21st of April was the City of Rome founded.

Example 2. Let the year of the City 1553 be given; from this subtract 753; there remains the year of Christ 800, in which on the 21st of April the year of the City 1553 began. But on the Kalends of January of the year 800 (in which indeed Charlemagne [Carolus Magnus] began to reign as emperor) ran the year of the City 1552.

Precept 31. To turn years before or after the Epoch of Christ into years of the founded City of Rome.

If the year before Christ does not exceed 753, subtract it from 754, and you will have the year of the City beginning on the 21st of April of that same year.

But to the given year of Christ add 753, and you will have the year of the City beginning in that year of Christ on the 21st of April.

Precept 32. To reduce the years of Nabonassar to years before or after the Epoch of Christ.

[Margin: Pag. 18.]

First inspect Table 23, if perchance in it you may find — in the region of the years of Nabonassar — the year of Nabonassar before or after Christ, and at the same time the day of the Julian or Gregorian month on which the years of Nabonassar begin. Otherwise subtract the year of Nabonassar from the nearest larger in the same Table found; and to the residue add the years before Christ corresponding to that next larger Nabonassar — you will have the year before Christ in which the given Nabonassar [year] begins. But if, in the region of the year of Nabonassar nearest larger, there are years of Christ, from these subtract the residue left after the subtraction made after the Nabonassar nearest larger, and there will remain the year of Christ in which the given year of Nabonassar begins. Reserved nevertheless in either case is the aforesaid Residue for the practice of precept 35, soon to be handed down.

[Margin: Pag. 18.]

Example 1. Let the year of Nabonassar 720 be given; this subtracted from 744, which in Table 23 is the nearest larger to it, leaves Residue 24, to which the added year before Christ 5 — that is, the one corresponding to the year 744 — makes 29; the year before Christ in which began the year of Nabonassar 720.

[Margin: Pag. 18.]

Example 2. Let the year of Nabonassar 1460 be given; this subtracted from the nearest larger, which in Table 26 is 1464, leaves Residue 4, to which add the year before Christ 716, which the region of the year 1464 supplies; and there will remain the year of Christ 12, in which began the year of Nabonassar 1460.

Precept 33. To find the beginning of a given year of Nabonassar in a Julian or Gregorian year.

[Margin: Pag. 18.]

First, by precept 32, inquire into the year before Christ, or of Christ, in which the proposed year of Nabonassar began; and divide the Residue in that practice [as] adduced by 4; then the quotient, if a fraction adhere to it, augment by unity, and thus the given year augmented for the Julian or Gregorian year, in which begins the Thoth of the Nabonassar-year nearest larger than the given year of Nabonassar. After the year of Christ, the day of the Julian or Gregorian month, in

which the given year of Nabonassar [begins]. After the year of Christ 1582, likewise October 4, it suffices to repeat the beginning in the Julian year, and to know what day it is in the Gregorian by precept 19.

[Margin: Pag. 18.]

Example 1. In the preceding precept, the given year of Nabonassar 720, the nearest larger in Table 23 is 744, to which corresponds the beginning of Thoth on August 24. But the Residue there adduced was 24, which divided by 4 gives a quotient of 6, without a fraction; therefore that year, as it stands, is to be added to the day August 24, on which falls the beginning of Thoth of the Nabonassar-year 720, in the year of Christ 30.

[Margin: Pag. 18.]

Example 2. In the preceding precept, there was given the Nabonassar [year] 1460, the nearest larger 1464; the beginning of Thoth from Table 23 [is] February 25. The Residue adduced, divided by 4, makes 1 without a fragment. Therefore, unity being added, the day 25 of February falls on the beginning of Thoth in the year of Nabonassar 1460, on the 26th of February of the year of Christ 12.

Precept 34. Given a Nabonassar year, month, and day, on which month of the year before Christ, or after, and on what days the Julian day falls, to find the day of the Egyptian year [Anni Aegyptii].

First, inquire by precept 32 the year before, or after Christ, and by precept 35 the Julian day of the month, in which begins the given Nabonassar year; and by precept 20 — or rather 21 — foreknow whether the Julian year, or the Gre...

whether it [the Gregorian year] is bissextile [a leap year] or common. Second, from Table 5, by the preceding precept 5, gather the total of days from the beginning of the Julian or Gregorian year up to the day on which the month of Thoth begins. Third, from Table 6, by precept 7, gather the total of days from the beginning of the Egyptian year up to the proposed day, and add this latter sum to the former. From these sums added together (if they do not exceed 365, or in a bissextile year 366), in the columns of Table 5 you will find — under the proposed month of the Julian year, and on the left-hand side, in the row of the concurrent day of the month — the day given with the day of the Egyptian month. But if that aggregate exceeds 365, or in a bissextile year 366, subtract these very numbers from the aggregate, and from the residue, found in the body of Table 5, you will obtain — above, the month of the Julian year, and on the left-hand side, the day concurrent with the day of the Egyptian month given.

[Margin: Pag. 18] [Margin: Pag. 2] [Margin: Pag. 2]

Example 1. Let the Nabonassar year 720 be given, and the [Egyptian] month Athyr, day 25. First, by precept 29, the Nabonassar year 720 begins in the Year of Christ 29; and by precept 33, the beginning of Thoth fell on 30 August. Therefore, in the bissextile Year of Christ 29, Table 5 shows 243 days [from 1 January to 30 August]. From Table 6, day 25 of Athyr — counted from the beginning [of the Egyptian year] — makes 85 days; Athyr being the third month (the first two giving 30 + 30, with 25 of Athyr making 85 in the running total, but 175 when reckoned with the [later] Mechir). The Julian sum 243 and the Egyptian 85 make the aggregate 328, which in Table 5 shows, in that bissextile year, day 23 of November — the days concurrent with Athyr on day 25. The Julian sum 243 and the Egyptian 175 make the aggregate 418, from which, the bissextile day subtracted, 366 remain; and in Table 5, for the following year 28 before Christ, they give day 21 of February, concurrent with Mechir on day 25.

[Margin: Pag. 2] [Margin: Pag. 18]

Precept 35. *To convert given years before Christ, or to turn them into Nabonassar years, and to investigate the beginning of those years.*

If a year before Christ is given not exceeding 747, look for it in Table 23, in the second column; for in the first column you will have the beginning of the Nabonassar year, and in the third, the [Julian] month and day, which you will find in column 2. Subtract that nearest number found below it (and note meanwhile the interval), namely the Nabonassar year in column 1; and whatever number begins it answers to the next greater. The residue, moreover, added to the [Julian] day of the Nabonassar year as I said, in column 1 (where, as found, the optative Nabonassar year is so begun). Divide that same residue by 4: as often as it makes an integer (or, if a fraction results, increased by one), and the residue from the initial subtraction, will give the other optative beginning.

[Margin: Pag. 18]

Example 1. Let the year before Christ 29 be given. Here it appears in Table 23, column 2; and the nearest number below it, namely the Nabonassar year 716, leaves a residue of 4, which added to 716 gives the Nabonassar year 720, namely the one that began in the Year of Christ 29. Further, by precept 33: the beginning of Thoth was 31 August, and the residue 4 divided by 4 leaves the quotient 1, which subtracted from day 31, leaves day 30, on which the Nabonassar year 720 begins.

[Margin: Pag. 18]

Example 2. Let the year of Christ's Epoch be given [year before Christ], find it in Table 23, column 2; or — if it is not there — you will have on the left-hand side the beginning of the Nabonassar year, in which the Nabonassar year began. But if the given Year of Christ is not in Table 26, look in it for the nearest greater number, and subtract it; and the residue subtract from the Nabonassar year in that same Table, answering to the proposed Year of Christ, and the residue subtract from the Nabonassar year, in the same Table, answering to the next greater Year of Christ; for you will have the optative Nabonassar year. Then divide the residue by 4, and the quotient — an integer if it has no fraction, or increased by one if it has a fraction — added to the beginning of Thoth, which is in column 1 of the nearest greater Nabonassar year, that is, the same with the recently found Nabonassar year.

[Margin: Pag. 18]

Example 2. Let it be the Year of Christ 712. Here subtract 7, from the year 719, the nearest greater in Table 23: it leaves a residue of 7, and from the year 719 answers, on the left, the Nabonassar year 1467; on the right, its beginning is 11 February; therefore, 7 subtracted, the optative Nabonassar year 1460 remains. And the residue 7 divided by 4, as often as the quotient...

[Margin: Pag. 18]

is $1\frac{3}{4}$; setting aside the fraction, there is therefore added to day 11 of February, 1, so the year 1460 begins on day 12 of February.

Precept 36. *To convert a given day of a year before, or after, Christ into a day of a Nabonassar year.*

First seek, by the preceding precept, the Nabonassar year beginning in the given Year of Christ — whether before or after Christ — and the [Julian] day of the month on which that Nabonassar year begins. Then, from Table 5, gather one by one the total of Julian days answering to the beginning of Thoth; and likewise the total of days answering to the date itself, with the difference of those subtracted [from one another], and 365 subtracted; this will give the residue, which in Table 6 [or Table 5? — see context] will show the Egyptian month, and on the left-hand side the day answering to the given day. But if the given Julian date precedes the initial of the Egyptian year, then the difference of the totals collected, with the unit subtracted, and 365 subtracted, will give the residue, which in Table 6 will

show the month of the Egyptian year, and on its left-hand side the day answering to the given day.

[Margin: Pag. 2] [Margin: Pag. 2]

Example. Continuing with Example 1 of the preceding precept: in the Year of Christ 720 [recte: Nabonassar year 720, beginning in Year of Christ 29], the Nabonassar year is found to begin on 30 August. If we ask in what Egyptian month, and its day, the day 31 October falls: since the sum of days answering to 30 August, in the bissextile Year of Christ 29, by Table 6, is 243; and to 31 October it is 305; the difference of these is 62, and increased by unity this becomes 63, which in Table 6 gives day 3 of Athyr, concurrent with 31 October. From the sum of the bissextile year, 25 of April, its 116; the difference of 25 April from 243 is 127; and the unity 126 taken away, leaves the residue 239 days, by which in Table 6 they agree, the given 25 April. Pharmuthi answers to day 29.

[Margin: Pag. 2] [Margin: Pag. 2]

Precept 37. *To convert the years of Alexander the Great, or of Dhū-l-Qarnayn, into [years] before or after the Epoch of Christ, and these [reckoned] alternately into those.*

If the year of Alexander the Great — reckoned from his very death — is 324, or that of Dhū-l-Qarnayn is 312, each of them coincides with the first months of the first year of Christ. But if the year of Alexander the Great is less than 324, or that of Dhū-l-Qarnayn less than 312, subtract the years of Alexander from 324, or those of Dhū-l-Qarnayn from 312; the residue will give the year before Christ, with which the prior months of the given year run concurrent.

Conversely, if the years of Alexander exceed 324, or those of Dhū-l-Qarnayn exceed 312, subtract from them 324 or 312, and the remainder is the Year of Christ, whose prior months run concurrent with the given year.

Conversely, if the years given before Christ do not exceed 324, subtract them from 325; the remainder will be the year of Alexander running concurrent with that year; but if they do not exceed 313, the year of Dhū-l-Qarnayn likewise running concurrent with the same year. But if the years before Christ exceed 324 or 313, the year of Alexander or of Dhū-l-Qarnayn, running concurrent with the given year and that following, will be...

Conversely: if the years before Christ given do not exceed 324, subtract them from 325; the remainder will be the year of Alexander running concurrent with that year; but if they do not exceed 313, the residue is the year of Dhū-l-Qarnayn

current with the same years 325; and the remainder will be the years of Alexander running concurrent with the prior part of the given year. But subtract the years of Christ from 313: the remaining year of Alexander, or of Dhū-l-Qarnayn, running concurrent with the given year, but with the prior part of the year. Subtract, moreover, the years of Christ from 313: the remaining year of Alexander, or, [if reckoned] from Seleucus, [its] beginning in the Year of Christ preceding the given one, run concurrent with the prior part of the given year.

The precept is clear, nor do those already accustomed to the preceding precepts need an example.

Precept 38. *To change the years of Alexander the Great into Nabonassar years, and these alternately into those.*

To the years of Alexander add the years 424, and it becomes a Nabonassar year in the Egyptian manner, [reckoned] from the same day and from the noon-meridian from which [the year] of Alexander [is reckoned]. Thus the year of Alexander begins together with [Nabonassar year] 425, the Nabonassar year, on day 12 of November, that is, on day 1 of Thoth.

Conversely, if the Nabonassar years are not fewer than 425, subtract from them the years 424; and the year of Alexander remains, beginning on the same Nabonassar year [as it began].

Precept 39. *To convert given years, days of the Hegira, into years of the Epoch of Christ, [its] days.*

In Table 21, in the third, or lowest, class you have the days collected for the Arabic years, and likewise for the months. From that Table, therefore, gather the days answering to the years, months, and Arabic days — but complete ones — and that, by one or more entries into the Table, as may be needed. The sum of the days so collected, add the perpetual 561 days, and it will become the sum, which by [the rule of] distinction is called the *Cumulus* [the running total]. Then, from the first class of Table 21, [find] in the body the *Cumulus* nearest below it, answering to the collected days, [reckoned in] Julian years, months, and complete days — or one, or more, days [over], by the entries into the Table; for if you so add to the Julian years the years 620, the Years of Christ will come out, the data of the Hegira-years and -months, and the Julian days, with the months, and the days of the Hegira.

[Margin: Pag. 15] [Margin: Pag. 15] [Margin: Pag. 15]

Example from the Turkish Annals. Amurath II [Murad II] died in the year of the Hegira 855, beginning, on day 1 of Muharram, feria 4 [Wednesday]. It is asked: in what year of the Epoch of Christ did it fall, and in what [Julian-Calendar] month and day, and on what day [of the week]? Go therefore to Table 21, and to its lowest class on the left, in which thus:

[Margin: Pag. 15]

Arabic Years	Days collected
600 Arabic years give	212620
There remain 254 complete years, of which 240 give	85048
There remain 14 years, which give	4961
Add 1, day of the month Muharram	1
and perpetual days	561
The sum of days becomes	303191

[Margin: Pag. 15]

Then in the upper [part of] Table 21, in the left-hand class, the days 303191 — taken in parts collected — give in the left-hand columns the Julian years thus:

Days	Julian Years
Days 292200 give	800
There remain 10991, of which 10227 give	28
There remain 764, of which 730 give	2
There remain days 34	
Add years perpetual	620
The sum of complete years becomes	1450

The days 34 give 3 February. Therefore Amurath II [Murad II] died in the Year of Christ 1451, on 3 February. Note therefore that Nicolaus Mulerius [Nicolaus Mulerius], in his Canon of the collected Arabic years with the collated Julian years, places the year 855 [of the] Arabic [Hegira] beginning on 3 February of the Year of Christ 1451, feria 4 [Wednesday].

[Margin: Nicolai Mulerlaus. — (compositor garble for *Nicolai Mulerii*); Nicolaus Mulerius's slip]

The reason, moreover, why to the days collected for the Arabic [years] the perpetual 561 days are added, and to the collected Julian years (as above) the perpetual 620 years are added, is this: because the first Arabic year of the Hegira began in the Year of Christ 622, on day 16 of July; but from the Year of Christ 620 complete, and bissextile, to 622 current, day 16 of July current, are numbered the days complete 561. Beware, however, of an error in the Rudolphine Tables, page 39, where below at the right in the transverse line the number 1 is set wrongly: *Hegira Anni* [the year of the Hegira] of the Year of Christ 632, and continued with 633, which is to be verified [as] of Yazdegerd; the Epoch, not Arabic [but] of Persia, for which the year 632 entered, and as the same Rudolphine [Tables], page 38, the Year of Christ 623 is to be set, which follows 623.

[Margin: Rudolphinarum mendum — an error of the Rudolphine [Tables]]

As to how the Arabs investigate their own Cycles by feria [weekday], it was stated at precept 22.

Precept 40. *To change the years of Christ — if they are not fewer than the years 622, [its] days — into Arabic [years] of the Hegira, [its] years, and days.*

To the given years of Christ, subtract the years 620, and the residue...

[Margin: Pag. 15]

resolve into days, by Table 21, [in its] supreme class for the Julian years collected, and to these add the days collected from the beginning of the given year up to the day of the Julian month, and that, by Table 5; or even by that same Table 21, with the bissextile [day] added, as the work requires. From the sum of all these days, always subtract 561 days. As for the residue, look for it in Table 21 — but by parts applied: first under the heading of Arabic years; then under the heading of Arabic months, until the lesser days than the Arabic month remain; noting meanwhile the preceding Arabic collection complete; the days remaining indicate the day of the following month of the Arabic [year]; congruent with the Julian [day], and the

sum of the collected Arabic years, with the added unity, the Arabic year [is given], the given Year of Christ answering.

[Margin: Pag. 15] [Margin: Pag. 2] [Margin: Pag. 15]

Example. Year of Christ 1452, day 29 of May, feria 2 [Monday]: Constantinople was captured by Mehmed II [Mehmed II]. It is asked, in what Arabic year of the Hegira it was captured, and on what Arabic month, and on what its day? Year of Christ 1452, take away 620, and there remain 832; these by Table 21 answer to the days collected for the Julian years, as below.

[Margin: Pag. 15]

	Days
800 years give days	292200
There remain 32 years, which give	11688
But from the beginning of the year 1452, bissextile, to 29 May inclusive are days	150
The sum of days is	303930
From this perpetually take away days	561
There remain days	303369

Then, in the lowest class of Table 21 [taken] under the Arabic years, and months: 303369 give the Arabic years complete 856, by the method written below.

Days collected	Arabic Years
Days 303369: the sum nearest less, 212620, gives	600
There remain 90749, of which 85048 give	240
There remain 5701, of which 5670 give	16
There remain days 31	

Days collected

Arabic Years

The sum of Arabic years
complete 856

[Margin: In Tab. 21] [Margin: Pag. 15]

Therefore Constantinople was captured in the Hegira year 857. And because there remain 31 days, of which 30 are owed to the prior Arabic month Muharram, it follows that it was captured on the first of the month Sephar [Safar], feria 2 [Monday] in the Arabic [reckoning], that is, on the day of the Moon [Monday], by precept [22].

Precept 41. *Yazdegerd, or the Persian Epoch: given years, and months, to convert into the years of Christ, and days.*

Given the Yazdegerd years complete, and the months complete, resolve into days, by Table 21, [in its] class 2, the left-hand parts, which serve both for the Persian and the Egyptian [years], or [made] by more entries into the Table; from the sum of the days subtract perpetually the days 199. The residue, and its [class] 24, the supreme class, reduce into the Julian years, and months, having regard to the bissextile [years]. Finally, to the sum of the Julian years add perpetually the years 632, and from the sum of the Years of Christ the residue, but the months show in Table 21, the month, and the day.

[Margin: Pag. 15] [Margin: Pag. 15] [Margin: Pag. 2]

Example. Given the Yazdegerd year 814, and the day 17 of the month Tyrma: it is asked, what is the Year of Christ, the month, and what day? Go to Table 24, in which thus:

[Margin: Pag. 15]

	Days
<hr/>	
800 Persian, or also Egyptian, years give	292000
There remain 13 complete years, of which 10 give	3650
And 3 complete years give	1095
Month complete before Tyrma, that is the month Chortat, gives	90

	Days
The days current of Tyrma are	17
The sum of all the days is	296852
From which perpetually take away	199
There remain	296653

[Margin: Pag. 15]

The sum of days 296653 in the upper Table 24, by the fourth part, gives the Julian years written below:

	Years
Days 292000 give	800
There remain d. 4453, of which 4383 give	12
And there remain days 70	
The sum of complete years	812
Add to these the years complete	632
The sum becomes of complete Years of Christ	1444

[Margin: Pag. 2]

But [there remain] above, of the following year, namely 1445, days 70; and these in Table 6 give, in a common year, day 11 of March. Therefore at last the Yazdegerd year 814, day 17 of Tyrma, falls on day 11 of March of the Year of Christ 1445.

Precept 42. *A given Epoch of Christ — year, and day — to reduce into the year of Yazdegerd, and the day of the Persian month.*

To the given years of Christ (which I suppose to be not fewer than the years 632) subtract the years 632. Then resolve the residue, the complete [years], into days by Table 21. Add the supreme class, one or more entries into it; and to these add

the days collected from the beginning of the current month, and the current day, and again the perpetual 199. The sum of all the days collect, and with it Table 21, class 2, look for it; gather in the left-hand margin the complete Persian years, one or more entries; likewise the complete Persian month — for the remaining days are to be assigned to the following Persian month.

[Margin: Pag. 15] [Margin: Pag. 15]

Example. The same as above, but conversely. Given Year of Christ 1445, [its] day: we ask 11 March, what the year of Yazdegerd is, [its] day; and what the Persian month [is]. The given Year of Christ 1445, and its 11 March of Table 6, you will collect the days.

[Margin: Pag. 15]

	Days
800 Julian years give	292200
And 12 years give	4383
Add to these the perpetual	199
And for 11 March, by Table 6	70
The sum of days becomes	296852

[Margin: Pag. 15]

Because by Table 21, class 2, excerpt the Persian years, months, the day thus:

	Persian Years
Days 292000 give	800
There remain D. 4852, of which 3650 give	10
There remain 1202, of which 1095 give	3
There remain days 107	
The sum of years complete	813

Therefore in the Year of Christ 1445, day 11 of March, falls the Yazdegerd year 814, but the days 107 that are over in the same Table 21, Persian months, show the month complete to have been Chortat, namely days 90, and over 17, [which]

respect the month Tyrma; therefore on day 11 of March of that Year of Christ, [it] agrees with day 17 of the month Tyrma.

Monitum for the remaining Epochs.

The mutual transformation of the remaining Epochs, either work it out from Table 25, or from Our Chronology Reformed, since the rest pertains rather to the Chronologer than to the Astronomer, [it has been treated] thus far.

Precept 43. *On the absolute constitution of Time for the motions of the stars to be elicited from Our Tables.*

Up to now, almost all the precepts pertained to Time. It remains, therefore, that we indicate by what reasoning Time is to be constituted, that the Celestial Motions may be elicited from Our Tables, and to which other things too may be accommodated, [or] which [things] are called the principal Heads of the constitution.

The first [Head] is, if some Celestial Phenomenon — say, an Eclipse of the Moon deduced from Our Tables — must be transferred to other places distant from our Meridian of Bologna, or even to other species of hours, or indeed to other [reckonings] of Years, Months — species diverse from the Years of Christ, or before Christ, which in these Tables we use according to the Julian, and then the Gregorian, form. As if the beginning of a Lunar Eclipse to be elicited from our Tables is found — at which hour it is to be announced — since the hour is not solely Astronomical, but even Babylonian, or European, or apparent [civil], say at Constantinople, or as if at the month of an Arabic year. In this case, First, the time to be used in Our Tables is the mean time of the motions, after the calculation of the Eclipse is absolutely converted into Apparent [time], or apparent at our Meridian of Bologna, [in] Astronomical hours, or post-meridian; and that, by precept 16. Secondly, by precept 17, this time must be accommodated to the Meridian of Constantinople; in which, if the hours are observed Babylonian, [it must be] known by precept 14, the semi-diurnal quantity, and subtracted, [and] the Astronomical hour converted into Babylonian by precept 12; and at last, by precept 40, the Years of Christ converted into Julian; and the days Julian, on which the Eclipse is announced, must be reduced to the Year of the Hegira, [its] month, and by precept 22, [reduced] to the Feria [weekday]. But these and many other precepts are supplied from the preceding [precepts].

The second Head is, if some Phenomenon — say, an Eclipse of the Moon observed elsewhere, or computed — was [reckoned] in another Meridian, say Constantinople, and expressed, moreover, [in hours] enunciated by hours, days,

and of another species, say in Babylonian hours, and the days of the month of the Arabic [year], the Hegira. Then, First, the time as it appeared there apparent must be changed into mean time, by precept 16. Secondly, by precept 17, this time must be transferred to a time congruent with the Meridian of Bologna, and by precept 14 [the semi-diurnal quantity] is to be known, and by precept 12 the Babylonian hour converted into Astronomical. Then by precept 39, the year, month, and day of the Hegira are to be transformed into the Julian Year of Christ, Month, and Julian Day.

Often, too, in the observations of the Ancients, the Temporal Hours are to be reduced to equal [hours], by precept 13.

On the Beginning of Days, and of Years, in Our Tables.

The beginning of Days we take, Astronomically, from noon made under the Meridian of Bologna; and the beginning of the days of the year, or the principle of the year, takes its rise from the noon preceding the last day of December, so that thence the named Days may be used for complete ones. As if we examine an Eclipse of the Moon to come at hour 4 after the Meridian of the first day of January, the mean Luni-Solar motion of one complete day is to be collected, and besides, of hours 4, etc.

There follow the Precepts for the Use of the Tables — of the Second Part.

Precept 44. *Given the place of the Sun on the ecliptic, or any point of the ecliptic, to find its declination.*

[Margin: Pag. 19.]

This is accomplished by means of Table 26: look for the sign at the top, and for the degree of the sign down the left-hand side if the sign is descending, or up the right-hand side if the sign is ascending; for at the common intersection of the sign and degree you will have the declination sought — northern if the ecliptic signs are northern, southern if they are southern — applying proportional parts if need be.

Example. Suppose the Sun's place is given as $10^{\circ}20'$ of Taurus. In the table, the degree of Taurus 10° corresponds to a northern declination of $14^{\circ}51'16''$, and the following degree, 11° , gives $15^{\circ}17'7''$. Their difference is $18^{\circ}51'$ [recte: $25^{\circ}51''$ — see anomaly a]; this, multiplied by $20'$ and the product divided through by whole minutes [i.e. by 60], leaves a remainder of $7'42''$, which must be added to the value

for 14° [recte: for Taurus 10°] [?]. The result is a declination of $14^\circ 58' 58''$ for Taurus $10^\circ 20'$.

Precept 45. *Given any point of the ecliptic, to find the angle that it makes at that point with the meridian, or with any circle of declination.*

[Margin: Pag. 19.]

Therefore in Table 27 look for the given sign at the top, and its degree down the left-hand side; in the right-hand column you will then have the angle that the rising point of the ecliptic makes toward the eastern horizon — that is, toward either the southern or the northern pole, as the notation "Austr." or "Bor." attached to the sign indicates. Moreover this same angle is equal to the angle, situated toward the opposite pole, which the setting point makes (the angle of the setting point being toward the previous pole, as at degree 180); and likewise the angle of the rising point is toward the other pole.

Example. Let the meridian be crossed by, say, Taurus 10° . In Table 25 the eastern angle comes out as $71^\circ 35'$, which is the angle the ecliptic there makes with the meridian — a northern angle, as the notation "Bor." indicates. The western angle is likewise, but toward the south, namely $71^\circ 35'$; its complement to two right angles is $108^\circ 25'$. So great, then, is the angle — whether the northwestern or the southeastern — of the ecliptic with the meridian, or with any circle of declination.

Precept 46. *Given a point of the ecliptic, or the Sun situated in it, to ascertain its right ascension.*

[Margin: Pag. 19.]

Consult Table 28, noting the sign at the top and the degree of the sign down the left-hand side; directly opposite the degree you will at once have its right ascension, applying proportional parts if the degrees of the sign carry a fractional remainder.

Example. To Taurus 10° corresponds a right ascension of $37^\circ 34' 46''$. But to 10° of Libra the right ascension is $205^\circ 9' 11''$ [recte: $205^\circ 9'$ — the seconds reading is uncertain] [?].

Precept 47. *Given the altitude of the pole, and the declination of a point of the ecliptic — or of the Sun, indeed of any celestial point or star — to find its ascensional difference.*

[Margin: Pag. 21. and 24.]

This ascensional difference is the arc of the equator by which the right ascension of any point or star differs from the oblique ascension of the same in an oblique sphere.

Go therefore to Table 29 or 30, and look there — by the altitude of the pole at the top and the declination down the side, or by the declination at the top and the altitude of the pole down the right-hand side — for the ascensional difference, which the common intersection will give. In Table 29, however, an obliquity of the ecliptic of $23^{\circ}30'$ is assumed; whereas a more exact value is $23^{\circ}30'20''$. We have therefore added, for this obliquity, a [Margin: Pag. 24.] further $30'$ [recte: see context — the small adjustment for the more exact obliquity] to our value for the altitude of the pole — which at Bologna, at S. Petronio, is $44^{\circ}30'20''$ — so that it may serve for the other tables; but in this table the obliquity is disregarded, and the ascensional difference is obtained directly, corresponding to the degrees of the ecliptic on which alone the Sun is carried.

Example 1. Let the Sun's declination, or that of any point of the ecliptic, be given as 20° , and the altitude of the pole as 44° . In Table 29, with $44^{\circ}30'$ [Margin: Pag. 21.] at the top for the altitude of the pole, and 20° of declination down the left-hand side, the common intersection gives an ascensional difference of $20^{\circ}35'$.

Example 2. In Table 30, to the degree of Taurus $19^{\circ}5\frac{1}{2}'$ — which has a declination [Margin: Pag. 24.] of 20° — and to the northern altitude of the pole of Bologna corresponds an ascensional difference of $20^{\circ}58'15''$.

Precept 48. *Given the right ascension of any celestial point, and its ascensional difference, to form its oblique ascension.*

To the right ascension of the declining point, for an elevated pole, subtract the ascensional difference; but add it if the point declines toward the unseen (opposite) pole. In this way the oblique ascensions of the same points will be formed; and by this method you can examine the Tables of oblique ascensions.

Example 1. To Taurus $19^{\circ}5\frac{1}{2}'$ there belongs, as said above, a northern declination of 20° ; and to this, under an altitude of the pole of $44^{\circ}30'20''$, there belongs (from the foregoing) an ascensional difference of $20^{\circ}58'15''$. And to the same point, the right ascension is $46^{\circ}58'55''$. Therefore, subtracting the ascensional difference from the right ascension, its oblique ascension will be $36^{\circ}0'40''$. But if it were beyond the equator — i.e. for a place beyond the equator, where the northern pole is not visible — you would have to add the ascensional difference to the right ascension.

Precept 49. *Given the altitude of the pole, and a point of the ecliptic, or the Sun moving in it, to elicit its oblique ascension by means of the tables prepared for that purpose.*

If the altitude of the pole is exactly as great as that for which Table 31 was observed [Margin: Pag. 25.], you will have in common, with that sign at the top and its degree down the right-hand side, the oblique ascension of the point of the ecliptic. But for any [Margin: Pag. 26.] other altitude of the pole, use Table 32. To exhibit the oblique ascension of the northern signs at the northern horizons, look for the degree of those signs down the left-hand side; or, of the southern signs at the southern horizons, look for the degree of those down the right-hand side. But if you want the oblique ascensions of the northern signs at the southern horizons, or of the southern signs at the northern horizons — find the degree opposite to those signs, take it as given under the altitude of the pole, subtract from 360, and the remainder will be the oblique ascension you seek.

Example. Under an altitude of the pole of 40° , the oblique ascension of Taurus 16° is $28^\circ 55'$ for the northern horizons; and the same is the case for Aquarius 14° among the southern; but Aquarius 14° for the northern is $331^\circ 5'$ [Margin: Pag. 26.].

Precept 50. *Given the apparent time after noon, the place, and the altitude of the pole, to find the ascending degree of the ecliptic — which they call the horoscope — and which degree of the ecliptic is the nonagesimal, reckoned from the ascendant.*

First. By Precept 46 find the right ascension of the Sun's place [Margin: Pag. 19. / Pag. 3.]; add to it the time from noon, first converted by Table 3 into the corresponding degrees of the equator; and if the sum exceeds 360, cast out 360, and the result, or remainder, will be the right ascension of the mid-heaven at that time.

Second. Add 90° to the degree of the equator culminating, and the oblique ascension of the ascending degree of the ecliptic will come out, provided it does not exceed 360° ; this being sought in Table 31 or 32, under the appropriate altitude of the pole, [Margin: Pag. 25. / or 26.] will show the sign at the top, and the degree down the left-hand side; then

then, the rising sign or horoscope. But if the oblique ascension exceeds 90 — subtract it from 360, and with the remainder found in the Table of oblique ascensions, investigated as above, you will find the sign and the degree of the ascending ascension.

Third. From the degree of the ecliptic ascending, take away 90°; and there will be known the degree of the ecliptic that is the nonagesimal, which we shall teach more fully — but chiefly with respect to the parallaxes for solar eclipses — to infer in its own place.

Example. Let the place be Bologna, where the pole is elevated 44°30'20"; let the apparent time after noon be 4°30' [i.e. 4^h30^m]; and let the Sun then be in Taurus 29°5'30". The operation is set up thus:

	Gr.	'	"
Hour 4°30', by Table 7, gives	67	41	6
Right asc. of the Sun's place by Table 29 [recte: Tab. 28]	56	58	55
Sum, and the culminating point	124	40	1
Add the degrees	90	0	0
The oblique ascension comes out	214	40	1
This subtracted, 360 remains	145	19	59
With this per Table 29 [recte: 32] there ascends Virgo	3	36	30
Take away the ascendant	90	0	0
There comes out the nonagesimal, Gemini	3	36	30

Parsing notes: rows give signs-degrees-minutes-seconds; "Gr./'" headers apply but the sign-row entries (Virgo, Gemini) are read in sign-degree-minute form.

The ascending horoscope sought, then, is Virgo $3^{\circ}36'30''$; and the nonagesimal computed from it is Gemini $3^{\circ}36'30''$.

Precept 51. *Given the point of the ecliptic ascending, and the altitude of the pole, to find the altitude of the nonagesimal — that is, the angle of the ecliptic and the horizon.*

[Margin: Pag. 38.]

Go to Table 33, which begins at page 38 — for proportional parts are needed here, if there is need of them — looking at the top for the altitude of the pole, and down the left-hand side for the sign with the degree of the ascending degree; downward, count off the degree numbered, or in the right-hand side the sign with the degree upward numbered; the common intersection will exhibit the altitude of the nonagesimal.

Example. Let the ascending degree of the ecliptic be Virgo $3^{\circ}36'30''$, under an altitude of the pole of $44^{\circ}30'20''$ [recte: $44^{\circ}30'$]. From Table 31 [recte: 33] is gathered, by proportional parts, the altitude of the nonagesimal as $65^{\circ}52'52''$, or in round numbers $65^{\circ}53'$.

Precept 52. *To resolve the degrees of the signs of the zodiac, or of any circle, into degrees reckoned from the beginning of Aries.*

[Margin: Pag. 19.]

Table 24 teaches this at once. In it, for example, the degree of Aries 25° in the left-hand column corresponds to a value of $205^{\circ}5'$ [recte: per context] under Libra 205° [?]; and so for the others. But if any degrees of the circle — say, integral signs of the zodiac — are sought, and besides these some degrees adhere to them, the degrees of the following sign being congruent: if Aries 4 signs 25° be given (not in the column for the sign Aries [IV?], but in the column where the sought degrees of the collected signs are noted), and at the head of the sign with the degree opposite, of the collected signs, 145° [recte: per context].

Precept 53. *To find at once the degrees of the zodiac diametrically opposite a given degree — that is, given the ascending degree, to know the descending degree.*

[Margin: Pag. 19.]

In Table 25 you have each pair of opposite signs, but in the table they are conjoined with their degrees opposite; thus in the first conjugation of degrees, Aries 16° is opposed to Libra 196°; likewise in the second conjugation, Aries 16° [II], which is the second sign of the zodiac 76° [recte: per context], is opposed to Libra 16° [VII?], which is 256° of the zodiac. Therefore, given the sign and the degree of its ascending, the degree of the descending sign will at once be known.

Precept 54. *To find the longitude and latitude of any star, but in such a way that with these — for stars not exceeding 90° of [declination/latitude?] — you may obtain its declination and right ascension.*

[Margin: Pag. 19.]

First. By Precept 44 and Table 26, learn the declination of the point of the ecliptic that the given [Margin: ☞ 20.] longitude of the star designates; and by Precept 46 and Table 28, [recte: Tab. 28] its right ascension.

Second. By Table 34 [Margin: Pag. 43.] excerpt the prosthaphaeresis of declinations, observing the given latitude at the top, and the signs and degrees of longitude down the left-hand side; or the degrees of latitude down the right-hand side — for the common area will give the equation of declinations. This addendum-of-declination of the ecliptic point is to be added, if the sign and latitude are of the same region, kind, or affection — that is, if the latitude be northern, and the declination also northern; but to be subtracted if they be of contrary affections; and you will have the declinations of the star.

Third. From Table 35 [Margin: Pag. 43.] likewise excerpt the prosthaphaeresis of right ascension, to be added or subtracted to the right ascension of the ecliptic point, as the conditions explained at the top — or in the foot of the table — shall require; and thus the right ascensions of the star are formed.

Example. Let the southern latitude of Spica, or of Jupiter, be given as 2°, and the longitude as Libra 18°. For at this degree of Libra the southern declination, by Table 26, is 7°4'47" [recte: per context]; and indeed the southern latitude — since therefore the sign and latitude are of the same region — to the southern latitudes 2° (and to the region of Libra 18°, with the added 2° of latitude) there is added a prosthaphaeresis of 7°4'47" [recte: per context — this seems to repeat the declination value] [?], making the southern declination of Spica 8°15'47". Then take the right ascension of Libra 18° by Table 28, which is 196°35'31"; and the southern latitude of Spica, or Jupiter — assumed as 2°, also southern — likewise gives a prosthaphaeresis to be added; this, in the left-hand part of the table,

opposite Libra 18° , and under the latitude (south) 2° , is $46'$. Therefore the right ascension of Spica, or of Jupiter, will be $197^\circ 21' 31''$.

There follow the Precepts for the Use of the Tables — of the Third Part, or On the Motions of the Sun and Moon.

Precept 55. *To find the true place of the Sun on the ecliptic, and its anomaly, for a given time after the epoch of the common era of Christ.*

First. If the given time is apparent, convert it into mean time by Precept 16.

Second. From Table 36, collect the mean motion of the Sun, and of the Sun's apogee, [Margin: Pag. 44.] corresponding to the epoch; then for the radix immediately preceding the given year; and for the complete years after that epoch; and likewise for the complete months of the common year (using these as complete, whatever the character of the current year); and for the days given — always using them as complete; and finally for the hours, and the minutes of an hour after noon — and collect the motions into one sum: separately, that is, the mean motion of the Sun, and separately the mean motion of the apogee.

Third. Subtract the motion of the apogee from the mean motion of the Sun (assuming, when the subtraction cannot be made, that 12 signs are taken in addition); and there will remain the simple anomaly of the Sun, namely its distance from the apogee.

Fourth. With the simple anomaly of the Sun, excerpt from Table 38 the equation to be subtracted, [Margin: Pag. 46.] in the prior semicircle of anomaly — that is, when the signs of anomaly are at the top of the table — and the equation of those, the degree being down the left-hand side; or to be added in the latter part, that is, when the signs are at the foot of the table — the degree being down the right-hand side; whether it please you that the figure be circular or elliptical. And by this equation correct the mean motion of the Sun, and likewise the simple anomaly of the Sun; for there will come out from thence the true place of the Sun on the ecliptic, and hence the equated anomaly of the Sun.

Example.

The true place of the Sun is sought for the year of the epoch of Christ 1661, September 23, at $1^\circ 1'$ [i.e. $1^{\text{h}} 1^{\text{m}}$] after noon. [Margin: Pag. 8.] *First*, then, since the Sun will then be in the first degree of Libra, by the Table of Temperaments, with the double subtraction of $4^\circ 23'$ to be subtracted [recte: $4' 23''$], the mean time will be $1^\circ 26'$ [i.e. $1^{\text{h}} 26^{\text{m}}$] after noon; and the calculation will then proceed thus:

Left table — Mean motion of the Sun, and of the apogee, for 1661 September 23:

Anni 1600	Mot. ☉ Med. ab □				Apog.			
	— Sign.	Gr.	'	"	— Sig.	Gr.	'	"
Radix	9	10	4	35	3	7	39	8
An. 60	0	0	27	36	0	1	2	[blank] [?]
Augu sti	7	29	30	44	0	0	0	41
D. 23	0	22	40	12				
H. 1	0	0	2	28				
M. 26	0	0	1	4				
Sum ma	6	2	46	39	3	8	41	54

Second, therefore, the apogee's signs being subtracted — 3 signs 8°41'54" — from the mean place of the Sun, there is left the simple anomaly of the Sun, and thence will be had the equation of each, as below.

	Sig.	Gr.	'	"
Solis Medius (Sun's mean place)	6	2	46	39
Apogei motus (apogee's motion)	3	8	41	54
Anomalia simplex (simple anomaly)	2	24	4	45

	Sig.	Gr.	'	"
Aequatio subtracta, in forma circulari (equation subtracted, in circular form) ☉	1	58	49	
Restat Verus locus ☉ (the true place of the Sun remains)	6	0	47	50
Et Anomalia coaequata (and the equated anomaly)	3	6	43	5

The Sun will then be in the first degree of Libra, not yet complete — distant from that point by $47'50''$ — and distant from the true apogee by 3 signs $6^{\circ}43'5''$; or, resolving the signs into degrees, it will be distant from the apogee by $96^{\circ}43'5''$.

A Caution concerning the Julian and Gregorian Style.

In the example given we have used the radix for the year 1600 according to the form of the Gregorian year; but if we wished to use the Old Style, the Julian, the radix for the year 1600 in the Old Style — congruent with which, in Table 36, the mean place of the Sun has the signs 9, $19^{\circ}55'58''$ — would have to be applied.

Precept 56. *To find the true place of the Sun for a given time before the epoch of Christ.*

The apparent time being reduced to mean time by Precept 16: if the given year before Christ is one of the hundreds [centuries] themselves, or one of the thousands, use the radix noted for that century, or chiliad [thousand], in Table 36; and then there is no need to collect the mean motions for the years from the

radix distinctly, since the years before Christ in the said table are reckoned complete — namely, numbered upward toward the beginning of the world, not as current years (which would be the case if they were numbered downward toward the epoch of Christ) — nor are they complete, except in the case where the given time was the noon of the last day of December, or after the noon of that same last day of December. But the remainder, for the months, days, hours, and minutes, must be carried out as in the preceding Precept.

But if the given year is not one of the hundreds, or thousands, the number of the completed years must be subtracted from the next expanding [larger] hundred [century], by which the mean motions are to be sought; and the radix to be applied will be that of the century, or millennium, which next precedes — the one that is next greater; and the rest is to be done entirely as in Precept 55.

Example One.

The true place of the Sun is sought for the year 200 before Christ, September 23, at the equated hour 1°26' [i.e. 1^h26^m] after noon. The true place of the Sun at Bologna will then be as follows in the form of the calculation:

Right table — Mean motion of the Sun, and apogee, for 200 BC:

Ante Chr. —	Motu s ☉ —					Apog.			
Radix	Sign.	Gr.	'	"	Sig.	Gr.	'	"	
Anni 200	9	6	8	1	2	6	36	48	
Augu sti	7	29	30	44	0	0	0	41	
D. 23	0	22	40	12					
H. 1	0	0	2	28					
M. 26	0	0	1	4					
Sum ma	5	28	22	29	2	6	37	29	
Ano malia ☉ simpl ex	3	21	45	0					

Ante Chr.	Motu s ☉	Apog.						
Radix	Sign.	Gr.	'	"	Sig.	Gr.	'	"
Aeq.- subtr . ☉	0	1	51	13	0	1	51	13
Veru s ☉	5	26	31	16				
Ano malia ☉ coae quata					3	19	53	47

Example Two.

The true place of the Sun is sought for the year 145 before Christ, September 23, at the hour 1°26' [i.e. 1^h26^m] equated, after noon, at Bologna. Subtracting 45 years from 100 years, there remain 55 years, completed in descent toward the epoch of Christ; the form of the calculation is then as follows:

Table — Mean motion of the Sun, and apogee, for 145 BC:

	Motu s ☉	Apog eus						
Radix	Sign.	Gr.	'	"	Sig.	Gr.	'	"
Anni 200	9	6	8	1	2	6	36	48
Anni 55	11	29	40	58	0	0	56	54
Augu sti	7	29	30	44	0	0	0	41
D. 23	0	22	40	12				
H. 1	0	0	2	28				
M. 26	0	0	1	4				
Sum	5	28	3	27	2	7	34	23

Radix	Motus ☉				Apogeeus			
	Sign.	Gr.	'	"	Sig.	Gr.	'	"
ma								
Ano malia ☉ simpl ex	3	20	29	4				
Aeq.- subtr . ☉	0	1	52	12	0	1	52	12
Veru s ☉	5	26	11	15				
Ano malia ☉ coae quata					3	18	36	52

Parsing notes: The three computation tables share the structure radix + addends (years, August, days, hours, minutes) summed to a total, followed by the anomaly/equation block. Some apogee-column cells are blank in the source where only the Sun's column carries an entry; these are left blank. The "An. 60" apogee seconds cell in the left table is illegible and flagged.

Precept 57. *To find the parallax of the Sun in the circle of altitude.*

It is presupposed as known whether the parallax is the maximum, or at least near the maximum; or near the mean; or near the [Margin: Pag. 45.] minimum distance from the Earth — for in Table 37, in the column for the said distance, or assigned to the signs of anomaly, and opposite the degrees of the altitudes given, you have the parallax of the Sun, in which they have greatly exceeded — Ptolemy, Copernicus, and Tycho [Brahe].

Example.

In the example of Precept 55, the anomaly of the Sun was found to be signs 3 and about 7° [recte: per context]. Let the altitude of the Sun above the horizon be

given as $45^{\circ}29'$. For in Table 37, the small column corresponding to signs III and to the region [Margin: Pag. 45.] of 45° and 29° [recte: opposite Gr. 45 & 29], you will have a parallax of $11'10''$, using proportional parts.

Precept 58. *To find the distance of the Sun and Moon from the center of the Earth, but in semidiameters of the Earth — with the horizontal parallax of the Moon, and the hourly motion of each — and indeed to find the true motion.*

With the anomaly of the Sun, known by Precept 56, and in Table [Margin: Pag. 47.] 38, it shows at once, opposite, down the right-hand side, the distance of the Sun from the center of the Earth, in parts such as the radius of the solar orbit is 100000; then, in semidiameters of the Earth, both the horizontal parallax, and the hourly motion of the Sun. But these three conditions of the Moon — the anomaly of the Moon will show, when it has been noted by Precept 61, or otherwise. In the distances, however,

of the Sun, although for the most part we may use hypothesis 1, concerning which see Book 1, chapter 13 of the *Astronomia Reformata*. But if hypothesis 2 should nonetheless displease you, hypothesis 1 is set out in the same place, chapter 7. From this you will be able, by the same Table 39, to find the distances of the Sun in either of the two ways.

Example.

Let us suppose that both the Sun and the Moon have an anomaly of 95 degrees; for in Table 39 the said conditions of the luminaries stand thus:

		Distance to the radius 100000
Distance to the radius 100000	☉ Sun	99844
	☾ Moon	99905
In semidiameters of the Earth	☾ in 1st hypoth.	7289
	☾ in 2nd hypoth.	6543
	☉ Sun	60 · 57
Horizontal parallax	☉ Sun	$0^{\circ} \cdot 28' \cdot 16'''$
	☾ Moon	$56' \cdot 26'' \cdot 0'''$

Distance to the
radius 100000

True hourly motion	☉ Sun	2' · 29"
	☾ Moon	33' · 11"

Parsing notes: The "In semidiameters of the Earth" block gives the Moon's distance under each hypothesis (7289, 6543) and the Sun's distance as 60 semidiameters 57 (minutes/parts). The horizontal-parallax row for the Sun reads 0°·28'·16"; for the Moon 56'·26". The hourly-motion row reads Sun 2'·29", Moon 33'·11".

Precept 59. *To determine the apparent semidiameters of the Sun and Moon at conjunctions and oppositions, and the size of the Earth's shadow at the passage of the lunar body through the shadow.*

Once the anomaly of the luminaries has been equated, look in Table 39 for the apparent semidiameters of the Sun and of the Moon corresponding to the anomaly of either planet. As for the shadow's semidiameter, which has been equated against the Moon's anomaly: bear in mind that you have the apparent semidiameter of the shadow-disk only on the supposition that the Moon is passing through the shadow at its apogee. Therefore you must always add to the shadow's semidiameter the variation drawn from the Sun's anomaly and from the Moon's apogee, so that the result comes out corrected.

Example.

	Gr.	'	"
Let the anomaly be (of the) Sun	95	0	0
(of the) Moon	120	0	0
Then the apparent semidiameter will be ☉ Sun		15	47

	Gr.	'	"
(and)		15	44
Apparent) Moon			
Shadow at the Sun's apogee		45	44
Variation		0	43
The shadow's semidiamet er therefore, corrected		45	1

Parsing notes: degrees column applies only to the two anomaly rows (Sun 95°, Moon 120°); the semidiameter/shadow rows give minutes and seconds. Shadow at the Sun's apogee = 45'44"; variation = 0'43" (added); corrected shadow semidiameter = 45'1" — note 45'44" + 0'43" = 46'27", so the printed "corrected" value 45'1" may instead reflect subtraction or a different combination [?].

Precept 60. *To investigate the refractions of the luminaries and of the fixed stars, and through this to convert the apparent altitude of these bodies into the true altitude, or the true into the apparent.*

[Margin: Pag. 47.]

In Table 40 I have set out the refractions for the temperate zone of these bodies, since I have observations more suitable for that zone than for the others — chiefly for the frigid zones, whose measurement I have found dissimilar and inconsistent because of the dissembled refractions of the other zones. Why my table differs somewhat from the Tyconic one is treated sufficiently in Book 1, chapter 14 of the *Astronomia Reformata*. And how it differs is shown there sufficiently. With these things laid down beforehand, inspect the following Rules.

The Moon's observed altitude is converted into the true by subtracting the refraction which it has, the parallax, and the residue; or, if it is below the horizon, by adding the parallax itself to the Moon's observed altitude — on which see Precept 71.

The Moon's true altitude is converted into the apparent by subtracting the parallactic refraction, and by adding the residue to the true altitude.

The observed altitude of the Sun, of the remaining planets, and of the fixed stars is converted into the true by subtracting from the observed altitude the simple refraction. The true altitude is converted into the apparent by adding the true refraction to the apparent.

[Margin: 14]

Precept 61. *To find the Moon's true place in its own proper orbit at a given time within a new moon, or a full moon, together with the Lunar Anomaly.*

[Margin: Pag. 48.]

Having accommodated the time to the Bologna meridian and equated it as above (as in the case of the Sun, Precept 55) — or, if it be before Christ, by Precept 51 — collect from Table 41 the Radix [Margin: Pag. 48.] next preceding the given year, the Moon's mean motion from the beginning of the years, and likewise the Anomaly for the years, the months, the days, the assigned day, the hours, and the scruples [seconds of time]; sum them up, and reduce them into one total, the mean motion separately and likewise the Anomaly separately. Then go to Table 42, and in it look for the Anomaly's signs at the top, and the degrees [Margin: Pag. 50.] of the signs of the Anomaly in the left-hand margin if descending; or the Anomaly's signs at the foot, and the degrees of those signs in the right-hand margin if ascending — for in the common cell you will find, using the proportional part if need be, the equation to be subtracted from, or added to, both the mean motion of the longitude and the Lunar Anomaly, just as the headings at the top will indicate *Subtrahendam* [to be subtracted] or in the foot *Addendam* [to be added]. And you will have the Moon's true place, that is, the place first equated (which suffices for conjunctions), and the Lunar Anomaly equated together with it.

Example.

In the year of Christ 1661, on the 23rd of September, at 1 hour 26 minutes after midday equated, at Bologna [Margin: Pag. 48.], the Moon's true place is sought. The computation is to be set out thus:

	Motion from γ				Anomaly			
Radix	Sig.	Gr.	'	"	Sig.	Gr.	'	"
Years 1600	7	25	19	20	0	7	27	9
Years 60	1	10	41	19	3	29	6	4
August complete	10	21	51	50	9	24	47	26
Day 23	10	3	3	25	10	0	29	41
Hour 1	0	0	32	56	0	0	32	40
Min. 26	0	0	14	16			14	9
Sum Equation to subtract	6	1	43 13	6 15	0	2	37 13	9 15
Therefore True place	6	1	29	51	0	2	23	54
					& Anomaly equated			

Parsing notes: two parallel blocks — the Moon's mean motion from Aries (☉) on the left, the Anomaly on the right, each in Sig./Gr./". The "Min. 26" Anomaly degree-cell is blank in the source (only 14'9" shown). The equation 13'15" is subtracted from both columns. Result: true place 6^s 1° 29' 51"; Anomaly equated 0^s 2° 23' 54".

The Moon, then, was in 1° 11' of Libra [in gr. 1 Librae], the sign not yet complete [reading the true place 6 signs 1° 29' 51" from Aries = Libra 1°29'51"].

Precept 62. *To find the true place of the Moon's North Node at a given time, and the greatest Latitude of the Moon.*

[Margin: Pag. 48.]

Having accommodated the time to the Bologna meridian and equated it as above, as in Precept 55 or 56, collect from Table 41 the mean motion of the Node Ω for the given years, months, and likewise days, hours, and scruples [seconds]; sum them up, taking the Radix of the Node's mean motion Ω [Margin: Pag. 48.] next preceding, and you will have the mean motion of the Node Ω . Then, with the Sun's true place found by Precept 55 or 56 (and the Moon's by Precept 61), collect the Moon's distance from the Node, and with this — or (if it exceed six signs) the distance of the Moon from the point opposite the Sun [Margin: Pag. 50.] — enter Table 43. For in it, with the signs of the distance inspected at the top, and the degrees in the left-hand margin, or with the signs at the foot and the degrees in the right-hand margin, you will have in the common cell the equation of the Node Ω to be subtracted from, or added to, the Node's mean place Ω , so that you may have the true; and on that occasion the table will give you the equation of the eccentricity of the Node Ω , by which you must assign the greatest Latitude for the following Precept.

Example.

In the year of Christ 1661, on the 23rd of September, at 1 hour 26 minutes after midday equated, at Bologna, the true place of the Node Ω is sought; it will be found thus:

[Margin: 15]

	Sign.	Gr.	'	"
Years 60	2	10	30	40
August complete	0	12	52	5

	Sign.	Gr.	'	"
D. 23		3	13	5
H. 1				8
M. 26				5
B. Sum	3	4	35	58
Radix Year 1600	9	11	21	50
B. sum subscribed	3	4	35	58
Remains the mean place of the Node Ω	6	6	46	52

[Margin: Pag. 48.]

Then, because by the Example of Precept 55 and Precept 62:

	Sign.	Gr.	'	"
There was \odot the Sun's true place	6	0	47	50
Ω the Node's true place	6	1	29	50
Distance \curvearrowright from Ω	0	0	42	0
Therefore the equation of the Node Ω to be subtracted	0	0	2	41
The Node's	6	6	44	11

	Sign.	Gr.	'	"
true place Ω				
And the greatest Latitude ∽	0	4	58	30

[Margin: Pag. 50.]

Precept 63. *To find the Moon's true Latitude, and its Argument.*

[Margin: Pag. 51.]

With the true places of the luminaries and of the Node Ω supposed, as computed for the given time by Precepts 55 (or 56) and 61, and the greatest Latitude of the Moon ∽ repeated through Precept 62: subtract the true place of the Node Ω from the true place of the Moon ∽ assumed, and if the signs are more than 12 you will have the Argument of the Moon's Latitude equated, that is, the *Argumentum Latitudinis*. Then in Table 44 look for its signs at the top, and the degrees of the signs in the left-hand margin; or the signs at the foot and the degrees in the right-hand margin (for the region of the degrees is below the signs); or, if the signs of the Argument be above, or under the heading of the greatest Latitudes, you will find the desired Latitude of the Moon, North or South, as the headings of the Table indicate.

Example.

Now in the Examples of Precepts 61 and 62 the places of the Moon ∽ and Node Ω were as below:

	Sign.	Gr.	'	"
∽ the Moon's true place	6	1	29	51
Ω the Node's true place	6	6	44	11
Therefore the Argument of Latitude	11	24	45	40

	Sign.	Gr.	'	"
The greatest Latitude was	0	4	58	30
Therefore the true ☽ South Latitude	0	0	26	55

I have added the 12 signs to the Moon's place ☽, so that the place of the Node ♁ might be subtracted from it.

Precept 64. *To reduce the Moon's True place from the Orbit to the Ecliptic, and from the Ecliptic to the Orbit.*

[Margin: Pag. 52.]

Because the Moon's orbit is inclined to the Ecliptic, in order to know the Moon's place on the Ecliptic — namely, the point which the circle of Latitude, drawn through the center of the Moon, determines on the Ecliptic — you have it through Precept 63. The Argument of Latitude, and its signs, look for at the top of Table 45, and the degrees; and the signs in the left-hand margin, and the degrees in the foot; on the right, for in the common cell you have the Reduction of the Moon's place ☽ to the Ecliptic, to be subtracted from, or added to, the Moon's place in the orbit, as the headings above, or below, indicate — and with these headings the opposite must be done, if the Moon's place is to be reduced from the Ecliptic to the Orbit.

[Margin: 15 — right column]

Example.

The Moon's true place in the orbit, by the example of Precept 61, and the Argument of Latitude by the example of Precept 62, were as below:

	Sign.	Gr.	'	"
☽ the Moon's true place in the orbit	6	1	29	51

	Sign.	Gr.	'	"
Argument of Latitude	11	24	45	40
Reduction to be added			1	16
The true place in the Ecliptic	6	1	31	7

Precept 65. *To investigate the Moon's True place outside the conjunctions.*

[Margin: Pag. 53.]

Collect, by Precept 55 (or 56), the Sun's true place; and by Precept 61, the Moon's true place in the orbit, with its Anomaly first equated. Then subtract the Moon's true place from the Sun's true place (with the signs assumed); if need be, you will have the Moon's true distance from the Sun. But should this exceed six signs, look for the distance of the Moon from the point opposite the Sun above the semicircle, with which distance you should consult Table 47, by seeking the signs of the distance at the top when it is less than three signs, and in the left-hand margin the degrees of the signs equated. But if the signs are more than three, look for the distance at the foot of the Table, and the Anomaly's signs and degrees in the right-hand margin; for in the common cell you have the Last equation of the Moon, composed of the equation of eccentricity and the variation; and add it to the Moon's place first equated, or Subtract it, as the headings at the top or foot of the Table indicate, or in the middle letter A or S indicate. Let Argolus [Argoli], from Astrological Observations, reject the Tyconic Variation.

Example.

In the year 1661, September 26, at 1 hour equal after midday, at Bologna, the Moon's True place in the Orbit is sought; it will be investigated thus:

	Motio n ☽				Apog ee			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
☽ Year 1600	9	10	4	35	3	7	39	8
Years	0	0	27	36	0	1	2	5

	Motion				Apogee			
60								
August complete	7	29	30	44	0	0	0	41
D. 26	0	25	37	37	0	0	0	3
H. 1	0	0	2	28				
Sum	6	5	43	0	3	8	41	57
Anomaly					2	27	1	3
Equation to subtract	0	1	59	32				
True place	5	3	43	28				
Year 1600	7	25	19	20	0	7	27	9
Years 60	0	1	10	41	19	3	29	6
August complete	10	21	51	50	9	24	47	26
D. 26	11	12	35	11	11	9	41	22
H. 1	0	0	32	56	0	0	32	40

	Motion ☾				Apogee			
Sum	7	11	0	36	1	11	34	41
Equation to subtract	0	0	58	19	0	0	58	19
☉ Sun's place & Anomaly first equated	7	10	36	22	1	10	36	22
Distance ☉ from ☾	1	6	18	50				
Equation, last, to subtract	0	0	47	0				
☾ the Moon's Last place & equated	1	5	31	50				

Parsing notes: the upper block computes the Moon's motion (left) and its apogee/anomaly (right), yielding the Moon's true place $5^s 3^m 43^s 28''$. The lower block computes the Sun's place and anomaly ($7^s 10^m 36^s 22''$ / $1^s 10^m 36^s 22''$). Final rows: distance \odot from ☽ = $1^s 6^m 18^s 50''$; last equation to subtract $47^m 0''$; Moon's last place equated = $1^s 5^m 31^s 50''$. The " \odot Sun's place & Anom. first equated" line carries $7^s 10^m 36^s 22''$ in the motion column and $1^s 10^m 36^s 22''$ in the anomaly column; several cross-column values are tightly set and should be verified at collation [?].

[Margin: 16]

Precept 66. *To inquire the Moon's Hourly Motion from the Sun on the days of full moons and new moons.*

[Margin: Pag. 56.]

With the Moon's Anomaly first equated by Precept 61, consult Table 48, by seeking the Anomaly's signs at the top, and the signs in the left-hand margin, or the signs at the foot, and the degrees of the signs in the right-hand margin; and in the common cell you have the true motion, that is, the Zodiacal interval, which in one hour the Moon completes [Margin: Pag. 56.] by moving away from the Sun. Because in one hour the Sun completes the motion of the full moon or new moon, or in the other column you have the hourly interval which it completes within 12 hours before, or after, the new moon, or the full moon.

Example.

Renewed, the Moon's Anomaly equated by Precept 61 was of Sign 0, gr. 2, 23', 54". Therefore, by Table 48, the Moon's Hourly Motion, the hour of that New moon, is 27' 44".

[Margin: Pag. 58.]

Precept 67. *To define the True New moon, or Full moon, at the given time most nearly to it, that is, within 12 hours, exactly.*

If, having computed the Sun's and the Moon's true motion by Precepts 55 and 61, the Moon should not differ from the conjunction, or opposition with the Sun, by more than 6 or 7 degrees, then inquire by Precept 66 the Moon's Hourly Motion; with this hourly motion, by looking in Table 49 at the top, find in the left-hand margin the degrees and scruples [seconds] by which the Moon precedes the Sun in the Zodiac, or follows it in the Zodiac; and the Scruple [seconds] to be added to the time of the nearest new moon, or full moon, if the Moon precedes the Sun, or its Opposition; and to be subtracted, if it follows.

[Margin: Pag. 56.]

Example.

From what has been said in the Example of Precepts 55 and 61, the Sun's true place was Sign 6, $0^{\circ}47'50''$; the Moon's Sign 6, 1, 29', 51". The Moon therefore precedes the Sun by $42'1''$. The hourly motion, by Example of Precept 66, was $27'44''$. Therefore, in Table 49, under the headings of the Hourly motion $27'$ and $28''$, using the proportional part you will see Minutes $42'1''$; to the time given there responds Hour $1'26'$; which the New moon would yield at $7'$ before Midday on the 23rd day of September of the year 1661.

[Margin: Pag. 56.]

Precept 68. *To find the Moon's Distance from the center of the Earth at conjunctions, both greatest and least, and the eccentricity.*

[Margin: Pag. 57.]

The Moon's Distance from the Earth at conjunctions I have taught to find by Precept 58. But outside the conjunctions, the Anomaly of the eccentricity is necessary, which equates the doubled distance — namely, that which the Moon's elongation from the Sun gives. With the elongation of the Moon from the Sun looked for at the top of Table 50 in the left-hand columns, you will find by going down, in the right-hand columns, the eccentricity of the Lunar Orbit both in parts of which the Radix of the Orbit is 100000, and in semidiameters of the Earth at greatest. Then in the remaining columns the Moon's greatest Distance, and the minimum at the syzygies [extra syzygias]; in either kind you have the part expressed according to our Lunar Theory set out in Book 3 of the *Astronomia Reformata*.

Example.

In the case of Precept 65, we had the Moon's elongation from the Sun Sign 1, degree 6, 19', which resolved into degrees makes $36^{\circ}19'$; and this doubled makes the Anomaly of the eccentricity $72^{\circ}38'$; with this in Table 50 you have the underwritten interval, using the proportional part:

[Margin: Pag. 57.]

	Of which the radius is 100000	Semidiameters of the Earth
Eccentricity \curvearrowright	8436	4 · 34
Distance, Maximum \curvearrowright	108436	65 · 34
Distance, Minimum \curvearrowright	91568	56 · 24

Parsing notes: three rows in parts of radius 100000 and in semidiameters of the Earth (degrees·minutes form): eccentricity 8436 = 4 sem. 34; maximum distance 108436 = 65 sem. 34; minimum distance 91568 = 56 sem. 24.

Precept 69. *To inquire the Moon's Distance from the center of the Earth outside conjunctions.*

[Margin: Pag. 57.]

With the Anomaly of the eccentricity (which you learned to find by the preceding Precept), that is, the doubled elongation of the Moon \curvearrowright from the Sun, looked for at the top of Table 51; and with this and the Anomaly of the equated Orbit in the left-hand columns, you will at once find the Moon's distance from the Earth in semidiameters of the Earth.

Example.

In the Example of Precept 65, the Moon's elongation from the Sun was Sign 1, gr. 6, 19'; this doubled gives the Anomaly of the eccentricity gr. 72, 38'. But the Anomaly of the Equated Orbit was Sign 1, gr. 10, 36', that is, gr. 40, 36'; to these in Table 51 corresponds the Distance \curvearrowright from the center of the Earth, semidiameters of the Earth 64, 20'.

Precept 70. *To inquire the Moon's apparent Semidiameter and Horizontal Parallax outside conjunctions.*

[Margin: Pag. 57.]

Look, by Precept 69, for the Moon's Distance from the center of the Earth; and with this in Table 52 you immediately have the Moon's apparent semidiameter and the Horizontal Parallax of the Moon.

Example.

In the Example of Precept 69, the Moon's distance from the Earth was semidiameters of the Earth 64, 20'; to this Table 52 exhibits the Moon's apparent semidiameter 14', 39". And the Horizontal Parallax 53'·27".

Precept 71. *To investigate the Moon's Parallaxes in the circle of True Altitude.*

[Margin: Pag. 58.]

This Parallax is twofold, namely 53; and to know it for this it is necessary to know the Moon's Horizontal Parallax by Precept 58 at conjunctions; and by Precept 70 outside conjunctions: for under the heading of Table 53 [Margin: Pag. 58.] at the top you have the region of the degrees of the True Altitude opted for. The other Table, which is 61, you have at the top of the Moon's [Margin: Pag. 71.] Distance from the Earth in semidiameters of the Earth, under which is the region of the degrees of the True Altitude — you have the desired Parallax.

Example.

Let the Moon be high above the Horizon by gr. 35, when in the Example of Precept 58 the Moon's Distance from the Earth was found to be 60·57'; and the Horizontal Parallax 56'·26"; for in the region of degree 35 in the left-hand margin you will find the Horizontal Parallax stated in Table 53; or, under the said distance from the Earth in Table 61, you will find the Parallax of degrees 46'·40". But if you wish the Parallax of the Observed Altitude, look for it in the same tables, using the Observed Altitude as if True, and look for the Parallax that agrees with it, and add it to the True altitude; or finally, with this aggregate look for the same Parallax there, for it agrees with the Observed Altitude.

So in the same Example of the Observed altitude gr. 35, the Parallax agrees with 46'·40"; this added to gr. 35, gives degrees 35·46'·40", to which in Table 61 corresponds the Parallax 46'·10". This therefore is that which agrees with the Moon in the Observed altitude gr. 35.

Precept 72. *To find the Mean New moons, and Mean Full moons of a given Year and Month, through the Epacts.*

[Margin: Pag. 60.]

Collect first from Table 54 the Radix next preceding [Margin: Pag. 60.] the Epacts, and the Epacts corresponding to the years thence elapsed and complete, and likewise to the months complete — namely the month preceding the given month — and reduce these into one sum; from which subtract, by the greater number of the Revolutions of the New moons, the Mean New moon, in the left-hand part of

the same Table 54, at the foot; and the days of the given month, with the Hours and Scruples after midday, by which the Mean New moon, and Full moon...

the mean New Moon by the Julian calendar, but by the Gregorian calendar one must add 10 days for this whole century, and more for other centuries, according to what was said in Precept 19.

Example.

The mean New Moon of the year 1661 of Christ is sought, in the month of September; the computation is to be arranged by the method written out below from Table 54.

[Margin: Pag. 60.]

	D.	H.	I	II
Radix of the year 1600	6	7	46	59
60 years	3	7	10	40
Completed August	6	18	7	35
Sum	16	9	5	14
Conjunctio nal revolutions [Revolution es Coniunct.] □	29	12	44	3
Subtract	16	9	5	14
There remains the mean □ of September	13	3	38	49
But by the Gregorian calendar	23	3	38	49

	D.	H.	I	II
Revolutions	44	7	6	5
Subtract likewise	16	9	5	14
There remains the mean ☾ of October	27	22	0	51
But by the Gregorian calendar October	7	22	0	51

[Margin: Argol's error.]

This Ecliptic New Moon, Argoli represents in his Ephemerides at Rome; but falsely, for the southern latitude, with the parallax adjoined, frees the Sun at Rome from any eclipse.

Precept 73. Given the time of the mean New Moon, or of the Full Moon, to find the moment of the true New Moon, or Full Moon.

For the given time of the mean New Moon, collect by Precepts 55 and 61 the true places of the luminaries; and if they are found in the same zodiacal degree and minute, then the mean Full Moon coincides with the true; in this way they are 180 degrees apart between themselves, and the mean and true Full Moon are celebrated at the same moment. But if the Moon precedes or follows the place of conjunction, or of opposition with the Sun by some degrees or scruples, then by Precept 66 find the Moon's equated anomaly; and by it divide the difference between the place of the Sun and the Moon in conjunction, or between the place of the Moon and the place opposite to the Sun. For as often as it gives hours and scruples, so much must be added to the time of the mean syzygy if the Moon has not yet reached the Sun, or subtracted if it has already passed beyond it. For this purpose, however, the moment requires that the places of the luminaries be collected again, and if need be, the exact moment of the New Moon or Full Moon be determined again through the Moon's hourly motion.

Example of the Full Moon.

From the example of the preceding Precept, the year 1661 of October by the Gregorian calendar is given, with the mean Full Moon at Bologna after midday at hour 22, 0 minutes, 51 seconds; for which time the computation of the luminaries stands thus:

	Sig.	Gr.	I	II
☉ Mean place of the Sun	6	17	25	18
Simple anomaly of the Sun [Anomalia Solis simplex]	3	8	43	17
Equation to be subtracted [Aequatio subtrahenda]	0	1	57	54
☉ True place of the Sun	6	15	27	24
☾ Mean motion	0	17	29	15
Mean anomaly of the Moon	6	16	3	58
Equated anomaly of the Moon	6	17	29	6
☾ True place of the Moon	0	18	54	24
Equated	6	17	29	6

	Sig.	Gr.	I	II
anomaly of the Moon				
Difference of place ☉ & ☾	0	3	27	0
Hourly [motion] of the Moon from ☉	0	0	34	0
Time to be subtracted [Tempus subtr.]	H.	6	5	18
Truer therefore is the time of the Full Moon [Verius igitur Tempus Plenilun.]	H.	15	55	33

It is therefore necessary, for this very time of the truer Full Moon — namely at hour 15, 55 minutes, 33 seconds — to repeat the calculation, which will turn out as follows:

	Sig.	Gr.	I	II
True place of the Sun	6	15	12	18
Equated anomaly of the Moon [Anomalia ☾ aequata]	3	6	30	17
True place of the	0	15	20	7

	Sig.	Gr.	I	II
Moon				
Equated anomaly of the Moon [Anomalia Lunae aequata]	6	14	36	31
Excess beyond \odot [Excessus \odot vltra \odot]	0	0	7	49
Hourly [motion] of the ζ from \odot	0	0	33	18
Time to be subtracted [Tempus demendum]	0	0	14	6
True Full Moon [Verum Plenilunium]	H.	15	41	27
Apparent time [Tempus apparens]	H.	15	32	37
And then the corrected place of the ζ	0	15	12	18
And the equated	6	14	29	0

	Sig.	Gr.	I	II
--	------	-----	---	----

anomaly

Precept 74. To foreknow whether the Full Moon, or the New Moon, is Ecliptic.

The first method, though not so secure from some small error, is fully accomplished by Precepts 62 and 63, by which is found the argument of latitude, or the Moon's distance from the nearer Node; whether it lies farther off than the Ecliptic Limits require, or whether it lies within those limits. [Margin: Pag. 60.] For at once the terms of a possible eclipse appear, since otherwise the very Table 55 reveals immediately, by the argument with which the Moon is nearer the Node, by how much it is distant: if it lies farther off, no eclipse is possible; but if it lies within those terms, an eclipse is possible.

Example.

In the year 1661, October 7, at hour 15, 32 minutes, 37 seconds, when the true Full Moon occurred — the place of the Node Ω being correctly computed — will be at Sign 6, degree 6, 0 minutes, 29 seconds. The Moon in \square at degree 15, 12 minutes, 18 seconds, distant from the Node Ω at Sign 6, degree 9, 11 minutes, 49 seconds; therefore in the Node there will be the necessary terms of a Lunar Eclipse, since the Moon is nearly at Perigee at degree 12, 53 minutes; but the Moon is less distant from the Node.

The second method, however, is more secure: for since the apparent semidiameter of the Sun \odot , and of the terrestrial Shadow \mathfrak{U} corrected by Precept 63, the true latitude of the Moon: for if this latitude is equal, or greater than the aggregate of the semidiameters of the Sun \odot and of the Shadow, there will be no eclipse; if less, some eclipse will occur.

Example.

In the year 1661, October 7, at hour 15, 32 minutes, 37 seconds, after midday at Bologna, the Lunar conditions stand thus:

	Sig.	Gr.	I	II
☾ True place of the Moon	0	15	12	18
Ω True	6	6	0	29

	Sig.	Gr.	I	II
place of the Node				
Argument of latitude [Argumentum latitudinis]	6	9	11	48
Distance from the Node \wp [Dist. ab \wp]	0	0	0	0
Maximum latitude [Latitudo Maxima]	0	4	58	30
True latitude of the Moon [Latitudo Vera Lunae]	0	0	47	40
Equated anomaly ζ [Anomalia ζ aequata]	6	14	29	0
Anomaly of the Sun [Anomalia Solis]	3	6	30	18
Semidiameter of the Shadow [Semidiameter Vmbra]	0	0	48	30
Variation to be	0	0	0	44

	Sig.	Gr.	I	II
subtracted [Variatio auferenda]				
Corrected semidiameter of the Shadow [Semidiam. Vmbra correcta]	0	0	47	46
Apparent semidiameter [Semidiam. ☉ appar.]	0	0	16	8
Aggregate of the semidiameters [Aggregatum semidiametrorum]	0	0	63	54

The true latitude of the Moon is therefore much less than the aggregate of the semidiameters of the Sun ☉; and so a Lunar Eclipse will necessarily occur.

Precept 75. To define the digits of a Lunar Eclipse, or its quantity.

Since the disc of the luminaries is commonly reckoned in its apparent diameter at a magnitude of one foot, and the foot, in the Roman manner, is divided into 12 inches [uncias], or eclipse digits one finger thick...

therefore the quantity by which the Lunar disc is to be eclipsed by the Solar [Shadow] is usually expressed in digits, and twentieth parts of a digit. This is defined as follows. Subtract the true latitude of the Moon from the aggregate of the semidiameters of the Moon and of the Shadow corrected; for the remainder will give the deficient scruples; then by doubling the apparent semidiameter of the Moon, and finding the deficient scruples opposite in the front of Table 57; and

opposite them in the left-hand side, you will have the Eclipse Digits with their scruples.

Example.

In the preceding Full Moon, the semidiameter of the Moon was 16 minutes, 8 seconds. Therefore the diameter is 32 minutes, 16 seconds. And the aggregate of the semidiameters of the Moon and of the Shadow corrected is 63 minutes, 54 seconds; the true latitude of the Moon, which was likewise 47 minutes, 40 seconds. There remain the deficient scruples 16 minutes, 14 seconds, which quantity in Table 57 under the diameter 32 minutes, 16 seconds, with the proportional part applied, finds the Eclipse Digits 6 minutes, 5 seconds; that is, this eclipse will be partial, or of 6 digits, and 5 minutes. But if the Digit were 12, it would be a Total Eclipse without scruples; or if more than 12, total with delay [cum mora].

Precept 76. To determine the scruples of incidence of a Lunar Eclipse, or of its very beginning and end; and indeed the delay in shadow, if it is total with delay.

Astronomers call the scruples of incidence those [scruples] of the zodiac, or of the Lunar orbit, which the Moon traverses from the beginning of the Eclipse, until the middle; and the scruples of repletion [Repletionis], which it runs through from the middle to the end. And the scruples of half-delay [Mora dimidia], which the Moon completes from the moment of total obscuration up to the same.

The scruples of incidence of a partial Eclipse you will find its duration thus: take in the front of Table 59 the sum of the semidiameters of the Moon and of the Shadow corrected, and opposite the true latitude of the Moon, which is in the left-hand side, you will have the scruples of incidence. Then repeat, as above, find the equated anomaly of the Moon, and by the hourly motion of the Moon from the Sun, divide by this; more finely, however, you will do it, if the resolved one hour into 60 [parts], you multiply by these the scruples of incidence; and the product divided by the hourly motion of the Moon, the half-scruples of the hour, the moment of the Full Moon subtracted will give the beginning of the Eclipse, and added the end.

Example.

In the preceding Full Moon, the sum of the semidiameters of the Moon and of the Shadow corrected was found to be 63 minutes, 54 seconds; and the true latitude

47 minutes, 40 seconds; opposite which, in Table 59 under the sum 63 minutes, 54 seconds, the scruples of incidence are found, with the proportional part, the scruples of incidence 42 minutes, 32 seconds. The hourly motion of the Moon was found above to be 33 minutes, 18 seconds. Resolving this therefore into seconds [the minutes into seconds], the hourly motion is in seconds 1998; and the incidence in seconds 1552 1/2, which, drawn through the hour of one minute 60, gives the second of an hour 1998, and the incidence 1552 1/2; here divide for the time of one minute 60; relinquishing the hour of an hour 76 2/3, that is, hour 1, 16 minutes, 39 seconds, which from the Full Moon's Ecliptic moment, namely hour 15, 32 minutes, 37 seconds subtracted, and afterwards added, and at last aggregated, give the Eclipse's Beginning, and End, as below.

	Post Meridiem at Bologna		
	H.	I	II
In \circ of the Orbit [In \circ Orbitae]			
Beginning of the Eclipse [Initium Eclipsis]	14	15	58
Middle [Medium]	15	32	37
End [Finis]	16	49	16
Total duration [Duratio tota]	2	33	18

A Total Eclipse, however, with delay [cum Mora], is to be reckoned thus: First, find as above the scruples of incidence, which in this case comprehend also the half of the delay; and so [Margin: Pag. 68.] Table 59 has the title: *Scruples of incidence, and half-delay in the Eclipse \odot and U , and by it the hourly [motion] divide, as above.*

**

Secondly, subtract the semidiameter of the Moon, from the semidiameter of the Shadow, and from their remainder, which is in the front of Table 58, [Margin: Pag. 67.] whose title is: *Scruples of incidence in the Eclipse \odot and U , and half-delay in the Eclipse;* for from the region of the true latitude of the Moon, in the left-hand side, find the scruples of half-delay, dividing by the hourly motion of the Moon;

and let there proceed the time to be subtracted from the moment of the Ecliptic Full Moon; and you will have the beginning of total obscuration; but adding, in order that you may have the beginning from the emersion from the Earth's Shadow.

Monitions for a more subtle calculation of a Lunar Eclipse.

Firstly, the controversy is not yet decided, whether the moment of the Full Moon is when the Moon in its orbit is precisely 180 degrees distant from the Sun; or that, when the place of the Moon reduced to the Ecliptic is likewise 180 degrees distant from the Sun; or whether, when the center of the Moon, and the center of the Shadow are equally distant from the nearer Node: which thing Kepler advised in the *Rudolphine* [Tables] toward the end of Precept 155. Neglecting this, however, if the Full Moon, such as we have computed thus far in its orbit, we wish to reduce to the Ecliptic, by Precept 64; then if the reduction were of the addition, that scruple, divided by the hourly [motion], is to be subtracted from the moment of the Full Moon; but if of the subtraction, to be added; the foresaid scruple subtracted.

For example, in the Full Moon of Precept 73, the place of the Moon was in its orbit at Sign 0, degree 15, 12 minutes, 18 seconds. The argument of latitude, however, was Sign 6, degree 9 etc. Therefore the reduction to be subtracted [reductio subtractiua] is 2 minutes, 10 seconds; and the Ecliptic place is Sign 0, degree 15, 10 minutes, 8 seconds. The hourly [motion] was 33 minutes, 18 seconds; from each minute 2 minutes, 10 seconds; for the minutes of time 2 minutes, 10 seconds; which added to the hour 15, 32 minutes, 37 seconds gives the minutes of time 3 minutes, 11 seconds; which added to hour 15, 32 minutes, 37 seconds. The Ecliptic Full Moon by this reckoning gives the hour 15, 35 minutes, 58 seconds; from which the others at the beginning, and the end of the moment are to be estimated, and limited, if they were [the truer ones]:

In \circ	Respect to the Ecliptic [Respectu Eclipticae]		
	H.	I	II
Beginning [Initium]	14	19	19
Middle [Medium]	15	35	58

	Respect to the Ecliptic [Respectu Eclipticae]		
In \circ	<hr/>		
End [Finis]	16	52	37

Secondly, the student keen on astronomical subtlety is to be warned, of what is more fully explained in Book 5 of the *Almagestum Novum* in the Scholium of Chapter 6, namely that the moment of the Ecliptic Full Moon, and especially of the greatest obscuration, are not the same; which difference, though perhaps it may attain to 6 minutes of an hour, can be contemned. Moreover, when there happens the greatest obscuration, when the Moon's place in its orbit is exactly distant from the Sun 180 degrees; because then the arc drawn to the Moon's orbit at right angles to the Ecliptic point, in which is the center of the Shadow, is shorter than the arc drawn from the Moon's center at right angles to the Ecliptic point, in which is the center of the Shadow, as is there demonstrated; in which second case, if the Ecliptic Full Moon were already reduced to its orbit and to the Ecliptic, in which this difference may first be noted in the monition, it will have together the difference of the Ecliptic Full Moon, and the moment of the greatest obscuration. As in our example the greatest obscuration of the digits is 5, attains the hour 15, 32 minutes, 37 seconds. But the Ecliptic Full Moon from the Eclipse, and the phases of that Eclipse are not only denominated from the Eclipse thus, attains the hour 15, 35 minutes, 58 seconds.

Precept 77. To determine the true latitude of the Moon at the beginning, and end; and the Eclipse.

By Precept 58 find the hourly motion of the Sun, and by it the scruples of incidence found in Precept 76, and you will have the true motion of the Sun congruent to the time of the half of the duration, to which add the scruples of incidence, and of delay; subtract the argument of latitude to the middle of the Eclipse; and there will proceed the argument of latitude to the beginning of the Eclipse; but if to the same argument you add the foresaid sum, you will have the argument of latitude to the end.

Example.

In the preceding Full Moon the hourly motion of the Sun was 2 minutes, 29 seconds; therefore the motion of the half of the duration of the Eclipse congruent, namely for hour 1, 16 minutes, 39 seconds, was 3 minutes, 6 seconds. The

scruples of incidence by Precept 76 found were 42 minutes, 32 seconds; to which adding 3 minutes, 6 seconds, the sum is 45 minutes, 39 seconds. [Margin: Pag. 51.] The argument of latitude to the middle of the Eclipse was Sign 6, degree 8, 26 minutes, 9 seconds; from this subtracting the sum 45 minutes, 39 seconds, the argument of latitude for the beginning of the Eclipse is Sign 6, degree 8, 26 minutes, 9 seconds [recte: see source]; which in Table 44 fits the southern latitude 43 minutes, 43 seconds; for the beginning of the Eclipse; but to the same argument of latitude to the middle, in latitude the argument of latitude Sign 6, degree 9, 57 minutes, 27 seconds, for the end of the Eclipse; to which fits the southern latitude 51 minutes, 31 seconds. Therefore the latitudes of the Moon are to be noted, and below always southern.

		True Latitude ⊙ [Latitudo Vera ⊙]	
		I	II
In Eclipse [In Eclipsi]			
Beginning [Initio]	A	43	43
Middle [Medio]	A	47	40
End [Fine]	A	51	31

Precept 78. To delineate the diagram of a Lunar Eclipse.

The true latitude of the Moon being known, and its species, by Precept 77, the diagram of the Lunar Eclipse is easily designed graphically, together with the inclination to the regions of the Horizon, by the rules which we have fully handed down in Book 5 of the *Almagestum Novum*, Chapter 7. Therefore the diagram of the preceding Eclipse will be as written below.

Diagram. A geometric construction of the lunar eclipse, showing three overlapping circles: a large central circle (the terrestrial Shadow) and the smaller circles representing the Moon at the beginning and end of the eclipse, with cardinal directions marked around the figure and a path-line traced through the centers.

- Bor. (top): North [Boreas]
- Austr. (bottom): South [Auster]
- Or. (left): East [Oriens]
- O. Occ. (right): West [Occidens]

- L, D, M (upper inner region): construction points along the Moon's path
- K, C, A, E, H, B (middle row, left to right): construction points; A at the center is the center of the Shadow
- I, F, G (lower inner region): construction points
- P (far left): construction point on the East line

Let the center of the Shadow be A, its semidiameter AF; let the disc of the terrestrial Shadow be FCDE. The Moon's latitude in the middle of the Eclipse is AF, but at the beginning GH, and at the end IK; the region in which the Eclipse begins is L, designated by the line GAL; and the region in which the end terminates is M, designated by the line IAM; the inclination to the beginning is the angle GAO, and to the end the angle IAP.

Corollary against Argoli.

[Margin: Argol's error.]

Argoli, therefore, or his disciples, perpetually represented this Lunar Eclipse of the year 1661, October 7, depicted by us, with northern latitude, when it is always southern; so that I say nothing of the Eclipse's time anticipated by them by about forty minutes.

Precept 79. To reduce the apparent time of the Eclipse to equal [time].

To convert apparent time into equal, and vice versa equal into apparent, I have already taught in Precept 16; and I have already used this in the Example of the Ecliptic Full Moon of Precept 73.

Precept 80. To survey the regions of the Earth's orb, in which the Lunar Eclipse will be visible, or not.

This is accomplished not without facility, and pleasantness, by means of the *Geographical Cross* [Crucem Geographicam], which we formerly inserted in Book 10 of the *Geographia Reformata*; thither, therefore, we refer the reader for a fuller note; here it suffices to say in brief, that wherever there appears, by the instrument, at once the place of the Eclipse, and so far as it can be seen, or it could appear with the phases of the Eclipse; and on the contrary, wherever at that time there is day, and where the Earth those phases cannot be seen; it can nevertheless, especially by benefit of refractions, be seen, even a little before sunset, and a little after sunrise of the Sun, be observed.

But if, regarding some particular place of the Earth, you are anxious — for example, regarding *Lima*, City of the Kings in Peru — collect from the Catalogue, [Margin: Pag. 9.] or Table 14, the difference of time, to be subtracted for the eastern [places], or to be added for the western, with respect to Bologna; and transfer that time from midday; then from Table 11 take out the semidiurnal, and the seminocturnal time, by means of the place of the Sun, namely with the Hours, and Scruples after midday written down, at beginning, middle, and end of the Eclipse, provided they do not exceed the aggregate of the semidiurnal, and nocturnal time, the Night will be in that place, and that phase of the Eclipse there will be visible; otherwise it will be day, and not visible, except in the confines of those very [times]/days.

Example for Lima.

Difference of time of Lima [Lima Differentia Temporis] To be subtracted from Bologna time [Subtrahenda Bonon. tempori]	H.	6	11'
Southern altitude of the Pole [Poli Altitudo Austrina]	Gr.	12	20'
☉ Place $\hat{=}$ [☉ Locus □]	Gr.	15	12'
Semidiurnal time [Semidiurnum tempus]	H.	5	55
Seminocturnal	H.	6	5

[Seminocturnum]			
Nocturnal	H.	12	10
[Nocturnum]			
Beginning	H. / H.	14 / 8	15" / 4 — 58" / 58
{Bologna / Lima}			
[Initium]			
Eclipse — Middle	H. / H.	15 / 9	32 / 21 — 37 / 37
{Bologna / Lima}			
[Medium]			
End {Bologna / Lima} [Finis]	H. / H.	16 / 10	49 / 38 — 16 / 16

Parsing notes: The "Eclipse" group brackets three rows (Initium, Medium, Finis), each split into a Bologna value and a Lima value; the columns are Hours / minutes / seconds. Beginning: Bologna H. 14, 15', 58" / Lima H. 8, 4, 58. Middle: Bologna H. 15, 32, 37 / Lima H. 9, 21, 37. End: Bologna H. 16, 49, 16 / Lima H. 10, 38, 16. Some seconds-column values are tight against the gutter; read with moderate confidence.

Since therefore at the beginning as well as at the end, the time after midday at Lima exceeds the quantity of the semidiurnal time, and does not exceed the aggregate of the semidiurnal, and nocturnal [time], which is of hours 16, 5 minutes, the whole Lunar Eclipse will be visible at Lima at this time.

Precept 81. To find in whose Meridian the future Moon will be at the highest of the Eclipse; and for whom it will be Vertical.

First inquire whether the Moon at the time of the Ecliptic Full Moon is in the eastern Hemisphere, if too much before mid-night following [it]; or in the western, namely as it would happen, if the Ecliptic Full Moon were after the hours 12 after midday, and reckoned the [hours] after midday; then if it is in the East, subtract the apparent time of the Full Moon from 12; but if it is in the West, subtract the apparent time of the Full Moon from the hours 12; and convert the remainder into degrees of the Equator; for the quantity of these will show the

distance of the Meridian, in which the Moon is at the highest of the Eclipse from the Meridian of the Tables toward the East in the first case, or toward the West in the second case. Thirdly, with the true latitude, and the place of the Moon in the Ecliptic, inquire by Precept 54 the Declination of the Moon, as great as it will be, so great the altitude of the Pole of that place, for which in the foresaid Meridian the Moon will be Vertical at the highest of the Eclipse.

Praecepta pro usu Tabularum (continued)

Example.

The eclipsed full moon discussed above, in the Example of Precepts 73 and 74, fell at 15 hours 32 minutes 37 seconds after noon at Bologna. The Moon, therefore, with respect to the Bologna meridian, lay in the western hemisphere. Subtracting these 12 hours leaves 3 hours 32 minutes 37 seconds — that is, 53 degrees 9 minutes 15 seconds — and this is the amount by which the meridian sought differs westward from the Bologna meridian.

Furthermore, the Moon at that time stood in Aries at 15 degrees 12 minutes, whose northern declination is 6 degrees 6 minutes 6 seconds. And the Moon's southern latitude was 47 degrees 40 minutes, to which in Table 34 corresponds equation 42 [?]. Subtracting the northern declination [from this] leaves the Moon's declination as 5 degrees 18 minutes. Therefore that place — namely, the one whose meridian lies as stated, and which has the northern pole-altitude of 5 degrees 18 minutes — will have the Moon standing vertically overhead at the eclipse-maximum.

Consulting cosmographical maps, then, you will find that place: its longitude from the island of Palma is 341 degrees 20 minutes 45 seconds, and its northern latitude is 5 degrees 18 minutes.

Recapitulation of the Entire Foregoing Calculation of the Eclipsed Full Moon.

In the year 1661, October 7, at Bologna, 15 hours 41 minutes 27 seconds after noon in equal time, but 15 hours 32 minutes 37 seconds in apparent time.

	Sig.	Gr.	I	II
True place of the Sun	6	15	12	18
Equated	3	6	30	16

	Sig.	Gr.	I	II
anomaly of the Sun				
True place of the Moon in its orbit	0	15	12	18
True place of the node Ω	6	6	0	29
Argument of latitude	6	9	11	48
True place of the Moon in the ecliptic	0	15	10	8
Southern latitude of the Moon			47	40
Apparent semidiameter of the shadow \curvearrowright			16	8
Semidiameter \curvearrowright corrected for the shadow			47	46
Sum of the semidiameters			63	54
Whole diameter			32	16
Deficient scruples			16	14
Digits to be	D.	6	5	0

	Sig.	Gr.	I	II
eclipsed				
Hourly motion \curvearrowright from \odot			33	18
True hourly motion \curvearrowright			2	29
Scruples of incidence			42	32
Semiduration of the eclipse	H.	1	16	39
Total duration	H.	2	33	18
Beginning of the eclipse, p.m.	H.	14	15	58
Middle [of the eclipse] at Bologna, p.m.	H.	15	32	27
End [of the eclipse] after noon	H.	16	49	16
Latitude \curvearrowright A. at the beginning			45	43
Latitude \curvearrowright A. at the end			51	31
Moment of maximum obscuration	H.	15	32	37
But the	H.	15	35	58

	Sig.	Gr.	I	II
eclipsed full moon with respect to the place of the eclipse				
Longitude of the meridian on which [the Moon stands] at mid-eclipse	G. 341		20	45
Pole- altitude of the place on the said meridian where the Moon will be vertical, at the eclipse- maximum	5	18	Bor.	

Parsing notes: in the "Longitude of the meridian" row the source prints "G. 341" running across the Sig./Gr. columns; rendered here as the whole-degree value 341 in the Sig. column with the minutes/seconds (20' 45") following. The "True place of the Sun" / "True place of the Moon in its orbit" rows share identical I-II values (12 18) as printed.

Precept 82. To know beforehand the order to be observed in the recapitulation of a solar eclipse.

It is indeed desirable to think ahead about by what route you will at last accomplish so laborious a calculation, and through what steps you must climb to the desired end. Therefore the items to be sought are listed below in order, and these are:

To be sought	by Precept
The mean new moon	72
The true new moon	74
Or, by Precepts 55, 61, 66 together	67
The apparent time of the true new moon	55, 61
The true place of the luminaries	55, 61
The equated anomaly of the luminaries	55, 61
The right ascension of the Sun	46
The parts of the equator corresponding to the time	11
The right ascension of mid-heaven; and hence	50
The oblique ascension of the ascending degree, and the ascending degree itself	—
The ecliptic degree of the ascendant	—
The ninetieth ecliptic degree counted from the ascendant	50
The altitude of the ninetieth [degree]	51
The node Ω ϑ northern, of the heavens; and hence	62
The altitude of the ninetieth [degree] in the Moon's orbit	—
The horizontal parallax of longitude at conjunction	58
The parallax of the Moon from the Sun in altitude	84
The parallax δ in longitude	85
The parallax of the Moon in latitude	86

To be sought	by Precept
The parallax δ in longitude for one hour or another before [conjunction], and for the hours before or after	87
The apparent motion of the Moon for one hour or another	88
The apparent new moon	89
The parallax δ in longitude at the moment of the apparent new moon, and for the hours before or after	90
The true latitude, and the latitude seen at the time of the apparent new moon	91
The digits of the solar eclipse	92
The beginning, the end, and the duration of the solar eclipse	93
The true latitude δ at the beginning and end of the eclipse	94
The delineation [diagram] of the solar eclipse	95

Up to this point, the New Astronomy advances, and as a new promontory it has carried forward this inquiry to the principal phases of a solar eclipse remarkable in various regions; but chiefly in those regions in which a total or central eclipse will be seen — concerning which, see below.

Parsing notes: the right-hand column heads "per Praec." (by Precept); several rows where the source gives no number are left blank ("—"). Rows for "True place of the luminaries," "Equated anomaly of the luminaries," "Apparent time" each show "55 61" as a paired reference.

Example.

The eclipsed new moon of the year 1659, November 14, at 3 hours 30 minutes after noon, in equal time at Bologna.

	Sig.	Gr.	I	II
True place of the Sun	7	22	11	58
Equated anomaly of the Sun	4	13	32	0
True place of the Moon	7	22	20	40
Equated anomaly)	4	8	53	0
Hourly motion) from ☉			31	57
Excess of the place [of the Moon] beyond ☉			8	42
Time corresponding to this			16	10
Therefore the truer new moon, October [recte: November] 14, p.m.	Hor.	3	13	50

Then, with the calculation re-established:

	Sig.	Gr.	I	II
True place of the Sun	7	22	11	18
Anomaly of the Sun	4	13	31	20

	Sig.	Gr.	I	II
True place of the Moon	7	22	11	16
Equated anomaly ☽	4	8	43	39
Hourly motion ☽ from ☉			31	56
The [Moon] falls short of the [Sun's] place by Time correspond ing to this				2 3
True new moon, October [recte: November] 14	H.	3	13	53
Equation of days to be added			13	55
True apparent time of conjunction ☉ ☽	H.	3	26	48

And so the true and exact new moon at Bologna will be in the year 1659, November 14, at 3 hours 26 minutes 48 seconds in apparent time after noon, the luminaries being corrected, in Scorpio at 22 degrees 11 minutes 18 seconds.

Parsing notes: the running header refers to "October 14" in two rows although the example is dated November 14; transcribed verbatim and flagged as a compositor slip ([recte: November]).

Precept 83. To find the altitude of the ninetieth [degree] in the Moon's orbit, and the ninetieth itself, by the foregoing precepts.

First, by Precept 46, look up the right ascension of the place of the Sun; by Precept 50, the ascending ecliptic degree, and from it the ninetieth computed; and by Precept 51, the altitude of the ninetieth. Then [find] the place of the lunar node Ω by Precept 62, which you subtract from the ninetieth, and with the remainder feign [an argument] as though it were the argument...

of latitude, look up in Table 44 the latitude — the latitude to be added to the altitude of the ninetieth if the latitude is northern, and to be subtracted if southern — for thus you will obtain the altitude of the ninetieth in the Moon's orbit.

Example in the preceding new moon.

	Sig.	Gr.	I	II
True place of the Sun	7	22	11	18
Right ascension of the Sun		229	34	23
Time from the meridian, apparent	H.	3	26	48
Parts of the equator		51	42	0
Right ascension of the culminating point, with 90 added, becomes		281	16	23

	Sig.	Gr.	I	II
Oblique ascension of the ascendant		11	16	23
Pole- altitude of Bologna		44	30	20
The ascendant [□]	□	21	4	0
Therefore the ninetieth [□]	□	21	4	0
And the altitude of the ninetieth		23	50	0
Node ♁ ☿ true place	7	12	43	55
Feigned argument of latitude	2	8	20	5
And the northern latitude		4	37	22
Altitude of the ninetieth in the Moon's orbit		28	27	22

[Margin: Pag. 51 (referring to Table 44 / Precept 46 on p. 51)]

Precept 84. To find the horizontal parallax of the Moon from the Sun.

With the equated anomaly of the Sun and of the Moon, look up in Table 39 the horizontal parallax of each of the two luminaries; then, subtracting the solar parallax from the lunar, there will remain the horizontal parallax \curvearrowright from the Sun.

[Margin: Pag. 47]

Example in the preceding new moon.

	Sig.	Gr.	I	II
Equated anomaly \odot	4	8	43	39
Equated anomaly \curvearrowright	4	13	31	20
Parallax horizontal \curvearrowright			57	51½
Parallax horizontal \odot				1½
Parallax horizontal \curvearrowright from \odot			57	50½

Precept 85. To investigate the parallax of the Moon in longitude.

Consult Table 56, whose title is *Parallax Mecoplatica* [the parallax brought to the ecliptic plane], and at its front look up the horizontal parallax of the Moon from the Sun (calculated by Precept 84); and in the right-hand side, whose title is *Latus Longitudinis* [the side of longitude], [look up] the altitude of the ninetieth in the Moon's orbit (foreknown by Precept 83); for in the common area you will find the horizontal parallax of longitude \curvearrowright , which would be the one to use if the Moon were on the horizon itself. But when [the Moon] is above the horizon, look up its distance from the ninetieth by subtracting the smaller from the greater, and with this [distance] in that same Table 56's right-hand side, but at the front with the horizontal parallax of longitude \curvearrowright , you will find in the common area the absolute and exact parallax of longitude \curvearrowright .

[Margin: Pag. 61]

Example in the preceding new moon.

	Sig.	Gr.	I	II
Altitude of the ninetieth in the orbit		28	27	22
Parallax horizontal ☽ from the Sun			57	50
Parallax horizontal of longitude			27	33
True place of the Moon	7	22	11	18
Ninetieth [□]	□	21	4	0
Distance ☽ from the ninetieth		58	52	42
Parallax of longitude			23	35

Precept 86. To inquire into the parallax of the Moon in latitude.

In the Table of Parallax Mecoplatica, which is Table 56, look up at the front the parallax of the Moon from the Sun, taken from Precept 84; and in the left-hand side, whose title is *Latus Latitudinis* [the side of latitude], [look up] the altitude of the ninetieth in the Moon's orbit found by Precept 83; and the common area, with the help of the proportional parts, will at once furnish you the parallax of latitude.

[Margin: Pag. 61]

Example, of which above.

	Gr.	I	II
Altitude of the	28	27	22

Gr.	I	II
ninetieth in the orbit		
Parallax \bowtie from \odot , horizontal	57	50
Parallax of latitude	50	28

Precept 87. To investigate the parallax of the Moon in longitude for one hour or another before or after the true new moon.

This precept is necessary so that we may apply the apparent hourly motion of the Moon, and so set the beginning and end of the solar eclipse. First, then, [take] from the degrees of the oblique ascension of the ascending point at the moment of the true new moon, for each of the hours before the true new moon, subtract fifteen degrees per hour, for from these afterwards the ascending point will go forth; that is, the ascending ecliptic point at that time before, or after the new moon assumed — for which look up again, by Precept 83, the ascendant and the ninetieth, and the altitude of the ninetieth in the Moon's orbit.

Second, with the horizontal parallax of the Sun retained as found above (since this, within a few hours, does not vary perceptibly), with the anomaly of the Moon at the time assumed before, or after the conjunction equated, look up the horizontal parallax \bowtie from the Sun by Precept 84, and by Precept 85 the parallax of longitude, but the horizontal one only.

Third, in place of the Moon (which at the moment of the true new moon, for the individual hours before the true new moon assumed, you subtract its hourly motion \bowtie from the Sun by as many times as there are hours before; but for the hours after, add), and there will emerge the true place of the Moon at the time assumed before, or after the new moon.

Fourth, with the true distance of this place of the Moon from the ninetieth, and with the absolute horizontal parallax of longitude, by Precept 85, look up the parallax of longitude \bowtie for the hour before, or after the true new moon chosen. For the most part, however, only one hour before, or after, is assumed, especially if the Moon is in the eastern ecliptic quadrant; but afterwards if it is in the western. Because, therefore, in the preceding new moon the Moon is in the

western [quadrant], we shall take the hour one [hour] after the new moon. But we shall look up the parallax δ in longitude...

Example for hour 1 after the true new moon, of which above.

There was above	Sig.	Gr.	I	II
Oblique ascension of the ascendant	0	11	16	23
With added	0	15	0	0
The oblique ascension of the ascendant becomes		26	16	23
And the other ascendant []	[]	15	48	0
Therefore the ninetieth []	[]	15	48	0
And the altitude of the ninetieth		26	50	0
Node Ω place as above	7	12	43	55
Argument of latitude	2	2	54	5
Northern latitude		4	25	34
Altitude of the		31	15	34

There was above	Sig.	Gr.	I	II
ninetieth in the orbit)				
Parallax horizontal) from ☉, as above			57	50
Parallax of longitude, horizontal			30	0
True place of the Moon at the true new moon	7	22	11	18
	Sig.	Gr.	I	II
Hourly [motion]) to be added			31	56
Place of the Moon for the hour after the new moon	7	22	43	14
Distance of this place from the ninetieth		83	4	46
Therefore the parallax of longitude			29	49

Precept 88. To define the apparent motion of the Moon for one hour or another.

First, with the parallax of longitude μ found for the beginning and end of the hour assumed by Precept 87, subtract the smaller parallax from the greater. You should also have the true hourly [motion] at the time of the new moon.

Second, if for the whole assumed time of the hour [the Moon] remained in the eastern zodiacal quadrant, and at the beginning of the hour the assumed parallax was greater, but at the end smaller, subtract the difference [of] the parallax from the hourly motion μ , and you will have the apparent motion for that hour. But if the Moon remained for that whole time in the western quadrant, and the parallax was greater at the beginning of the hour but smaller at the end, add the difference of the parallax to the hourly motion μ , and there will result the apparent motion for that hour. But if [the parallax was] smaller at the beginning of the hour and greater at the end, subtract, and the apparent motion μ will come out — these things agreeing with what was said above at the end of Precept 82.

Third, if within that hour [the Moon] is partly in the eastern, partly in the western [quadrant], in each part [the parallax], that is, the aggregate of the parallaxes from the beginning to the ninetieth, subtract from the hourly motion μ ; but the [parallax] found from the ninetieth to the end, add to that hour; for thus the apparent motion for that hour is to be made — against Reinhold. To this matter Maginus [Magini] and Lansbergius [Lansberge] bear witness; and by example Lord Vincentius Rainerus [Vincenzo Renieri] has demonstrated it in the recently printed *Tabulae Mediceae* [Medicean Tables], page 289.

Example.

In the preceding new moon the Moon remained in the eastern quadrant, both at the moment of the new moon and at the beginning of the hour one before the new moon; therefore we shall proceed thus in the calculation:

	I	II
Parallax of longitude at the new moon	23	35
Parallax of longitude, hour 1 after	29	49
Difference of the parallaxes	6	14
True hourly [motion] μ	31	56

	I	II
Therefore the apparent motion ∽ for that hour	25	42

Precept 89. To define the moment of the apparent new moon.

First, if the Moon was in the eastern quadrant, look up its apparent motion for one hour before the true new moon by Precept 88; and if the scruples of the parallax of longitude at the time of the true conjunction were greater, divide them by the scruples of the parallax: for as often as you do so, it will give the time to be subtracted from the apparent time of the true new moon, so that the apparent time of the new moon, or of the seen conjunction, emerges.

Second, if the Moon was in the western quadrant, [take] its apparent motion by Precept 88 for one hour after the true new moon; and if the scruples of the parallax of longitude of the true new moon were greater, divide by that the time to be added to the apparent time of the true conjunction, so that the moment of the seen conjunction may be made.

Third, if the apparent hourly motion was smaller than the parallax of longitude found at the moment of the true new moon, subtract the parallax from the apparent hourly motion, and set aside the residual parallax. Then, by Precept 88, inquire further into the motion of the Moon due for the other hour before [the new moon] if it was in the eastern quadrant, after if in the western, and for that hour set aside the residual of the apparent motion of the Moon. With the parallax, as often as it is added to that hour, it will give the time to be subtracted from the apparent time of the true conjunction, if...

the Moon is in the eastern quadrant, [and] to be added if it is in the western, so that at last the moment of the seen conjunction may be had.

Finally, if the Moon is at the ninetieth itself, the true and the seen conjunction coincide.

Example.

In the preceding new moon, because the Moon is in the western quadrant, and the apparent hourly motion ∽ is sought, the parallax is found at hour 1 after the true new moon as 25 minutes 42 seconds. But the parallax of longitude at the moment of the true new moon was found to be 23 minutes 35 seconds. Therefore the hourly motion is greater than this parallax. Say, then: if 25 minutes 42

seconds — for hour 1, or 60 minutes — require how many minutes, and a second require 23 minutes 35 seconds; the answer comes out, by the Golden Rule, 1542 [?]. Resolving these three numbers in the series by the Golden Rule, the first second comes out 1542, the second 2604 [?], the third 1416 [?]; led therefore for the second per the third, and the sum divided per the first, the fourth number comes out proportional 2304 [?]: that is, 55 minutes 4 seconds; this one [hour] added to the apparent time of the true new moon, namely as stated above at the end of Precept 82. At hour 3, 26 minutes 48 seconds, the time of the seen conjunction of November 14 is made, [namely] hour 4, 21 minutes 52 seconds.

Parsing notes: the arithmetic in this paragraph (the Golden Rule / rule-of-three worked example, numbers 1542, 2604, 1416, 2304) is set in continuous prose; the digit strings are flagged [?] where the small type and the cramped fractions make individual figures uncertain. The result "4^h 21' 52''"¹ is legible.

Precept 90. To investigate the parallaxes of longitude of the Moon for the moment of the seen conjunction with the parallax of longitude, both for the moment and for the hours before or after.

So that the apparent hourly motion may be had — the hour 1 before and after the seen conjunction — there is need of the parallax of longitude for the hour 1 before and after. First, then, [take] the difference of time between the true and the seen conjunction, convert it into parts of the equator, and subtract these from the oblique ascension of the ascending degree at the time of the seen conjunction (add if [the Moon] is in the eastern quadrant; if in the western [subtract]), so that the oblique ascension of the ascending point at the time of the seen conjunction may emerge. Then look up, by Precept 87, the parallaxes of longitude at the time of the seen conjunction, both for one hour [before] and for one hour after the seen conjunction.

Furthermore, you should have the place of the Moon at the time of the apparent new moon, and thence the distance of the Moon from the ninetieth; and from there inquire into the parallaxes, as the interval of time between the true and seen conjunction directs, and produce [it] divided by 60. And the quotient subtracted from the place of the Moon at the true time of conjunction — if the Moon is in the eastern quadrant, add; in the western, subtract. But if hour 1 before, or the seen conjunction, the Moon stood off from the ninetieth by more than 90 degrees [the ascendant?], it will be below the horizon, and then the parallax is sought in vain.

Example.

In the preceding new moon, by Precept 89, the interval of the true and seen conjunction was 45 minutes 45 seconds, with which you will operate thus:

	Sig.	Gr.	I	II
Interval of ☉ ☽ true from seen			55	4
Whose parts of the equator		13	46	0
Oblique ascension of the ascendant in the true [conjunction]		11	16	23
Oblique ascension of the ascendant in the seen [conjunction]				5
Ascending ecliptic point [☉]	☐	25	2	23
Ninetieth from this [☉]	☐	13	57	0
Altitude of the ninetieth		31	57	0
Node ♁ place as above	7	12	43	55
Argument	3	1	13	5

	Sig.	Gr.	I	II
of latitude				
Northern latitude, to be added		4	58	24
Altitude of the ninetieth in the orbit)		30	50	24
Parallax) from ☉ in another horizon			57	50
Parallax of longitude, horizontal			29	49
Hourly motion, internal due			20	42
Place) true in the seen new moon	7	22	47	30
Distance) from the ninetieth		81	15	30
Parallax of longitude			25	30
And parallax of latitude			49	29

Parsing notes: the "Interval of ☉) true from seen" row prints 55' 4" in the I-II columns although the prose names the interval as 45' 45" — transcribed as printed; flagged below. In the second row the printed value "13 46 0" appears to

be the equator-parts of the interval. The "Oblique ascension ... in the seen [conjunction]" row shows only a single figure (5) in the II column as printed.

(continuing Precept 90, the parallaxes for one hour before and after the seen conjunction)

Now for one hour before the seen conjunction: subtract 15° from the oblique ascension of the seen conjunction's ascending point — which was $25^\circ 2' 23''$ — and what remains is the oblique ascension of the ascending point at one hour before the seen conjunction, namely $10^\circ 2' 23''$. From this the rest of the calculation follows.

	Sig.	Gr.	'	"
Oblique ascension of the ascending point [Ascensio Obliq. Puncti Ascend.]	0	10	2	23
Ecliptic point of the ascendant [Punctum Eclipt. Ascendens]	♈ (Aries)	18	49	0
The ninetieth from it [Nonagesimus ab eo]	♉ (Pisces)	18	49	0
Altitude of the ninetieth [Nonagesimi Altitudo]		22	38	0
Place of the	7	12	43	55

	Sig.	Gr.	'	"
node, as above [Nodi locus vt supra]				
Argument of latitude [Argument um Latitudinis]	2	6	5	5
Latitude, north, to be added [Latitud. Boreal. addenda]		4	32	48
Altitude of the ninetieth in the [lunar] orbit [Altitud. Nonagess. in Orbita ⋈]		27	10	48
Parallax of the Moon from the Sun, horizontal [Parallax. ⋈ à ☉ Horizont.]			57	50
Parallax of longitude, horizontal [Parallax. Longit.]			26	26

	Sig.	Gr.	'	"
Horiz.]				
Hourly motion, true, to be subtracted [Horarius verus subtr.]			31	56
True place one hour before the seen conjunction [Verus › locus hor. 1. ante Visa ☉]	7	22	9	34
Distance › from the ninetieth [Distant. › à Nonagess.]		56	39	26
Parallax of longitude [Parallaxis longitudinis]			22	5

But now for one hour after the seen conjunction: add 15° to the oblique ascension of the ascending point at the moment of the seen conjunction, so that for one hour after the seen conjunction one obtains the oblique ascension of the ascending point, and the rest as below.

	Sig.	Gr.	'	"
Oblique ascension	0	40	2	23

	Sig.	Gr.	'	"
of the ascending point [Ascensio Obliq. puncti Ascend.]				
Ecliptic point of the ascendant [Punctum Eclipt. Ascendens]	♉ (Taurus)	4	19	0
The ninetieth from it [Nonagesimus ab eo]	♈ (Aries)	4	19	0
Altitude of the ninetieth [Nonagesimi i Altitudo]		30	27	0
Place of the node, as above [Nodi locus vt supra]	7	12	43	55
Argument of latitude [Argum. Latitud.]	♃ 3 [L3?]	21	35	5
Latitude, north [Latitudo Borea]		4	37	31

	Sig.	Gr.	'	"
Altitude of the ninetieth in the orbit [Nonagess. Altit. in Orbita ☽]		35	14	31
Parallax ☽ from the Sun on high, as above [Parall. ☽ à ☉ in altum vt supra]			57	50
Parallax of longitude, horizontal [Parall. Longitud. Horiz.]			33	12
Hourly motion, true, to be added [Horarius verus addendus]			31	56
True place 7 1 hour after the seen conjunction [Verus ☽ loc. b. 1. post visam ☉]	7	23	13	26
Distance ☽ 3	3	11	5	34

	Sig.	Gr.	'	"
from the ninetieth [Distantia › à Nonagesim o]				
Parallax of longitude, sought in vain — for the Moon is now below the horizon, yet it is greater than [Parallaxis Longitudini s frustra quaesita; nam › iam infra Horizonte m, est tamen maior, quàm]			57	50

[Precept 91 heading:] **Precept 91. To find the true and seen latitude of the Moon at the time of the new moon [Latitudinem Lunae Veram, & Visam ad tempus Nouilunij Visi inuenire].**

First, by Precept 63, find the true argument of latitude for the moment of the true new moon, and subtract its parallax of longitude for the moment, found by Precept 90, if the Moon is in the eastern part [of the sky]; or add it if in the western part. Thus you will obtain the true argument of latitude for the time of the seen conjunction; and with this argument, by the same Precept 63, find the true latitude.

Second, compare the parallax of latitude found for the moment of the seen conjunction (Precept 90) with the true latitude. If the true latitude is northern toward us, add to it the parallax of latitude, and the sum is the seen northern latitude toward us. If the true latitude is southern toward us, and the parallax of latitude is greater, subtract this [latitude] from it, and what remains is the seen latitude, still northern. But if the parallax of latitude is greater than the true latitude, the seen latitude is still northern; whereas if [the parallax of latitude is smaller], the seen latitude is southern.

From this learn what must be done in southern regions: there, if the latitude is northern, add the parallax, and the seen latitude will be northern; but if the true latitude is southern, a smaller parallax subtracted leaves a seen northern latitude; whereas a smaller parallax, subtracted from the southern latitude, leaves the seen latitude still southern.

	H.	'	"
Time of incidence [Tempus Incidentiae]	1	17	0
Time of the seen apparent conjunction [Tempus appar. Synodo Visa]	4	21	52
Beginning of the eclipse [Initium Eclipsis]	3	4	52
Time of repletion [Tempus Repletionis]	1	5	0
End of the eclipse [Finis Eclipsis]	5	26	52
And the whole duration, in	2	22	0

	H.	'	"
hours [Et tota duratio Hor.]			
Half-daytime [Semidiurnum tempus]	4	45	0
Beginning, in Italian [reckoning] [Initium Italicè]	22	20	0
Civil clock [Horolog. Ciuil.]	21	30	0

[Precept 94 heading:] **Precept 94. To define the seen latitude of the Moon at the beginning, and at the end of the eclipse [Latitudinem Lunae visam ad initium, finemq; Eclipsis definire].**

[Margin: Pag. 51.]

Enter Table 44, and in its columns seek the seen latitude of the Moon at mid-eclipse, found above by Precept 91; observing the latitude found in the column of greatest latitude. Observe the sign in front, and the degree in the left-hand side, if the latitude is north and the Moon is near the northern node; but if the seen latitude is southern, observe the sign at the foot and the degree on the right-hand side. But if the eclipse is near the southern node, and the latitude is north, in that case the signs are at the foot and the degrees on the right-hand side; whereas if [the latitude is] southern, the signs are in front and the degrees on the left-hand side, corresponding to the seen latitude. In this way you will have the true argument at the time of the seen conjunction; from which subtract the scruple of incidence found above by Precept 93, and the true argument at the beginning of the eclipse will remain; whereas on the contrary add to the true argument of the seen conjunction the scruple of incidence, and the true argument at the end of the eclipse will be the sum. With this argument, in the same Table 44, you will have the seen latitude at the beginning and the end of the eclipse.

[Exemplum:] **Example in the new moon near the northern node Ω**
[Exemplum in Nouilunio \curvearrowright prope Nod. Ω].

	Sig.	Gr.	'	"
Seen latitude at mid-eclipse [Latitudo \curvearrowright visa in medio Eclips.]	B.	0	1	41
Argument answering to this [Argument um huic respondens]	0	0	19	19
Scruple of incidence [Scrupula Incidentia]	0	0	31	41
True argument of the seen latitude at the beginning [Argum. \curvearrowright Visae latit. ad init.]	11	29	47	37
True argument of the seen latitude at the end [Argument um \curvearrowright Visa	0	0	33	23

	Sig.	Gr.	'	"
latit. ad finem]				
Seen latitude at the beginning, north [Latitudo › visa ad initium A.]	0	0	1	3
Seen latitude at the end, north [Latitudo › visa ad finem B.]	0	0	1	52

Parsing notes: in the first row "B." denotes Borealis (north); abbreviations "A." / "B." in the last two rows likewise denote north (Borealis/Australis distinction — here both marked as north per the heading).

[Precept 95 heading:] **Precept 95. To delineate the type [figure] of the solar eclipse [Typum Solaris Eclipsis delineare].**

Repeat the seen latitude of the Moon at mid-eclipse by Precept 91, and at the beginning and end by Precept 94; and from what was said in Precept 78, On the figure of the lunar eclipse, it is easy to delineate the solar one too.

Recapitulation [Epilogue] of the foregoing calculation, from Precept 82 to 94 [Epilogismus calculi praecedentis à Praec. 82. ad 94].

In the year 1659, November 14, at 3 hours 30' after noon, at Bologna [Anno 1659. Nouembr. 14. Hora 3. 30'. post Merid. Bononiae].

	Sig.	Gr.	'	"
True place of the Sun [Solis Locus	7	22	11	58

	Sig.	Gr.	'	"
Verus]				
Anomaly of the Sun, equated [Anomalia Solis aeq.]	4	13	32	0
True place of the Moon [Lunae locus Verus]	7	22	20	4
Anomaly of the Moon, equated [Anomalia Lunae aequata]	4	8	53	0
Hourly motion of the Moon from the Sun [Horarius Lunae à Sole]			31	57
Excess of the place) beyond ☉ [Excessus loci) vltra ☉]			8	42
Time answering to the excess			16	10

	Sig.	Gr.	'	"
[Tempus excessui congruent]				
Therefore the new moon nearer [Ergo Nouiluniu m propius]	H.	3	13	50

With the calculation now restored [Instaurato tunc calculo]	Sig.	Gr.	'	"
True place of the Sun [Solis locus verus]	7	22	11	18

(right-hand column of page 24, continuing the recapitulation table)

	Sig.	Gr.	'	"
Anomaly of the Sun [Anomalia Solis]	4	13	31	20
True place of the Moon [Luna locus verus]	7	22	11	16
Anomaly of	4	8	43	39

	Sig.	Gr.	'	"
the Moon, equated [Anomalia Lunae aequata]				
Hourly motion of the Moon from the Sun [Horarius Lunae à Sole]			31	56
It falls short of ☉ by [Deficit ☾ ab ☉]				2
Time answering to the defect [Tempus defectui congruent]				3
Therefore the true new moon [Verum ergo Nouiluniu m]	H.	3	13	53
Equation of days, natural, to be added [Aequatio dierum]			12	55

	Sig.	Gr.	'	"
natural. addi]				
Time of the apparent new moon [Tempus apparens vera ☽]	H.	3	26	48
The luminaries together in [Luminarib us simul in]	☐ 22	11	18	
	Sig.	Gr.	'	"
Right ascension of the place ☉ [Ascensio Recta loci ☉]		229	34	23
Parts of the equator from the meridian [Partes Aequatoris teporis à Merid.]		51	42	0
Right ascension of the culminatin g point [Ascensio recta		281	16	23

	Sig.	Gr.	'	"
puncti culminantis]				
Oblique ascension of the ascendant [Ascensio Obliq. ascendentis]		11	16	23
Altitude of the pole of Bologna [Altitudo Poli Bononia]		44	30	20
Ecliptic poin t of the ascendant [Punctum Ecliptica ascendens]	□ 21	4	0	
The ninetieth [Nonagesim us altitudo]	□ 21	4	0	
The ninetieth of the ecliptic [Nonagesim us Ecliptica]				
Place of the node Ω, north, as	7	12	43	55

	Sig.	Gr.	'	"
above [Nodi Ω Borei \curvearrowright locus verus]				
Argument of latitude, hence (or distance \curvearrowright from the ninetieth) [Argument. latit. hinc (seu dist. \curvearrowright \grave{a} Nonagesim o)]	2	8	20	5
Latitude, north, to be added [Latitudo Boreal. addenda]	0	4	37	22
Altitude of the ninetieth in the orbit [Nonagesim i altitudo in orbita \curvearrowright]	0	27	22	0
Parallax \curvearrowright horizontal [Parallax \curvearrowright Horizontal.]	0	0	0	1
Parallax	0	0	57	51

	Sig.	Gr.	'	"
horizontal [Parallax Horizontal.]				
Parallax) horizontal [Parallax.) Horizont.]	0	0	57	50
Parallax) horizontal, of longitude [Parallax.) Horizont. longit.]	0	0	27	23
Distance) from the ninetieth [Distantia) à Nonagesim o]	0	58	52	42
Parallax of longitude [Parallax. Longitudini s]	0	0	23	35
Parallax of latitude [Parallax Latitudinis]	0	0	50	28
Thus far at the moment of the true				

	Sig.	Gr.	'	"
conjunction [Hactenus in momento verae ☽]				
	Sig.	Gr.	'	"
The oblique ascension of the ascendant was [Erat Ascensio Obliq. Ascendenti s]	0	11	16	23
For one hour after the true [conjunctio n] add [Pro Hora 1. post verum ☉ adde]	0	15	0	0
The oblique ascension of the ascendant becomes [Fit Ascensio Obliq. Ascendenti s]	0	26	16	23
And the ascendant	☐ 15	48	0	

	Sig.	Gr.	'	"
one hour after [Et Ascendens Hora 1. post]				
The ninetieth from it [Nonagesim us ab eo]	□ 15	48	0	
Altitude of this ninetieth [Nonagesim i huius Altitudo]	0	26	50	0
Place of the node Ω , as above [Nodi Ω locus vt supra]	7	12	43	55
Argument hence, of latitude [Argument um hinc latitudin.]	2	2	54	5
And latitude, north, to be added [Et latitudo Bor. addenda]	0	4	25	34
Altitude of	0	31	15	34

	Sig.	Gr.	'	"
the ninetieth in the orbit [Altitudo Nonagesimi in ☽ orbita]				
Parallax ☽ horizontal, as above [Parallax. Horiz. ☽ à ☉ vt supra]	0	0	57	50
Parallax of longitude, horizontal [Parallax. longitud. Horizontal.]	0	0	30	0
Place ☽ in the true [conjunctio n] [Lunae locus in vera ☉]	7	22	11	18
Hourly motion of the Moon, to be added [Horarius Lunae addendus]	0	0	31	56
Place ☽ one hour after [Luna locus Hora 1. post]	7	22	43	14

	Sig.	Gr.	'	"
Distance \bowtie now from the ninetieth [Luna nunc distantia à Nonagesim o]	0	83	44	46
Parallax of longitude, one hour after [Parallax longit. Hor. 1. post \bowtie]	0	0	29	49
Parallax of longitude in itself [Parallax longit. in ipso]	0	0	23	35
Difference of parallaxes of longitude [Differentia parallaxum longit.]	0	0	6	14
Hourly motion \bowtie from \odot , true [Horarius \bowtie à \odot verus]	0	0	31	56
Apparent	0	0	25	42

	Sig.	Gr.	'	"
motion 〕 for one hour before [Motus Visus pro Hora 1. ante 〕]				
Time from this seen motion of parallax [Tempus ex hoc viso motu parallaxis]	0	0	55	4
Answering proportion ally is [Responde s proportion aliter est]				
But the true new moon was [Erat autem Nouilun. Verum]	H.	3	26	48
Therefore the seen new moon [Ergo Nouiluniu m Visum]	H.	4	21	52

**And then
[Et Tunc]**

At the interval between true and seen [Interuallo Verae, & Visae]	0	0	55	4
The parts of the equator answering to this [Aequatoris partes his respond.]	0	13	46	0
The oblique ascension of the ascendant in the true [conjunctio n] was [Erat Ascensio obliq. ascend.in vera ☉]	0	11	16	23
Therefore the oblique ascension of the ascendant in the seen [conjunctio n] [Ergo Asc. obliq.	0	25	2	23

And then
[Et Tunc]

ascend.in
 visa ☉]

And the □ 13 57 0
 ascending
 point then
 [Et
 punctum
 tunc
 ascendens]

The □ 13 57 0
 ninetieth
 from this
 [Nonagesim
 us inde]

Altitude of 0 25 52 0
 this
 ninetieth
 [Altitudo
 Nonagesimi
 huius]

Place of the 7 12 43 55
 node Ω, as
 above
 [Nodi locus
 Ω ∽ vt
 supra]

Argument 2 1 13 5
 hence, of
 latitude
 [Argum.
 hinc
 latitudinis]

Latitude, 0 4 58 24
 north, to be
 added

And then
[Et Tunc]

[Latitudo
 Boreal.
 addenda]

Altitude of the ninetieth in the orbit	0	30	50	24
---	---	----	----	----

[Nonagesim
 i Altitudo in
 › orbita]

Parallax › from ☉, as above, horizontal	0	0	57	50
--	---	---	----	----

[Parallax.
 › à ☉ vt
 supra
 Horiz.]

Parallax › of longitude, horizontal	0	0	29	40
--	---	---	----	----

[Parallax.
 › longitud.
 Horiz.]

Hourly motion at the interval of seen and true	0	0	29	42
--	---	---	----	----

[Horarius
 interuallis
 › visae &
 vera]

Place therefore ›	7	22	41	30
----------------------	---	----	----	----

**And then
[Et Tunc]**

in the seen
[conjunctio
n] [Locus
ergo Luna
in Visa ☉]

Distance ☽	0	81	15	30
------------	---	----	----	----

from the
ninetieth
[Distantia
Luna à
Nonagesim
o]

(left-hand column, continuing the recapitulation)

	Sig.	Gr.	'	"
Parallax of longitude in the seen [conjunctio n] [Parallax. longit. in Visa ☉]	0	0	29	22
And parallax of latitude [Et Parallax. latitud.]	0	0	49	49

**Then to
one hour
before the
seen
conjunctio
n [Deinde
ad Hora 1.
ante Visam
Synodum]**

Oblique ascension of the ascendant in the seen [conjunctio n] [Ascensio Obliq. Ascend.in Visa ☉]	0	25	2	23
15° taken away [demptis]	0	15	0	0
There remains the oblique ascension of the ascendant [Restat Asc. Obl. Ascendenti s]	0	10	2	23
Ecliptic poin t of the ascendant [Punctum Eclipt.	□ 18	49	0	

**Then to
one hour
before the
seen
conjunctio
n [Deinde
ad Hora 1.
ante Visam
Synodum]**

Ascendens]

The □ 18 49 0

ninetieth
thence, the
number
[Nonagesim
us inde
Numerus]

Altitude of 0 22 38 0

the
ninetieth
[Nonagesim
i Altitudo]

Place of the 7 12 43 55

node Ω , as
above
[Nodi Ω
locus vt
supra]

Argument 2 6 5 5

hence, of
latitude
[Argument.
hinc
latitudinis]

Latitude, 0 4 32 48

north, to be
added
[Latitudo

**Then to
one hour
before the
seen
conjunctio
n [Deinde
ad Hora 1.
ante Visam
Synodum]**

Bor. addenda]				
Altitude of the ninetieth in the orbit [Nonagesim i Altitud. in › orbita]	0	27	10	48
Parallax › horizontal, as above [Parallax. Horiz. › à ⊙ vt supra]	0	0	57	50
Parallax › horizontal, of longitude [Parallax.H oriz. longitud.]	0	0	26	26
Hourly motion, true, to be subtracted [Horarius verus subtrahend	0	0	31	56

**Then to
one hour
before the
seen
conjunctio
n [Deinde
ad Hora 1.
ante Visam
Synodum]**

us]

Place › one hour before the seen [conjunctio n] [Locus › Hora 1. ante Visam ⊙]	7	22	9	34
---	---	----	---	----

Distance from the ninetieth [Dist. › à Nonagesim o]	0	56	39	26
--	---	----	----	----

Therefore the parallax of longitude [Ergo parallaxis longitudini s]	0	0	22	5
--	---	---	----	---

**But now to
one hour
after the
seen
conjunctio
n [Contra
verò ad
Horam 1.
post Visam
Synodum]**

Oblique ascension of the ascendant in the seen [conjunctio n] [Ascens. Obl. Ascendetis in Visa ☉]	0	25	2	23
15° added [Additis]	0	15	0	0
The oblique ascension of the ascendant becomes [Fit Asc. Obliq. Ascendenti s]	0	40	2	23
Ecliptic poin t of the ascendant [Punctum Ecliptica Ascendens]	□ 4	19	0	
The	□ 4	19	0	

**But now to
one hour
after the
seen
conjunctio
n [Contra
verò ad
Horam 1.
post Visam
Synodum]**

ninetieth
thence,
computed
[Nonagesim
us inde
comput.]

Altitude of this	0	30	27	0
---------------------	---	----	----	---

ninetieth
[Nonagesim
i huius
altitudo]

Place of the node Ω , as above [Nodis Ω locus vt supra]	7	12	43	55
--	---	----	----	----

Argument hence of latitude [Hinc Argumentu m latitud.]	3	21	35	5
---	---	----	----	---

Latitude, north, to be added [Latitudo]	0	4	37	31
--	---	---	----	----

**But now to
one hour
after the
seen
conjunctio
n [Contra
verò ad
Horam 1.
post Visam
Synodum]**

Bor.

addenda]

Altitude of the ninetieth in the orbit [Nonagesim i Altitudo in) orbita]	0	35	14	31
---	---	----	----	----

Parallax) from ☉, as above [Parallax.) à ☉ vt supra]	0	0	57	50
---	---	---	----	----

Parallax) of longitude, horizontal [Parallax.) longitud. Horizontali s]	0	0	33	12
--	---	---	----	----

Hourly motion, true, to be added to the place	0	0	31	56
---	---	---	----	----

**But now to
one hour
after the
seen
conjunctio
n [Contra
verò ad
Horam 1.
post Visam
Synodum]**

[Horarius
verus
addendus
loco]

Place › one hour after the seen [conjunctio n] [Locus › Hora 1. post Visam ☉]	7	23	13	26
--	---	----	----	----

Distance from the ninetieth [Distantia à Nonagesim o]	3	11	5	34
--	---	----	---	----

Parallax of longitude, roughly [Parallax. longitudini s circiter]	0	0	58	0
--	---	---	----	---

For the
Moon is
now below
the horizon

**But now to
one hour
after the
seen
conjunctio
n [Contra
verò ad
Horam 1.
post Visam
Synodum]**

[Luna enim
infra
Horizonte
m]

**The rest of
the
calculation
[Reliquum
Calculi]**

True argument of latitude in the true [conjunctio n] [Argum. Verum latitud. in Vera ☉]	0	9	27	23
Parallax of longitude in the seen [conjunctio n] [Parallax. longitud. in Visa ☉]	0	0	29	22

**The rest of
the
calculation
[Reliquum
Calculi]**

Argument of latitude in the seen [conjunctio n] [Argument um latitud. in Visa ☉]	0	9	56	45
Therefore the true latitude, north [Esui [Esto?] true latitudo Vera ☉ Bor.]	0	0	51	30
Parallax of latitude in the seen [conjunctio n] [Parallax. latitudinis in visa ☉]	0	0	49	49
Therefore the seen latitude, north, in the seen [conjunctio n] [Ergo Latitudo visa Bor. in	0	0	1	41

**The rest of
the
calculation
[Reliquum
Calculi]**

visa ☉]

Apparent semidiamet er of the Sun [Semidiame ter apparens Solis]	0	0	15	55
---	---	---	----	----

Apparent semidiamet er of the Moon [Semidiame ter apparens Lunae]	0	0	15	49
--	---	---	----	----

Sum of the semidiamet ers [Aggregatu m Semidiamet rorum]	0	0	31	44
--	---	---	----	----

Apparent diameter of the Sun [Diameter apparens Solis]	0	0	31	50
---	---	---	----	----

Seen latitude of the Moon	0	0	1	41
---------------------------------	---	---	---	----

**The rest of
the
calculation
[Reliquum
Calculi]**

[Latitudo
Visa Lunae]

Digits 11 1 8

obscured
[Digiti
obscurati]

True 0 0 31 56

hourly
motion \curvearrowright
from \odot

[Horarius
Verus \curvearrowright à
 \odot]

Parallax of 0 0 22 5

longitude
one hour
before
[Parallax.
longit. Hor.
1. ante]

Parallax of 0 0 22 5

longitude
one hour
after
[Parallax.
longit. Hora
1. post]

Apparent 0 0 24 40 / 0 0 29 0

motion \curvearrowright
one hour
before, one
hour after
[Motus

**The rest of
the
calculation
[Reliquum
Calculi]**

Visus Lunae Hora 1. ante, Hora 1. post]					
Scruple of incidence [Scrupula Incidentia]	0	0	31	42	
Time of them [Tempus eorum]	H.	1	17	0	
The time of the seen apparent conjunction was [Erat Tempus app. Visa ☉]	H.	4	21	52	
Therefore the beginning of the eclipse [Ergo initium Eclipsis]	H.	3	4	52	
And time of repletion [Et tunc Eclipsis]	H.	5	26	52	

**The rest of
the
calculation
[Reliquum
Calculi]**

And the whole duration [Et tota Duratio]	H.	2	22	0
Half-daytime at Bologna [Semidiurnum tempus Bonon.]	H.	4	45	0
Beginning of the eclipse, Italian hour ☉ [Initium Eclipsis Hora Italica ☉]	H.	22	19	52
Mid-eclipse, Italian hour [Medium Eclipsis Hora Italica]	H.	23	36	52
End, Italian hour [Finis Hora Italica]	H.	0	41	0
	Sig.	Gr.	'	"
Seen	0	0	1	3

	Sig.	Gr.	'	"
latitude at the beginning, south [Latitudo Visa ad Initium Austr.]				
Seen	0	0	1	41
latitude at mid- [eclipse], north [Latitudo Visa ad Medium Bor.]				
Seen	0	0	2	52
latitude at the end, north [Latitudo Visa ad Finem Bor.]				

Parsing notes: in the "Apparent motion \curvearrowright one hour before / one hour after" row the source gives two paired values (one for before, one for after); transcribed as printed. Several abbreviated row-labels (e.g. "Esui"/"Esto") are conjectural expansions, marked above where uncertain.

(right-hand column of page 25)

It was observed, however, through cloud as well; the beginning of this eclipse appeared at Bologna somewhat earlier [than computed], whether for physical causes, or because of the Moon's occultation [hiding] of the Sun still in motion — by which the beginning is anticipated in eclipses — or because of the parallax of longitude varying continuously in the eclipses, but not uniformly.

Thus far we have pursued the calculation of the older astronomy, accurate though not so absolute as is now customary [Hactenus Calculum Astronomiae Vetustae, quamuis non adeo accurate olim absoluti soliti]. The rest we shall pursue from the recent astronomy; and first,

On Horizontal Eclipses [De Eclipsibus Horizontalibus].

[Precept 96 heading:] **Precept 96. To discern the moment of time at which the Sun rises or sets [Momentum temporis, quo Sol oritur, aut occidit discernere].**

[Margin: Pag. 5.]

First, from Table 11 — extracted under the given altitude of the pole — find the semidiurnal time for the place; for the time of rising will be eastward from the meridian, the time of setting westward. Or certainly, on account of refraction, a little before the minute computed by 4. There remains the hour after noon of the preceding meridian, at which the Sun rises, by about 4', somewhat earlier on account of refraction.

[Precept 97 heading:] **Precept 97. To inquire into the true places of the luminaries at the moment of rising or setting [Vera Luminarium Loca in momento Ortus, Occasusue inquirere].**

In the preceding precept we supposed the Sun in the horizon at its very rising, or setting. But when an eclipse of the Sun is to be seen, the new moon either occurs a little before, or a little after, rising, or before the very setting; the place anticipates rising when it succeeds [follows]; therefore, when the place attains rising, it precedes; but when it attains setting, it follows.

First, then, find the difference of time between the rising of the Sun, and the new moon, or between the new moon and setting, and the mean motion conforming to such a difference of time, and that in a morning eclipse subtract from the place which the new moon held; whereas in an evening eclipse, add; and you will have the place of the Sun at the moment of rising, or setting.

Second, with the equated anomaly of the Moon, find the hourly [motion] of the Moon from the Sun, and by this multiply the predicted difference of time; what arises hence, in a morning eclipse subtract from the place of the Moon in the morning new moon, whereas in an evening one, add; this will give the place of the Moon, seen, for the moment of rising, or setting of the Sun.

[Precept 98 heading:] **Precept 98. To inquire into the parallaxes of the Moon in longitude and latitude at the moment of rising or setting [Parallaxim Lunae in longum, & latum in momento Ortus, Occasusq; inquirere].**

First, [find] the lunar motion of scruples due to the interval of time between the new moon and rising, or before setting, and the new moon's true [place]; or add the equated anomaly of the Moon to the time of the new moon, just as in the preceding precept; the same scruples being subtracted, but add these to the same place: thus, in a morning eclipse you will have the equated anomaly of the Moon for the moment of the same rising, or setting; and with the equated anomaly of the Moon, find the horizontal parallax of the Moon from the Sun by Precept 58.

[Margin: Pag. 38.]

Second, consult Table 33, [for] the altitudes of the ninetieth, and on its side with the place of the Moon at the time of rising in a morning eclipse, or at the time of setting in an evening one; and under the given altitude of the pole, find the altitude of the ninetieth. With this subtracted, [use] the place of the node as the argument, find in Table 44 the northern latitude to be added, in order that you may have the altitude of the ninetieth in the lunar orbit.

[Margin: Pag. 51.]

Third, finally, in Table 56 [find] the parallactic [reduced] horizontal parallax of the Moon from the Sun in front, and on the right-hand side the altitude of the ninetieth in the lunar orbit; for that area will give the parallax of the Moon in longitude. But under the same horizontal parallax in front, and with the altitude of the ninetieth in the lunar orbit, on the left-hand side you obtain the desired parallax of latitude.

[Margin: Pag. 61.]

Precept 99. To find the distance between the centers of the Sun and of the apparent Moon at the hour of sunrise or sunset on that same day.

First, for the Moon's true place at the time of sunrise, take the assumed equated anomaly of the Moon — if the eclipse is in the morning — but if it is in the evening, subtract that anomaly from the Moon's place. Then find the Moon's hourly motion for the interval between New Moon (or sunrise or sunset, by precept 97), and find the motion in the argument of latitude for the time of the true conjunction. If the eclipse is in the morning, add this; if in the evening, subtract it; for so you will have the argument of latitude for the said moment of sunrise or sunset.

Second, with this argument find by precept 91 the true latitude and the apparent latitude at the moment of sunrise or sunset.

[Margin: Pag. 71]

Third, gather the difference between the place of the visible Moon — that is, the true place at its rising or setting — and the place of the Sun. With this difference, enter Table 60 on the left side. In the second column on the same row, you will find the area; this common area will give the first scruples (so I call them, to distinguish them). Again, enter the same Table with the apparent latitude of the Moon on the left side, and with the second column at the top of the area; this area will give the second scruples (which are called the *Posteriora* — the later ones).

Fourth, gather the sum of the prior and later scruples, and find that sum as an area within Table 60. The minutes on the left side and the second column at the top will show you how far apart the centers of the luminaries are.

Precept 100. To investigate the digits of the eclipse at the moment of sunrise or sunset of the luminaries.

[Margin: Pag. 47]

With the anomaly of the luminaries, gather from Table 39 their apparent semidiameters. Subtract their sum from the distance between the apparent centers found by precept 99. With the remainder, and with the diameter of the Sun, find in Table 57 the digits to be obscured — that is, that remainder, taken as the deficient scruples.

[Margin: Pag. 66]

On Solar Eclipses occurring in the Subterranean Hemisphere

Precept 101. To find the semidiameter of the Earth's disk as it would be visible from the Moon.

[Margin: Pag. 47]

At the moment of New Moon, with the equated anomaly find in Table 39 the horizontal parallax of the Moon. For as large as this parallax is, just so large will the semidiameter of the Earth's disk be as seen from the Moon.

Example.

In the year 1657, on 11 June, there was an ecliptic conjunction at apparent hour 11h 11m after noon at Bologna; the Moon's equated anomaly being 11 signs, 12°, 12'. The Moon's equated anomaly came out at 74° 57' 22", and hence its horizontal parallax, and the apparent semidiameter of the Earth's disk, was 55' 35".

Precept 102. To find the altitude of the ninetieth in the region in which a central or partial solar eclipse occurs, given the conjunction of the true New Moon and that of the visible New Moon.

[Margin: Pag. 61]

Gather the latitude of the true New Moon, and find this same in the areas of the parallax-Table 56, under the semidiameter of the Earth's disk, that is, under the horizontal parallax found by the preceding precept. For since the region of latitude is on the left side of the Table, you will have the altitude of the ninetieth in that region in which the true and visible conjunction occurred at the same moment. If the latitude is northern, the ninetieth will incline to the south; but if it is southern, to the north.

Example.

In the eclipse of the preceding example, the northern latitude of the Moon was 11' 43", and the horizontal parallax 55' 35", under which in the parallax-Table 56, on the row of the said latitude, is found the altitude of the ninetieth of 37° 25', inclining toward the south.

Precept 103. To inquire the altitude of the Pole of the aforesaid region.

For the place of the ecliptic in which the true New Moon is celebrated, add three signs, that is 90°; and you will have the ecliptic point Ascending for the said region; with this enter Table 33. With the side found, and with the Altitude of the Ninetieth found by the preceding precept observed, in the area on the row of the Ascending [point], find in the front of the Altitude-Table the altitude of the Pole.

But if in Table 33 you do not find the said altitude of the ninetieth (the eclipse not being about to be central), then in the Torrid Zone it is either total or partial; in the temperate or frigid zones it is partial; in the temperate, however, the eclipse will be either total or partial. Then add the regions in which the eclipse will be most nearly central, in which the Moon's edge will graze the topmost semidiameters of the Sun, and the true latitude of the Moon — which is always in these cases greater, and with the remainder, in the parallax-Table 56, under the

horizontal parallax of the front [column] in question, you will have on the left side the altitude of the ninetieth, with which, and with the Ascending ecliptic degree, by the precept of this precept find the altitude of the Pole of the region desired.

[Margin: Pag. 61]

Example.

In the aforesaid eclipse the place of the true conjunction was 2 signs, 21°, 12'; add three signs: the Ascending [point] becomes □ 21° 12', of whose region in the areas nowhere is found an altitude of the ninetieth of 37° 25'. Therefore the eclipse is not central within the Torrid Zone, but Temperate.

Therefore, to note the altitude of the Pole of that region where the margin of the Moon grazed the margin of the Sun, let us proceed in the calculation.

	Sig.	Gr.	'	"
Anomaly of the Sun [Anomalia Solis]	11	12	34	0
Equated anomaly of the Sun [Anomalia ☉ aequata]	2	14	57	22
Apparent semidiameter of the Sun ☉			15	32
Apparent semidiameter of the Moon ☾			15	17
Sum of the semidiameters			30	49
Northern true			43	43

	Sig.	Gr.	'	"
latitude of the Moon [Latitudo Lunae vera Bor.]				
Remaining sum [Residuum summae]			12	54
Horizontal parallax was [Erat Parallax. Horizontali s]			55	35
Altitude of the ninetieth [Altitudo Nonagesimi]		76	25	0
And the Ascending point was [Erat punctum Ascendens]	□	21	12	0
Altitude of the Pole [Poli Altitudo]		36	35	0

Therefore for the region to which the North Pole was elevated 36° 35', the eclipse was least, and the margin of the Moon only just touched the margin of the Sun; in the remaining altitudes of the Pole, however greater, some partial eclipses occurred.

Precept 104. To compute eclipses to be celebrated in the Southern region.

When the latitude of the Moon is southern, and the parallax of latitude joined to it makes, in any northern region whatever, the sum greater than the aggregate of the semidiameters of the luminaries, the eclipse does not occur except in the southern regions. And then all the things which have been carried out up to this point from precept 101 — concerning finding the place of the true central New Moon, and the visible — must be carried out again, but with the ecliptic degree opposite to that in which the central New Moon is celebrated.

Precept 105. To determine the digits of a central solar eclipse.

[Margin: Pag. 66]

In central eclipses, consulting Table 57, find in its front the deficient scruples of the apparent diameter of the Sun, and on the left side find the apparent diameter of the Moon; for the common area will give the digits. And if these are precisely 12, the eclipse will be total but momentary; if greater than 12, it will be total, and with a delay [of totality] in darkness, but for the fewer [the surplus], there will be left around the Moon the margin of the Sun in the form of a luminous annulus.

Example.

In the preceding eclipse	'	"
Semidiameter of the Sun ☉ was [Semidiameter ☉ fuit]	15	32
Whole diameter [Diameter tota]	31	4
Semidiameter [Semidiameter]	15	17
Whole diameter [Diameter tota]	30	34
Therefore the ecliptic digits [Ergo Digiti Ecliptici]	11	48

Therefore in some region of the Arctic circle, where we have indicated above the eclipse to have been central, there appeared around the Moon a luminous annulus.

On the Principal Phases of a Solar Eclipse

Precept 106. To find the time which the Moon takes from the point at which the lunar shadow first strikes the Earth, up to the moment at which the said shadow leaves the Earth, and the [points] at which the said phases occur.

[Margin: Pag. 70]

Gather into one sum the apparent semidiameters of the luminaries and the horizontal parallax of the Moon, and find this in Table 60 on the left side. The minutes in question in the front of the area will give the degrees and scruples, which are called the *Priora* (prior). Again, on the left side of the same Table, find the true latitude of the Moon, and in the front of the area the second [column]; the area will give the degrees and scruples, which are called the *Posteriora* (later). Subtract these *Posteriora* from the *Priora*, and find the remainder as an area in the same observed Table; see what minutes are on the left side, and what second is in the front of the area, [for these] answer. For if those minutes, and the second, are divided by the true hourly motion of the Moon from the Sun, they will give in the quotient the hours which the Moon takes from the moment at which the lunar shadow strikes the Earth, and at which the edge of the Sun begins to be grazed by the limb of the Moon, up to the moment of true conjunction; and consequently the time which the Moon takes from the moment of true and visible conjunction, up to the moment at which the lunar shadow abandons the Earth, and at which, the Sun setting with the close of day, the end likewise of the eclipse occurs somewhere, the Moon entirely emerging from the disk of the Sun.

Example.

In the year 1654, on 11 August, at apparent hour 22h 58m 28s after noon, there was at Uraniburg, by the Rudolphine [Tables], an eclipse of the Sun in $\square 19^{\circ} 33' 45''$; then therefore the calculation is thus:

	Sig.	Gr.	'	"
Anomaly of the Sun [Anomalia Solis]	1	14	19	46

	Sig.	Gr.	'	"
Equated anomaly of the Sun [Anomalia ☉ aequata]	8	9	26	1
Apparent semidiamet er of the Sun [Semidiam. appar. Solis]			15	3
Apparent semidiamet er of the Moon [Semidiam. appar. Lunae]			15	55
Horizontal parallax [Parallax. Horizont.]			61	57
Argument of the Moon's latitude [Argument um latitud. Lunae]	5	24	4	18
Its northern latitude [Latitudo eius Borea]			30	57
Sum of the			92	55

	Sig.	Gr.	'	"
semidiamet ers and parallax [Summa semidiam. & Parallaxis]				
Prior scruples [Scrupula Priora]		10	8	51
Later scruples [Scrupula Posteriora]		1	7	19
Remainder of scruples [Residuum scrupuloru m]		9	1	18
Scruples to be divided by the hourly [motion] from the Sun [Scrupula dividenda per Horarium à ☉]			87	39
			35	20
Which gives the hours	H.	2	28	50

	Sig.	Gr.	'	"
[Quotiens dat Horas]				
The New Moon was at hour [Nouiluniu m fuit Hora]	H.	22	58	28
Beginning of the eclipse on Earth [Initium Eclipsis in Terris]	H.	20	29	38
End of the eclipse on Earth on day 12 [Finis Eclipsis in Terris die 12.]	H.	1	27	18

Therefore, from the beginning at which the Moon's shadow began to strike the Earth, and to graze the western margin of the Sun ☉, up to the end at which the Moon's shadow left the Earth, and the Moon ☾ withdrew from the eastern margin of the Sun, there intervene 4h 57m 40s. And that beginning was at Uraniburg at hour 20h 29m 38s after noon of day 11 August. The end, moreover, [was] after noon of day 12 at hour 1h 27m 18s.

Precept 107. To find the altitude of the ninetieth in the regions in which the beginning of the solar eclipse first appears, and in which the end appears last.

First, the scruples (which by the preceding precept, through the true hourly [motion] of the Moon, were divided) subtract from the argument of true latitude of the Moon at the time of true conjunction; and you have the argument of the

first phase of the eclipse, namely when the eclipse begins on Earth; but on the contrary, if you add the same to the same argument, you will have the argument of the last phase, namely when the eclipse entirely ceases on Earth. And with these arguments find the true latitudes of the Moon, for each phase.

Second, divide the latitude of the first phase by the sum of the semidiameters of the luminaries and the horizontal parallax, and what comes out find in the parallax-Table, under the column written above with 60; for the area of its left side will have the altitude of the ninetieth of that region in which the rising Sun begins to suffer the eclipse from the Moon.

Third, divide the latitude of the last phase by the same sum of the said three, and find the quotient in the same column of 60 minutes observed; for it answers on the left side the altitude of the ninetieth in that region of the world in which the setting Sun ceases to suffer the eclipse from the Moon.

Example concerning what is said in Precept 106.

	Sig.	Gr.	'	"
Argument of latitude [Argumentum Latitudinis]	5	24	4	18
Scruple of incidence [Scrupula Incidentiae]			87	39
Argument of latitude in the first phase [Argum. latitud. in 1. Phasi]	5	22	26	39
And its latitude [& Latitudo Bor.]			38	32

	Sig.	Gr.	'	"
Argument of latitude of the last phase [Argum. latitud. ultima Phasis]	5	25	31	57
And its latitude [& Latitudo Bor.]			23	20
Sum of the semidiamet ers and parallax [Summa semidiam. & Parallax.]			92	55
Of the visible [latitude] by the first latitude [de visa per primam latitudine]			38	32
The quotient is [Quotiens est]			24	53
Hence the altitude of the ninetieth in the place of the first		65	5	0

	Sig.	Gr.	'	"
phase [Hinc Nonagesimi Altitudo in loco prima Phasis]				
But divided by the same sum [At diuisa per eandem summam]			92	55
By the latitude [Latitudine]			23	20
The quotient is [Quotiens est]			15	4
And the altitude of the ninetieth in the place of the last phase [Et Nonagesimi Altitudo in loco postrema Phasis]		75	27	

Precept 108. To find the altitude of the Pole in the two aforesaid regions.

First, find the interval of time between the true conjunction and the beginning of the eclipse on Earth by precept 106, [already] found above; and subtract the mean motion of the Sun from the place of the Sun at the time of New Moon given; and with the signs and degrees thus remaining, on the other side of Table 33

observed, where you find directly the altitude of the ninetieth of precept 107, in the front for the first phase of the eclipse you will have the altitude of the Pole desired.

[Margin: Pag. 38]

Second, the same mean motion of the Sun, add to the place of the true Sun at the time of New Moon given, and with the signs and degrees thus, then from these made, but opposite in the same Table 33, see in whose columnar area the altitude of the ninetieth of precept 107 is for the last phase found; for above that in the front you will have the altitude of the Pole in question.

Example of the aforesaid New Moon.

	Sig.	Gr.	'	"
The intervals were [Hora internallierant]	H.	2	28	50
The mean motion of the Sun ☉ [Horum motus ☉ medius]			6	7
The place of the Sun ☉ in the true [conjunction] [Locus ☉ in vero ☐]	☐	19	33	45
The place of the Sun ☉ in the first phase [Locus ☉ in 1. Phasi]	☐	19	27	38
The		65	5	0

	Sig.	Gr.	'	"
altitude of the ninetieth then [Alt. Nonagesimi tunc]				
Therefore the northern altitude of the Pole [Ergo Poli Altitudo Bor.]		41	22	0
The place of the Sun ☉ for the last phase [Locus ☉ pro vlt. Phasi]	□	19	39	52
The opposite place [Locus oppositus]	□	19	39	52
The altitude of the ninetieth then [Nonagesim i Altitudo tunc] Which in the areas does not		75	27	0

	Sig.	Gr.	'	"
appear [Quae in areis non apparet]				
Therefore as before [Vt ergo prius]	□	19	39	52
Whence the southern altitude of the Pole [Vnde Poli Australis alt.]		3	42	0

Note that if you do not find in the said areas the altitude of the ninetieth, by direct reasoning from the place of the Sun, it is a sign that there will be a southern altitude of the Pole; [find it] with the place of the Sun opposite, that is, with the prior place [for which] you have just made the trial — namely with the opposite place tried.

Precept 109. To determine the regions themselves by means of the longitude, for the first and the last phase, in the manner stated.

First, with the place of the Sun for precept 108 found at the moment of the first phase, find the oblique ascension under the elevation of the Pole already found at the first phase; subtract 90° , and the right ascension of the Tabular Meridian will come forth at the moment of the first phase. Then from the hours of the interval between the first phase and the New Moon, already found in precept 106, [taking those hours] resolved into degrees of the equator, add to the right ascension of that degree of the place of the Sun, of which the oblique ascension was just found; and the right ascension of the Tabular Meridian for the moment of the first phase will come forth. If this is subtracted from the right ascension of the [actual] Meridian first found, the difference of the meridians for the East will be given, the longitude sought toward the East. If the right ascension of the [actual] Meridian is prior — that is, greater than the right ascension of the Tabular Meridian — [it is] toward the West, if less; and by the preceding [reasoning], the

altitude of the Pole being known, on the Geographical Chart inquire the place desired.

Second, for the place of the last phase with the ecliptic degree opposite to it — but with the same altitude of the Pole — find the oblique ascension, and subtract 90°; [add] to the congruent oblique ascension of that phase the right ascension of the region. Then [taking] the hours of the interval between the New Moon and the last phase, and the place of the true New Moon and the last phase, and the aggregate in degrees of the equator resolved, add the right ascension of the place of the Sun in the last phase found; for you will have the right ascension of the Tabular Meridian. Therefore if you subtract from this the right ascension of the preceding Meridian, you acquire the difference of the longitudes; and so, with the longitude and the altitude of the Pole, you have the region desired.

Note, moreover, that if in either phase the elevation of the Pole was found to be southern, 180° must be added to the right ascension of the Tabular Mid-heaven, and from the aggregate the right ascension of the other Meridian is to be subtracted, that you may have the difference of longitudes.

Example in the preceding New Moon.

	Sig.	Gr.	'	"
The place of the Sun in the first phase [Locus Solis in 1. Phasi]	□	19	27	38
The altitude of the Pole for the first phase [Altitudo Poli Bor. in 1. Phasi]		41	22	0
The oblique ascension of the place [Ascensio		128	12	6

	Sig.	Gr.	'	"
Obliqua loci]				
The right ascension of the Tabular Meridian [Asc. Recta Meridiani optati]		38	12	6
The right ascension of the place [Asc. Recta loci]		141	53	48
The hour of the first phase [Hora prima Phaseos]	H.	20	29	38
Their parts in the equator [Earum partes Aequatoris]		307	24	30
The right ascension of the Tabular Meridian [Asc. Recta Merid. Tabularum]		89	18	18

	Sig.	Gr.	'	"
Subtracted right ascension first Meridian [Subducta Asc. Recta 1. Merid.]		38	12	6
The difference of the Meridians [Differentia Meridianor um]		51	26	12
Uraniburg's longitude in the Rudolphine [Tables] [Uraniburgi Longit. in Rudolphin.]		36	45	0
The longitude of the region in the first phase [Longitudo Regionis 1. Phasi]		345	38	48

Therefore the first of all the [places of] eclipse, with the Sun rising, was in the Atlantic Ocean near the island of Fagudan [Faial?]; because its altitude of the Pole is nearly $41^{\circ} 22'$, and its longitude $345^{\circ} 38' 48''$.

For the last phase [Pro vltima Phasi]	Sig.	Gr.	'	"
The place of the Sun in the last phase [Locus Solis in vltima Phasi]	□	19	39	52
The southern altitude of the Pole [Poli Australis Altitudo]		3	42	0
The oblique ascension of the place of the Sun [Asc. Obliqua loci Solis]		141	4	40
The right ascension of the Tabular Meridian [Asc. recta Merid. optati]		51	4	40
The right ascension of the place of the Sun [Asc. recta		142	4	49

For the last phase [Pro ultima Phasi]	Sig.	Gr.	'	"
loci Solis]				
The hour of the last phase [Hora ultima Phasis]	H.	1	27	18
The degrees of the equator [Gradus Aequatoris]		21	49	30
The right ascension of the Tabular Meridian [Asc. recta Meridiani Tabular.]		163	54	19
Because the altitude of the Pole is southern, add [Quia Altit. Poli est Austr. adde]		180	0	0
The aggregate is [fit aggregatum]		343	54	19

For the last phase [Pro ultima Phasi]	Sig.	Gr.	'	"
Subtract the prior Meridian's ascension [Subtrahe prioris Merid. Ascens.]		51	4	40
The remaining difference of the Meridians [Restat Meridianor . differential]		292	49	39
The longitude sought [Longitudo quaesita]		103	55	21

The last [place] therefore of the eclipse on Earth was in the Eastern Ocean near the island of S. Petri de Mascarenas [Mascarene Islands]; because its longitude is southern, $103^{\circ} 55' 21''$, and the latitude is south $3^{\circ} 42'$. Therefore the eclipse ceased upon the Earth, and the lunar shadow left it, in that place where the North Pole is elevated $23^{\circ} 55'$; and whose longitude from Palma [Palma in the Canaries] is $289^{\circ} 1'$, namely near the cape of S. Antonii Insulae Cubae [Cape San Antonio, Cuba].

Precept 110. To find the time from the moment at which, the Sun rising, the first total central eclipse of the Sun occurs, up to the middle [moment], and the moment of true and visible central conjunction, and thence up to the moment at which, the Sun setting, the last central eclipse occurs.

[Margin: Pag. 70]

With the apparent semidiameter of the Earth's disk, or with the horizontal parallax of the Moon, take from Table 60 the degree and the scruple, which are called the *Priora* (prior). This same do with the true latitude of the Moon found at the moment of true New Moon; you will gather the degree and the *Posteriora* scruple, which subtract from the *Priora*, and find the remainder as an area in the same Table 60; you will gather, on the left margin, the seconds divided by the hourly [motion] of the Moon from the Sun, [for] from the front the seconds divided will give the minutes — by which the hourly [motion] of the Moon from the Sun, you will have the interval of time from the moment at which first on Earth, the Sun rising, the central eclipse appears, up to the moment at which, the ninetieth being from the true rising, the visible central conjunction will appear. If this interval-time you subtract from the time of apparent true conjunction, you will have the time of this phase. Likewise, if you add it to the same time of true conjunction, you will have the time at which, the Sun setting, the last central eclipse appears.

Example in the preceding New Moon.

	Sig.	Gr.	'	"
Horizontal parallax of the Sun ☉ [Parallax ☉ Horizontal.]			61	57
Prior scruple [Scrupula priora]		4	28	58
The Moon's true latitude [Latitud. ☽ in vera ☐]		0	30	57
Later scruple [Scrupula posteriora]		1	7	33

	Sig.	Gr.	'	"
Residual scruples [Residua scrupula]		3	21	25
Scruple to be divided [Scrupula diuidenda]		0	55	57
By the hourly [motion] of the Moon from the Sun [Per Horarium › à ☉]		0	35	20
Therefore the hour [Ergo Hora]	H.	1	34	26
The hour of the New Moon was [Hora Nouilunij fuit]	H.	22	58	28
Therefore the hour of the central eclipse [Hora igitur cur. ☉ centralium]	H.	21	24	2
And the last [eclipse] of the central [phases] on		0	32	54

	Sig.	Gr.	'	"
day 2 August [Et ultima cêntraliū diei 2. Aug.]				

Precept 111. To find the altitude of the ninetieth-point [altitudo nonagesimi] in the two regions for the two phases just described.

The scruples that you divided in the preceding precept by the hourly motion, subtract from the Argument of Latitude of the true New Moon. This leaves the Argument of Latitude for the time of the first of the central eclipses, which is to be sought; and once found, look it up in the columns of Table 56 of the parallax tables under the observed Horizontal Parallax. You will then see, on the left-hand side directly opposite, the altitude of the ninetieth-point sought for this last phase. [Margin: Pag. 61.]

But if you instead add those same scruples to the same Argument, you will have the Argument of Latitude for the time of the last of the central eclipses, and from it the latitude. In that same Table 56, under the Moon's Horizontal Parallax, this will show on the left-hand side the altitude of the ninetieth-point for this last phase.

Example in the preceding New Moon.

	Sig.	Gr.	'	"
Argument of Latitude, true	5	24	4	18
Argument of Latitude for the first of the central eclipses	5	23	8	41
Argument of Latitude for the last of the	5	24	59	55

	Sig.	Gr.	'	"
central eclipses				
Latitude at the first of the central eclipses, North			35	46
Latitude at the last of the central eclipses, North			26	7
Horizontal Parallax of the Moon			61	57
Altitude of the ninetieth-point at the first of the central eclipses		54	44	0
Altitude of the ninetieth-point at the last of the central eclipses		64	56	0

Precept 112. To find the altitude of the Pole for each of the two aforesaid phases and regions.

Take the mean motion of the Sun corresponding to the time midway between the first of the central eclipses and the true New Moon found in Precept 110; subtract from it the place of the Sun for the first of the central eclipses, and add the place of the Sun for the last of the central eclipses, together with the Signs and Degrees

of that place, correcting them by the heads of the table. Then, from the altitudes of the ninetieth-point found in the preceding precept (those already acquired), you will find on the front of the table the altitude of the Pole sought, according to the instruction of Precept 109.

Example in the preceding New Moon.

	Sig.	Gr.	'	"
Place of the Sun in the true New Moon	□	19	33	45
Time between the New Moon and the first of the central eclipses	H. 1	34	26	
Mean motion of the Sun for this time			3	53
Place of the Sun for the first of the central eclipses	□	19	29	52
Place of the Sun for the last of the central eclipses	□	19	37	38
Altitude of the ninetieth-point at the first		54	44	0

	Sig.	Gr.	'	"
Altitude of the ninetieth- point at the last		64	56	0
Altitude of the Pole for the first of the central eclipses, North		51	9	0
Altitude of the Pole for the last of the central eclipses, North		6	26	0

But this is found together with the place opposite to the Sun.

Precept 113. To determine the regions themselves by their Longitude.

Once the place of the Sun and the altitude of the Pole have been found by the preceding precept, the Oblique Ascensions must be sought, and everything else done that was prescribed in Precept 109. So that, for the first and the last of the central eclipses, you have the difference of the Meridians from the Meridian of the Tables, and hence the longitude of each place desired. I add this here in brief by way of example:

[The lower-left corner of the page is partly degraded; a short worked-example fragment appears here but the figures are largely illegible: "[?] [?] [?]"]

[Margin: Pag. 61.]

Example of the preceding New Moon.

For the first of the central eclipses:

	Sig.	Gr.	'	"
Altitude of □		51	9	0

	Sig.	Gr.	'	"
the Pole, North				
Place of the Sun at that time	□	19	29	52
Its Oblique Ascension		122	26	6
Right Ascension of the chosen Meridian		32	26	6
Right Ascension of the place of the Sun		141	56	38
Hour of this phase	H. 21	14	2	
Their parts in the Equator		321	0	30
Right Ascension of the Meridian of the Tables		102	57	8
Difference of the Meridians		70	33	2
And the longitude of the region sought		326	11	58

Accordingly, the first of the central eclipses occurred on the northern coastline of Nuremberg [Norimberga], where the altitude of the Pole is $51^{\circ} 9'$ and the longitude $326^{\circ} 11' 58''$.

For the last of the central eclipses:

	Sig.	Gr.	'	"
Altitude of the Pole, North		6	26	0
Place opposite to the place of the Sun	□	19	37	38
Its Oblique Ascension		323	17	48
Right Ascension of the chosen Meridian		233	17	48
Place of the Sun	□	19	37	38
Its Right Ascension		142	3	38
Hour of this phase	H. 0	32	54	
Their parts in the Equator		8	13	30
Right Ascension of the Meridian of the Tables		150	17	8
Difference of the Meridians		276	59	20

	Sig.	Gr.	'	"
Longitude sought		119	45	40

Therefore the last of the central eclipses occurred in the Eastern Indian Ocean, near the Ganges Gulf [Sinus Gangeticus], where the altitude of the Pole, North, is $6^{\circ} 26'$ and the longitude $119^{\circ} 45' 40''$.

Precept 114. To find the region for which — with the ninetieth-point in conjunction with the true position, and by way of the true Syzygy — a central eclipse appears.

First, by Precepts 101, 102, and 103, find the semidiameter of the Earth's Disc, the altitude of the ninetieth-point, then the Pole of the region for which this phase occurs. Next, with the place of the Sun in the true New Moon and the degrees increased by 90, set under the said altitude of the Pole, find the Oblique Ascension, and subtract 90° from it; you will then have the Right Ascension of the Meridian, under which this phase occurs. Finally, to the Right Ascension of the place of the Sun add the parts of the Equator corresponding to the apparent Hours of the New Moon, and you will get the Right Ascension of the Meridian of the prior one, which will differ from the Right Ascension of the Meridian of the Tables. By comparing the Right Ascension of the Meridian of the Tables (which you compare with the Right Ascension of the Meridian of the prior) you obtain the difference of the Longitudes, and hence the Longitude of the region sought, in which this phase occurs.

Example of the preceding New Moon.

	Sig.	Gr.	'	"
Semidiameter of the Earth's Disc	0	0	61	57
At the true Latitude in conjunction			30	57
Altitude of the ninetieth-point		60	2	0
And the		43	6	0

	Sig.	Gr.	'	"
altitude of the Pole, North				
Place of the Sun in conjunction	□	19	33	45
With 90 added		90	0	0
Ascendant degree	□	19	33	45
Its Oblique Ascension		244	27	19
With 90 taken away		90	0	0
Right Ascension of the chosen Meridian		154	27	19
Right Ascension of the place of the Sun in conjunction		126	36	48
Hour of the apparent New Moon	H. 22	18	28	
Their parts in the Equator		344	37	0
Right Ascension of the Meridian of		126	36	48

	Sig.	Gr.	'	"
the Tables				
Difference of the Meridians		332	9	29
Longitude sought		64	35	31

Therefore, in that place where the North Pole is elevated $43^{\circ} 6'$, and whose longitude is $64^{\circ} 35' 31''$, there will be the ninetieth-point, and the central Syzygy was seen — namely, on the maritime coast of the Euxine [Black Sea] near Amasia, and on the river Thermodon; though not so in the whole of that tract over which the Moon's Shadow passed, since the eclipse occupied 12 digits $43'$ in its entirety.

Precept 115. To find the regions of the Earth above which the Moon's Shadow is carried during the whole time of a Solar Eclipse.

Once the five places of the phases have been found, from Precept 106 to Precept 114, it is easy — on Globes, Maps, or Geographical charts — to mark out the tract of the Earth over which the Lunar Shadow passed during the whole time of the Solar Eclipse. Thus, in the eclipse described above, after the Sun rose over the *Fortunate Isles* [Fagada, of the Atlantic islands], it began to be obscured on its western part by the interposed Body of the Moon; gradually, with the loss increasing, it rose over *Nuremberg*, where the northern coastline was first touched by the Moon. From there, with the centre of the Lunar shadow rising, it passed across to the East: first it travelled across the *Land of the Laborer* [terra Laboratoris], then the Caledonian Ocean, Scotland, the Danes, the Cimbri, and the most distant coasts of Germany, and through Poland and Podolia it crossed the Euxine Sea, where, at the true ninetieth-point and with the central Syzygy seen, it appeared. Further, it proceeded to Armenia and the southern coasts of Persia, and thence to East India, where the Ganges Gulf concealed the Sun, the whole of it westward-setting, finally. Lastly, with the Sun setting on the West, it left the Moon free at the *Island of St. Peter of Mascarenas* [Insula S. Petri de Mascarenas], and its Shadow withdrew from the Earth.

Precept 116. To compute the place of Saturn [♄] in Longitude according to the Orbit.

Apply, if there is need, the precepts of Part I, or follow the order written below.

1. First, by Precept 55 or 56, find the true place of the Sun and its equated Anomaly.
2. Second, from Table 62 (which is found on page 72) take out the mean motion of Saturn from the Equinox, its Apogee, and the North Node.
3. Third, subtract the motion of the Apogee from the motion of Saturn from the Equinox, and you will have the simple Anomaly; with which, in Table 63 (which is on page 73), seek the centric Equation, or that of the first inequality of Saturn, to be added or subtracted from its mean motion as required (per the heads of the Tables), so that you have the eccentric place of Saturn — that is, the place first equated, or seen from the Sun.
4. Fourth, subtract the centric place of Saturn from the true place of the Sun, and the *Anomaly of the Orbit* [Anomalia Orbis] will remain.
5. Fifth, with the simple Anomaly (of which there is mention in number 3, found in Table 64 on page 73), find the *Equated Anomaly* [Anomalia aequata].
6. Sixth, with the Equated Anomaly of the Sun and with the Equated Anomaly of Saturn, find in Table 65 (which is on page 74) the *Maximum Equation of the Orbit of Saturn* [Maxima Aequatio Orbis Saturni].
7. Seventh, finally, with the Maximum Equation of the Orbit of Saturn, going to the General Table of the Prosthaphaeresis of the Orbit (which is on page 94), observe on the front, or on the side of the Table, with the Anomaly of the Orbit (from number 4) descending on the right, the corresponding prosthaphaeresis of the Orbit. Add it to, or subtract it from, the centric place of Saturn, and you will have the place of Saturn in the Orbit, or equated as seen from the Earth. This same order will hold for Jupiter and for Mars, applying, however, the tables proper to each, as will be said below.

Example for Saturn [ʰ].

In the Year of Christ 1604, on September 27, at about Hour 8 in the evening at Prague, from observations Saturn and Mars were thought to be in the same Longitude. The place of Saturn is sought here. The order of calculation is as follows:

	Sig.	Gr.	'	"	
True place of the Sun	6	4	47	44	Tab. 36

	Sig.	Gr.	'	"	
⊙					
Anomaly of the Sun, equated	2	27	4	44	38
⊙					
Mean motion of Saturn \hbar from \square	8	13	49	13	Tab. 62
Motion of the Apogee	8	26	6	51	Pag. 72
Motion of the Node Ω	3	20	32	5	
Simple Anomaly	11	17	42	22	
Equation 1, to be added	0	1	18	33	Tab. 63
Eccentric place of Saturn \hbar	8	15	7	46	Pag. 73
Anomaly of the Orbit	9	19	39	58	
Anomaly of Saturn \hbar , equated	0	11	35	30	Tab. 64
Maximum Equation of the	0	5	41	30	Pag. 73

	Sig.	Gr.	'	"	
Orbit					Tab. 65
					Pag. 74
Equation of the Orbit, subtractive	0	5	10	30	Tab. 95
Place of Saturn h in the Orbit	8	9	57	16	Pag. 94

Therefore Saturn was then in Sagittarius [Sagittarius] $9^{\circ} 58' 16''$.

Precept 117. To compute the Latitude of Saturn [□].

1. First, with the Anomaly of the Eccentric of Saturn equated, observe on the front, or foot, of Table 66 (which begins on page 75, or such Anomaly of the Orbit of Saturn) on the left, or on the right side of the same Table, look up in the common angle the proportional scruples of latitude.
2. Second, with the Anomaly of the Orbit observed, look up what scruples are in the penultimate column, whose title is *Scrup. Prop. Incr. & Decr.* [proportional scruples of increment and decrement].
3. Third, if the *Scrup. Incr. or Decrement* are in the penultimate column (whose part above the title is A, or whether they correspond to the Anomaly of the Orbit by its first three or last Signs). Taking the proportional scruples (whose title is FB, or such anomaly) accepting the inferior, whose title is *Increm. in σ* [Increment in conjunction]. Take the proportional scruples in the lower part, whose title is FB, accepting the increment or decrement of them; the title is FB, but it falls between, and you take the scruple of decrement from the proper columns; you take, that is to say, with the Anomaly of the Sun equated on the front, or the place of Table 66, and with the Anomaly of the Eccentric of Saturn on the left, or on the right side.
4. Fourth, do, by 60, the scruples of increment, or of decrement, of which I have said number 3 — so the scruple of increment, or of decrement of the penultimate column, of which is number 2 — to the fourth proportional

number; but indeed the number, or this quotient, add, if it is increment; but if it is decrement, subtract the scruples of latitude from the first number found, and you will have the scruples of Latitude corrected.

5. Fifth, go to Table 67 (page 76) and with the distance of the Eccentric place of Saturn from the North Node sought (on the front, or foot, by which Signs and by the degrees of the Signs on the left, or on the right side, look in the columns of latitudes) the Latitude is a right sine, as the Radius is to 60.
6. Sixth, finally, do, by 60, the sine of latitude as the Radius is right, of which number 5; so the scruples of latitude corrected, of which the number, or other, and there will come out number 5, but if number 96 (page 107) in the General Table of the Latitude of Saturn, will exhibit its affections, how distant from the North Node ♄ the Signs in Table 67 indicate.

Example.

The same case as that treated in the preceding Precept.

	Sig.	Gr.	'	"	
Anomaly equated	0	11	35	30	Tab. 66
ħ					
Anomaly of the Orbit	9	19	9	58	
Therefore			51	44	
e					
proportio					
nal					
scruples					
of					
latitude					
And			17	52	
scruple					
of Incr.					
or Decr.					
Because					
they are					
above,					
they					

	Sig.	Gr.	'	"	
indicate <i>Increment</i> <i>t</i>					
Anomaly of the Sun ☉ equated was	2	26	34	44	
Therefor e Increme nt in ☉			6	30	Per 60

Precept 122. To compute the place of Mars in longitude.

Carry out everything as in Precept 116, but use the tables proper to Mars, which begin at Table 74 (p. 81) and end on p. 84.

Example.

In the year 1604, on October 9, a little before noon, a conjunction of Jupiter and Mars was observed from the observations made at Prague. For me, the time was then 23^h 0^m after the meridian of October 8, that is, at 8°15'19" of Sagittarius [in gr. □ 8. 15'. 19"]. The place of Mars is now sought; the calculation runs as follows.

	Sig.	Gr.	'	"	Tab.
☉ True place [Locus verus]	6	16	18	20	36 &
☉ Equated anomaly [Anomali a aequata]	3	8	35	4	38
□ Mean motion [Medius]	10	3	36	22	Tab.

	Sig.	Gr.	'	"	Tab.
motus]					
Motion of apogee [Apogei motus]	4	29	17	49	74
Motion of the north node [Nodi Borei mot.]	1	15	37	54	
Simple anomaly [Anomali a simplex]	5	4	18	33	Tab.
Equated anomaly of inequalit y [Aequati o I. inaeq. sub.]	0	5	8	11	75
□ Eccentric place [Locus Excentric us]	9	28	28	11	
Anomaly of the orbit [Anomali	8	17	50	9	Tab.

	Sig.	Gr.	'	"	Tab.
a Orbis]					
Equated anomaly of Mars [Anomali a □ aequata]	5	2	0	3	76 &
Maximu m equation of the orbit [Maxima Orbis aequatio]	0	45	15	0	77
Equation of the orbit, subtracti ve [Orbis aequatio subtr.]	1	9	13	49	&
□ Place in the orbit [Locus in Orbita]	8	19	14	22	95

Precept 123. To compute the latitude of Mars.

Do everything as in Precept 117, but use the tables proper to Mars, which begin at p. 81.

Example, concerning which see in the preceding Precept.

	Sig.	Gr.	'	"
Equated anomaly of Mars	5	2	0	3

	Sig.	Gr.	'	"	
[Anomal. □ aequata]					
Anomaly of the orbit	8	17	50	9	
[Anomali a Orbis]					
Therefor e scruples of latitude	0	14	20	0	Tab.
[Ergo scrup. Latit.]					
And scruples increase or decrease	0	11	37	0	78
[Et scrup. Incr. vel Decr.]					
(which are the higher ones)					
[Quae sunt superior a]					
And they indicate increase					
[Et indicant					

	Sig.	Gr.	'	"
Increm.]				
☉	3	8	35	4
Equated anomaly [Anomal. ☉ aequata]				
Scruples- increase on ☐ [Scrup. Incr. in ☐]	0	0	4	0

Since 60" corresponds to 14'20", so 4' corresponds to 57"20" [ita 4'. 57". 20"]; this is to be added to the scruples of latitude, so that the corrected latitude comes to 15'17'20" [gr. 15. 17'. 20"].

	Sig.	Gr.	'	"	
Distance of the eccentric place from the node Ω [Distanti a loci Excentr. in Nodo Ω]	8	12	50	17	Tab.
Sine of latitude [Latitudi nis Sinus]	0	7	4	0	80

Since 60° corresponds to 15'17'20", so the sine 1.47 [Sinus 1. 47] corresponds to 4' [4'. 20"]. As for the signs in the General Table of Latitude, etc. [Qui in Generali

Tabula Latitudinis dat Latitud. gr. 1. 52'. Australem gr. 1. 52'. Australem], the southern latitude of 1°52' — as is indicated by the signs of the distance from the node Ω .

	Sig.	Gr.	'	"	
					Tab.
					96

[The marginal note "Tab. 96" applies to the General Table of Latitude cited above.]

Precept 124. To reduce the place of Mars from the orbit to the ecliptic, and to work out its curtation.

Do everything as in Precept 118, but use the table proper to Mars, namely Table 80, which is found on p. 84.

[The remainder of this precept's worked example is continued in the *Exemplum Superioris Casus* in the right column below.]

Example of the case above.

	Sig.	Gr.	'	"	Tab.
Distance of the eccentric place from Ω [Dist. loci Excent. à Ω]	8	11	50	17	
Therefor e curtation [Ergo Curtatio]	0	0	1	7	Tab.
And reductio n, subtracti ve [Et Reductio	0	0	0	32	80

	Sig.	Gr.	'	"	Tab.
subtr.]					
Because it approached the limit [Quia accedebat ad limitem]					
Place in the orbit [Locus in Orbita] is	8	19	14	22	
Therefore place in the ecliptic [Ergo Loc. in Ecliptica]	8	19	13	50	
Maximum equation of the orbit [Aequatio Orbis maxima]	0	45	15	0	
Equation of the orbit, subtractive [Aequatio Orbis subtr.]	0	49	13	49	

Therefore, as $45^{\circ}15'$ corresponds to the curtation $1'7''$, so $49^{\circ}13'49''$ corresponds to the curtation $1'13''$ — by which the equation of the orbit must be diminished, in order that less be subtracted; but in the same way, as if you were to add $1'13''$ to the place of Mars reduced to the ecliptic. Hence the place of Mars reduced and curtated was in Sagittarius $19^{\circ}15'3''$ [in Sagittarii gr. 19. 15'. 3"], while that of Jupiter was at $19^{\circ}15'36''$ of Sagittarius [gr. □ 19. 15'. 36"]. Hence a little after 23^{h} the conjunction of Mars and Jupiter was celebrated — namely at $23^{\text{h}} 50^{\text{m}}$ after the meridian of October 8, as the observation has it [vt habet observatio].

Precept 125. To compute the place of Venus in longitude.

First, find by Precept 55 the true place of the Sun and its equated anomaly.

Second, in Table 81 (found on p. 85), extract the mean motion of Venus from the equinox, the motion of the apogee, and the motion of the north node.

Third, subtracting the motion of the apogee from the mean motion of Venus, you will have the *simple anomaly* [Anomalia simplex]; with this, in Table 82 (on p. 86), you will have the first equation [primam Aequationem], to be added to, or subtracted from, the mean motion of Venus — as the headings of the table will indicate — and the place of Venus equated for the first time will result, that is, the eccentric place, or the place as seen from the Sun [Locus Veneris primò Aequatus, seu Excentricus, seu ex Sole visus].

Fourth, subtract the true place of the Sun from the eccentric place of Venus, and the anomaly of the orbit [Anomalia Orbis] will remain.

Fifth, with the simple anomaly (which is in Table 83, p. 86), find the equated anomaly of Venus; with which, and with the equated anomaly of the Sun, in the side-columns of Table 84 (pp. 86–87), find the maximum equation of the orbit [Maximam Orbis Aequationem].

Sixth, with the anomaly of the orbit (in the side-columns), and with the maximum equation of the orbit at the front of Table 95, collect the equation of the orbit to be added to, or subtracted from, the place of the Sun — as the headings of the table teach — and you will have the place of Venus as seen from the Earth [Veneris locum ex Terra visum].

Example.

Longomontanus [Longomontanus] reports that in the year 1585, on September 14, by the old style, at the hour of $5^{\text{h}} 15^{\text{m}}$ past the meridian, Venus was observed by Tycho [Tychonem] at its greatest digression from the Sun, in $17^{\circ}15'$ of Leo [in

Leonis gr. 17. 15'. 58']. Let it be by the Danish Tables, with reduction and curtation set aside [absq; Reductione, & Curtatione], 15°53'20" in degrees [dent gr. 15. 53'. 20"]. Yet the place was somewhat falser when Tycho's place of the Sun was assumed, on account of the too-great parallax of the Sun assumed, the declination, etc. Let us see what our tables present.

	Sig.	Gr.	'	"	Tab.
☉ True place [Locus verus]	6	1	48	41	Tab.
☉ Equated anomaly [Anomal. aqu.]	1	24	25	23	36
☐ Mean motion [Motus medius]	1	10	37	22	38
Motion of apogee [Apogei mot.]	10	5	10	14	Tab.
Node ♁ [Nodi ♁]	2	15	59	52	81
Simple anomaly [Anomali a simpl.]	3	5	27	30	Tab.
First equation, subtractive [Aequatio 1. sub.]	0	0	54	24	82
☐ Eccentric	1	9	42	58	

	Sig.	Gr.	'	"	Tab.
place [Locus ex.]					
Anomaly of the orbit [Anomali a Orbis]	7	7	54	17	Tab.
Equated anomaly [Anomali a Aequata]	3	4	59	57	83
Maximu m equation of the orbit [Maxima Orb. Aeq.]	0	46	4	30	84
Equation of the orbit, subtracti ve [Orbis Aequatio sub.]	1	5	41	50	85
□ Place in the orbit [Locus in Orbita]	4	16	6	30	

It was therefore in Leo $16^{\circ}6'30''$ [in □ grad. 16. 6'. 30"].

Precept 126. To compute the latitude of Venus.

First, from Table 85 (p. 88), draw out the proportional scruples of latitude, with the anomaly of the Sun equated at the front [in fronte], or with the anomaly of the orbit of Venus in the side-columns; and with this, the inferior scruple at the foot of the table [scrupula inferiora in calce Tabulae].

Second, in Table 86 (p. 89), with the anomaly of the Sun equated at the front, or at the foot of the table, and with the equated anomaly of Venus in the side-columns, find the scruples of decrement [Scrupula Decrement].

Third, work so that, as 60" is to the scruples of decrement found by Table 85, so the inferior scruple is to the decrement found by Table 86; and subtract this from the scruples of latitude first found, in order that they come out corrected.

Fourth, with the distance of the eccentric place of Venus from the north node [distantia loci Excentrici Veneris à Nodo Boreo] (which is in Table 87, p. 89), find the sine of the latitude.

Fifth, work so that, as 60" is to the sine of latitude, so the corrected scruple is to another scruple, which in the general table (which is Table 96) will give the latitude of Venus, of the same kind that the distance from the north node indicated in Table 87.

Example in the case above.

	Sig.	Gr.	'	"	Tab.
☉	2	24	25	23	Tab.
Equated anomaly [Anom. aequata]					
Anomaly of the orbit □ [Anomali a Orbis □]	7	7	54	17	85
Scruples of latitude [Scrupul a latitud.]	0	24	18	0	

	Sig.	Gr.	'	"	Tab.
Inferior scruple [Scrupul a inferiora]	0	11	58	0	
Anomaly □ equated [Anom. □ aq.]	3	4	59	57	Tab.
Scruple decreme nt [Scrup. Decrem.]	0	1	56	0	86

Since now 60" corresponds to 1'56", so 18" [11'. 58"] corresponds to the scruple decrement 1'36' and 18" [gr. 1. 36'. 18"]; this, being subtracted from the scruples of latitude, leaves the corrected latitude at 24°0' [grad. 24. 0'].

	Sig.	Gr.	'	"
Node Ω place [Nodi Ω locus]	2	13	59	52
□ Eccentric place [Locus ex.]	1	9	42	58
Distance ♀ from Ω [Distanti a ♀ à Ω]	1	4	16	53
Sine of latitude	0	5	45	0

	Sig.	Gr.	'	"
[Sinus latitudinis]				

Since now 60" corresponds to this sine of 5'45" [grad. 5. 45'], so the corrected scruple of latitude of 24°0' [grad. 24. 0'] corresponds to the other sine of 2'18" [gr. 2. 18'], which in Table 96 gives the latitude of Venus of 2'24" [grad. 2. 24'] North [Borealem] — provided the distance of Venus from the further north node was 2°4'14" [Sign. 2. gr. 4. 14']; therefore *Descending* [Descendens].

Precept 127. To reduce the place of Venus from the orbit to the ecliptic, and to work out its curtation.

First, with the distance of the eccentric place of Venus, or its place as seen from the Sun, from the north node, find in Table 87 the reduction and the curtation. But if Venus happens to be in the orbit, there are no reductions, only maximal curtations; on the contrary, in the conjunctions there are no curtations, only maximal reductions.

Second, work so that, as the maximum equation of the orbit corresponds to the reduction found, so the difference between the maximum equation of the orbit and the equation of the orbit corresponds to the reduction to be added to, or subtracted from, the anomaly of the orbit, if the planet approaches the nodes by receding from the limit; but it is to be subtracted if it recedes from the nodes by approaching the limit.

Third, work so that, as the maximum equation corresponds to the curtation found, so the anomaly of the orbit corresponds to the curtation to be added to, or subtracted from, the equation of the orbit; so that, if the equation of the orbit was subtractive, less should be subtracted, but if direct, less should be added.

Example in the preceding case.

	Sig.	Gr.	'	"
□	1	4	16	53
Distance from Ω was [Dist. à Ω fuit]				
Therefor	0	0	2	48

	Sig.	Gr.	'	"
e reduction to be added [Ergo Reductio add.]				
And	0	0	3	18
curtation [Et Curtatio]				
Maximum equation of the orbit [Maxima Aequat. Orb.]	0	46	4	30
Equation of the orbit [Orbis Aequatio]	0	45	41	50
Difference of these [Differen tia harum]	0	0	22	40

Now, as $46^{\circ}4'30''$ corresponds to the reduction $2'48''$, so it differs by $22'40''$, that is, $40''$ corresponds to the reduction [Reduct. $1' 18''$], so the reduction was $1'18''$ [Reductus fuit Sig. 4. grad. 16. $7' 48''$]; that is, Sign 4, $16^{\circ}7'48''$.

Next, as $46^{\circ}4'30''$ corresponds to the curtation $3'18''$, so $45^{\circ}41'50''$ corresponds to the curtation $3'11''$; this, subtracted from the place of Venus reduced [loco Veneris Reduto], gives the curtated place in Leo $16^{\circ}10'48''$ [Curtatum in Leonis gr. 16. $10'$.

48" — namely 13" minutes [13" fere minutis] more advanced than the Tychonic one [Tychonico], but false on account of the too-great parallax of the Sun and the declination, and perhaps too on account of the observations themselves [ob ipsam observationem].

Precept 128. To compute the place of Mercury in longitude.

Do everything as in Precept 125 (as you did for Venus), but apply the tables proper to Mercury, which begin at Table 88 (from p. 90) and end on p. 94.

Example.

In the year 1481, on October 21, at 18^h 10^m after noon at Bologna [Hora Bononiae 18. 10'. post merid.], Mercury was observed more easterly than Saturn, by more than a diameter of the Moon; Saturn was then in Libra 15°20' [in Libra grad. 15. 20'], for me. Therefore Mercury was very nearly in Libra 18°46' [in Libra gr. 18. 46']. The place from the Earth is sought; the calculation is as follows.

	Sig.	Gr.	'	"	Tab.
☉ True place [Locus verus]	7	7	52	30	36
☉ Equated anomaly [Anomal. aequ.]	4	2	16	42	38
♀ Mean motion [Motus medius]	3	9	39	30	Tab.
Motion of apogee [Apogei mot.]	8	8	10	49	88
Node ♁ [Nodi ♁]	1	9	20	48	
Simple anomaly	7	1	28	41	

	Sig.	Gr.	'	"	Tab.
[Anomal. simpl.]					
First equation to be added	0	15	31	0	Tab.
[Aequatio 1. add.]					
☿ Place from the Sun	3	25	10	30	89
[Locus ex Sole]					
Anomaly of the orbit	8	17	18	0	
[Anomalia Orbis]					
Equated anomaly	7	7	46	34	Tab.
[Anomalia Aequata]					
Maximum equation	0	18	59	0	90
[Maxima Aequatio]					
Equation of the orbit, subtractive	0	18	49	50	91
[Orbis Aequatio sub.]					

	Sig.	Gr.	'	"	Tab.
☿ Place in the orbit [Locus in Orbita]	6	19	2	40	95

The place of Mercury in the orbit was therefore in Libra 19°2'40" [in □ grad. 19. 2'. 40"].

Precept 129. To compute the latitude of Mercury.

First, with the equated anomaly in the sign opposite at the front of Table 92, or at the foot of the table — the anomaly of Mercury in the side-columns — find the proportional scruples of latitude. But if the signs are 6 or greater [Vt si Signa sint 6. gr. 20.], use Sign 1, gr. 2, because in the investigation of the scruples of latitude, the table begins at the perigee, where the longitude begins at the apogee.

Second, note in Table 92 that the two columns of proportional scruples of increment and decrement — namely the second and the next-to-last — respond, the second one to the least distance of Mercury from the Sun, and this is to be used when the anomaly is eccentric, but changed as I have said, that is: at the front of the table, if the sign is less than Sign 1, or greater than 10 — the next-to-last is to be used. But when the maximum distance of Mercury from the Sun is to be served, namely when the eccentric anomaly is reckoned, changed in the opposite sign, if the sign is greater than 4 or greater than 8; when, finally, the anomaly is less than Sign 4 or 10, you are to use the middle distances, which respond in part to the proportional column, and you should collect the columns; and the next-to-last, compared at the same time — these things being well understood, find in Table 92 the *Proportional scruples of increment and decrement*, noted in the side-columns with the anomaly of the orbit.

Third, if the scruples of increment and decrement are superior, and pertain to the part of the second column, or the next-to-last, whose title is B, then in that same table the next-to-last column being taken, the scruples of decrement are in conjunction direct with the equated anomaly of the Sun. But if the scruple [is] in-

[Continuation of Precept 129:] -crement and decrement are inferior, and pertain to the part of the second column, or the next-to-last, whose title is B, then in Table 93, with the anomaly of Mercury equated at the front, or at the foot, and with the

equated anomaly of the Sun in the side-columns, the *Scruples of decrement* are to be taken in opposition, that is, in the retrograde conjunction.

Fourth, work so that, as 60" is to the proportional scruples of decrement in ☐ direct, or retrograde, of which there is mention, so the proportional scruples of increment, or decrement, found, correspond to the scruple to be applied to the correction of the scruples of latitude, and to be added to them.

Fifth, with the distance of the eccentric place of Mercury from the north node, find in Table 94 the sine of latitude, and work so that, as 60" is to this sine, so the corrected scruple of latitude corresponds to the other sine, which in Table 96 will exhibit the latitude of its kind, such as Table 94 indicates the distance of Mercury from the north node.

Example in the preceding case.

	Sig.	Gr.	'	"	
Anomaly ☿ equated [Anomali a ☿ aequata]	7	7	46	34	
Opposite to which are [Pro qua opposita sunt]	1	17	46	34	
Anomaly of the orbit [Anomali a Orbis]	8	17	18	0	
Equated anomaly of the Sun [Anomali a Solis]	4	2	16	42	Tab.

	Sig.	Gr.	'	"	
aq.]					
Scruples of latitude [Scrupul a Latitud.]	0	22	24	0	92
Scruple increase or decrease [Scrup. Incr. vel Decr.] (which are the inferior) [Quae sunt inferiora] Therefor e [the] scruples of decreme nt [Ideo scrup. Decreme nti]	0	2	17	0	
In □ retrograd e are [In □ Retrogra da sunt]	0	0	31	0	93

Tab.

Since now 60" corresponds to 31", so 17" [gr. 2. 17'] corresponds to 12" [1'. 12']; subtracting the scruples of 22'24" [gr. 22. 24'], so that the corrected scruples remain at 21°12' [gr. 21. 12'].

Then:

	Sig.	Gr.	'	"	
Node Ω place was [Nodi Ω locus erat]	1	9	20	48	
\wp Eccentric place [Locus \wp Excentric us]	3	25	10	30	
Distance \wp from node Ω [Distanti a \wp à Nodo Ω]	2	15	49	42	
Sine of latitude [Latitudi nis Sinus]	0	6	15	0	in Table 94

Since now 60" corresponds to 6'15" [gr. 6. 15'], so 21'12" [gr. 21. 12'] corresponds to the sine 2'13" [Sinum 2. 13'], which in Table 96 gives the latitude of 2°18' North [grad. 2. 18'. Borealem], as the signs indicate the distance from the node and ascending [Distantia à Nodo, & Ascendentem], on account of the approach to the north limit [ob accessum ad litem Boreum].

Precept 130. To reduce the place of Mercury from the orbit to the ecliptic, and to work out its curtation.

Do everything as for Venus in Precept 127, but use the tables proper to Mercury, namely 91 and 94.

Example in the preceding case.

	Sig.	Gr.	'	"	
Distance ☿	2	15	49	42	Tab.
Eccentric Ω [Dist. ☿ Excentric i Ω]					
Reductio n, subtracti ve [Reductio subtr.]	0	0	6	3	94
Curtatio [Curtatio]	0	0	10	3	
Maximu m equation [Aequati o Maxima]	0	18	59	0	Tab.
Equation of the orbit [Aequati o Orbis]	0	18	49	50	95
Differenc e of these [Differen tia harum]	0	0	9	0	

As $18^{\circ}19'$ corresponds to the reduction $6'3''$, so the difference $9'$ corresponds to $16''$ [$9'$. ad $16''$]. Therefore the place of Mercury reduced to the ecliptic was in \square $19^{\circ}1'24''$ [in \square grad. 19. 1'. 24'']. Next, as the maximum equation of the orbit $18^{\circ}19'$ corresponds to the curtation $10'3''$, so the equation of the orbit $18^{\circ}49'50''$ corresponds to the curtation $10'$ [ad Curtationem $10'. 3''$ ad Curtationem $10'$]; this, added to the place of Mercury reduced, [gives] indeed the equation of the orbit, which was subtractive [si quidem Orbis Aequatio fuit subtractiva], so the curtated place in the ecliptic was in \square $19^{\circ}11'$ [in \square grad. 19. 11']. This observation was placed in \square at $18^{\circ}46'$ circiter [in \square grad. 18. 46'. circiter], on account of the fallacious eye-estimation [oculi aestimationis] and the Lunar day's quantity between Saturn and Mercury seen [inter ♄ & ♃ visam].

Precept 131. To find the declination and right ascension of the planets by the tables.

By the tables, I say, without the solution of spherical triangles. Therefore first inquire the longitudes by Precept (and the like), and the latitudes of the planets by the precepts handed down above; then use Precept 54 and Tables 34 and 35, made for that use.

Precept 132. To find the distance of the minor planets from the Sun, in parts of which the mean radius of the Sun's annual orbit, or the radius of the annual orbit, is 100000.

You have, from the precepts given above for each individual planet, the equated anomaly of the planet; and resolve it into degrees — for if these degrees are sought first, in the first, or second, column of Table 97 (which is found on p. 108), then over against those degrees you will have, under each individual planet, the distance of that planet itself from the Sun, in parts of which the radius of the Sun's annual orbit, or the greater semidiameter of the Solar Ellipse, or the mean of the Sun from the Earth, is 100000. But if there is need, use the proportional part, as in Saturn.

Example, from Jupiter.

Above, in the Example of Precept 116, the equated anomaly of Saturn was Signs 0, gr. 11, $35'30''$ [Signorum 0. gr. 11. $35'. 30''$]. Resolved into degrees, it remains gr. $11^{\circ}35\frac{3}{4}'$ [grad. 11. $35' \frac{3}{4}$]; for these, in Table 97, under ♄ corresponds the distance from the Sun of 1008340 parts [partium 1008340], as may be seen by the proportional part.

But in the Example of Precept 119, the equated anomaly of Jupiter was Signs 3, gr. 6 [Sign. 3. gr. 6.]; for this, gr. 96 [grad. 96], which is precisely in Table 97 under \sphericalangle , corresponds the distance 935927 parts [distantia 935927. partium], of which the radius of the Sun's annual orbit is 100000. And so for the rest.

Precept 133. To find the distance of the minor planets from the Earth in parts of the radius of the Sun's annual orbit.

If you should desire the extreme distances from the Earth — when the planet is in apogee, or perigee (that is, in aphelion, or perihelion) — those are exhibited at the foot of Table 97. The rest must be hunted out by the help of trigonometry: from the distance from the Sun given by Precept 58, and the distances of the minor planets by Precept 132, with the angle of the equated anomaly comprehended from these distances.

Precept 134. To find the distance of the planets from the Sun, or from the Earth, in semidiameters of the Earth.

We have the distance of the planet first in parts, of which the radius of the Sun's annual orbit is 100000, by Precepts 132 and 133; and multiply it by the semidiameters of the Earth, which the mean distance of the Sun from the Earth contains, according to the opinion which you please here to follow; and divide the product by 100000 — for in the quotient you will have the distance you desire, in semidiameters of the Earth.

Example in Jupiter.

In the Example of Precept 132, for \sphericalangle we had the distance of Jupiter from the Sun of 935927 parts, of which the radius of the annual orbit is 100000. Now, since by us the mean distance of the Sun from the Earth is reckoned at 7300 semidiameters of the terrestrial [orb], multiply 935927 by 7300; the product is 6832287300; and this divided by 100000 leaves the distance of Jupiter from the Sun of 68323 terrestrial semidiameters [semidiametrorum terrestrium 68323].

Precept 135. To find the longitude and latitude of the fixed stars at any given time.

Therefore first, in Table 98 (which is found on p. 109), seek the longitude and latitude of the given fixed star, given to the end of the year of Christ 1700; for the latitude indeed is there found in perpetuity. Then [seek] the intervals of years between the given year and the year, and between the year 1700,

[Continuation of Precept 135 — the fixed stars' longitude and latitude for any given time.]

seek out from Table 100 the motion of the fixed stars matching the expanded and collected years, and reduce them into a single sum. If you add this sum, when the given time falls after the year 1700, or subtract it, when the given time precedes 1700 — the result is, or there remains, the longitude of the fixed star for the given time.

Example for Regulus, in the year 456.

For the completed year 1700 of Christ, the longitude of Regulus is 25° 38' 32" of Leo [□]. Its latitude, by contrast, is perpetually north at 0° 26' 20". Now let the year 456 of Christ be given, completed; subtracting this from 1700 leaves an interval of 1244 years, to which there corresponds, from Table 100, a motion of 15° 30' 29" — for the sum stands as follows:

Motion	Gr.	I	II	III
For 1000 years	14	4	26	6
For 200 years	2	48	53	20
For 44 years	0	37	9	20
Sum	15	30	28	46

If you subtract this (because the given time precedes the epoch) from Regulus's radix longitude of 25° 38' 32", there remains for Regulus a longitude of 10° 8' 3", which agrees with that found at the end of the year 456. And the north latitude is 0° 26' 20".

Precept 136. To find the right ascension and declination of the fixed stars for a given time, with a notable advisory concerning the Pole Star [the bright star in the Lesser Bear's shoulder] and stars like it.

If the fixed star in Table 99 is not the Pole Star [the bright Humerus of the Lesser Bear], seek its right ascension in Table 99, and adjoin to that very right ascension the centennial difference belonging to it at the end of the year 1700 of Christ. This difference is to be subtracted if the given time precedes 1700, but added if it follows — for at the year 1700 the procedure is reversed: where it says "subtract" you must add, and where it says "add" you must subtract. Furthermore, each

difference is to be multiplied by the interval of time between the year 1700 and the given time, and the product divided by 100; for there comes out the difference to be added to, or subtracted from, the radix of the year 1700, as I have said.

Example for Regulus, in the year 456.

In Table 99, for the completed year 1700, the right ascension of Regulus is $148^{\circ} 4' 15''$; its centennial difference is $1^{\circ} 22' 30''$. Its declination, by contrast, is north at $13^{\circ} 25' 16''$; and its centennial difference is $28^{\circ} 30'$ [*recte* read in context below]. Now the interval of preceding time was 1244 years, which, multiplied by the right-ascension difference of $1^{\circ} 22' 30''$, yields a sum in seconds of 4950"; this makes a sum of seconds of 5157800", which, divided by 100, leaves 51578" — that is, $14^{\circ} 19' 38''$. And because the given time precedes the radix, these subtracted differences are pulled away from the right ascension of $148^{\circ} 4' 15''$ stated; subtracting the said $14^{\circ} 19' 38''$ leaves, for the year 456 of Christ, Regulus's right ascension of $133^{\circ} 44' 37''$.

But concerning the declination, the difference is not to be subtracted but added — beforehand, since the centennial difference is $28^{\circ} 30'$, that is 1710", which, multiplied through the 1244 years, makes 2327240"; dividing this by 100 leaves 23272", that is $6^{\circ} 27' 52''$; and these added to the declination of the year 1700, namely $13^{\circ} 25' 16''$, give for the year 456 of Christ Regulus's north declination of $19^{\circ} 53' 8''$.

On the bright Humerus of the Lesser Bear, for the year 456.

We showed once before, in Book 6, Problem 11, and we stressed it in Volume One of the *Astronomia Reformata*, Book 4, that the right ascension of certain stars sometimes decreases, even while their longitude increases. Supposing the obliquity of the ecliptic to be perpetually $23^{\circ} 30'$ — as we suppose — the right ascension begins to decrease in the first quadrant of the ecliptic and ceases to decrease in the second, for stars of greater latitude than $66^{\circ} 29' 40''$. But if the stars are northern, the right ascension begins to decrease in the first quadrant of the ecliptic and ceases in the second. Of such stars we have here numbered thirty-five in Table 99 — except the bright Humerus of the Lesser Bear, which, in our own time, was Cynosura [the constellation tail-tip], and nearest the Pole of the World; for this star the north latitude is no greater than $72^{\circ} 48' 40''$. Hence it follows that, from the beginning of the World, its right ascension continually decreased, the longitude continually increasing, until it should reach roughly 15° of Leo — which befalls around the year 2137 of Christ.

Therefore, since the right ascension at the year 1700 in Table 99 is given as $222^{\circ} 39' 20''$, and the centennial difference is $1^{\circ} 15'$ — that is $75''$ — which, multiplied by the 1244 years that intervene from the year 456 to 1700, makes 93300"; and this, divided by 100, leaves 933", that is $15^{\circ} 33''$ — these are not to be subtracted but added, since the right ascension is decreasing, as the page 222, 39, 20 bears out; and so the right ascension of the bright Humerus of the Lesser Bear, for the year 456 of Christ, comes out to $238^{\circ} 12' 20''$.

TABVLAE NOVALMAGESTICAE

OF THE SECOND MOTIONS [SECVNDORVM MOBILIVM]

With several Tables of the Primum Mobile necessary to them.

[Half-title / banner page. Reverse-side (verso) show-through of the preceding tables is visible but carries no independent text.]

Prima Pars Tabularum Astronomicarum spectans ad Tempus.

[The First Part of the Astronomical Tables, concerning Time.]

[Table-volume pagination restarts here at 1.]

TABVLA I. Of the Parts of the As applied. [Partium Assis applicatarum.]

Parts [Partes] — Assis	Parts — Unciae [Vnciae]	Circle [Circulo] — Degrees [Grad.]	Of a Degree, or of an Hour [Gradui, vel Horae] — Minutes [Minuta]	Of a Day [Diei] — Hours [Horae]
Uncia	1	30	5	2
Sextans	2	60	10	4
Quadrans	3	90	15	6
Triens	4	120	20	8
Quincunx	5	150	25	10

Parts [Partes] — Assis	Parts — Unciae [Vnciae]	Circle [Circulo] — Degrees [Grad.]	Of a Degree, or of an Hour [Gradui, vel Horae] — Minutes [Minuta]	Of a Day [Diei] — Hours [Horae]
Semissis	6	180	30	12
Septunx	7	210	35	14
Bes	8	240	40	16
Dodrans	9	270	45	18
Dextans	10	300	50	20
Deunx	11	330	55	22
As (Libra)	12	360	60	24

Parsing notes: The first column gives the Roman fractional-unit name of the *as* (uncia = 1/12, sextans = 2/12, etc.); "Unciae" gives the count in twelfths.

TAB. 2. Resolution of an Hour, a Degree, or a Circle into Sexagesimal Parts [Scrupula]. [Resolutio Horae, Gradus, aut Circuli in Scrupula.]

1 Hour or 1 Degree contains [Hora 1. vel Gradus 1. continet]	Value	One whole Circle contains [Circulus unus continet]	Value
Minutes [Minuta]	60	Degrees [Gradus]	360
Seconds [Secunda]	3600	Minutes [Minuta]	21600
Thirds [Tertia]	216000	Seconds [Secunda]	1296000
Fourths [Quarta]	12960000	Thirds [Tertia]	77760000
Fifths [Quinta]	777600000	Fourths [Quarta]	4665600000
Sixths [Sexta]	46656000000	Fifths [Quinta]	279936000000

1 Hour or 1 Degree contains [Hora 1. vel Gradus 1. continet]	Value	One whole Circle contains [Circulus unus continet]	Value
Sevenths [Septima]	2799360000000	Sixths [Sexta]	1679616000000 0
Eighths [Octava]	1679616000000 00	Sevenths [Septima]	1007769600000 000
Ninths [Nona]	1007769600000 0000	Eighths [Octava]	6046617600000 0000
Tenths [Decima]	6046617600000 00000	Ninths [Nona]	3627970560000 000000
		Tenths [Decima]	2176782360000 00000000 [?]

Parsing notes: This is the successive sexagesimal expansion ($\times 60$ at each step). The final "Decima" entry in the right-hand "whole Circle" column has the most digits and is hardest to count exactly; the trailing-zero run is read as best as the resolution allows and flagged [?]. The "Decima" cell for the left column ends the left ladder; the right column carries one extra row.

TAB. 3. Conversion of Hours, and their Sexagesimal Parts, into First and Second Parts of a Day, etc. [Conversio Horarum, earumque Scrupulorum in Diei Scrupula Prima, & Secunda, &c.]

Hours [Hore] / Minutes [Minuta] / Seconds [Secunda]	Dies	I / III	II / IV	Horae / Minutes / Seconds	Dies	I / III	II / IV
1	0	2	30	31	1	17	30
2	0	5	0	32	1	20	0

Hours [Hore] / Minutes [Minuta] / Seconds [Secunda]	Dies	I / III	II / IV	Horae / Minuta / Seconds [Secunda]	Dies	I / III	II / IV
3	0	7	30	33	1	22	30
4	0	10	0	34	1	25	0
5	0	12	30	35	1	27	30
6	0	15	0	36	1	30	0
7	0	17	30	37	1	32	30
8	0	20	0	38	1	35	0
9	0	22	30	39	1	37	30
10	0	25	0	40	1	40	0
11	0	27	30	41	1	42	30
12	0	30	0	42	1	45	0
13	0	32	30	43	1	47	30
14	0	35	0	44	1	50	0
15	0	37	30	45	1	52	30
16	0	40	0	46	1	55	0
17	0	42	30	47	1	57	30
18	0	45	0	48	2	0	0
19	0	47	30	49	2	2	30
20	0	50	0	50	2	5	0
21	0	52	30	51	2	7	30
22	0	55	0	52	2	10	0
23	0	57	30	53	2	12	30
24	1	0	0	54	2	15	0

Hours [Hore] / Minut es [Minu ta] / Secon ds [Secun da]	Dies	I / III	II / IV	Horae / Minut a / Secun da	Dies	I / III	II / IV
25	1	2	30	55	2	17	30
26	1	5	0	56	2	20	0
27	1	7	30	57	2	22	30
28	1	10	0	58	2	25	0
29	1	12	30	59	2	27	30
30	1	15	0	60	2	30	0

Parsing notes: The table is laid out in two half-tables side by side (entries 1–30 left, 31–60 right). The leftmost stub stacks three labels (Horae / Minuta / Secunda) and the value columns three (I/II, II/III, III/IV) — i.e. an hour resolves into Dies + first/second day-parts; a minute one rank lower; a second one rank lower again. Each numbered argument multiplies by 2½ (= 2'30") of a day-part, the regular progression confirming the readings.

TAB. 4. Conversion of the Sexagesimal Parts of a Day into Equal Hours, and into Hour-Sexagesimals [Scrupula Horaria]. [Conversio Scrupulorum Diei in Horas Aequales, & Horaria scrupula.]

Sexagesimal Parts of a Day [Scrupula Diei]: Prima / Secunda / Tertia	Horae / I / II	I / II / III	Scrupula Diei: Prima / Secunda / Tertia	Horae / I / II	I / II / III
1	0	24	31	12	24

Sexagesimal Parts
of a Day
[Scrupula
a Diei]:

Scrupula
Diei:

Prima / Secunda / Tertia	Horae / I / II	I / II / III	Prima / Secunda / Tertia	Horae / I / II	I / II / III
2	0	48	32	12	48
3	1	12	33	13	12
4	1	36	34	13	36
5	2	0	35	14	0
6	2	24	36	14	24
7	2	48	37	14	48
8	3	12	38	15	12
9	3	36	39	15	36
10	4	0	40	16	0
11	4	24	41	16	24
12	4	48	42	16	48
13	5	12	43	17	12
14	5	36	44	17	36
15	6	0	45	18	0
16	6	24	46	18	24
17	6	48	47	18	48
18	7	12	48	19	12
19	7	36	49	19	36
20	8	0	50	20	0
21	8	24	51	20	24
22	8	48	52	20	48
23	9	12	53	21	12
24	9	36	54	21	36
25	10	0	55	22	0
26	10	24	56	22	24

Sexagesimal Parts of a Day [Scrupula a Diei]:			Scrupula Diei:		
Prima / Secunda / Tertia	Horae / I / II	I / II / III	Prima / Secunda / Tertia	Horae / I / II	I / II / III
27	10	48	57	22	48
28	11	12	58	23	12
29	11	36	59	23	36
30	12	0	60	24	0

Parsing notes: Again two half-tables side by side (1–30 left, 31–60 right). Each argument-step adds 24 hour-sexagesimals (the inverse of Table 3: one day-sexagesimal = 24 minutes of time). The stub stacks Prima/Secunda/Tertia day-parts against Horae + I/II hour-parts. At argument 60 the value is exactly 24 hours, confirming the column.

[Table-page number: 1]

Tabulae novalmagesticae — Part I (Time tables), continued

(Table-volume pagination: page 2 = page 3 = page 4 =)

TABLE 5. Collection of the Days of the Common and Bissextile Roman Year

[TABVLA 5. Collectio Dierum Anni Romani Communis, & Bissextilis.]

The stub-column **Bissex.** (bissextile) carries entries only in the lower portion (running counts 28–31 with the cross mark † for the leap-day positions); **Côm.** (common) is the ordinary day-of-year argument. Each of the twelve month columns gives the accumulated day-number reached at the end of that day in that month.

Bis	Ia	M	M	Iu	Iul	Au	Se	Oc	No	De			
se	nu	art	ai	ni	ius	gu	pt	to	ué	cé			
x.	m.	br.	ril.	us.	us.	st.	éb.	b.	b.	b.			
	1	1	32	60	91	12	15	18	21	24	27	30	33
						1	2	2	3	4	4	5	5
1	2	2	33	61	92	12	15	18	21	24	27	30	33
						2	3	3	4	5	5	6	6
2	3	3	34	62	93	12	15	18	21	24	27	30	33
						3	4	4	5	6	6	7	7
3	4	4	35	63	94	12	15	18	21	24	27	30	33
						4	5	5	6	7	7	8	8
4	5	5	36	64	95	12	15	18	21	24	27	30	33
						5	6	6	7	8	8	9	9
5	6	6	37	65	96	12	15	18	21	24	27	31	34
						6	7	7	8	9	9	0	0
6	7	7	38	66	97	12	15	18	21	25	28	31	34
						7	8	8	9	0	0	1	1
7	8	8	39	67	98	12	15	18	22	25	28	31	34
						8	9	9	0	1	1	2	2
8	9	9	40	68	99	12	16	19	22	25	28	31	34
						9	0	0	1	2	2	3	3
9	10	10	41	69	10	13	16	19	22	25	28	31	34
					0	0	1	1	2	3	3	4	4
10	11	11	42	70	10	13	16	19	22	25	28	31	34
					1	1	2	2	3	4	4	5	5
11	12	12	43	71	10	13	16	19	22	25	28	31	34
					2	2	3	3	4	5	5	6	6
12	13	13	44	72	10	13	16	19	22	25	28	31	34
					3	3	4	4	5	6	6	7	7
13	14	14	45	73	10	13	16	19	22	25	28	31	34
					4	4	5	5	6	7	7	8	8
14	15	15	46	74	10	13	16	19	22	25	28	31	34
					5	5	6	6	7	8	8	9	9
15	16	16	47	75	10	13	16	19	22	25	28	32	35
					6	6	7	7	8	9	9	0	0

Bis	Ia	M	M	Iu	Iul	Au	Se	Oc	No	De			
se	Cô	nu	Fe	art	Ap	M	Iu	Iul	Au	Se	Oc	No	De
x.	m.	.	br.	.	ril.	ai	ni	ius	gu	pt	to	ué	cé
						us.	us.	.	st.	éb.	b.	b.	b.
16	17	17	48	76	10	13	16	19	22	26	29	32	35
					7	7	8	8	9	0	0	1	1
17	18	18	49	77	10	13	16	19	23	26	29	32	35
					8	8	9	9	0	1	1	2	2
18	19	19	50	78	10	13	17	20	23	26	29	32	35
					9	9	0	0	1	2	2	3	3
19	20	20	51	79	11	14	17	20	23	26	29	32	35
					0	0	1	1	2	3	3	4	4
20	21	21	52	80	11	14	17	20	23	26	29	32	35
					1	1	2	2	3	4	4	5	5
21	22	22	53	81	11	14	17	20	23	26	29	32	35
					2	2	3	3	4	5	5	6	6
22	23	23	54	82	11	14	17	20	23	26	29	32	35
					3	3	4	4	5	6	6	7	7
23	24	24	55	83	11	14	17	20	23	26	29	32	35
					4	4	5	5	6	7	7	8	8
24	25	25	56	84	11	14	17	20	23	26	29	32	35
					5	5	6	6	7	8	8	9	9
25	26	26	57	85	11	14	17	20	23	26	29	33	36
					6	6	7	7	8	9	9	0	0
26	27	27	58	86	11	14	17	20	23	27	30	33	36
					7	7	8	8	9	0	0	1	1
27	28	28	59	87	11	14	17	20	24	27	30	33	36
					8	8	9	9	0	1	1	2	2
28	29	29	60	88	11	14	18	21	24	27	30	33	36
					9	9	0	0	1	2	2	3	3
29	30	30	✠	89	12	15	18	21	24	27	30	33	36
					0	0	1	1	2	3	3	4	4
30	31	31	✠	90	12	15	18	21	24	27	30	33	36
					1	1	2	2	3	4	4	5	5
31		✠	✠	91	12	15	18	21	24		30		36
					1	2	2	3	4		5		6

	Th	Pa	At	Ch		M	Ph	Ph	Pa		Ep		
Di	ot	op	hy	œ	Ty	ec	en	ar	ch	Pa	Ep	es	
es	h	hi.	r.	ac.	bi.	r.	h.	hi.	.	i.	hi.	.	m
													æ
24	24	54	84	11	14	17	20	23	26	29	32	35	
				4	4	4	4	4	4	4	4	4	
25	25	55	85	11	14	17	20	23	26	29	32	35	
				5	5	5	5	5	5	5	5	5	
26	26	56	86	11	14	17	20	23	26	29	32	35	
				6	6	6	6	6	6	6	6	6	
27	27	57	87	11	14	17	20	23	26	29	32	35	
				7	7	7	7	7	7	7	7	7	
28	28	58	88	11	14	17	20	23	26	29	32	35	
				8	8	8	8	8	8	8	8	8	
29	29	59	89	11	14	17	20	23	26	29	32	35	
				9	9	9	9	9	9	9	9	9	
30	30	60	90	12	15	18	21	24	27	30	33	36	
				0	0	0	0	0	0	0	0	0	

Parsing notes: The **Epagomenæ** column carries values only at arguments 1–5 (361–365), the five epagomenal days that close the Egyptian year; below that it is blank, as printed.

TABLE 7. Conversion of the Hours of the Primum Mobile into parts of the Equator, with the Equation to be Added for the hours of the Solar Day

[TAB. 7. Conuersio Horarum Primi Mobilis in Partes Aequatoris, cum Aequatione Addenda pro horis Diei Solaris.]

This table is printed in three side-by-side panels (each with its own argument run) so as to fit a full conversion on one page. Each panel converts an argument of the Primum Mobile into degrees and scruples of the equator (**Æquat.**: Gr. = degrees, with the sexagesimal scruples I = primes/minutes, II = seconds, III = thirds, IV = fourths), and gives the **equation to be added for the Sun** (☉, "Adde pro ☉").

Panel 1 — argument: Hours of the Primum Mobile (*Pri.Mob. Horæ; Minut.; Secund.*)

Column unit-stack as printed: argument **Horæ** (units I), **Minut.** (units II / I), **Secund.** (units III / II); equator **Æquat. Gr.** with scruples **I** (units II), **II** (units III); add-for-Sun **I** (units III), **II** (units IV).

Horæ	Æquat. Gr.	Adde ☉			
		I	II	Adde ☉ I	II
1	15	2	28	—	—
2	30	4	56	—	—
3	45	7	24	—	—
4	60	9	52	—	—
5	75	12	20	—	—
6	90	14	47	—	—
7	105	17	15	—	—
8	120	19	43	—	—
9	135	22	11	—	—
10	150	24	39	—	—
11	165	27	7	—	—
12	180	29	35	—	—
13	195	32	3	—	—
14	210	34	31	—	—
15	225	36	59	—	—
16	240	39	26	—	—
17	255	41	54	—	—
18	270	44	22	—	—
19	285	46	50	—	—
20	300	49	18	—	—
21	315	51	46	—	—
22	330	54	14	—	—
23	345	56	42	—	—
24	360	59	10	—	—

Parsing notes: In Panel 1 the "Adde pro ☉" sub-columns are blank for the whole-hour arguments (the solar equation accrues only at the finer minute/second resolution shown in Panel 2). Argument label printed as **Horæ** (hours of the Primum Mobile).

Panel 2 — argument: Minutes / Seconds of the Primum Mobile (*1.Mob. Min.; Secund.; Tert.*)

Min.	G.	Æquat. I	Æquat. II	Adde ☉	
				Adde ☉ I	II
1	0	15	0	0	2
2	0	30	0	0	5
3	0	45	0	0	7
4	1	0	0	0	10
5	1	15	0	0	12
6	1	30	0	0	15
7	1	45	0	0	17
8	2	0	0	0	20
9	2	15	0	0	22
10	2	30	0	0	25
11	2	45	0	0	27
12	3	0	0	0	30
13	3	15	0	0	32
14	3	30	0	0	35
15	3	45	0	0	37
16	4	0	0	0	39
17	4	15	0	0	42
18	4	30	0	0	44
19	4	45	0	0	47
20	5	0	0	0	49
21	5	15	0	0	52
22	5	30	0	0	54
23	5	45	0	0	57
24	6	0	0	0	59

Min.	G.	Æquat. I	Æquat. II	Adde ⊙	
				Adde ⊙ I	II
25	6	15	1	0	2
26	6	30	1	1	4
27	6	45	1	1	7
28	7	0	1	1	9
29	7	15	1	1	11
30	7	30	1	1	14

Parsing notes: Panel-2 column stack as printed: argument **Min.** (units I) / **Secund.** (units II) / **Tert.** (units III); **G.** (degrees, II); **Æquat. I** (III) and **II** (IV); **Adde ⊙ I** (III) and **II** (IV). At argument 25 the "Adde ⊙" pair rolls over to the next sexagesimal place (II = 2). Reading of the lower-right add-column digits is tight but legible.

Panel 3 — argument: Minutes / Seconds of the Primum Mobile (continued 31–60) (1.Mob. Minur.; Secund.; Tert.)

Min.	G.	Æquat. I	Æquat. II	Adde ⊙	
				Adde ⊙ I	II
31	7	45	1	1	16
32	8	0	1	1	19
33	8	15	1	1	21
34	8	30	1	1	24
35	8	45	1	1	26
36	9	0	1	1	29
37	9	15	1	1	31
38	9	30	1	1	34
39	9	45	1	1	36
40	10	0	1	1	39
41	10	15	1	1	41
42	10	30	1	1	44
43	10	45	1	1	46
44	11	0	1	1	48
45	11	15	1	1	51

Min.	G.	Æquat. I	Æquat. II	Adde ☉	
				Adde ☉ I	II
46	11	30	1	1	53
47	11	45	1	1	56
48	12	0	1	1	58
49	12	15	2	2	1
50	12	30	2	2	3
51	12	45	2	2	6
52	13	0	2	2	8
53	13	15	2	2	11
54	13	30	2	2	13
55	13	45	2	2	16
56	14	0	2	2	18
57	14	15	2	2	21
58	14	30	2	2	23
59	14	45	2	2	25
60	15	0	2	2	—

Parsing notes: At argument 60 the equator value is 15° 0' (matching argument 4 of Panel 2 scaled), consistent with 60 minutes = 1 hour-of-PrimumMobile → 15°. The final "Adde ☉ II" cell at arg 60 is blank/cut in the source (the running pattern would give ~28); flagged [?] for that single cell only.

TABLE 8. Conversion of the parts of the Equator into time of the Primum Mobile, with the Equation to be Subtracted for the times of the Solar Day

[TAB. 8. Conuersio Partium Aequatoris in Tempus Primi Mobilis, cum Aequatione Subtrahenda pro Diei Solaris Temporibus.]

Three side-by-side panels. Each converts an argument of the equator (**Æquat.**: Grad. = degrees, Min. = minutes, Secúd. = seconds) into time of the Primum Mobile (**Tép. 1.Mob.**: Hor. = hours, with scruples I, II) and gives the **equation to be subtracted for the Sun** (☉, "Subtr. pro ☉": I, II).

Panel 1 — argument: Degrees of the Equator (*Æquat. Grad.; Min.; Secúd.*)

Column stack as printed: argument **Grad.** (units I) / **Min.** (II) / **Secúd.** (II); time **Hor.** with scruples **I** (units I, II) and **II** (II); subtract-Sun **I** (III) and **II** (IV).

Grad.	Hor.	Tép. I	Tép. II	Subtr. ☉	
				I	II
1	0	4	0	0	1
2	0	8	0	0	1
3	0	12	0	0	2
4	0	16	0	0	3
5	0	20	0	0	3
6	0	24	0	0	4
7	0	28	0	0	5
8	0	32	0	0	5
9	0	36	0	0	6
10	0	40	0	0	7
11	0	44	0	0	7
12	0	48	0	0	8
13	0	52	0	0	9
14	0	56	0	0	9
15	1	0	0	0	10
16	1	4	0	0	10
17	1	8	0	0	11
18	1	12	0	0	12
19	1	16	0	0	12
20	1	20	0	0	13
21	1	24	0	0	14
22	1	28	0	0	14
23	1	32	0	0	15
24	1	36	0	0	16
25	1	40	0	0	16
26	1	44	0	0	17
27	1	48	0	0	18
28	1	52	0	0	18

Grad.	Hor.	Tép. I	Tép. II	Subtr. ☉	
				I	II
29	1	56	0	0	19
30	2	0	0	0	20

Panel 2 — argument: Degrees of the Equator (continued 31–60) (*Æquat. Gr.; Min.; Sec.*)

Gr.	H.	Tép. I	Tép. II	Subtr. ☉	
				I	II
31	2	4	0	0	20
32	2	8	0	0	21
33	2	12	0	0	22
34	2	16	0	0	22
35	2	20	0	0	23
36	2	24	0	0	23
37	2	28	0	0	24
38	2	32	0	0	25
39	2	36	0	0	25
40	2	40	0	0	26
41	2	44	0	0	27
42	2	48	0	0	27
43	2	52	0	0	28
44	2	56	0	0	28
45	3	0	0	0	29
46	3	4	0	0	30
47	3	8	0	0	30
48	3	12	0	0	31
49	3	16	0	0	32
50	3	20	0	0	32
51	3	24	0	0	33
52	3	28	0	0	34
53	3	32	0	0	34
54	3	36	0	0	35

Gr.	H.	Tép. I	Tép. II	Subtr. ☉	
				I	II
55	3	40	0	0	36
56	3	44	0	0	36
57	3	48	0	0	37
58	3	52	0	0	38
59	3	56	0	0	38
60	4	0	0	0	39

Panel 3 — argument: Degrees of the Equator (tens, 70–360) (*Æquat. Gr.; Min.; Sec.*)

Gr.	H.	Tép. I	Tép. II	Subtr. ☉	
				I	II
70	4	40	0	0	44
80	5	20	0	0	53
90	6	0	0	1	1
100	6	40	0	1	8
110	7	20	0	1	12
120	8	0	0	1	19
130	8	40	0	1	25
140	9	20	0	1	32
150	10	0	0	1	38
160	10	40	0	1	45
170	11	20	0	1	51
180	12	0	0	1	58
190	12	40	0	2	5
200	13	20	0	2	12
210	14	0	0	2	18
220	14	40	0	2	24
230	15	20	0	2	31
240	16	0	0	2	37
250	16	40	0	2	44
260	17	20	0	2	50

Gr.	H.	Tép. I	Tép. II	Subtr. ☉	
				I	II
270	18	0	0	2	57
280	18	40	0	3	4
290	19	20	0	3	10
300	20	0	0	3	17
310	20	40	0	3	23
320	21	20	0	3	30
330	22	0	0	3	36
340	22	40	0	3	43
350	23	20	0	3	49
360	24	0	0	3	56

Parsing notes: Panel 3 jumps from the by-degree argument of Panels 1–2 to a by-ten-degrees argument (70, 80, ... 360). At 360° the time equals 24h 0', as expected (full rotation). The "Subtr. ☉" column grows monotonically to 3' 56" at 360°. Several mid-column thirds/fourths digits in this panel are faint; the readings given follow the smooth progression and are confident, but rows 130 ("Subtr. ☉ II = 25"?) and 290 are slightly ink-light.

TABLE 9. Conversion of Hours into other Hours, reckoned from a different beginning of the Day

[TABVLA 9. Conuersionis Horarum in alias Horas, à diuerso Diei initio numeratas.]

This is a rule-table (a prose conversion grid), not a numerical table. The left stub names the **Hours to be converted** (*Horæ conuertendæ*); the right body gives **They are converted** (*Conuertuntur*) into the target reckoning by the stated rule.

Babylonian hours, or reckoned from Sunrise (*Babylonicæ, seu ab Ortu Solis, in*) are converted into —

- **Astronomical hours** (*reckoned from the preceding noon*): by adding to the Babylonian hours the half-day quantity (*semidiurnam quantitatem*) and the nocturnal quantity (*& nocturnam*).
- **European hours** (*from noon*): by subtracting from the Babylonian hours the half-day quantity, if the Babylonian hours exceed it; but if they do not exceed it, then once the subtraction is made, subtract the remainder from 12 hours — and there will remain the European hours from midnight.

- **Italian hours, or reckoned from Sunset** (*seu ab Occasu*): by adding the nocturnal quantity (*nocturnam quantitatem*).

Italian hours, or reckoned from Sunset (*Italica, seu ab Occasu Solis, in*) are converted into —

- **Astronomical hours:** by adding the half-day quantity.
- **European hours** (*from noon*): (if the Italian hours do not exceed the half-nocturnal quantity) by adding the half-day quantity (*semidiurnam*).
- **European hours** (*from midnight*): (if the Italian hours exceed the half-nocturnal quantity) by subtracting the half-nocturnal quantity (*seminocturnam*).
- **Babylonian hours:** by subtracting the nocturnal time (*tempus nocturnum*) from the Italian hours.

Astronomical hours, or from noon to noon (*Astronomica, seu à meridie ad meridiem, in*) are converted into —

- **European hours from noon** (*à meridie*): if they do not exceed 12, by adding or subtracting nothing.
- **European hours from midnight** (*à media nocte*): if the Astronomical hours exceed 12, let 12 be taken away (*demantur 12*).
- **Babylonian hours:** by adding to the Astronomical hours the half-day quantity.
- **Italian hours:** by subtracting from the Astronomical hours the half-day quantity.

European hours from midnight — which, because from midnight, coincide with the Astronomical (*Europœa à media nocte, namque à meridie coincidunt cum Astronomicis, in*) are converted into —

- **Astronomical hours:** by adding 12 European hours.
- **Babylonian hours:** by subtracting the half-nocturnal quantity from the European hours.
- **Italian hours:** by adding the half-nocturnal quantity to the European hours.

General rules (*at the foot of the table*):

Whenever the subtraction cannot be made (*Quoties subtractio fieri nequit*), add 24 to the given hours, and from the sum subtract what is required.

Whenever from the addition more than 24 results (*Quoties ex Additione fiunt plusquam 24*), cast away 24 and keep the rest.

TABLE 10. The Quantity of one Temporal Hour, corresponding to the quantity of the Artificial Day

[TABVLA 10. Quantitas Horæ unius Temporalis, Respondens quantitati Diei Artificialis.]

Six side-by-side panels share the layout. Each pairs an argument with the corresponding quantity of a single temporal (seasonal) hour. The first two panels use the argument **Minuta Diei Artific.** (minutes of the artificial day) → **Duodecima eorum pars** (their twelfth part, in I = minutes, II = seconds); the remaining four panels use the argument **Artific. Diei. H.** (hours of the artificial day) → **Duodecima pars** (its twelfth part, in I, II).

Panel A — Min. Diei Artific. → Duodecima pars (Min.; I, II)

Min.	I	II
1	0	5
2	0	10
3	0	15
4	0	20
5	0	25
6	0	30
7	0	35
8	0	40
9	0	45
10	0	50
11	0	55
12	1	0
13	1	5
14	1	10
15	1	15
16	1	20
17	1	25
18	1	30

Min.	I	II
19	1	35
20	1	40
21	1	45
22	1	50
23	1	55
24	2	0
25	2	5
26	2	10
27	2	15
28	2	20
29	2	25
30	2	30

Panel B — Min. Diei Artific. → Duodecima pars (continued 31–60)

Min.	I	II
31	2	35
32	2	40
33	2	45
34	2	50
35	2	55
36	3	0
37	3	5
38	3	10
39	3	15
40	3	20
41	3	25
42	3	30
43	3	35
44	3	40
45	3	45
46	3	50

Min.	I	II
47	3	55
48	4	0
49	4	5
50	4	10
51	4	15
52	4	20
53	4	25
54	4	30
55	4	35
56	4	40
57	4	45
58	4	50
59	4	55
60	5	0

Panel C — Artific. Diei H. → Duodecima pars (H.; I, II)

H.	I	II
1	0	5
—	10	5 50
2	0	10
—	10	10 50
3	0	15
—	10	15 50
4	0	20
—	10	20 50
5	0	25
—	10	25 50
6	0	30

Parsing notes (Panel C): This panel is printed as interleaved sub-rows: each whole-hour argument (1, 2, ...) is followed by an indented 10-line giving the value when 10 minutes are added to that hour. The interleaving and the bound digits

make the sub-rows hard to align precisely; the whole-hour values (H.1 → 0' 5", H.2 → 0' 10", ..., H.6 → 0' 30") are confident, but several of the indented 10-line second-place digits are [?]. Treat Panel C as a for the indented sub-rows.

Panel D — Artific. Diei H. → Duodecima pars (H.; I, II)

H.	I	II
7	0	35
8	0	40
9	0	45
10	0	50
11	0	55
12	1	0

Parsing notes (Panel D): As in Panel C, each whole-hour row is followed by indented 10-, 20-, 30-, 40-, 50-minute sub-rows giving intermediate twelfth-part values; those indented digits are faint and partially bound in the gutter region. The whole-hour values (H.7 → 0' 35" ... H.12 → 1' 0") are confident. Sub-row digits [?]

Panel E — Artific. Diei H. → Duodecima pars (H.; I, II)

H.	I	II
13	1	5
14	1	10
15	1	15
16	1	20
17	1	25
18	1	30

Parsing notes (Panel E): Same interleaved sub-row structure; whole-hour values confident (H.13 → 1' 5" ... H.18 → 1' 30"). Indented sub-row digits [?]

Panel F — Artific. Diei H. → Duodecima pars (H.; I, II)

H.	I	II
19	1	35
20	1	40
21	1	45

H.	I	II
22	1	50
23	1	55
24	2	0

Parsing notes (Panel F): Whole-hour values confident (H.19 → 1' 35" ... H.24 → 2' 0", i.e. a 24-hour artificial day yields a temporal hour of exactly 2' 0" of the twelfth-part scale — consistent with the linear law value/12). Indented sub-row digits faint and partly cut at the bottom-of-page / gutter; [?].**

[Foot signatures, left→right: A | B | C | D | E | F]

Tabulae novalmagesticae — Part I (Time Tables), Table 11

TAB. 11. *Semidiurni Temporis, quando Sol est in Signis Borealibus, Seminocturni autem quando Sol est in Signis Australibus ad infrascriptas Poli Altitudines.* [TABLE 11. Of the semi-diurnal time, when the Sun is in the northern signs, but of the semi-nocturnal time when the Sun is in the southern signs, for the pole altitudes written below.]

This is a single full table running across three table-volume pages (pp. 5–7 = giving the length of the semi-diurnal arc expressed in time (hours **H.** and minutes / of time) as a function of two arguments:

- **Stub (argument) columns:** at the left and right edges, the Sun's position. The left pair gives **Sign. Aust.** (southern sign) / the sign-glyph and **Gradus** (degrees within the sign) for the northern-sign case; the right pair gives **Sign. Bor.** / **Gradus** in the reciprocal (southern-sign) case. The degree argument runs 0, 3, 6, 9, 12, 15, 18, 21, 24, 27 (and 30) within each sign.
- **Column groups across the top:** the **Poli Altitudo** (pole altitude / terrestrial latitude) in whole degrees, each split into **H.** (hours) and / (minutes) sub-columns.

Each pair of entries is the half-length of the day (or night) at that latitude for that solar position, in equinoctial hours and minutes. Values near 6h 0' correspond to the equinoctial situation; they increase with latitude and with the Sun's distance from the equator.

The decorative sign-glyphs in the stub: ♈ Aries, ♉ Taurus, ♊ Gemini (northern, ascending) paired against ♎ Libra, ♏ Scorpio, ♐ Sagittarius (southern); and at the far right the reciprocal glyphs ♍ Virgo, ♌ Leo, etc., marking where the same numeric body serves the complementary case.

Table 11 — Panel 1 (table-volume p. 5 = PDF p. 457, upper half): Pole altitudes 6°–37°

[Left stub: **Sign. Aust. / Sign. Bor., Polus, Gradus.** Right stub: **Sign. Bor. / Sign. Aust., Polus, Gradus.**]

Sign sequence in the left stub for this panel: ♎ (Libra group) with ♈ Aries; then ♉/♊ Taurus; then ♊/♈ Gemini. Right-stub reciprocals: ♍, ♌, etc.

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Parsing notes: □/□ solstitial limit at the foot, right stub. Foot signature **F**; right margin catchword **Poli** (catching "Poli Altitudines" of the next page). At degree 15, the 49°-column prints "7 19", identical to the 47°-column "7 19" in the same row;

the across-column progression (7 15 → "7 19" → "7 19") is non-monotone — one of the two (most likely the 47°-column entry) is a suspected compositor repeat. Transcribed as printed in both cells.

Table 11 — Panel 3 (table-volume p. 6 = PDF p. 458, upper half): Pole altitudes 50°–59°

[Header: **Poli Altitudines**. Left stub: **Polus / Gradus**; right stub **Gradus**.]

Sign/Grad (left)	50 H.	50 /	51 H.	51 /	52 H.	52 /	53 H.	53 /	54 H.	54 /	55 H.	55 /	56 H.	56 /	57 H.	57 /	58 H.	58 /	59 H.	59 /	Grad (right)
□ 0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	30
3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	7	6	7	6	8
6	11	6	12	6	12	6	13	6	13	6	14	6	14	6	15	6	15	6	16	6	16
24	9	6	17	6	18	6	18	6	19	6	20	6	21	6	21	6	22	6	23	6	23
6	24	21	12	6	23	6	24	6	24	6	25	6	26	6	27	6	28	6	29	6	29
6	31	6	32	18	15	6	28	6	29	6	31	6	32	6	33	6	34	6	35	6	34
35	6	37	6	38	6	40	15	18	6	34	6	35	6	37	6	38	6	39	6	41	6
6	41	6	42	6	44	6	46	6	48	12	21	6	40	6	41	6	43	6	44	6	44
6	46	6	48	6	49	6	51	6	53	6	56	9	24	6	45	6	47	6	49	6	49
6	50	6	52	6	54	6	56	6	59	7	1	7	4	6	27	6	51	6	53	6	53
6	55	6	57	6	59	7	1	7	3	7	6	7	8	7	12	3	0	6	56	6	56
58	7	0	7	3	7	5	7	7	7	10	7	13	7	16	7	19	□ 30	3	7	1	7
7	4	7	6	7	9	7	11	7	14	7	17	7	20	7	23	7	27	27	6	7	7
7	7	9	7	12	7	15	7	17	7	21	7	24	7	27	7	31	7	35	24	9	7
9	7	12	7	15	7	17	7	20	7	24	7	27	7	30	7	33	7	38	7	43	21
43	21	12	7	17	7	20	7	23	7	26	7	30	7	33	7	37	7	41	7	45	7
7	45	7	50	18	15	7	22	7	25	7	28	7	32	7	33	7	39	7	43	7	43
7	48	7	52	7	57	15	18	7	27	7	30	7	34	7	37	7	41	7	45	7	45
7	49	7	54	7	59	8	4	12	21	7	31	7	35	7	39	7	42	7	47	7	47
7	51	7	56	8	0	8	6	8	11	9	24	7	36	7	39	7	43	7	47	7	47
7	52	7	56	8	1	8	7	8	12	8	18	6	27	7	40	7	44	7	48	7	48
7	52	7	57	8	2	8	7	8	12	8	18	8	25	3	0	7	44	7	48	7	48
52	7	57	8	2	8	7	8	12	8	18	8	24	8	31	□ 30	3	7	48	7	52	7
52	7	56	8	1	8	6	8	12	8	17	8	23	8	30	8	37	27	6	7	51	7
51	7	56	8	0	8	5	8	10	8	16	8	22	8	28	8	35	8	43	24	9	7
9	7	54	7	59	8	4	8	9	8	14	8	20	8	26	8	33	8	40	8	48	21
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S i g n / G r a d (l e f t)																G r a d (r i g h t)							
6		6		6		6		6		6		6		6		6		6					
0		1		2		3		4		5		6		$\frac{2}{3}$		6		6					
H		H		H		H		H		H		H		H		H		H					
/		/		/		/		/		/		/		/		/		/					
		9		3		8		3		8				1		4		8		6		4	
9		7		4		7		5		7		5		8		3		8		8		8	
		7		2		7						4		2		6		0		9		1	
1		7		5		8		0		8		6		8		1		8		1		8	
2		5								2		8		5		4		8		2		3	
1		8		3		8		8		8		1		8		2		8		2		8	
5						4		1		8		5		5		0		5				5	
1		8		1		8		1		8		2		8		3		8		3		8	
8		0		6		3		0		8		6		6								0	
2		8		1		8		2		8		3		8		3		8		4		8	
1		8		4		1		9		7		6				4		0		4			
2		8		2		8		3		8		4		8		5		9		7		9	
4		5		2		0		8		7				9		7		3		9		6	
2		8		3		8		3		8		4		8		5		9		3		9	
7		2		9		8		6				7		1		9		6		0			
□		8		3		8		4		8		5		9		5		9		1		9	
0		8		7		5				6		8		2		2		0		0		2	
																						0	
3		8		4		8		5		9		2		9		1		9		2		9	
		4		4				3		5		8		4		0		0		3		0	
6		8		5		9		2		9		9		9		2		9		3		9	

Parsing notes: latitude 60°–68°. Past the Arctic Circle (66⅔°) the Sun no longer sets near the solstice, so the lower-right cells run blank (—) where continuous day begins; the appendix below handles those cases. The 66⅔° column reaches "12 0" (a full half-day) at the last row. The blanks (—) in the 67° and 68° columns are genuine blank cells in the source (layout feature, not illegibility). The □/□ boundary row at "0" is the Taurus/Gemini junction.

Table 11 — Panel 5 (table-volume p. 7 = PDF p. 459, upper half): Pole altitudes 69°–80°

[Header: **Poli Altitudines**. Left stub: **Polus / Grad.**; right stub **Polus / Grad.**]

S i g n / G r a d (l e f t)														G r a d (r i g h t)									
	6	7	7	7	7	7	7	7	7	7	7	7	8										
9	6	0	7	1	7	2	7	3	7	4	7	5	7	6	7	7	7	8	7	9	7	0	8
f	9	0	1	2	3	4	5	6	7	8	9	0	h										
t	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
)	.	/	.	/	.	/	.	/	.	/	.	/	.	/	.	/	.	/	.	/	.	/)
□	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	3
0																							
3	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	2	6	2	6	2	6	2	2
		2		3		3		4		5		6		8		9		1		3		5	7
6	6	2	6	2	6	2	6	2	6	3	6	3	6	3	6	3	6	4	6	4	6	5	6
		5		6		7		9		1		3		6		8		2		6		0	5
9	6	3	6	3	6	4	6	4	6	4	6	4	6	5	6	5	6	5	7	3	7	9	7
		7		9		1		4		7		0		4		8						5	3

S i g n / G r a d d (l e ft)	8 1 H)	8 2 H)	8 3 H)	8 4 H)	8 5 H)	8 6 H)	8 7 H)	8 8 H)	8 9 H)	8 0 t)	G r a d (r i g h t)
8	6	0									2
2	1	2	—	—	—	—	—	—	—	—	9
1	0										
2	—	—	—	—	—	—	—	—	—	—	6
4											
2	—	—	—	—	—	—	—	—	—	—	□
7											3
											0
											[
											3
]

Parsing notes: latitude 81°–89°, with the pole (90°) collapsing to a single column. Near the pole, even small solar declinations yield perpetual day; almost all cells blank. Right-stub glyph at foot □ / □ marks the reciprocal sign-limit. The "90" stub holds only the □0 entry.

Appendix to Table 11 (table-volume p. 7 = PDF p. 459, lower half)

[Display heading:]

Appendix TAB. 11. pro Maxima Die, ubi Polus elevatur plus Gradibus 66⅔, ex Sphæra Clavii cap. 4. non considerantis Refractiones, pro quibus vide nostram Geographiam Reformatam. [Appendix to Table 11, for the longest day, where the pole is elevated more than 66⅔ degrees, from the *Sphere* of [Christopher] Clavius,

chapter 4, which does not take account of refractions — for which see our *Reformed Geography*.]

This appendix gives, for high latitudes (pole elevations beyond the Arctic Circle, where the day becomes continuous), the **Arcus semper apparens** (the arc of the ecliptic / sky always above the horizon — i.e. the band of perpetual day) and the **Dies continuus** (the duration of continuous day), as functions of **Elevatio Poli** (pole elevation in degrees).

- **Elevatio Poli** (Gr. = degrees): the latitude argument.
- **Arcus semper apparens** (Gr. degrees, M. minutes of arc): the always-visible arc.
- **Dies continuus** (D. days, H. hours, M. minutes): the length of the continuous day.

Elevatio Poli (Gr.)	Arcus semper apparens (Gr.)	Arcus (M.)	Dies continuus (D.)	Dies (H.)	Dies (M.)
67	22	52	22	1	40
68	40	0	52	1	16
69	52	0	54	16	25
70	61	26	64	13	46
71	70	26	74	6	0
72	78	22	82	6	39
73	84	56	89	4	58
74	92	12	90	7	0
75	96	20	104	9	4
76	105	16	110	7	27
77	114	20	116	14	22
78	117	0	122	17	6
79	122	46	127	9	58
80	128	22	134	4	58
81	133	50	139	31	36
82	139	6	145	6	43
83	144	22	151	2	6
84	149	36	156	3	3

Elevatio Poli (Gr.)	Arcus semper apparens (Gr.)	Arcus (M.)	Dies continuu s (D.)	Dies (H.)	Dies (M.)
85	154	42	161	5	23
86	159	50	166	11	23
87	164	52	171	21	47
88	169	58	176	5	29
89	174	58	181	21	58
90	180	0	187	6	39

Parsing notes: the table is printed in two side-by-side halves (rows 67–78 on the left, 79–90 on the right); I have stacked them into one sequence by **Elevatio Poli**. The **Dies continuus** "H." column at Elevatio 81 reads "31" which exceeds 24 — flagged as impossible (likely a compositor error or a misread of the day-count carry); transcribed as printed. The **Dies continuus** "D." column jumps 90 → 104 between rows 74 and 75 (a 14-day jump where neighbours step by ~5–10); transcribed as printed (suspected source error). The reference is to Clavius, *In Sphaeram Ioannis de Sacro Bosco Commentarius*, ch. 4.

[A faint offset/show-through of a table from the facing leaf is visible at the lower right margin — not part of this page's content.]

TABLE 12. The Equation of Time at the Sun's apogee [in ☉ apogeo], according to Tycho [Brahe], with the obliquity of the ecliptic posited at 23° 30' 20"

[TAB. 12. Aequat. Temporis in ☉ apogeo, Tychonicè, ad mentem ejus positâ Obl. Ecl. gr. 23. 30'. 20".]

[Heading rubric over the body: **Subtract from the Apparent. Add to the Equal time.** (*Subtr. Appar. Adde Æqu. temp.*)]

The argument column at the left ("Gr." = degrees) is the Sun's place; the upper paired-sign banner runs ☐ & ☐ | ☐ & ☐ | ☐ & ☐ | ☐. The four data groups give the

equation in minutes/seconds/etc. (" " """) and a final "Gr." column descending 30→0.

Gr.	(□	'	"	""	(□	'	"	(□	'	"	(□	'	"	Gr.
0	0	0	8	23	8	8	45	29	—	30				
1	0	19	52	8	33	51	8	45	10	29				
2	0	39	41	8	39	29	8	24	24	28				
3	0	59	30	8	53	44	8	12	50	27				
4	1	19	13	9	1	8	0	24	26	26				
5	1	38	51	9	9	27	7	47	7	25				
6	1	58	24	9	16	48	7	33	37	24				
7	2	17	50	9	23	34	7	19	36	23				
8	2	37	7	9	29	46	7	4	54	22				
9	2	56	12	9	34	20	6	49	41	21				
10	2	15	49	9	39	6	6	33	58	20				
11	3	33	42	9	44	3	6	17	34	19				
12	3	52	10	9	47	22	6	0	56	18				
13	4	10	2	9	51	22	5	43	51	17				
14	4	27	55	9	52	54	5	25	30	16				
15	4	46	44	9	53	10	5	7	53	15				
16	5	2	53	9	55	45	4	49	16	14				
17	5	19	59	9	53	42	4	30	18	13				
18	5	36	40	9	52	50	4	10	54	12				
19	5	53	2	9	50	29	3	51	18	11				
20	6	8	43	9	48	46	3	31	17	10				
21	6	23	57	9	45	27	3	11	9	9				
22	6	39	22	9	41	32	2	50	34	8				
23	6	53	59	9	37	20	2	29	48	7				
24	7	8	9	9	32	9	2	8	23	6				
25	7	21	43	9	26	11	1	47	14	5				
26	7	29	0	9	23	22	1	26	18	4				

Gr. (□ □)	'	"	'''	(□ □)'	"	(□ □)'	"	(□)'	"	Gr.
27	7	51	38	9	11	52	1	4	54	3
28	8	0	28	9	3	50	0	43	12	2
29	8	12	2	8	54	51	0	21	41	1
30	8	23	8	8	45	29	0	0	0	0

[Footer rubric: **Gr.** (left) | **Add to the Apparent, Subtract from the Equal.** (*Adde Apparenti Subtrahe Æquali.*) | **Gr.** (right)]

Parsing notes: This is a four-quadrant equation-of-time table; the ascending argument (0→30) reads the upper sign-pairs, the descending argument (30→0) reads the lower rubric. Several blank cells (where the ascending and descending series meet) left empty as printed. Row 10's first group reads "2 15 49" where a smooth progression would expect □ 3 15; flagged below as a likely compositor error.

[Lower-left sub-table on table-page 8:]

Residuum [Remainder] of TABLE 12.

[The argument column "Ano-maliæ" (anomaly), in "Gr.", runs 0→30; the table gives corrections of the Sun's equation of time ("Anomal. Solis Coæqu.") under headings I, II,... for the several signs, with descending "Anomalæ" at the right.]

Anomal. Gr.	I. Subtr. (□) VI. Add ' "	II. Subtr. (□) VII. Add ' "	III. Subtr. (□) VIII. Ad. ' "	Anomal. Gr.
0	0 0	0 5 5	5 32 50	30
1	0 4	0 7 3	5 24 29	29
2	0 8	0 10 3	5 16 28	28
3	0 13 2	0 14 3	5 8 27	27
4	0 17 0	0 17 3	5 0 26	26
5	0 21 2	0 21 3	4 53 25	25
6	0 26 2	0 24 3	4 44 24	24
7	0 30 2	0 30 3	4 36 23	23

Anomal. Gr.	I. Subtr. (□) VI. Add ' "	II. Subtr. (□) VII. Add ' "	III. Subtr. (□) VIII. Ad. ' "	Anomal. Gr.
8	0 34 2	0 33 3	4 47 22	22
9	0 38 0	0 34 3	4 49 21	21
10	0 42 2	0 37 3	5 0 20	20
11	0 46 2	0 41 3	5 2 19	19
12	0 50 2	0 44 3	5 3 18	18
13	0 55 2	0 47 3	5 4 17	17
14	0 59 2	0 50 3	5 6 16	16
15	1 3 2	0 53 3	5 7 15	15
16	1 7 2	0 56 3	5 58 14	14
17	1 11 2	0 59 3	5 59 13	13
18	1 15 3	0 2 4	5 6 12	12
19	1 19 3	0 4 4	5 8 11	11
20	1 24 3	0 7 4	5 9 10	10
21	1 28 3	0 10 4	5 9 9	9
22	1 32 3	0 13 4	5 8 8	8
23	1 36 3	0 16 4	5 6 7	7
24	1 40 3	0 18 4	5 5 6	6
25	1 44 3	0 21 4	5 4 5	5
26	1 47 3	0 23 4	5 3 4	4
27	1 51 3	0 26 4	5 2 3	3
28	1 55 3	0 28 4	5 2 2	2
29	1 59 3	0 30 4	5 1 1	1
30	2 3 3	0 32 4	5 0 0	0

[Footer rubric: **V. Subtr.** | **IV. Subtr.** | **III. Subtr.** — **XI. Add.** | **X. Add.** | **IX. Add.**
| **Anomal. Solis Coæqu. Signa** (the signs of the equated solar anomaly).]

Parsing notes: This compact residuum/interpolation sub-table is badly cramped in the gutter; the three-column digit grouping is the best reading achievable at this resolution. The third group ("III/IX") jumps from a leading "5 32 50" downward, and the second digit-pair is hard to separate from the first — several cells flagged uncertain. Whole sub-table

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
												16
4	2	5	5	1	36	60	54	12	10			
	46	28	33	57	2			40	13			
									1			
									11			
									17			
									11			
									5			
5	2	5	5	1	47	54	44	46	57	24		
	26	38	43	53	2	5	11	9	1	11		
										27		
										10		
										54		
6	26	5	5	2	31	38	4	51	39	11		
		47	32	97	3	6	12	9	2	11		
										37		
										10		
										42		
7	1	5	5	2	33	22	23	56	23	35		
	47	56	22	27	5	6	13	9	2	11		
										47		
										10		
										30		
8	1	64	5	2	7	56	43	09	2			
	27		12	43	34		13		59			
									11			
									54			
									10			
									17			
9	18	6	51	2	7	2	72	13	43	25		
		11		59	34	47		8	3	12		
										2		
										10		

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
										4		
10	0 48	6 11	4 49	3 16	7 33	2 31	7 20	13 5	8 50	5 12		
									8 9	5 1		
11	0 29	6 25	4 36	3 32	7 32	2 13	7 20	13 7	8 4	4 12		
									14 9	3 7		
12	0 9	6 31	4 23	3 47	7 11	1 54	7 58	13 8	43 4	38 12		
										19 9		
13	0 9	S. 6 36	4 10	4 2	7 28	1 36	8 13	10 8	7 22			
									5 2	12 24		
14	0 27	6 41	3 56	4 13	7 7	1 18	8 33	13 7	7 0	5 25		
									12 27	8 52		
15	0 45	6 46	3 42	4 32	7 22	0 59	8 49	13 6	5 5	48 12		

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
									30			
									8			
									54			
16	13	6	3	4	7	0	97	13	56			
		48	27	46	17	40		4	12			
									12			
									33			
									8			
									36			
17	1	6	3	50	7	0	9	13	5			
	21	53	13		11	20	23	4	16			
									6			
									32			
									12			
									33			
									84			
18	1	6	2	5	76	00	9	12	5			
	38	53	57	13			38	57	27			
									6			
									53			
									12			
									34			
									7			
									47			
19	1	6	2	5	6	0.	9	12	5			
	56	54	42	23	59	S.	54	52	47			
						19			6			
									47			
									12			
									33			
									7			
									32			
20	2	6	2	5	6	0	10	12	4			
	13	55	26	37	52	40	9	47	40			

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
										7 1		
										12		
										32		
										7		
										17		
21	2	6	2 9	5	6	1 0	10	12	4			
	29	55		49	44		23	41	15			
									7 5			
									12			
									30			
									6			
									54			
22	2	6	1	6 0	6	1	10	12	3			
	45	54	52		36	20	37	34	50			
									8			
									14			
									12			
									28			
									6			
									30			
23	2 6	6	1	6	6	1	10	12	3			
		53	36	11	27	41	50	27	26			
									8			
									33			
									12			
									25			
									6 9			
24	3	6	0	6	6	2 1	11	12	12			
	17	51	19	21	21		2	16	9 2			
									13			
									7			
									24			
									9			
									11			

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
									17			
									5			
									49			
25	3	6	16	6	6	22	11	12	2			
	36	36		31	16		16	9	33			
									97			
									11			
									15			
									5			
									47			
26	3	6	0	6	55	2	11	11	29			
	47	44	45	39		43	27	58	97			
									11			
									12			
									5			
									21			
27	41	60	0	6	5	32	11	11	1			
			27	47	44		38	48	49			
									3			
									19			
									11			
									18			
									4			
									47			
28	4	6	09	6	5	3	11	11	1			
	18	35		54	32	23	49	37	17			
									9			
									38			
									11			
									58			
									4			
									45			
29	4	6	0	71	5	3	11	11	0			
	28	29	A.		23	43	59	25	52			

Gr.	□	□	□	□	□	□	□	□	□	□	□	□
	Ad	Su	Su	Ad	Ad	Ad	Su	Su	Su	Su	Ad	Ad
	d.'	btr	btr	d.'	d.'	d.'	btr	btr	btr	btr	d.'	d.'
	"	.'"	.'"	"	"	"	.'"	.'"	.'"	.'"	"	"
			8							10		
										13		
										11		
										54		
										4		
										31		
30	4	6	0	77	57	4	9	11	26			
	16	23	26			12	11	10	10			
									27			
									11			
									43			
									44			

Parsing notes: This twelve-column civil-day equation table is exceptionally dense, with sign-column boundaries that the original prints without rule-lines between every pair, so adjacent sign-columns' digit pairs run together. Cells marked "S." / "A." are the printed switch-points where the correction changes from Subtract to Add (or vice versa) mid-column (e.g. "0. S. 19" at □/row 19; "0 A. 8" at □/row 29). Many interior digit-pairs are ambiguous at this resolution and the per-cell groupings should be regarded as provisional; whole table

[Lower-right sub-table on table-page 8:]

Another [Altera] provisional TABLE of the Equation of Civil or Natural Days, serving exactly for the Year of Christ 1736; for [converting] Common [Apparent] into Equal [Mean Time].

[Altera TAB. Temporaria Aequationis Dierum Civilium, & servient exactè Anno Christi 1736. pro Comm. App. in Aeq.]

Same structure as the table above (argument "Loci ☉," "Gr." 0→30; twelve zodiacal sign columns, each Add./Subtr. in minutes & seconds).

	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Ad	Su	Su	Ad	Ad	Ad	Su	Su	Su	Su	Ad	Ad
	d.'	btr	btr	d.'	d.'	d.'	btr	btr	btr	btr	d.'	d.'
Gr.	"	.'"	.'"	"	"	"	.'"	.'"	.'"	.'"	"	"
0	4 2	4	6 4	0	7	5	4 2	12	11			
		31		46	24	15		13	22			
									0			
									42			
									10			
									9			
									11			
									31			
1	3	4	5	1 4	7	5 2	4	12	10			
	40	43	58		47		24	21	58			
									0			
									A.			
									10			
									23			
									10			
									23			
									11			
									23			
2	3	4	5	1	7	4	3	30	45			
	23	51	50	21	36	36	12	10	0			
									35			
									10			
									48			
									11			
									8			
3	3 5	5 6	5	1	7	4	3	38	31			
			42	39	36	16	12	10	0			
									47			
									11			
									0			
									10			

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
										55		
4	2	5	5	1	7	3	2	46	24			
	44	16	33	57	34	56	13	10	10			
									11			
									13			
									10			
									46			
5	2	5	5	1	7	44	1	46	53			
	25	23	23	37	34		53	9	5			
									32			
									11			
									27			
									10			
									30			
6	25	58	4	3	7	2	0	0	37			
			40	19	46	37	12	13	5			
									31			
									11			
									32			
									10			
									41			
7	1	5	5	47	4	1	6	7	56			
	46	44	53		73	16	12	13	9			
									15			
									2			
									43			
									11			
									39			
									11			
									6			
8	1	5	4	43	4	1	6	9				
	28	53	55		71	16	13	15				
								27				
								0				

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
								11				
								19				
								6				
								11				
								47				
								17				
								7				
9	19	61	47	43	47	0	10	11	56			
						35	48	8	9			
									31			
									11			
									52			
									4			
10	0	66	4	45	3	7	2	13				
	50		21		35	46	37	16				
								59				
								5				
								31				
								11				
								52				
								9				
11	0	6	4	4	5	4	9	57				
	31	16	12	53	17	21	17	11				
								54				
								11				
								54				
								11				
								59				
								9				
								27				
12	0	6	4	5	5	4	9	57				
	13	17	24	11	17	21	17	11				
								5				
								64				

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
								9				
								13				
13	0 S.	6	3	4	7	1	12	18				
	5	23	49	22	40	38	5	8 5				
								7 5				
								43				
								12				
								8 8				
								51				
14	0	6	3	4	36	30	23					
	25	31	56	13	7	1	8					
								32				
								13				
								5 7				
								27				
								12				
								8 8				
								49				
15	0	6	3	4	17	34	13					
	43	36	21	53	7	0	6					
								49				
								11				
								5				
								64				
								12				
								1 8				
								48				
16	0	6	3	5 0	7	8	8					
	59	35	53		13	28	49					
								13				
								16				
								5				
								12				
								8				

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
							18					
							7					
							30					
17	1	6	2	5	8	00	6					
	16	36	50	17	11		23					
							9					
							23					
							12					
							5					
							16					
							6					
							32					
							12					
							18					
							7					
							17					
18	1	6	2	5	7	00	9					
	34	37	35	13	16		40					
							12					
							56					
							5					
							27					
							6					
							18					
							7					
							16					
							12					
							17					
							7					
							17					
19	1	6	2	5	65	0	9					
	51	37	19	23		35	54					
							13					
							5					

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
							47					
							6					
							18					
							7					
							16					
							12					
							17					
							7					
							17					
20	27	6	28	5	67	0	10					
		39		56		35	5					
							13					
							16					
							4					
							17					
							7					
							16					
							11					
							77					
21	2	6	1	6	6	10	10					
	25	39	47	19	30		25					
							12					
							54					
							4					
							15					
							78					
							11					
							16					
							66					
22	2	6	1	6	6	1	10					
	38	37	32	30	46	38	39					
							12					
							44					
							44					

Gr.	Ad d.'	Su btr	Su btr	Ad d.'	Ad d.'	Ad d.'	Su btr	Su btr	Su btr	Su btr	Ad d.'	Ad d.'
							8 5					
							11					
							6 6					
							35					
23	2	6	1 7	6	6	2 1	10					
	54	35		37	30		53					
							12					
							36					
							3					
							41					
							8					
							33					
							11					
							16					
							6					
							12					
24	3 4	6	0	6	6	2	11					
		33	57	48	27	18	19					
							12					
							19					
							12					
							13					
							9 8					
							11					
							19					
							6 6					
25	3	6	0	6	5	2	11					
	36	32	37	56	76	18	11					
							12					
							9 2					
							50					
							9					
							53					
							11					

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
							12					
							6					
							13					
26	3	6	0	7	6	13	54	59	46	59		
	26	30	23			5	2	11	11	2		
										25		
										9		
										24		
										11		
										38		
										5		
										47		
27	3	6	0	7	7	5	3	0				
	56	22		13	42	73		11				
								53				
								11				
								38				
								1				
								39				
								11				
								13				
								11				
								39				
								4				
								32				
28	4	6	0	7	5	4	4					
	17	A.	20	73	12		21					
		12					12					
							36					
							11					
							8					
							9					
							54					
							11					
							39					

Gr.	□ Ad d.'	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'	□ Ad d.'	□ Su btr	□ Su btr	□ Su btr	□ Su btr	□ Ad d.'	□ Ad d.'
	"	.'"	.'"	"	"	"	.'"	.'"	.'"	.'"	"	"
						4 1						
29	4	6	0	7	5	3	11					
	19	12	12	22	23	12	9					
							13					
							13					
							14					
30	4	6	0	7 7	4 7	4						
	31	11	22			21						
						12						
						13						
						11						
						11						
						22						
						0						
						42						
						11						
						9						
						11						
						31						

[Footer rubric, spanning both right-column sub-tables: **If [the correction] is to be applied to the Apparent [time] [Si Aequale vertendum sit in Apparens], do the opposite of the title** (*Fac contrarium Tituli*).]

Parsing notes: Both right-column sub-tables (TAB. 13 and its *Altera*) are the densest on the page — twelve sign-columns of minute/second pairs printed without separating rules. The digit groupings within each row should be treated as provisional; the original frequently runs the trailing column of one sign into the leading column of the next. The "S." / "A." in-column markers flag where a given sign's correction crosses from Subtract to Add. Both sub-tables No sexagesimal value clearly exceeds 59 in the seconds positions that could be confidently isolated, but column alignment is too uncertain to certify the absence of impossibles.

TABLE 14. CATALOGUE OF THE MORE NOTABLE PLACES.

[TAB. 14. CATALOGVS LOCORVM INSIGNIORVM.]

With the Difference of Time to be Added to, or Subtracted from, the Time of the Bologna Italic meridian, and the Altitude of the North Pole [latitude], where no "A." is added [the difference is to be subtracted, "sub."]. Taken from Book 9 of our *Geographia Reformata*, in which it is treated much more fully.

[Cum Differentia Temporis Addenda, aut Subtrahenda Tempori Meridiani Bononiensis Italici, & Altitudine Poli Borealis, ubi non additur A. sumptus ex Lib. 9. Nostrae Geographiae Reformatae, in quo habetur multò amplius.]

Column headings: **Nomina Locorum** (Names of Places — Latin name, then a vernacular/modern form in italics); **Differentia Temporis** (Difference of Time: H. = hours, ' = minutes, " = seconds; "ad." = add, "sub." = subtract); **Altitudo Poli** (Altitude of the Pole = latitude: G. = degrees ' "). The page is set in two parallel halves; the entries below run the left half first, then the right half.

[Left half of table-page 9:]

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
Abbavilla Picardiæ. <i>Abbeville</i>	0 41 27 sub.	50 0 0
Aberdona Scotiæ. <i>Aberdon</i>	0 55 28 sub.	57 7 0
Alba Græca Hungariæ. <i>Belgrado</i>	0 42 0 ad.	46 28 0
Alba Iulia Transilvan. <i>Vveissemburg</i>	0 48 16 ad.	48 10 0
Alba Regalis Hungariæ. <i>Alba regal</i>	0 30 40 ad.	47 5 0
Agra Mogoris	4 6 0 ad.	26. 50
Alcmaria Hollandiæ	0 26 36 sub.	52 4 39
Alepus Syriæ	2 10 20 ad.	36 46 0

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
Alexandriæ Ægypti	1 32 40 A.	30 58 0
Alexandria Liguriæ	0 11 34 sub.	44 44 0
Algerium Africæ	0 37 20 sub.	35 13 0
Amaguccium Iapponis	7 50 22 ad.	34 5 0
Amara Æthiopiæ	1 46 0 ad.	0 30 0
Ambacia. <i>Amboise</i>	0 45 0 sub.	47 39 0
Amberga Bavaricæ	0 2 24 sub.	49 29 0
Ambianum Amiens	0 40 8 sub.	49 51 0
Amsterdamum Holland.	0 26 20 sub.	52 21 30
Ancona Italiæ	0 9 44 ad.	43 54 0
Andegavi. <i>Angiers</i>	0 51 16 sub.	48 15 0
Angelopolis novæ Hispan.	7 44 0 sub.	19 38 0
Angola Africæ	0 16 0 ad.	9 30 A.
Angra Tertiariæ Insul.	2 45 28 sub.	38 50 0
Antiochia Syriæ	2 0 0 ad.	36 11 0
Antiochia ad Taurum	2 9 0 ad.	35 30 0
Antverpia Brabanticæ	0 24 40 sub.	51 12 0
Aquapulchum Mexici. <i>Aquapulcho</i>	7 22 28 sub.	15 30 0
Aquila Samnitium	0 10 52 ad.	42 42 0
Aquæ Sextiæ. <i>Aix</i>	0 26 0 ad.	43 33 0
Aquisgranum. <i>Aken</i>	0 21 0 sub.	50 46 0
Aracta Syriæ	2 12 0 ad.	36 0 0
Arbela Assyriæ. <i>Erbel</i>	2 32 48 ad.	35 0 0
Argentina. <i>Strasbourg</i>	0 16 4 sub.	48 31 0
Argentomagum.	0 41 12 sub.	46 54 0

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
<i>Argenton</i>		
Arelatum. <i>Arles</i>	0 29 0 sub.	43 36 0
Ariminum	0 4 56 ad.	44 14 0
<i>Cisalpinæ. Rimini</i>		
Armutia. <i>Ormuz</i>	3 20 0 ad.	27 35 0
Astracantum	3 10 0 ad.	49 30 0
Athenæ Græciæ.	0 55 0 ad.	37 40 0
<i>Sethines</i>		
Atrebatum. <i>Arras</i>	0 38 24 sub.	50 9 0
Auenio. <i>Avignon</i>	0 29 12 sub.	43 52 0
Augusta	0 2 30 sub.	48 24 0
<i>Vindelicorum.</i>		
<i>Augspurg</i>		
Aurelianum. <i>Orleans</i>	0 43 16 sub.	47 55 0
Aurantia. <i>Oranges</i>	0 29 0 sub.	44 6 0
Babylon vetus.	1 27 0 ad.	34 30 0
<i>Baldac</i>		
Babylon nova.	2 26 0 ad.	33 25 0
<i>Bagdad</i>		
Baiona Cantabriæ	1 27 40 sub.	43 18 0
Bamberga	0 2 44 sub.	49 56 0
<i>Franconiæ</i>		
Barcino. <i>Barcellona</i>	0 39 20 sub.	41 26 0
Barium Apuliæ. <i>Bari</i>	0 25 24 ad.	41 13 0
Basilea Helvetiæ.	0 16 40 sub.	47 52 0
<i>Basel</i>		
Bellovacum. <i>Beauois</i>	0 40 20 sub.	49 18 0
Bellunum Ciudaldi	0 1 44 ad.	46 13 30
<i>Bellun</i>		

[Right half of table-page 9:]

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
Benatica arx	0 13 0 ad.	50 18 30

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
Bohemiæ		
Bengala Indiæ	5 34 0 ad.	21 56 0
Beneuentum.	0 17 27 ad.	41 18 0
<i>Benevento</i>		
Berga Norvegiæ	0 14 40 sub.	61 0 0
Bergomum. <i>Bergamo</i>	0 7 28 sub.	45 43 0
Berona, seu Berna.	0 17 28 sub.	47 2 0
<i>Bern</i>		
Bituix. <i>Bourges</i>	0 39 34 sub.	47 20 0
Blæsæ. <i>Bloys</i>	0 43 0 sub.	47 46 0
Bolonia Normadiæ.	0 41 32 sub.	50 40 0
<i>Boulogne</i>		
Bononia Italiæ.	0 0 0	44 30 20
<i>Bologna</i>		
Borbonia Lancysia.	0 34 56 sub.	46 57 0
<i>Borbon Lancy</i>		
Bracara. <i>Braga</i>	1 24 32 sub.	41 48 0
Brandeburgum	0 8 0 ad.	52 16 0
Bransuicum.	0 1 4 sub.	52 15 0
<i>Brunsuich</i>		
Brema Saxonix.	0 11 4 sub.	53 8 0
<i>Bremen</i>		
Brigantia. <i>Braganza</i>	1 17 40 sub.	41 48 0
Brigantium.	0 19 48 sub.	44 48 0
<i>Bryançon</i>		
Brixia. <i>Brescia</i>	0 4 40 sub.	45 20 0
Brundusium.	0 29 46 ad.	40 47 20
<i>Brindisi</i>		
Bruxellæ. <i>Brusselles</i>	0 25 0 sub.	50 48 0
Buda Hungariæ.	0 33 28 ad.	47 46 0
<i>Ofen</i>		
Burdegala. <i>Bordeos</i>	0 59 48 sub.	45 12 0
Byzantium.	1 20 0 ad.	42 56 0

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
<i>Constantinopolis</i>		
Cæsaraugusta.	0 52 0 sub.	41 48 0
<i>Saragoza</i>		
Cadomum. <i>Caen</i>	0 49 20 sub.	49 10 0
Calagurris.	0 58 44 sub.	42 40 0
<i>Calahorra</i>		
Calecutium. <i>Calicut</i>	2 28 0 ad.	11 0 0
Calecutium. <i>Cales</i>	0 41 20 sub.	51 0 0
Cambaia Indiæ.	4 14 0 ad.	22 40 0
<i>Cambaia</i>		
Camboia Indiæ.	6 12 40 ad.	11 20 0
<i>Camboja</i>		
Cameracum.	0 36 44 sub.	50 4 50
<i>Cambray</i>		
Cantabrigia Anglic.	0 47 52 sub.	52 12 0
<i>Cambridge</i>		
Canatia Insula	2 7 40 sub.	28 25 0
Canton Chinæ	6 45 18 ad.	24 0 0
Capua. <i>Capoa</i>	0 15 28 ad.	41 20 0
Caput S. Augustini	3 4 40 sub.	8 10 A.
Caput Anguillæ C.das	0 38 0 ad.	34 1 0
<i>Aguillas</i>		
Caput Bonæ Spei	0 31 20 ad.	34 32 A.
Cap. Blancum Africæ	1 13 40 sub.	20 32 0
Cap. Currentium	1 42 0 ad.	24 0 A.
<i>Afriç</i>		
Cap. Desideratû. <i>C.</i>	6 26 0 sub.	52 58 A.
<i>Deseado</i>		
Cap. Finis Terræ.	0 50 48 sub.	45 5 0
<i>Celticum Promant.</i>		
Cap. Gardafuis.	3 1 40 ad.	11 0 0
<i>Promôt. Aromata</i>		
Cap. Lisardum	0 9 40 sub.	50 4 0

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
<i>Angliæ. C. Lezardo</i>		
Caput Mendocinum	10 35 20 sub.	42 42 0
Cap. Viride. <i>C. Verde</i>	2 13 48 sub.	14 27 0
Carmurum. <i>Chartres</i>	0 44 0 sub.	48 30 0
Carthago Africæ	0 28 ad.	36 50 0
Casale S. Euasii	0 12 8 sub.	44 54 30
Cassella Hassiæ.	0 10 0 sub.	51 19 40
<i>Casselen</i>		
Catana Siciliæ.	0 15 32 ad.	37 36 32
<i>Catania</i>		
Catacium. <i>Catanzaro</i>	0 23 0 ad.	39 5 6

Parsing notes: Place-name catalogue. Each entry gives the Latin place-name, an italic vernacular form, the time-difference (H ' " with ad./sub./A.), and the latitude (G ' "). The "A." after a latitude (e.g. *Angola, Caput S. Augustini, Caput Bonæ Spei*) marks Southern (Austral) latitude. Several time-difference and latitude minute/second values in the gutter were hard to resolve; transcribed as best read.

[TABLE 14, continued — CATALOGUE OF THE MORE NOTABLE PLACES. Same column structure (Names of Places; Difference of Time H ' " ad./sub.; Altitude of the Pole G ' ").]

[Left half of table-page 10:]

Nomina Locorum	Diff. Temp. H. ' "	Alt. Poli G. ' "
Caucincina	6 18 0 ad.	18 55 0
Cayitum. <i>Memphis</i>	1 37 0 ad.	29 50 0
Ceilanum. <i>Zeilan</i>	4 46 0 ad.	7 50 0
Cephalænia.	0 40 24 ad.	37 12 0
<i>Cefalonia</i>		
Cesena. <i>Cesena</i>	0 3 24 ad.	44 13 0
Chios Scio Insulæ urbs	1 9 0 ad.	38 30 0
Cibinium.	0 51 20 ad.	48 16 0
<i>Hermenstatt</i>		
Claramontium	0 38 8 sub.	46 11 0

Nomina Locorum	Diff. Temp. H ' "	Alt. Poli G ' "
<i>Auverniæ. Clermont</i>		
Claudiopolis.	0 46 0 ad.	48 25 0
<i>Claussemburg</i>		
Clivia Clives	0 21 44 sub.	51 48 30
Coccinum. <i>Cochin</i>	3 2 28 ad.	9 25 0
Colonia Agrippina.	0 18 0 sub.	50 54 50
<i>Coln</i>		
Comorinum	4 26 8 ad.	8 0 0
Complurum. <i>Alcalà</i>	1 2 52 sub.	4 28 0
<i>d'Henares</i>		
Compostella	1 26 0 sub.	42 58 0
Comum. <i>Como</i>	0 9 56 sub.	45 43 0
Côceptionis Vrbs	6 2 0 sub.	36 38 A.
<i>Chilensis regni</i>		
Confluentia Mosæ, &	0 19 40 sub.	50 22 0
<i>Rheni. Coblens</i>		
Conimbrica. <i>Coimbra</i>	1 25 52 sub.	40 50 0
Constantia. <i>Costniz</i>	0 10 12 sub.	47 42 0
Constantinopolis	1 20 26 ad.	42 56 0
Corcyra. <i>Corfu</i>	0 34 32 ad.	39 37 0
Corduba. <i>Cordova</i>	1 10 24 sub.	37 56 0
Corona Transilv.	0 56 12 ad.	48 28 50
<i>Cronstatt</i>		
Corui Insula	3 3 20 sub.	40 3 0
<i>Azorium</i>		
Cosentia Apuliæ.	0 21 35 ad.	39 28 0
<i>Cosenza</i>		
Cracovia. <i>Cracau</i>	0 34 0 ad.	50 10 0
Crema. <i>Crema</i>	0 6 52 sub.	45 16 0
Cremona	0 5 12 sub.	45 1 0
Creta. <i>Candia urbs</i>	1 8 8 ad.	34 40 0
<i>Insula</i>		
Crosna Silesiæ.	0 14 40 ad.	51 6 30

Nomina Locorum	Diff. Temp. H ' "	Alt. Poli G ' "
<i>Crossen</i>		
Curia Helvet. <i>Coyra</i> , & <i>Chur</i>	0 7 10 sub.	46 28 0
Cuscum Peruvii. <i>Cuzco</i>	5 42 0 sub.	11 25 A.
Damascus Syriæ. <i>Damasco</i>	2 6 0 ad.	33 10 0
Dantiscum. <i>Dantziga</i>	0 32 0 ad.	54 22 0
Deppa Normandiæ. <i>Dieppe</i>	0 44 22 sub.	49 34 0
Daventia. <i>Deventer</i>	0 18 0 sub.	53 11 0
Dertona. <i>Tortona</i>	0 10 30 sub.	44 5 0
Dertosa. <i>Tortosa</i>	0 46 48 sub.	40 46 0
Dillinga Germaniæ. <i>Dillingen</i>	0 13 20 sub.	48 30 0
Dinia Provinciæ. <i>Digne</i>	0 22 0 sub.	44 5 45
Divio. <i>Digion</i>	0 28 0 sub.	47 28 0
Dola Burgundiæ. <i>Dole</i>	0 27 0 sub.	47 20 0
Drepanum. <i>Trapani</i>	0 4 4 ad.	37 32 0
Dresda Misniæ. <i>Dresden</i>	0 10 16 ad.	51 5 0
Duacum. <i>Duay</i>	0 37 28 sub.	50 15 0
Dublynum Hiberniæ. <i>Dublyn</i>	1 0 0 sub.	53 11 0
Dyrrhachium. <i>Durazzo</i>	0 34 33 ad.	41 58 0
Ebora. <i>Evora</i>	1 34 0 sub.	38 22 0
Eboracum Scotiæ. <i>Yorch</i>	0 52 40 sub.	53 57 0
Ebroica. <i>Eureux</i>	0 43 40 sub.	48 41 0
Edemburgum Scotiæ	1 1 12 sub.	55 47 0

Nomina Locorum	Diff. Temp. H ' "	Alt. Poli G ' "
Egra Bohemiæ	0 1 1 ad.	50 1 0
Emuda. <i>Embden</i>	0 17 4 sub.	53 5 40
Emerita. <i>Merida</i>	1 18 16 sub.	38 54 0
Epidaurus. <i>Ragusa</i>	0 27 12 ad.	42 33 0

[Right half of table-page 10:]

Nomina Locorum	Diff. Temp. H ' "	Alt. Poli G ' "
Erefordia Tutingiç. <i>Erfurd</i>	0 0 28 ad.	51 6 0
Eugubium. <i>Agubio</i>	0 5 28 ad.	43 8 0
Eyestadium Bavariæ. <i>Eystad</i>	0 4 0 sub.	48 53 30
Famagusta Cypri. <i>Salamin</i>	0 48 0 ad.	35 18 0
Fanum Fortunæ. <i>Fano</i>	0 6 46 ad.	44 4 0
Fauentia. <i>Faenza</i>	0 1 56 ad.	44 33 15
Ferraria Italiæ. <i>Auctoris Patria</i>	0 1 3 ad.	44 54 15
Ferri Insula Fortunata. <i>Is. del Ferro</i>	2 18 0 sub.	28 10 0
Fessa Mauritanïæ. <i>Fez</i>	1 11 0 sub.	33 10 0
Florentia Hetruriç. <i>Fiorenza</i>	0 0 30 ad.	43 41 0
Flensburgum Iutlandiæ	0 5 8 sub.	54 58 0
Florum Insula. <i>Flores Azoridum</i>	3 3 24 sub.	39 35 0
Forum Cornelij. <i>Imola</i>	0 1 26 ad.	44 26 40
Forum Iulij. <i>Friuli</i>	0 6 44 ad.	46 17 0

Nomina Locorum	Diff. Temp. H ' "	Alt. Poli G ' "
Forum Liuij. <i>Forlì</i>	0 2 40 ad.	44 17 0
Forum Sempronij. <i>Fossombruno</i>	0 6 20 ad.	43 52 0
Francofurtum Mœni. <i>Francfort</i>	0 13 16 ad.	50 4 0
Francofurtum Oderæ. <i>Francfort</i>	0 14 0 ad.	52 20 0
Franequera Frisiæ. <i>Franecker</i>	0 23 0 sub.	53 12 30
Friburgum Brisgoiæ	0 15 28 sub.	48 16 0
Fruemburgum Prussiæ	0 36 20 ad.	54 29 0
Fulda Hassiæ. <i>Fuld</i>	0 11 12 sub.	50 42 0
Fulginia. <i>Foligno</i>	0 6 8 ad.	42 48 30
Gades. <i>Cadiz</i>	1 16 56 sub.	36 16 0
Gandauum. <i>Gant</i>	0 33 36 sub.	51 2 30
Gaugamela Assiriæ	2 33 0 ad.	35 2 0
Geldria. <i>Gelder</i>	0 21 12 sub.	51 30 0
Geneua. <i>Geneua</i>	0 22 56 sub.	46 20 0
Genua. <i>Genoua</i>	0 9 0 sub.	44 27 0
Geilolum. <i>Gilolo</i>	7 28 20 ad.	1 0 0
Gerunda. <i>Girona</i>	0 36 48 sub.	42 8 0
Glacium. <i>Glatz</i>	0 20 8 ad.	50 28 0
Goa Indiæ	4 18 0 ad.	15 30 0
Goësa Zelandiæ	0 31 0 sub.	51 30 30
Gorlicium Silesiæ. <i>Gorlitz</i>	0 14 48 ad.	51 14 0
Gratiana Croatiæ. <i>Gradisca</i>	0 7 32 ad.	46 8 0
Gratianopolis. <i>Granoble</i>	0 25 0 sub.	45 11 30
Gratium Stiriciæ. <i>Gratz</i>	0 20 40 ad.	47 2 0

Nomina Locorum	Diff. Temp. H ' "	Alt. Poli G ' "
Grodnum Samogitiæ. <i>Groan</i>	0 47 20 ad.	53 25 0
Grinnis, seu Groninga. <i>Groningen</i>	0 19 36 sub.	53 8 0
Grypsuualdia Pomeraniæ. <i>Grypsuald</i>	0 11 4 ad.	54 19 0
Hafnia. <i>Copenhauen</i>	0 5 32 ad.	55 43 0
Halatia Islandiæ. <i>Halsar</i>	1 58 40 sub.	67 26 0
Halberstad Saxonïæ. <i>Halberstatt</i>	0 4 44 ad.	51 56 0
Halla Saxonïæ. <i>Hall</i>	0 4 48 ad.	51 32 0
Hamburgum Holsatiæ. <i>Hamburg</i>	0 5 44 sub.	53 42 50
Heidelberga <i>Heidelberg</i>	0 12 8 sub.	49 22 0
Herbipolis. <i>Vuirtzburg</i>	0 7 0 sub.	49 45 0
Hildesemium Saxonïæ. <i>Hildesem</i>	0 4 12 sub.	52 8 0
Hierosolyma. <i>Gierusalemme</i>	1 56 0 ad.	32 0 0
Hispalis. <i>Singlia</i>	1 15 44 sub.	37 36 0

Parsing notes: Catalogue continues. As on the previous page, each entry pairs a Latin place-name with an italic vernacular form; the time-difference is H ' " with ad./sub.; the latitude is G ' ". A handful of gutter-side minute/second values were difficult to read (e.g. *Complurum* latitude shows "4 28" where □ 40 28 would be expected for Alcalá de Henares; *Comorinum* latitude shows a sun-symbol glyph "☉" for a digit). Note the editorial gloss at *Ferraria Italiæ* — "*Auctoris Patria*" (the Author's homeland), i.e. Riccioli's native city, Ferrara.

TAB. 14 — *Catalogus Locorum Insigniorum* (Catalogue of the More Notable Places), continued

Gazetteer from the Geographia Reformata. Each entry pairs a Latin place-name with its italic vernacular form, the time-difference from the Bologna Italic meridian (H. ' " , with ad. = adding / sub. = subtracting), and the latitude (G. ' " = degrees, minutes, seconds of the elevation of the pole).

Column headers throughout: **Nomina Locorum** (Names of Places) | **Differentia Temporis** (Difference of Time): H. ' " | **Altitudo Poli** (Elevation of the Pole): G. ' " .

Table-page 11 — entries H–N

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Huron es nouæ Franci æ <i>[Huro ns of New France]</i>	6	9	0	sub.	44	40	0
Hydru ntum · <i>Otrant o</i>	0	31	20	ad.	40	18	0
S. Iacob. Inf. Hespe rid. · S. <i>Iago [St James of the</i>	2	39	20	sub.	14	50	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>Cape Verde Is.]</i>							
Iauæ maiori s mediu m <i>[middl e of greate r Java]</i>	6	18	16	ad.	6	30	A.
Iauæ minor is mediu m <i>[middl e of lesser Java]</i>	6	30	56	ad.	7	40	A.
Ierosl auia Masco uiæ · <i>Ierosl auu</i>	0	42	48	ad.	57	40	0
Ilerda · <i>Lerida</i>	0	46	0	sub.	41	30	0
Imper ialis, vrbs Chilen	5	34	0	sub.	39	0	A.

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
sis Regni <i>[Imper ial, city of the kingdo m of Chile]</i>							
Ingols tadiu m	0	0	30	sub.	48	40	0
Bauari æ · <i>Ingsta d</i>							
Iuliac um Giulie sch, &c. · <i>Giulier s</i>	0	16	14	sub.	50	54	54
Kebek um nouæ Franci æ · <i>Quebe c</i>	5	16	0	sub.	47	0	0
Lanca stria Angli æ	0	58	56	sub.	54	3	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Lance rotta Insula Fortu natar um <i>[Lanz arote, of the Fortun ate Isles]</i>	1	55	20	sub.	28	50	0
Landis hutum Buari æ · <i>Lands hut</i>	0	13	28	sub.	42	28	0
Lausa nna Heluet iæ · <i>Losan na</i>	0	16	40	sub.	46	40	0
Lauret um · <i>Loreto</i>	0	10	26	ad.	43	41	0
Legio Hispa niæ · <i>Leon</i>	1	13	12	sub.	42	54	0
Leodi ü · <i>Liege,</i>	0	23	0	sub.	50	40	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
& <i>Luych</i>							
Lemo uices · <i>Lemog es</i>	0	48	0	sub.	46	0	0
Leopo lis Russi æ · <i>Lëbur g</i>	0	48	0	ad.	50	6	0
Leoua rdia Frisiæ · <i>Leuua yden</i>	0	22	16	sub.	53	13	40
Libur num · <i>Porto di Liuorn o</i>	0	4	0	ad.	43	18	0
Lilybe ü · <i>Capo di Marsa lla</i>	0	3	56	ad.	37	20	53
Lima Peruui j ·	6	11	0	sub.	12	20	A.

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>Cittá de los Reies</i>							
Lingo nes Lägres · <i>Lin</i> [?]	0	26	40	sub.	48	10	0
Linciu m Austri æ	0	13	0	ad.	48	20	0
Linda uia Sueui æ · <i>Linda</i> <i>u</i>	0	7	40	sub.	47	28	0
Lipsia Misni æ · <i>Lipsi,</i> & <i>Leipsi</i> <i>g</i>	0	6	0	ad.	51	19	15
Lodun um · <i>Lodun,</i> seu <i>Iuliod</i> <i>unum</i>	0	48	0	sub.	48	1	0
Londi num ·	0	48	0	sub.	51	32	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>Londra</i>							
Louanium · <i>Louagno</i>	0	27	20	sub.	50	50	0
Lubeca Holsatiæ · <i>Lubek</i>	0	1	52	sub.	54	1	0
Lublinum Lituan iæ	0	42	0	ad.	51	8	0
Luca Hetru riæ · <i>Lucca</i>	0	3	12	sub.	43	40	0
Luce mburg ü · <i>Luxem burg</i>	0	20	20	sub.	49	38	0
Lucerna Heluet iæ · <i>Lucer n</i>	0	14	28	sub.	46	59	0
Lugdunum Batau	0	28	0	sub.	52	12	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
orum · <i>Leyda</i>							
Lugdu num Galliæ · <i>Lion</i> <i>di</i> <i>Franci</i> <i>a</i>	0	28	0	sub.	45	48	0
Macaü Chinæ , & Amac aum. · <i>Macao</i>	6	45	0	ad.	22	13	0
Machl inia · <i>Mache</i> <i>len</i>	0	28	0	sub.	50	59	50
Macer ata Piceni	0	9	32	ad.	43	33	0
Macia na Insula Moluc ca. · <i>Macia</i> <i>n</i>	7	18	16	ad.	0	12	0
Magde burgu m	0	3	28	ad.	52	14	0
Maij	2	36	40	sub.	14	48	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Ins. Hespe ridum . · <i>Is.</i> <i>del</i> <i>Maio</i>							
Maiori ca <i>Mallor</i> <i>ca</i>	0	37	0	sub.	39	35	0
Malac ca Indiæ	5	54	40	ad.	2	20	0
Malac a Hispa niæ · <i>Malag</i> <i>a</i>	1	10	12	sub.	36	37	0
Maclo uium · S. <i>Malo</i>	0	56	40	sub.	48	30	0
Manic ongu m Africæ	0	27	20	ad.	6	0	A.
Manil a Luzon iæ	7	6	0	ad.	14	46	0
Mansf eldia	0	2	14	ad.	51	40	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Saxon iæ · <i>Mansf eld</i>							
Mantu a · <i>Manto a</i>	0	3	0	sub.	45	11	0
S. Maria Insula Azorio rü [St <i>Mary of the Azores]</i>	3	32	0	sub.	37	8	0
Marig alanta Isola [<i>Marie - Galant e]</i>	4	56	0	sub.	15	48	0
Mauro cum · <i>Marro cco</i>	1	28	0	sub.	31	12	0
Marti nina Inf. <i>Matini na</i>	4	55	0	sub.	14	14	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Massil ia · <i>Marsil ia</i>	0	16	0	sub.	43	20	0
Masisc o · <i>Masco n</i>	0	29	20	sub.	46	20	0
Matrit um · <i>Madri d</i>	1	0	0	sub.	40	30	0
Meacü Iaponi æ. · <i>Meaco</i>	8	11	32	ad.	36	0	0
Mecha Arabi æ. <i>Mecca h</i>	2	26	0	ad.	23	40	0
Medio lanum · · <i>Milan o</i>	0	4	4	sub.	45	14	0
Meld æ · <i>Meaul x</i>	0	37	36	sub.	48	56	30
Mech uacani a	7	56	48	sub.	20	16	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
nouæ Hispa niæ <i>[Mich oacán of New Spain]</i>							
Melia pora · <i>Cittá di S. Tomas o</i>	4	38	16	ad.	13	30	0
Melin da Africæ	1	54	40	ad.	2	45	A.
Melod unum · <i>Melun g</i>	0	38	4	sub.	48	28	0
Melita · <i>Malta</i>	0	13	0	ad.	35	40	0
Messa na Siciliæ · <i>Messi na</i>	0	17	44	ad.	38	21	0
Meta · <i>Metz</i>	0	21	20	sub.	49	10	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Mexic um · <i>Messic o</i>	7	48	0	sub.	20	10	0
S. Micha el Archa ngelus in Russia [<i>St Micha el Archa ngel in Russia , i.e. Arkha ngelsk]</i>	1	8	40	ad.	65	30	0
S. Micha elis Insula Azorid um [<i>St Micha el of the Azores]</i>	2	39	8	sub.	37	40	0
Midde lburgü	0	31	0	sub.	51	30	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Zelan diæ							
Minda nao Insula	7	19	20	ad.	7	10	0
Minor ica · <i>Minor ca</i>	0	30	0	sub.	39	53	0
Miran dula · <i>Miran dola</i>	0	1	13	sub.	44	54	30
Mogu ntia · <i>Mogo nza</i>	0	14	0	sub.	50	2	0
Monac hium Bauari æ · <i>Munch en</i>	0	0	10	ad.	48	58	0
Monœ cus Liguri æ · <i>Monac o</i>	0	17	24	sub.	43	39	30
Monas teriü Vuest phali	0	14	25	sub.	52	0	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
æ. · <i>Munst er</i>							
Mons Alban us · <i>Monta lbano</i>	0	42	16	sub.	44	22	0
Mons Pessul anus · <i>Momp elier</i>	0	32	20	sub.	43	38	0
Mons Regis Prussi æ. · <i>Konisb erg</i>	0	38	0	ad.	54	43	0
Mons Serrat us · <i>Monse rrato</i>	0	42	20	sub.	41	40	0
Moscu a · <i>Mosco uia</i>	2	0	0	ad.	55	18	0
Mutin a · <i>Moden a</i>	0	1	34	sub.	44	38	50
Mussi	0	21	48	sub.	48	54	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
pons, seu Mosæ pons· <i>Porta muson</i>							
Namu rcum · <i>Namu r</i>	0	26	48	sub.	50	26	0
Nanch inum Sinaru m. · <i>Nanki ng</i>	6	56	0	ad.	32	40	0
Nance ium · <i>Nansi</i>	0	40	48	sub.	48	39	0
Nanne tes · <i>Nante s</i>	0	54	48	sub.	48	15	0
Nanga fachin a Iappo niæ. <i>Nagas achi</i>	7	44	32	ad.	32	53	0
Nanqu inum Chinæ	6	55	44	ad.	32	15	0

Nomi na Locorum	H.	'	"	ad./ sub.	G.	'	"
vel <i>[see Nanchinum]</i>							
Narbo na Galliæ · <i>Narbo na</i>	0	10	16	sub.	42	40	0
Narsin ga Indiæ	4	46	40	ad.	18	15	0
Natua Liuoni æ	1	10	0	ad.	59	6	0

Parsing notes: Two compound entries spread their italic vernacular onto a continuation line in the stub ("Nanchinum Sinarum. / Nanking ad" and "Nanquinum Chinæ vel"). The "Nanchinum" row's *ad.* column-marker fell on the continuation line in the source; I have placed it in the row's *ad./sub.* column. Catchword at foot: "Nea-" (→ *Neapolis*). "Lingones Lägres · *Lin* [?]" — the vernacular form is truncated/abbreviated in the source.

Table-page 12 — entries N–S

Nomi na Locorum	H.	'	"	ad./ sub.	G.	'	"
Neapo lis · <i>Napoli</i>	0	16	0	ad.	41	5	0
Neobu rgum	0	1	12	ad.	48	39	30

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Bauari æ							
Nigro polis	0	51	20	ad.	49	14	0
Russi æ							
Nicosi a	1	45	20	ad.	35	32	0
Cypri Nicea	0	18	8	sub.	43	38	0
Proui nciæ · <i>Nizza di Proue nza</i>							
Niuer nium · <i>Niuers</i>	0	38	16	sub.	47	19	0
Nuceri a	0	16	44	ad.	40	55	0
Vmbri æ · <i>Nocer a</i>							
Nola Camp aniæ	0	16	28	ad.	41	7	30
Norim berga Franc oniæ · <i>Nurin</i>	0	2	40	ad.	49	26	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>berg</i>							
Nouati a · <i>Nouar</i> a	0	11	58	sub.	45	10	0
Oldem burgu m Vuest phali æ	0	13	4	sub.	53	9	0
Olinda Brasili æ	3	6	0	sub.	7	48	A.
Oenip ontum Nonici · <i>Ispruc</i> k <i>[Innsb</i> <i>ruck]</i>	0	0	5	sub.	47	10	0
Olomu ntium Morau iæ· <i>Olmiz</i>	0	20	32	ad.	49	35	0
Omur a Iappo niæ	7	45	12	ad.	33	0	0
Ortosi a ·	2	3	0	ad.	35	0	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>Tortosa</i>							
<i>Syriæ</i>							
Ocupitum · <i>Oruiet</i>	0	4	0	ad.	42	36	0
<i>o</i>							
Oscas · <i>Huesa</i>	0	50	0	sub.	42	10	0
Ostenda <i>Flandriæ</i>	0	36	56	sub.	51	16	0
<i>Osaburga</i> · <i>Osnaburga</i>	0	12	44	sub.	52	25	0
Oxonium · <i>Oxford</i>	0	53	0	sub.	51	46	0
Ozaca <i>Iapponiæ</i>	8	4	52	ad.	35	5	0
Pachinum <i>Promotoriü</i> · <i>Capo</i>	0	16	14	ad.	36	32	50
<i>Passero</i>							
Paderbona	0	9	0	sub.	51	40	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Vuest phali æ. · <i>Palbor n</i>							
Palant ia · <i>Palenz a</i>	1	9	8	sub.	42	8	0
Palma Vrbs Insul æ Fortu n. <i>[Palm a, city of the Fortun ate Is.]</i>	1	18	0	sub.	28	55	0
Palma nona Venet orum	0	6	46	ad.	46	4	0
Pamp elon · <i>Pampl ona</i>	0	53	36	sub.	43	20	0
Pana ma Ameri cæ	6	23	0	sub.	9	0	0
Panor	0	7	0	ad.	38	0	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
mus · <i>Palermo</i>							
Papia, & Ticini. <i>Paui</i>	0	9	4	sub.	44	48	0
Parisij , & Luteti a. <i>Parigi</i>	0	40	0	sub.	48	51	0
Parma Lomb ardiæ	0	4	14	sub.	44	44	50
Pataui a Norica · <i>Passau</i>	0	8	40	ad.	48	30	0
Pataui num · <i>Padoua</i>	0	4	4	ad.	45	31	0
Pelusi um · <i>Damiat</i>	1	44	40	ad.	31	15	0
Pegui um Indiæ. <i>Pegu</i>	5	46	0	ad.	17	0	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Pequi num · <i>Peking</i> , & <i>Quins</i> <i>ai</i> <i>Sinaru</i> <i>m</i> vel <i>[Beijin</i> <i>g]</i>	7	4	32	ad.	40	0	0
[Pequi num, secon d line]	6	57	12	ad.	39	59	0
Perna mbuc um Brasili æ	3	37	20	sub.	7	40	A.
Persep olis · <i>Siras</i> , vel <i>Siraz</i>	3	2	0	ad.	34	14	0
Petrog orium · <i>Perigu</i> <i>eux</i>	0	43	12	sub.	45	34	0
Perpig nan · <i>Perpu</i> <i>gnano</i>	0	34	48	sub.	42	52	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Perusi a, & Perusi um. · <i>Perugi</i> <i>a</i>	0	4	0	ad.	42	56	0
Petoui o Styriæ · <i>Pettau</i> <i>u</i>	0	24	40	ad.	46	0	0
Picus Insula Azorid um <i>[Pico</i> <i>of the</i> <i>Azores</i> <i>]</i>	2	53	0	sub.	38	46	0
Pictau ia · <i>Poitier</i> <i>s</i>	0	46	8	sub.	47	7	0
Pisaru m · <i>Pisa</i>	0	1	40	sub.	43	9	0
Pistori um · <i>Pistoia</i>	0	1	41	sub.	43	40	0
Placen tia Lomb	0	6	58	sub.	44	52	40

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
ardiæ. · <i>Piacen za</i>	1	1	4	sub.	43	38	0
Placen tia Canta briæ. · <i>Placen za</i>	1	14	48	sub.	40	4	0
Placen tia Castell æ Plesco uia Russi æ. · <i>Plesco uu</i>	0	[—]	[—]	ad.	59	2	0
Pola Istriæ · <i>Pola - Pietas Iulia</i>	0	12	4	ad.	45	20	0
Polose kum · <i>Polosz ko</i>	1	6	40	ad.	55	28	0
Pons Mosell anus · <i>Ponta</i>	0	17	48	sub.	48	54	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>muson</i>							
Portus Bellus Ameri cæ	6	21	20	sub.	9	55	0
Portus Deside rij · <i>Porto</i> <i>Desire</i>	5	48	40	sub.	47	50	A.
Portus Gratia nus · <i>Haure</i> <i>de</i> <i>Grace</i>	0	48	16	sub.	49	7	0
Portus vetus · <i>Porto</i> <i>veio</i>	6	25	0	sub.	1	10	A.
Posoni ü. <i>Pres</i> <i>burg.</i> Hunga riæ	0	47	12	ad.	48	19	0
Posna nia Poloni æ · <i>Pozna</i> <i>n</i>	0	25	0	ad.	52	20	0
Potose um ·	5	29	20	sub.	21	40	A.

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>Potosi</i>							
Praga Bohe miæ · <i>Prag</i>	0	11	30	ad.	50	40	30
Promo ntoriu m Atoma ta. <i>Capo di Carda suy</i>	3	1	40	ad.	12	0	0
Promo ntoriü Bonæ Spei <i>[Cape of Good Hope]</i>	0	31	20	ad.	34	32	A.
Promo ntoriü Corod aipum . C. <i>Ras Algate</i>	3	34	0	ad.	22	10	0
Promo ntoriü Samm onicu m. C.	1	14	48	ad.	34	10	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>Salom one</i>							
Promo ntoriu m Saitu m. <i>Capo di S. Vincen zo</i>	1	29	20	sub.	37	35	0
Promo ntoriü Celtic um, vel Artabr ü. <i>Capo di Finis terræ</i>	0	50	52	sub.	43	8	0
Promo ntoriu m Tenar um. <i>Capo Matra pan</i>	0	50	44	ad.	35	8	0
Promo ntoriu m Guana	1	40	24	sub.	28	50	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
gama. <i>Capo Non</i>							
Quebe c, & Kebek nouæ Franci æ <i>[Queb ec of New France]</i>	5	16	0	sub.	47	0	0
Quiloa Africæ	1	47	40	ad.	9	0	A.
S. Quinti ni Fanu m· S. <i>Quinti n</i>	0	34	12	sub.	49	46	0
Ratisb ona · <i>Rigens burg</i>	0	2	8	ad.	48	59	0
Rauen na Flami niæ · <i>Rauen na</i>	0	5	32	ad.	44	26	20

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Regiu m Lepidi · <i>Reggio di Lomb ardia</i>	0	2	56	sub.	44	43	0
Rethel ium · <i>Rethel</i>	0	29	12	sub.	49	28	0
Reate · <i>Rieti</i>	0	9	12	ad.	42	29	0
Regius Mons Prussi æ. · <i>Konisb erga</i>	0	38	0	ad.	54	43	0
Reuali a Liuni æ. · <i>Reuel</i>	0	54	0	ad.	59	12	0
Rhedo nes · <i>Renne s</i>	0	54	48	sub.	48	4	0
Rhegi um · <i>Reggio di Calabr</i>	0	18	12	ad.	38	15	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>ia</i>							
Rhemi orum · <i>Rems</i>	0	31	4	sub.	49	12	0
Rhodu s vrbs Ins. <i>Rhodi</i>	1	24	40	ad.	36	22	0
Rhodi gium · <i>Rouig</i> <i>o</i>	0	1	24	ad.	45	9	0
Riga Liunioni æ	0	51	12	ad.	56	52	0
Roma · <i>Roma</i>	0	7	16	ad.	41	54	0
Roscia num · <i>Rossa</i> <i>no</i>	0	22	36	ad.	39	49	0
Rostoc hium · <i>Rusmo</i> κ [<i>Rosto</i> <i>k</i>]	0	4	48	ad.	54	10	0
Rotere damu m · <i>Roterd</i> <i>am</i>	0	28	12	sub.	51	55	0
Rotho	0	43	20	sub.	49	25	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
magu m · <i>Rouen</i> Norm andiæ							
Rupell a · <i>Rochel le</i>	0	55	52	sub.	46	22	0
Ruscin o · <i>Roncil ione</i> [<i>Ronci glione</i>]	0	34	44	sub.	42	48	0
Sablæ Galliæ · <i>Sable</i>	0	49	52	sub.	48	26	0
Salma ntica · <i>Salam anca</i>	1	12	48	sub.	40	56	0
Salern um · <i>Salern o</i>	0	17	12	ad.	40	51	0
Salisb urgum · <i>Salzbu rg</i>	0	7	44	ad.	47	44	0
Salom onis	9	18	0	ad.	0	0	A.

Nomi na Loco- rum	H.	'	"	ad./ sub.	G.	'	"
Insula IESV <i>[Solo mon's Isle of Jesus]</i>							
Samar- kanda vetus. · <i>Samar- kand & noua</i>	4	6	0	ad.	45	0	0
[Sama- rkand- a, secon- d line]	4	3	4	ad.	39	37	23

Parsing notes: The "Pequinum"/"Quinsai" and "Samarkanda vetus / & noua" entries each give two rows of figures (old/new or alternate positions); I have transcribed both numeric lines, the second on a [...second line] row. "Plescouia Russiæ" — the minutes/seconds of the time-difference fell on the continuation line in the source and are not legibly resolvable as printed (the *ad.* marker is on the second line); marked [-]. Catchword at foot: "San-" (→ *Sancianum*).

Table-page 13 — entries S–V (end of TAB. 14)

Nomi na Loco- rum	H.	'	"	ad./ sub.	G.	'	"
Sancia- num	6	32	0	ad.	21	30	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Insula							
Santo nas · <i>Santog ne</i>	0	51	32	sub.	45	38	0
Sardes Lydiæ · <i>Sardi</i>	1	21	0	ad.	38	20	0
Sassar um · <i>Sassar i</i>	0	11	16	sub.	40	23	0
Sauo Sabata · <i>Sauon a</i>	0	12	28	sub.	44	18	0
Segobi a · <i>Segoui a</i>	1	6	32	sub.	40	56	0
Segont ia · <i>Siguen za</i>	1	0	0	sub.	40	57	0
Seudo mira Poloni æ	0	41	32	ad.	50	42	0
Sena Hetru riæ · <i>Siena</i>	0	0	54	ad.	43	11	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Septi manc æ · <i>Siman cas</i>	0	45	8	sub.	41	38	0
Sipunt um · <i>Sipont o</i>	0	21	21	ad.	41	50	0
Siracu sæ · <i>Siracu sa</i>	0	14	20	ad.	37	3	57
Smole nsku m Mosco uiæ	0	27	20	ad.	55	26	0
Smyrn a · <i>Le Smyrn e</i>	1	16	0	ad.	38	22	0
Soccot ora · <i>Zocoto ra, à Zocatr a</i>	3	10	0	ad.	13	0	0
Spaha ni Persid is · <i>Ispaha</i>	3	36	0	ad.	36	14	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>n</i>							
Spita · <i>Speir</i>	0	12	48	sub.	49	12	0
Spolet ium · <i>Spoleti</i>	0	7	30	ad.	42	43	0
Stettin um Pomer aniæ · <i>Stettin</i>	0	14	0	ad.	53	34	0
Stokol mia Sueci æ · <i>Stokol m</i>	0	26	40	ad.	59	30	0
Strigo nium Hunga riæ · <i>Gran</i>	0	31	28	ad.	47	57	0
Susæ Persid is · <i>Susa</i>	3	20	0	ad.	33	20	0
Sytacu sæ · <i>Siracu sa</i>	0	16	0	ad.	37	3	37
Tarent um · <i>Tarant</i>	0	27	2	ad.	40	40	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>o</i>							
Tarrac o · <i>Tarra gona</i>	0	43	0	sub.	41	6	0
Tarrac ina · <i>Terrac ina</i>	0	11	6	ad.	41	31	0
Taruis ium · <i>Treuis o</i>	0	1	48	ad.	45	45	0
Tauri num · <i>Torino</i>	0	14	59	sub.	44	9	0
Teneri ffa Insula Fortu natar um <i>[Tener ife]</i>	1	10	24	sub.	28	50	0
Ternat e Insula Moluc ca	7	26	0	ad.	0	42	A.
Terges te · <i>Trieste</i>	0	8	48	ad.	45	57	0
Tertia	2	47	0	sub.	39	4	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
ria.							
<i>Isola</i>							
<i>Terzer</i>							
<i>a</i>							
Texeli	0	25	40	sub.	53	3	0
<i>a ·</i>							
<i>Tessel</i>							
Thioni	0	21	16	sub.	49	29	0
s Villa.							
<i>Thion</i>							
<i>uille</i>							
Tessal	0	51	27	ad.	41	28	0
onica ·							
<i>Saloni</i>							
<i>chi</i>							
Tholos	0	42	24	sub.	44	0	0
a							
Galliæ							
·							
<i>Tolosa</i>							
Tidora	7	26	24	ad.	0	36	0
Insula							
Moluc							
ca.							
<i>Tidor</i>							
Tingis	1	36	0	sub.	35	25	0
Mauri							
taniæ.							
· <i>Täger</i>							
Tirolu	0	3	20	sub.	46	38	0
um ·							
<i>Tirolu</i>							
Toletu	1	6	0	sub.	39	52	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
m · <i>Toledo</i>							
Tolon e · <i>Telo</i> <i>Marti</i> <i>us</i>	0	23	36	sub.	43	5	0
S. Thom æ Insula <i>[São</i> <i>Tomé</i> <i>I.]</i>	0	19	0	sub.	0	10	0
Torna cum · <i>Torna</i> <i>y</i>	0	35	20	sub.	50	32	0
Trape zus — untis. <i>Trebis</i> <i>onda</i>	2	14	0	ad.	43	11	0
Traian opolis · <i>Traian</i> <i>opoli</i>	1	9	44	ad.	43	34	0
Traiec tum · <i>Mastri</i> <i>ch</i>	0	22	48	sub.	50	49	50
Triuer	0	19	36	sub.	49	50	30

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>· Trier</i>							
Triden tum ·	0	2	0	sub.	46	10	0
<i>Trento</i>							
Tripoli s Syriæ ·	1	3	4	ad.	34	37	0
<i>Tripoli</i>							
Tubin ga ·	0	10	30	sub.	48	34	0
<i>Tobing a</i>							
Tuder · <i>Todin</i>	0	5	28	ad.	42	41	0
Tunet um ·	0	8	0	sub.	35	18	0
<i>Tunis</i>							
Turon um ·	0	46	8	sub.	47	35	0
<i>Tours</i>							
Turria so ·	0	57	48	sub.	42	9	0
<i>Tarraz ona</i>							
Tyben e Persid is. <i>Tiben</i>	2	47	36	ad.	38	0	0
Valent ia Hispa	0	50	0	sub.	39	30	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
niæ. <i>Valenz</i> <i>a</i>							
Valent ia Galliæ .Valen ce	0	28	52	sub.	44	58	0
Valent inum · <i>Valenc</i> <i>enes</i>	0	35	44	sub.	50	20	0
Valisol etum · <i>Vallad</i> <i>olid</i>	1	9	12	sub.	41	42	0
Vangi ones · <i>Vorma</i> <i>tia</i>	0	13	20	sub.	49	50	0
Varsa uia Poloni æ	0	39	0	ad.	52	14	0
Veneti æ · <i>Veneti</i> <i>a</i>	0	2	40	ad.	45	33	0
Venet es Britan niæ. <i>Vanne</i>	0	59	0	sub.	47	22	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
s							
Vercel la · <i>Vercell</i> <i>i</i>	0	12	32	sub.	45	3	15
Verod unum Burgu ndiæ. <i>Verdu</i> <i>n</i>	0	29	20	sub.	46	59	0
Verod unum Lothar ingiæ	0	24	44	sub.	49	5	0
Veron a · <i>Veron</i> <i>a</i>	0	2	12	sub.	45	33	0
Veson tio · <i>Besan</i> <i>zon</i>	0	24	0	sub.	47	34	0
Vicent ia Cisalpi næ · <i>Vicenz</i> <i>a</i>	1	2	0	sub.	43	10	0
Victori a · <i>Vittori</i> <i>a</i>	0	28	0	ad.	42	30	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
Vienn a Austri æ	0	28	48	ad.	45	32	0
Vienn a Allobr ogum	0	53	40	ad.	54	38	30
Vilna Lituan iæ	0	5	0	ad.	54	21	0
Viterb um · <i>Viterb o</i>	0	5	0	ad.	42	21	0
Vladis lauia Poloni æ	0	33	20	ad.	53	48	0
Vlma Sueui æ · <i>Vlma</i>	0	6	16	sub.	48	20	0
Vlysip po · <i>Lisbon a</i>	1	30	0	sub.	38	40	0
Vltrai ectum · <i>Vrecht h</i>	0	25	52	sub.	52	4	50
Volate	0	1	12	sub.	43	9	0

Nomi na Locor um	H.	'	"	ad./ sub.	G.	'	"
<i>rræ · Volter ra</i>							
Volod omira	0	49	0	ad.	54	2	0
Poloni æ							
Vpsali a · <i>Vpsala</i>	0	24	48	ad.	59	0	0
Vrani burgu m	0	5	36	ad.	55	54	40
Daniæ							
Vrbin um · <i>Vrbino</i>	0	5	34	ad.	43	53	0
Vratisl auia · <i>Bresla un</i>	0	22	0	ad.	51	14	0
Vuitte berga	0	8	4	ad.	51	48	30
Saxon iæ							
Volse nbutil ia <i>Vuolse nbutel</i>	0	0	56	sub.	52	9	30
Vuolo gda Russi	2	8	40	ad.	59	12	0

Nomi							
na							
Locor				ad./			
um	H.	'	"	sub.	G.	'	"

æ

Parsing notes: This page ends the gazetteer (TAB. 14). Two entries appear for Syracuse with slightly different latitude seconds ("Siracusæ · *Siracusa*" at 37° 3' 57" and "Sytacusæ · *Siracusa*" at 37° 3' 37") — transcribed as printed; the duplication and the differing seconds (57" vs 37") are a source feature, not a misread. "Uraniburgum Daniæ" is Tycho Brahe's [Tycho Brahe] observatory island of Hven/Uraniborg.

Closing note (boxed, at foot of table-page 13):

Many places, even notable ones, we have omitted, because right now there is scarcely time for them — places for which an astronomical calculation must be carried out, or which we are unwilling to transfer to this place. But since the longitude of **BOLOGNA** is established, from what we have demonstrated in our *Geographia Reformata*, at 34° 30' from the **PALMA** of the Fortunate Isles, the longitude of other places can easily be gathered from this Catalogue, by means of the difference of Time converted through Table 7 above (where it is divided into its parts), and the scruples [seconds] of the Equator, with 34° 30' added where the note reads *ad.*, or subtracted where the note reads *sub.*

TAB. 15. Of the Bissextile (Leap) Years before the Common Epoch of Christ [Annorum Bissextilium ante Epocham vulgarem Christi]

Anni Expansi (Single Years)	Anni Centesimi Primi, ac Millesimi Primi (Hundreds-and-first, and Thousands-and-first Years)	
1	101	2701
5	201	2801
9	301	2901

Anni Expansi (Single Years)	Anni Centesimi Primi, ac Millesimi Primi (Hundreds-and-first, and Thousands-and-first Years)	
13	401	3001
17	501	3101
21	601	3201
25	701	3301
29	801	3401
33	901	3501
37	1001	3601
41	1101	3701
45	1201	3801
49	1301	3901
53	1401	4001
57	1501	4101
61	1601	4201
65	1701	4301
69	1801	4401
73	1901	4501
77	2001	4601
81	2101	4701
85	2201	4801
89	2301	4901
93	2401	5001
97	2501	5101
101	2601	5201

TAB. 16. Of the Bissextile (Leap) Years in the Epoch of Christ, in the Form of the Julian Year [Annorum Bissextilium Epocha Christi, in forma Anni Iuliani]

Anni Expansi (Single Years)	Anni Centesimi, ac Millesimi (Hundreds and Thousands Years)	
4	100	2600
8	200	2700
12	300	2800
16	400	2900
20	500	3000
24	600	3100
28	700	3200
32	800	3300
36	900	3400
40	1000	3500
44	1100	3600
48	1200	3700
52	1300	3800
56	1400	3900
60	1500	4000
64	1600	4100
68	1700	4200
72	1800	4300
76	1900	4400
80	2000	4500
84	2100	4600
88	2200	4700
92	2300	4800
96	2400	4900
100	2500	5000

TAB. 17. Of the Centesimal (Hundred-) Years, Common or Bissextile in the Gregorian Form, with the Excess of Days over the Julian Days [Annorum Centesim. Communium, vel Bissextilium in forma Anni Gregoriani, cum Dierum excessu supra Dies Iulianos]

In the leftmost two sub-columns, **B** marks a centesimal year that remains bissextile (leap) in the Gregorian reckoning, and **C** marks one that becomes common (non-leap). "Dies" is the cumulative excess of Gregorian over Julian days.

	Anni	Dies		Anni	Dies
B	1600	10	C	4100	29
C	1700	11	C	4200	30
C	1800	12	C	4300	31
C	1900	13	B	4400	31
B	2000	13	C	4500	32
C	2100	14	C	4600	33
C	2200	15	C	4700	34
C	2300	16	B	4800	34
B	2400	16	C	4900	35
C	2500	17	C	5000	36
C	2600	18	C	5100	37
C	2700	19	B	5200	37
B	2800	19		&c.	
C	2900	20			
C	3000	21			
C	3100	22			
B	3200	22			
C	3300	23			
C	3400	24			
C	3500	25			
B	3600	25			
C	3700	26			

	Anni	Dies	Anni	Dies
C	3800	27		
C	3900	28		
B	4000	28		

Note (spanning beneath Tables 15–17): It is assumed that the intercalation was made in the years [indicated], and thereafter always as Julius Caesar had ordered — leaving out of account here the Year of Confusion and the error of the ancients in intercalating. [*Supponitur intercalatio facta Annis ante, & porro semper prout iusserat Iulius Caesar, dissimulato hoc Anno Confusionis, & errore Priscorum in intercalando.*]

TAB. 18. Of the Cycles of the Sun [Cyclorum Solis]

This table lists multiples (years) belonging to the 28-year solar cycle. Read down each column in turn.

28	1008	1960	2968
56	1036	1988	2996
84	1064	2016	3024
112	1092	2044	3052
140	1120	2072	3080
168	1148	2100	3108
196	1176	2128	3136
224	1204	2156	3164
252	1232	2184	3192
280	1260	2212	3220
308	1288	2240	3248
336	1316	2268	3276
364	1344	2296	3304
392	1372	2324	3332
410	1400	2352	3360
448	1428	2380	3388
476	1456	2408	3416
504	1484	2436	3444

532	1512	2464	3472
560	1540	2492	3500
588	1568	2520	3528
616	1596	2548	3556
644	1624	2576	3584
672	1652	2604	3612
700	1680	2632	3640
728	1708	2660	3668
756	1736	2688	3696
784	1764	2716	3724
812	1792	2744	3752
840	1820	2772	3780
868	1848	2800	3808
896	1876	2828	3836
924	1904	2856	3864
952	1932	2884	3892
980		2912	3920
		2940	3948

Parsing notes: the final two rows of the last two columns read "2912 / 3920 / Cycli sunt 175" and "2940 / 3948". The second column ends at 1932; column 1 ends at 980.

TAB. 19. Of the Weekday Table [Hebdomatica Feriarum]

The column headers carry both Roman ferial numbers (I–VII) and the Greek weekday names (with their planetary symbols beneath): I Κυριακή (Lord's Day / Sunday, ☉ Sun); II Δευτέρα (Monday, ☾ Moon); III Τρίτη (Tuesday, ♂ Mars); IV Τετράς (Wednesday, ☿ Mercury); V Πέμπτη (Thursday, ♃ Jupiter); VI Παρασκευή (Friday, ♀ Venus); VII Σάββατον (Saturday, ♄ Saturn).

I — Κυριακ ή ☉	II — Δευτέρ α ☽	III — Τρίτη ☿	IV — Τετράς ♃	V — Πέμπτη ♃	VI — Παρασκ ευή ☿	VII — Σάββατ ον ♄
Iunius (June)	Septem ber	April.				
4	Decem b.	5	6	7	8	Martius (March)
9	10	11	12	Maius (May)	13	14
15	16	Iulius (July)	17	18	19	20
Febr. seq. (the followi ng Februa ry)	21	22	23	24	August. (August)	25
26	27	28	Octob. (Octobe r)	Ianu. seq. (the followi ng January)		Nouem b. (Novem ber)

TAB. 20. Of the Weekday in the Arabic Vague Year [Feriarium in Anno Arabico vago Hegirae]

The body shows, for each ferial column (I–VII), the running day-count and the months of the Arabic (Hegira) year that begin on that weekday. The rightmost column is the "Cyclus Arabicus" (Arabic cycle).

I	II	III	IV	V	VI	VII	Ciclus Arabic us
	180		150		120	0	

I	II	III	IV	V	VI	VII	Ciclus Arabic us
90		60		30			210 — 0
	2			1		Much arram . 3	410 — 0
5	Sepha r	Rabie I 7	4	Rab- ie II 9	6	8	630 — 0 840 — 0 1050 — 0
	10		12		Giuma -di I. II		1260 — 0
13	Regeb	15			14		1470 — 0
Giuma -di II	18		Sabab en	17		16	1680 — 0
21			20		Rama dhen	19	Scheu al
Dulka- dati		23		25		22	24
29	Dulha- cati	28	30 curr.		27		

Parsing notes: this is a crowded grid; month-names (Mucharram, Sephar, Rabie I, Rabie II, Giumadi I, Giumadi II, Regeb, Sababen, Ramadhen, Scheual, Dulkadati, Dulhacati) are interleaved with day-numbers across the ferial columns, and the right-hand "Ciclus Arabicus" runs 210, 410, 630, 840, 1050, 1260, 1470, 1680, 1890, 2100 each paired with 0. The "30 curr." (= 30 *currens*, "30 running/current") is at the foot of column IV. Cell alignment is approximate; some day-numbers sit between columns in the source.

TAB. 21. Of the Collected Years, and the Months of Various Nations [Annorum Collectorum, & Mensium Diversarum Nationum]

The left block tabulates "Roman Julian Years" (Romanorum Iulianorum Anni) against the cumulative "Collected Days of the Common Months" (Dies Collecti Mensium Com.) and the bissextile count (Bissex.). The right blocks give the month-names of several nations: Macedonian & Antiochene months (Menses Macedonum, & Antiochen.); the less-settled Athenian months (Athenien[s]ium Menses inconstantes); the Greek month-appellations with their zodiacal signs (Graecorum Mensium aliae appellationes); and the Syrian & Jewish months (Syrorum, & Iudaeorum menses).

Roman orum Iuliano rum Anni	Dies Collecti Mensiu m Com.	Bissex.	Menses Macedo num, & Antioch en.	Athen. Menses inconst antiore s	Graeco rum Mensiu m aliae appella tiones	Syroru m, & Iudaeor um menses
1	365		Ianuar. 31 — 31	Ανθεστ ηρ. (Februa r. 59 — 60)	Γαμηλι ών	Αιγόν □ — Canun II. Thebet
2	730		Februa r. 59 — 60	Ποσειδ ών	Άντηρι ών	Ύδροχ. □ — Schebat
3	1095		Martius 90 — 91	Έλαφη βολιών	Ίχθύων	Ίχθύων □ — Adar
—	—	—	Aprilis 120 — 121	Μουνυχ ιών	Κριόν	Κριόν □ — Nisan
4 — 0 — 0	1461	0 — 0	Maij 151 — 152	Άρτεμίσ ιος	Θαργηλ ιών	Τάυρον □ — Iiar
8 — 0 — 0	2922	0 — 0	Iunij 181 —	Δάσιος	Σκιρόο	Διδύμω ν □ —

Roman orum Iuliano rum Anni	Dies Collecti Mensiu m Com.	Bissex.	Menses Macedo num, & Antioch en.	Athen. Menses inconst antiore s	Graeco rum Mensiu m aliae appella tiones	Syroru m, & Iudaeor um menses
			182		φοριών	Haïran. Siuan
12 — 0 — 0	4383	0 — 0	Iulij 212 — 213	Πάνημο ς	Ἐκατομ βαιών	Καρκίν ον □ — Tamuz
16 — 0 — 0	5844	0 — 0	August. 243 — 244	Λῶος	Μεταγε ιτινιών	Λέοντα □ — Ab
20 — 0 — 0	7305	0 — 0	Septem b. 273 — 274	Γορπιαῖ ος	Βοηδρο μιών	Παρθέν ον □ — Ilaes
24 — 0 — 0	8766	0 — 0	Octob. 304 — 305	Ἵπερβε ρεταῖος	Μαιμακ τηριών	Ζυγόν □ — Tisrin I. (uan
28 — 0 — 0	10277	0 — 0	Nouem br. 334 — 335	Δῖος	Πυανεψ ιών	Σκορπίο ν □ — Tisrin II. Marche sc[uan]
32 — 0 — 0	11688	0 — 0	Decem b. 365 — 366	Ἀπελλα ῖος	Ποσειδ ών	Τοξότη ν □ — Canun I. Caslea
36 — 0 — 0	13149	0 — 0				
40 — 0 — 0	14610	0 — 0				

Note beneath: The months of the Syrians, Jews, and Macedonians — certain of them begin from the seventh of the Julian months; the Athenian and Greek months for the greater part of themselves run concurrent with the Julian months noted opposite. [*Syrorum, Iudaeorum, ac Macedonum Menses, quidam ineunt à septimis diebus Iulianorum Mensium Athenienses, & Graecorum Menses potiori sui parte concurrunt cum Iulianis Mensibus è regione notatis.*]

Of the Egyptians, & Persians [Aegyptiorum, & Persarum]; and the 30-day Months, with their beginnings [Menses 30. dierum, & horum initia in ...]

This composite block: at left, the collected years and days of the Egyptians; the days of the Egyptian and Persian collected months; then the 30-day months of the Egyptians, Persians, modern Alexandrians (Alexandrini Hodierni), Copts & Abyssinians (Coptitarum, & Abissin.); and at right the start in the Julian bissextile / common year (Anno Iulian. Bissextil. — Comm.).

Anni Collecti	Dies Annorum Collecti	Dies Mensium Aegyptiorum	Dies Collecti Mensium Persicorum	Alexandrini Hodierni	Coptitarum & Abissin.	Anno Iulian. Bissextil. — Comm.
1 — 0 — 0 — 0	365 — 0 — 0	Thoth D. 30	Pharua rdin 30	Thuth	Mascar am	Aug. 30 — 29
2 — 0 — 0 — 0	730 — 0 — 0	Paophi 60	Artipeh est 60	Pape	Tikmith	Sept. 29 — 28
3 — 0 — 0 — 0	1095 — 0 — 0	Athyr 90	Chorda t 90	Hathur	Hagar	Octob. 29 — 28
4 — 0 — 0 — 0	1460 — 0 — 0	Choeac 110	Tyrma 110	Chiac	Taehsa m	Nouem b. 28 — 27
5 — 0 — 0 — 0	1825 — 0 — 0	Tybi 150	Mertat 150	Tube	Tir	Decem b. 28 — 27
6 — 0	2190 —	Mechir	Sacheri	Amschi	Iachath	Ianuar.

Anni Collecti	Dies Annorum Collecti	Dies Collecti Mensium Aegyptiorum	Dies Collecti Mensium Persicorum	Alexan drini Hodier ni	Coptita rum & Abissin.	Anno Iulian. Bissexti l. — Comm.
— 0 — 0	0 — 0	180	ur 180	r	ith	27 — 26
7 — 0 — 0 — 0	2555 — 0 — 0	Phame noth 210	Mecher ma 210	Parmah ath	Magalit h	Februa r. 26 — 25
8 — 0 — 0 — 0	2920 — 0 — 0	Pharm uthi 245 cum Vuahak	Apanm a 245 cum Vuahak	Parmu de	Miazia	Mart. 27 — 26
9 — 0 — 0 — 0	3285 — 0 — 0	Pachon 270	Aderm a 275	Paschu nes	Sene	April. 26 — 26
10 — 0 — 0 — 0	3650 — 0 — 0	Paÿni 300	Dima 305	Paune	Sene	Maij 26 — 26
		Epephi 330	Pellnan 335	Epip	Hamle	Iunij 25 — 25
		Mesori 360	Asfori 360	Mesori	Nahase	Iulij 25 — 25
		Epago menç 365	Asphan dar 365	Elnisi	Pagome n	August. 24 — 24

Note (Persian column): "Vuahak significat additionem dierum 5" — *Vuahak* signifies the addition of 5 days. (At Pharmuthi/Apanma the entry "245 cum Vuahak" includes the 5 epagomenal days.)

Parsing notes: the Egyptian month-names (Thoth, Paophi, Athyr, Choeac, Tybi, Mechir, Phamenoth, Pharmuthi, Pachon, Paÿni, Epephi, Messori, Epagomenae) and Persian month-names (Pharuardin, Artipehest, Chordat, Tyrma, Mertat, Sacheriur, Mecherma, Apanma, Aderma, Dima, Pellnan, Asfori, Asphandar) each

carry running day-totals; the "Anno Iulian." right column gives the Julian-calendar start for both bissextile and common years.

The Collected Days of the Arabic Hegira Years [Arabicorum Hegirae Annorum dies collecti]; Collected Days of the Arabic Months [Arabicorum Mensium Dies collecti]; the Month begun in Year 1 of the Hegira [Menses inibat Anno 1. Hegirae]; the Armenian 30-day Months [Armenorum Menses Dierum 30]; their beginning in the Julian [Ineunt in Iuliano]

Ann i	Ann Dies	Ann i	Ann Dies	Ann i	(×10 00)	Ara bico rum Me nsiu m Dies coll ecti	Ara bico rum Me nsiu m Dies coll ecti	Ar me nor um Me nes in ie bat Ann o 1. Heg irae	Ar me nor um Me nes in ie bat Ann o 1. Heg irae	Ar me nor um Me nes in ie bat Ann o 1. Heg irae	Ar me nor um Me nes in ie bat Ann o 1. Heg irae
1	354	16	567 0	30	106 31 — 0	Mu har ram	30	16 Iulij	Nau aza rd	Aug . 11	
2	709	17	602 4	60	212 62 — 0	Sep har	59	15 Aug	Hor i	Sept . 10	
3	106 3	18	637 8	90	318 93 — 0	Rab ie I.	89	13 Sept	Sah mi	Oct ob. 10	
4	141 7	19	673 3	120	425 24 — 0	Rab ie II.	118	13 Oct ob.	Dre Thri	Nou . 9	
5	177 2	20	708 7	150	531 15 — 0	Giu ma di I.	148	11 Nou	Kag ots	Dec. 9	
6	212 6	21	744 2	180	637 86 — 0	Giu ma di II.	177	11 Dec.	Ara cz	Ian u. 8	

Ann i	Dies	Ann i	Dies	Ann i	(×10 00)	Ara bico rum Me nsiu m Dies coll ecti		Me nses inie bat Ann o 1. Heg irae	Ar me nor um Me nses Dier um 30	Ine unt in Iuli ano
7	248 0	22	779 6	210	744 17 — 0	Reg eb	207	9 Ian.	Ma hegi	Feb r. 8
8	283 5	23	815 0	240	850 48 — 0	Sab abe n	236	9 Feb r.	Are ki	Mar t. 8
9	318 9	24	850 5	270	956 79 — 0	Ra ma dha n	266	8 Mar t.	Ahg i - Abe li	Apr il. 8
10	354 4	25	885 9	300	106 310 — 0	She nal	295	8 Apr il.	Mar ini	Mai j 8
11	389 8	26	921 3			Dul kad ate	325	8 Apr il.	Mar cacz	Iuni j 7
12	425 2	27	956 8			Dul haia ti	354	7 Mai j	Her odic z	Iulij 7
13	460 7	28	992 2			in Ann o abu nda nti	355	7 Iuni j	Aiel iacz	Aug ust. 6
14	496 1	29	102 72						inte rcal ar.	

Ann i	Dies	Ann i	Dies	Ann i	(×10 00)	Ara bico rum Me nsiu m Dies coll ecti	Ar me nor um Me Ine nt in Iuli ano
15	531	30	106				
	5		31				

Marginal note (right of the Hegira-year block): "Anno Chr. 622" — i.e., Year 1 of the Hegira corresponds to A.D. 622.

Parsing notes: the Hegira-year/day pairs run in three sub-columns (years 1–15, 16–30, then multiples of 30 up to 300). The "Menses iniebat Anno 1. Hegirae" column gives each Arabic month's cumulative day and its Julian-calendar starting date in Year 1 of the Hegira. The Armenian months (Nauazard, Hori, Sahmi, Dre Thri, Kagots, Aracz, Mahegi, Areki, Ahgi-Abeli, Marini, Marcacz, Herodicz, Aieliacz, with "intercalar." for the epagomenal) and their Julian starts complete the row.

TAB. 22. Synopsis of the Notable Epochs, with the Year before or after the Common Epoch of Christ noted in the left margin [Synopsis Epocharum Insigniorum, ineuntium Anno ante, vel post Epocham vulgarem Christi in sinistro margine, notato]

This is a chronological synopsis (two-column running text on the page, here transcribed as a table keyed to the marginal "Years before Christ" / "Years of Christ" values). Each entry describes the radix/beginning of a notable era.

Anni ante Christum (Years before Christ)	Epoch / Entry
5509	MUNDUS (The World): its beginning on the 1st of September [<i>Cal. Septembris</i>], according to the Greeks, under the Patriarch of Constantinople; but they reckon their fifteen-

Anni ante Christum (Years
before Christ)

Epoch / Entry

4713

year Indictions from another beginning.

IULIANA Periodus (The Julian Period): taken over from the Greeks by Joseph Scaliger [Iosepho Scaligero], which consists of 4980 [*recte*: 7980 — printed "7980" in error as "4980"? See note] years; for it is produced [by multiplying] 28 (Cycles of the Sun) by 19 (Lunar Cycle) — Lunar Cycles are 532, and these times 19 produce the Cycle of Indictions, 7980. In this very year [4713 B.C.] occurred the first year of any one of these Cycles. Hence, in what year of the first Christian Epoch the year of the Julian Period was 4714; and the Cycle of the Sun was 10, the Lunar 2, the Roman Indiction 4.

776

OLYMPIADIS primae Annus primus (First Year of the First Olympiad): in which Coroebus of Elis [Coroebus Elidensis] was first set down in the Catalogue of the Olympiads — Iphitus having restored the interrupted Olympic games. The Athenians, however, began these years from a new-moon nearer the summer solstice, namely from some day of June or July, or otherwise. This was year 3938 of the Julian Period. The Cycle of

Anni ante Christum (Years
before Christ)

Epoch / Entry

753

the Sun 18, of the Moon 5, the
Indiction 8.

**ROMA URBS Condita (The City
of Rome Founded):** the *Palilia*,
or 21st of April, thus [reckoned]
by this Marcus Varro, the
foremost of critics, censors, and
likewise of most learned men,
[and] of the magistrates
themselves in the secular games.
Let the founding [*Esto condita*]
be put at the year 752 before the
Christian Epoch, according to
Cato, Taruntius, the Capitoline
Fasti, and a few others. But
moreover the year 753 [is] of the
aforesaid 6th Olympiad. The
third year, not yet completed,
[is] of Julian Period 3961. The
Cycle of the Sun 13, of the Moon
9, the Indiction 1.

747

NABONASSARI (Nabonassar):
the year begins astronomically
at midday of the 26th of
February, whence the first
month Thoth in the Egyptian
Year, constant at 365 days, set
out; the completed beginning of
which falls in the year 1460 —
this is the *Magnus Annus*
Canicularis (Great Canicular
Year), or the *Periodus Sothiaca*
(Sothic Period); and in the year
1461 it returns to the same day
of the same Julian month. This
was year 3967 of the Julian

Anni ante Christum (Years
before Christ)

Epoch / Entry

	Period, ferial 4 [feria 4]. The Cycle of the Sun 19, of the Moon 15, the Indiction 7. The founding of the City [running] in the 6th year.
529	CAMBYSES I, son of Cyrus [Cambyses I. Cyri filius], began to reign in the Nabonassar year 219, who entered Egypt [in] 219. (1 January.)
433	METON: from the 26th of June began his nineteen-year Cycle, although together with the summer solstice of Euctemon, and he set up that Cycle to be observed in the year 432 before Christ, [on] the 27th of June.
330	CALIPPICAE Periodus (The Calippic Period): constant at 76 years, beginning from the summer solstice — by Greek reckoning, but by Egyptian on the 15th of November — entered in the Nabonassar year 419. The first year of the Calippic Period began in the year 254 before Christ, & the <i>Tertia</i> (Third) in the year 178.
324	ALEXANDRI Magni mors (The Death of Alexander the Great): in the year 4390 of the Julian Period, & 424 of Nabonassar completed, & beginning [year] 425, at midday of the 12th of November. The Egyptians reckon Alexander's

Anni ante Christum (Years
before Christ)

Epoch / Entry

312

[era] together with Ptolemy and Theon, & together with these al-Battānī [Albategnius] indeed reckons from there — the Alexandrian & Egyptian [eras] being Nabonassarian. Let Alexander's death be the preceding May, between April and June.

SELEUCIDARUM Aera (The Era of the Seleucids): it begins, or is called the Greek [era] of Contracts [*Graecorum dicta, seu Contractuum*], or that of Alexander Dhū'l-Qarnayn [Alexandri Dhilkarnayn] — that is, of the kingdom of Alexander divided into the two Great Horns [*in duo Magna Cornua*] of Seleucus, namely ... [text continues]

Anni ante Christum
(top, continuation)

Epoch / Entry (right column)

... begins to reign in Asia Minor; & of Ptolemy in Egypt. This Epoch the History of the Maccabees [*Historia Machabeorum*] employs in Judaic matters (Bk. 1), & it sets out from the 1st of Nisan, or the start of spring. But Bk. 2, in Greek matters, takes it up from autumn, or the Ides of October; & by this usage they are Antiochene; nay rather, the

Anni ante Christum

Epoch / Entry (right column)

	Arabs after Christ [reckon] it, but from the Kalends of October of the Julian Year. But the Chaldeans entered upon it in the following year from the Kalends of October.
311	DIONYSII Mathematici (Dionysius the Mathematician): the years among Ptolemy begin from the 27th of June.
285	[entry at 285 — see note]
45	IULIANORUM Annorum (The Julian Years): that is, ordained by Julius Caesar after the confusion of the years; the first of these is from the Kalends of January, ferial 6 [feria 6], according to the Augustan correction extended back retrospectively.
38	AUGUSTI Aera Hispanica (The Spanish Era of Augustus): begun from the Kalends of January, & in use in the Councils.

Christi Anni (Years of Christ)

Epoch / Entry

(heading)

The first year in the Roman Calendar begins from the Circumcision of the Lord, or from the Kalends of January, & in the Ecclesiastical [reckoning] indeed from midnight of the night preceding, [agreeing] with the ancient Romans, & with the

Christi Anni (Years of Christ)

Epoch / Entry

Prutenic Tables. But in our [present] Tables, & in the Medicean, & in the Maginus [tables], it begins at the last midday of the preceding December; whereas in the Rudolphine, Danish [Danicis], Tyconic, & Philolaic [Tables] [it begins] at the very first midday of January. But civilly some [reckon] from the Nativity, others from the Annunciation, & otherwise — concerning which more in our *Chronologia Reformata*.

(Christ, year 1)

The first **CHRISTIAN Epoch** [*CHRISTIANAE Epochae*] year is of the Julian Period 4714. The Cycle of the Sun 10, the Lunar 2, the Roman Indiction 10. & the same was of the Julian Years 46; & from the Kalends of January to the 21st of April, it ran concurrent with the Varronian year of the City founded, 753; but afterwards indeed with 754. Moreover, before the new-moon nearest the summer solstice it ran concurrent with the 194th Olympiad, year 4; but thereafter with the 195th Olympiad. Finally, however, with the 13th of August, in the midday year [Meridiem die] — & up to the 13th of August it was concurrent with the Nabonassarian year 748; & with Alexander 324; thereafter with the

Christi Anni (Years of Christ)	Epoch / Entry
	Nabonassarian year 749, & Alexander's 325.
28	VICTORIS Capuani (Victor of Capua): the Paschal Cycle begins from the October of this year.
81	DOMITIANI (Domitian): year 1 [begins] on the 13th of September.
96	NERVAE (Nerva): year 1 from the 19th of September, as in our <i>Chronologia Reformata</i> .
98	TRAIANI (Trajan): year 1 [begins] on the 10th of January.
117	ADRIANI (Hadrian): year 1 [begins] on the Ides of July, at the midday of the following 25th.
137	ANTONINI (Antoninus): year 1 on the 10th of July, [at] the following 11th.
222	HIPPOLYTI (Hippolytus): the Paschal Cycle begins on the Kalends of January.
238	CENSORINUS: in this year he writes to Q. Cerellius the golden booklet <i>On the Natal Day</i> [<i>De Die Natali</i>], which he illustrates by notable epochs — & that the Julian [year] 283 was from the Kalends of January, whence he had derived the Consulate of Ulpian, & of Pontianus; from the Olympiad it was the year M.XCIV (1094) [text continues] — the beginning of the summer

Christi Anni (Years of Christ)	Epoch / Entry
	of this year from the Agon Olympicus; the beginning 991, the beginning at the <i>Palilia</i> of this year, that is from the 21st of April; & the Nabonassarian year 986, the beginning of this ... [continues, cut at page foot]

Parsing notes: TAB. 22 is set as a continuous two-column synopsis on table-volume page 16, not a ruled grid; the left margin of each column carries the "Years before Christ" / "Years of Christ" radix-value for the entry. I have keyed each entry to its marginal year. The page is dense and several entries run on or are cut at the page foot; the entry at marginal year 285 (between Dionysius/311 and the Julian/45 block) has no caption visible at this resolution and is flagged below.

TAB. 22 (continued) — Chronological synopsis of epochs (conclusion)

This is the conclusion of the two-column running synopsis of epochs begun in the previous batch. Each entry is keyed by a Year of Christ in the left stub. The Censorinus entry (AD 238) carried over from the prior page; this page resumes within the entry surrounding it and continues through the close of the table.

Left column:

Year of Christ	Entry
(continued)	...on the day preceding the 6th Kalends of July [Iulias], that is, from the midday of 25 June, whence he adds that the Year of Alexander the Great [Alexandri Magni] had begun 562; for the corrected codices have it thus: it was the year 4451 of the Julian Period [Iulianae Periodi].
	Of DIOCLETIAN [DIOCLETIANI]: Year 1, from 29 August, with Solar Cycle [Cyclo

☉] 13, Moon [Lunae] 19, Indiction [Indictione] 2. From here begin the Paschal Cycles of Dionysius of Alexandria [Cycli Paschales Dionysij Alexandrini], and the Era of Martyrs [Aera Martyrum], likewise of the Egyptians [Elkopti, *seu Coptorum*], and also of the Abyssinians [Abassinorum] — though the Alexandrian Church chose, for the head of the Era of Martyrs, the Kalends of April of the year 285, which was then the head of the Paschal month.

312

The INDICATIONS [INDICTIONES] of Constantine [Constantini] begin to be used in the Imperial courts from 25 September; but the Greeks, that is the Greek emperors and the Church of Constantinople, from the Kalends of September. As for the Roman Church and its Pontiffs, from the Kalends of January, year 313; and Ignatius, Patriarch of Antioch, from the Kalends of May, or Artemisius, likewise of the year 313.

552

The Era of the ARMENIANS [ARMENORVM] begins here, from August, with Persian months — of which months 11 are full [Persici], but the intercalation is purely Roman.

622

Of the HEGIRA [HEGIRAE], that is the Muslim flight from

Year of Christ	Entry
	Mecca [Mahometicae fugae ex Mecca]. Here the first repetition of the Lunar [months] [Lunarium] begins, beginning on 16 July, Feria 6, Solar Cycle 23, Moon 15, Roman Indiction 10.

Right column:

Year of Christ	Entry
(continued)	...it being year 5335 of the Julian Period [Periodi Iulianae], the year 1370 of Nabonassar [Nabonassari] still running; but reckoned from its initiated day, 21 March. Following this Era of the Muslims [Aera Mahometani], the Arabs and Turks — though this is the Arab sect — which the Alphonsine [tables] [Alphonsini] follow, set the beginning of the Hegira at 15 July. Choeak [Chœac] 27, Feria 5.
632	Of YEZDEGERD [IESDAGIRDIS], King of the Persians [Persarum Regis], on 16 June; whence the Persian Era [Persica Aera] is reckoned, varying by year [vagos], and repeating in the manner of the Egyptian years.
800	CHARLEMAGNE [CAROLVS Magnus] begins as emperor [Imperator].
1079	The GELALAEAN [GELALAEA] Epoch of the Persians

Year of Christ

Entry

1453

[Persarum], restored by year through the equinox observed on 14 March.

CONSTANTINOPLE CAPTURED [CONSTANTINOPOLIS Capta], Feria 2, at Pentecost, by Muhammad the Ottoman [Mahumede Othomanico] on 29 May; whence the beginning of the Ottoman Empire [Imperij Othomanici].

1582

The GREGORIAN [GREGORIANA] correction of the calendar [Kalendarij correctio], absolute, promulgated, and accepted by the greatest part of the Christian world [Orbis Christiani]; of which the days 5 October were made 15. It was the year 6295 of the Julian Period [Iulianae Periodi].

The remaining Epochs, and the fuller treatment and confirmation of those preceding, see in our *Chronologia Reformata* [Chronology Reformed], if God grant it to come to light — into whose hands are both the Temporal Years [Anni Temporales] and the ETERNAL [Years]; to Him be Glory unto the ages of ages. Amen.

TAB. 23. — *Nabonassaris Anni Incipientes Anno ante, vel post Epocham CHRISTI, dieq; Mensis Iuliani, aut Gregoriani infranotato.*

TABLE 23. The Years of Nabonassar beginning in the year before or after the Epoch of CHRIST, and on the day of the Julian or Gregorian month noted below.

This table is laid out in three vertical panels across the page (each a self-contained block of columns), plus a running text block at the lower right and at the lower left a fourth small block that continues the leftmost panel. I transcribe each panel in turn. Column meanings: "Years of Nabonassar" [Anni Nabonassari]; "Years before / Epoch of Christ" [Anni ante Christum / Epochae Christi] — "B." prefixing a year marks a Bissextile (leap) year; "Beginning of the month Thoth" [Initium Mensis Thoth] giving the Julian-calendar date on which the Egyptian month Thoth (and hence the Nabonassar year) opens; in the rightmost panel the Thoth-opening is given in both Old Style [Veteri] (Julian) and Gregorian [Gregor.] reckonings.

Panel 1 (left)

Anni Nabonassari	Anni ante Christū	Initium Mensis Thoth
1	747	Febr. 26
2	746	26
3	B. 745	25
4	744	25
5	743	25
6	742	25
7	B. 741	poster. 24
8	740	rior 24
9	739	24
10	738	24
11	B. 737	prior 24
12	736	24
99	649	Febr. 2
100	648	Febr. 1
103	645	Febr. 1

Anni Nabonassari	Anni ante Christū	Initium Mensis Thoth
104	644	Ian. 31
223	B. 525	Ian. 2
224	524	Ian. 1
227	B. 521	Ian. 1
228	idē 521	Dec. 31
229	520	31
230	519	31
231	518	31
232	B. 517	30
348	B. 401	Dec. 2
351	398	Dec. 1
	2053	Oct. 1
	2056	
352	397	Nou. 2
468	281	Nou. 1
471	278	Nou. 1
472	B. 277	Oct. 31
592	B. 157	Oct. 1
595	154	Oct. 1
596	B. 153	Sept. 30
712	B. 37	Sept. 1
715	34	Sept. 1
	2330	[—]
	2331	[—]
716	B. 33	Aug. 31
744	B. 5	24
745	4	24
746	3	24
747	2	24
748	B. 1	23

Parsing notes (Panel 1): the "poster." / "rior" / "prior" annotations beside the day-24 entries flag whether the Thoth opening falls on the earlier ("prior") or later ("posterior") of two candidate days within a leap-cycle; "idē" (= idem, "the same") at year 228 marks repetition of the preceding "B. 521" argument. The orphan rows with "ante Christum" values 2053/2056 and 2330/2331 (no Nabonassar number) belong to a parallel Julian-Period reckoning interleaved in the same panel — transcribed in place.

Panel 1 — lower continuation block (lower left)

Nabonass.	Anni Christi	Initium Thoth
749	1	Aug. 23
750	2	23
751	3	22
752	B. 4	22
836	B. 88	Aug. 1
839	91	Aug. 1
840	92	Iulij 31
960	B. 212	Iul. 1
963	215	Iul. 1
984	216	Iunij 30
985	B. 236	Iun. 25
986	‡ 237	25
987	238	25
988	239	Iun. 25
1080	B. 240	Iun. 24
1083	332	Iun. 1
1084	335	Iun. 1
1204	B. 336	Maij 31
1207	456	Maij 1
1208	459	Maij 31
	B. 460	April. 30

Parsing note: the "‡" symbol (a cross) beside year 237 is a marginal mark in the source, transcribed in place; the surrounding Iunij/Maij progression is preserved as printed.

Panel 2 (center)

Anni Nabonass.	Epochae Christi	Initium Mensis Thoth
B. 576	April. 1	
579	April. 1	
B. 580	Mart. 31	
B. 700	Mart. 1	
703	Mart. 1	
B. 704	Febr. 28	
719	Febr. 25	
B. 720	poster. 24	
721	24	
722	24	
723	24	
B. 724	prior. 24	
725	23	
813	Febr. 1	
B. 816	Febr. 1	
817	Ian. 31	
837	Ian. 1	
B. 940	Ian. 1	
idē 940	Dec. 31	
B. 1060	Dec. 1	
1063	Dec. 1	
B. 1064	Nou. 30	
B. 1180	Nou. 1	
1183	Nou. 1	
B. 1184	Oct. 31	
B. 1304	Oct. 1	
1307	Oct. 1	

Parsing note (Panel 2): the stub here carries the Nabonassar argument with "B." (Bissextile) prefixes and a single "idē 940" (= idem) repetition; the "Epochae Christi"

column gives the Christ-epoch year, and the third column the Julian Thoth-opening date. The header label "Anni / Nabonass." stands over this panel's stub, then "Epochae / Christi", then "Initium Mensis / Thoth".

Panel 2 — lower continuation (Veteri / Gregor. dates)

Below the center panel a sub-block adds, for each Christ-epoch year, the Thoth-opening in Old Style [Veteri] and the corresponding Gregorian [Gregor.] date.

Epochae Christi	Stylo Veteri	Gregor.
1583	Iul. 24	Aug. 3
B. 1584	Iul. 23	Aug. 2
B. 1588	Iul. 22	Aug. 1
B. 1592	Iul. 21	Iul. 31
1595	Iul. 20	Iul. 30
1600	Iul. 19	Iul. 29
B. 1672	Iul. 1	Iul. 11
1675	Iul. 1	Iul. 11
B. 1676	Iun. 30	Iun. 10
1699	Iun. 25	Iun. 5
B. 1700	Iun. 24	Iul. 5
B. 1716	Iun. 20	Iul. 1
1719	Iun. 20	Iul. 1
B. 1720	Iun. 19	Iun. 30
1795	Iun. 1	Iun. 12
B. 1796	Maij 31	Iun. 11
1799	Maij 31	Iun. 11
B. 1800	Maij 30	Iun. 11
1840	Maij 20	Iun. 1
B. 1844	Maij 19	Maij 31
B. 1900	Maij 5	Maij 18
1916	Maij 1	Maij 14
B. 1920	April. 30	Maij 14
B. 1968	April. 18	April. 30
B. 1972	April. 17	April. 30

Epochae Christi	Stylo Veteri	Gregor.
B. 2000	April. 10	April. 23
B. 2036	April. 1	April. 14

*Parsing notes (Panel 2 lower): "Stylo / Veteri" = "in the Old Style"; "Gregor." = Gregorian. Several Gregorian entries that lag their Old-Style date (e.g. 1700 → Iul. 5; 1968 → April. 31; 1972 → April. 30) reflect the diverging Old-Style/New-Style gap and the leap-century suppression — transcribed verbatim. **Note the printed "April. 31" at year 1968: April has only 30 days, so a date "April. 31" is impossible — flagged below.**

Panel 3 (right)

Anni Nabonassari	Epochae Christi	Initium Thoth stylo Veteri	Initium Thoth stylo Gregor.
2789	B. 2040	Mart. 31	April. 13
2737	B. 2088	Mart. 19	April. 1
2841	B. 2192	Mart. 1	Mart. 31
2849	B. 2200	Mart. 16	Mart. 30
2909	B. 2160	Mart. 1	Mart. 15
2913	B. 2164	Febr. 28	Mart. 14
2917	B. 2168	Febr. 27	Mart. 13
2921	B. 2172	Febr. 26	Mart. 12
2925	B. 2176	Febr. 25	Mart. 11
2929	B. 2180	poster. 24	Mart. 11
2930	2181	Febr. 24	Mart. 10
2931	2182	Febr. 24	Mart. 10
2932	2183	Febr. 24	Mart. 10
2933	B. 2184	prior 24	Mart. 9
2934	2185	Febr. 23	Mart. 9
2935	2186	Febr. 23	Mart. 9
2936	2187	Febr. 22	Mart. 9
2937	B. 2188	Febr. 22	Mart. 8
2938	2189	Febr. 21	Mart. 8
2942	2193	Febr. 21	Mart. 7

Anni Nabonassari	Epochae Christi	Initium Thoth stylo Veteri	Initium Thoth stylo Gregor.
2945	B. 2196	Febr. 20	Mart. 7
2946	2197	Febr. 20	Mart. 6
2947	2198	Febr. 20	Mart. 6
2948	2199	Febr. 20	Mart. 6
2949	B. 2200	Febr. 19	Mart. 6
2950	2201	Febr. 19	Mart. 6
3144	B. 2395	Ianu. 2	Ianu. 18
3145	B. 2396	Ianu. 2	Ianu. 18
3146	2397	Ianu. 1	Ianu. 17
3147	2398	Ianu. 1	Ianu. 17
3148	2399	Ianu. 1	Ianu. 17
3149	B. 2400	Ianu. 1	Ianu. 17
3150	2400	Dec. 31	Ianu. 16

*Parsing notes (Panel 3): the right panel reaches into far-future projected years (Christ-epoch 2040–2400, Nabonassar 2737–3150). The "poster." / "prior" annotations at years 2180/2184 again flag the later/earlier candidate day. **The Nabonassar value "2737" against Christ-epoch 2088 breaks the otherwise-ascending Nabonassar progression (2789 → 2737 → 2841): the sequence dips then resumes — flagged as a possible compositor transposition.** Several leftmost Nabonassar values in this panel may be misreads given the tight engraving; see uncertain readings.*

Lower-right running text block

Since 1460 Julian years make up 1461 Egyptian years — and by this Period the Years of the Great Canicular [Cycle] [Anni Magni Canicularis], that is the Sothic [seu Sothiaci], are completed — the beginning of Thoth returns to the same day of the Julian year. For this reason, reckoned from the year before Christ 757, when the beginning of Thoth fell on the same day of the Julian month in February [Februarij], 24, there was no change up to the very Bissextile year, but from the year 1 after the Bissextile, and so up to the year before Christ 521, when the Nabonassar year becomes double [duplex Nabonassari Annus incipit]: for from there arises the change in that very Year, up to the Year of Christ 724, when again the beginning of Thoth reverts to February [Februarij] 24, the earlier [priorem].

Thereafter again the change is always made on the first day after the Bissextile, and so up to the Year of Christ 940, when once more the double Nabonassar year begins. [C] Hence further, from the change in that very Year, and so onward up to the Year of Christ 1184, when the beginning of Thoth a third time reverts to February [Februarij] 24, the earlier [priors]. Then, however, the change is made in the year first after the Bissextile, and so up to the Year of Christ 2400, when a third time the double Nabonassar year begins, [C] and there will be need to make a change of day in that very Bissextile year — but will the World endure so long?

God knows. [Deus novit.]

Banner (lower right, below the running block)

THE SECOND PART OF THE SELECTED TABLES, FROM THE PRIMUM MOBILE.
 [SECVNDA PARS TABVLARVM EX PRIMO MOBILI SELECTARVM.]

TAB. 24. — *Conversio Graduum Signorum in Gradus Zodiaci.*

TABLE 24. Conversion of the Degrees of the Signs into Degrees of the Zodiac.

A 30-row × 12-column grid: the stub (1–30) gives the degree within a sign; each of the twelve columns is headed by a zodiac sign-glyph and a Roman numeral (I–XII) for the sign's order, and gives the cumulative degree of the ecliptic (zodiacal longitude) for that degree of that sign. The column sub-heading "G." / "Gr." = degrees [Gradus].

Column heads (sign order I–XII): I ☉ Aries · II ♉ Taurus · III ♊ Gemini · IV ♋ Cancer · V ♌ Leo · VI ♍ Virgo · VII ♎ Libra · VIII ♏ Scorpio · IX ♐ Sagittarius · X ♑ Capricorn · XI ♒ Aquarius · XII ♓ Pisces.

°	VII											
	I	II	III	IV	V	VI	VII	I	IX	X	XI	XII
1	1	31	61	91	12	15	18	21	24	27	30	33
					1	1	1	1	1	1	1	1
2	2	32	62	92	12	15	18	21	24	27	30	33
					2	2	2	2	2	2	2	2
3	3	33	63	93	12	15	18	21	24	27	30	33
					3	3	3	3	3	3	3	3
4	4	34	64	94	12	15	18	21	24	27	30	33
					4	4	4	4	4	4	4	4
5	5	35	65	95	12	15	18	21	24	27	30	33

°	VII											
	I	II	III	IV	V	VI	VII	I	IX	X	XI	XII
22	22	52	82	11	14	17	20	23	26	29	32	35
				2	2	2	2	2	2	2	2	2
23	23	53	83	11	14	17	20	23	26	29	32	35
				3	3	3	3	3	3	3	3	3
24	24	54	84	11	14	17	20	23	26	29	32	35
				4	4	4	4	4	4	4	4	4
25	25	55	85	11	14	17	20	23	26	29	32	35
				5	5	5	5	5	5	5	5	5
26	26	56	86	11	14	17	20	23	26	29	32	35
				6	6	6	6	6	6	6	6	6
27	27	57	87	11	14	17	20	23	26	29	32	35
				7	7	7	7	7	7	7	7	7
28	28	58	88	11	14	17	20	23	26	29	32	35
				8	8	8	8	8	8	8	8	8
29	29	59	89	11	14	17	20	23	26	29	32	35
				9	9	9	9	9	9	9	9	9
30	30	60	90	12	15	18	21	24	27	30	33	36
				0	0	0	0	0	0	0	0	0

TAB. 25. — *Gradus Zodiaci, & Signorum diametraliter oppositi.*

TABLE 25. The Degrees of the Zodiac, and of the Signs, diametrically opposite.

A grid pairing each degree (stub 1–30, "Gr. cō." = degrees in common) with the diametrically opposite zodiacal longitude. The column heads run in opposite-sign pairs: ♈/♏, ♉/♍, ♊/♎, ♋/♑, ♌/♒, ♍/♓ — each column giving the longitude 180° away. "Gr." = degrees.

Column heads: ♈ Aries | ♏ Libra | ♉ Taurus | ♍ Scorpio | ♊ Gemini | ♎ Sagittarius | ♋ Cancer | ♑ Capricorn | ♌ Leo | ♒ Aquarius | ♍ Virgo | ♓ Pisces.

Gr.

cō.	♈	♏	♉	♍	♊	♎	♋	♑	♌	♒	♍	♓
1	1	18	31	21	61	24	91	27	12	30	15	33
		1		1		1		1	1	1	1	1

Gr.	cõ.	□	□	□	□	□	□	□	□	□	□	□
2	2	18	32	21	62	24	92	27	12	30	15	33
		2		2		2		2	2	2	2	2
3	3	18	33	21	63	24	93	27	12	30	15	33
		3		3		3		3	3	3	3	3
4	4	18	34	21	64	24	94	27	12	30	15	33
		4		4		4		4	4	4	4	4
5	5	18	35	21	65	24	95	27	12	30	15	33
		5		5		5		5	5	5	5	5
6	6	18	36	21	66	24	96	27	12	30	15	33
		6		6		6		6	6	6	6	6
7	7	18	37	21	67	24	97	27	12	30	15	33
		7		7		7		7	7	7	7	7
8	8	18	38	21	68	24	98	27	12	30	15	33
		8		8		8		8	8	8	8	8
9	9	18	39	21	69	24	99	27	12	30	15	33
		9		9		9		9	9	9	9	9
10	10	19	40	22	70	25	10	28	13	31	16	34
		0		0		0	0	0	0	0	0	0
11	11	19	41	22	71	25	10	28	13	31	16	34
		1		1		1	1	1	1	1	1	1
12	12	19	42	22	72	25	10	28	13	31	16	34
		2		2		2	2	2	2	2	2	2
13	13	19	43	22	73	25	10	28	13	31	16	34
		3		3		3	3	3	3	3	3	3
14	14	19	44	22	74	25	10	28	13	31	16	34
		4		4		4	4	4	4	4	4	4
15	15	19	45	22	75	25	10	28	13	31	16	34
		5		5		5	5	5	5	5	5	5
16	16	19	46	22	76	25	10	28	13	31	16	34
		6		6		6	6	6	6	6	6	6
17	17	19	47	22	77	25	10	28	13	31	16	34
		7		7		7	7	7	7	7	7	7
18	18	19	48	22	78	25	10	28	13	31	16	34

Gr.												
cō.	□	□	□	□	□	□	□	□	□	□	□	□
		8		8		8	8	8	8	8	8	8
19	19	19	49	22	79	25	10	28	13	31	16	34
		9		9		9	9	9	9	9	9	9
20	20	20	50	23	80	26	11	29	14	32	17	35
		0		0		0	0	0	0	0	0	0
21	21	20	51	23	81	26	11	29	14	32	17	35
		1		1		1	1	1	1	1	1	1
22	22	20	52	23	82	26	11	29	14	32	17	35
		2		2		2	2	2	2	2	2	2
23	23	20	53	23	83	26	11	29	14	32	17	35
		3		3		3	3	3	3	3	3	3
24	24	20	54	23	84	26	11	29	14	32	17	35
		4		4		4	4	4	4	4	4	4
25	25	20	55	23	85	26	11	29	14	32	17	35
		5		5		5	5	5	5	5	5	5
26	26	20	56	23	86	26	11	29	14	32	17	35
		6		6		6	6	6	6	6	6	6
27	27	20	57	23	87	26	11	29	14	32	17	35
		7		7		7	7	7	7	7	7	7
28	28	20	58	23	88	26	11	29	14	32	17	35
		8		8		8	8	8	8	8	8	8
29	29	20	59	23	89	26	11	29	14	32	17	35
		9		9		9	9	9	9	9	9	9
30	30	21	60	24	90	27	12	30	15	33	18	36
		0		0		0	0	0	0	0	0	0

TAB. 26. — *Decl. ☉, & Ec+lipt. ad Obliq. Gr. 23. 30'. 20".*

TABLE 26. The Declination of the Sun [Declinatio Solis], and of the Ecliptic, at an Obliquity of 23°30'20".

The Sun's declination [declinatio] as a function of ecliptic longitude, computed at obliquity 23°30'20". The stub at left and right (0–30) is the degree within a quadrant-sign; three paired columns each cover a sign-pair, giving degrees, minutes, and seconds [Gr. ' "]. The headers run: □ Bor. / □ Austr. (Aries northern / Libra

southern); ν Bor. / \mathcal{M} Austr. (Taurus N / Scorpio S); \mathbb{I} Bor. / ν Austr. (Gemini N / Sagittarius S). The foot-labels (reading the column upward, for the complementary signs) are: \square Bor. / \square Austr.; \square Bor. / \square Austr.; \square Bor. / \square Austr. "Bor." = northern [Borealis]; "Austr." = southern [Australis].

(stub)	\square Bor. / \square Austr. (Gr. ' ")	\square Bor. / \square Austr. (Gr. ' ")	\square Bor. / \square Austr. (Gr. ' ")	(stub)
0	0 0 0	11 30 11	20 12 23	30
1	0 23 55	11 51 14	20 24 57	29
2	0 47 51	12 12 5	20 37 3	28
3	1 11 46	12 32 46	20 48 57	27
4	1 35 39	12 44 13	21 0 24	26
5	1 59 31	13 13 28	21 11 26	25
6	2 23 22	13 33 30	21 22 6	24
7	2 47 10	13 55 16	21 32 20	23
8	3 10 54	14 12 51	21 42 10	22
9	3 34 38	14 32 12	21 51 38	21
10	3 58 17	14 51 16	22 0 40	20
11	4 21 51	15 10 7	22 9 18	19
12	4 45 24	15 28 44	22 17 29	18
13	5 8 50	15 47 1	22 25 16	17
14	5 39 59	16 5 6	22 32 38	16
15	5 55 30	16 22 51	22 39 32	15
16	6 18 41	16 40 21	22 46 2	14
17	6 41 46	16 57 33	22 52 8	13
18	7 4 47	17 14 29	22 57 44	12
19	7 27 40	17 31 6	23 2 54	11
20	7 50 24	17 47 23	23 7 40	10
21	8 13 4	18 3 23	23 11 58	9
22	8 35 33	18 19 5	23 15 48	8
23	8 58 4	18 34 25	23 19 10	7
24	9 20 9	18 49 26	23 22 9	6
25	9 42 14	19 4 10	23 24 39	5

(stub)	□ Bor. / □ Austr. (Gr. ')	□ Bor. / □ Austr. (Gr. ')	□ Bor. / □ Austr. (Gr. ')	(stub)
26	10 4 10	19 18 30	23 26 40	4
27	10 25 56	19 32 30	23 27 39	3
28	10 47 31	19 46 10	23 29 4	2
29	11 8 57	19 59 26	23 30 6	1
30	11 30 20	20 12 23	23 30 20	0
(foot)	□ Bor. / □ Austr.	□ Bor. / □ Austr.	□ Bor. / □ Austr.	(foot)

Parsing notes (TAB. 26): three sign-pair declination blocks, each "Gr. ' "" (degrees / minutes / seconds). The stub is bidirectional — the left stub (0→30) reads the top sign-pair downward; the right stub (30→0) reads the foot sign-pair upward, the standard mirror layout for a declination table. The terminal value 23 30 20 at row 30 of the third block equals the stated obliquity, confirming alignment. A few mid-table seconds (e.g. row 14 first block "5 39 59" where the smooth progression would suggest ~5 32) sit slightly off the monotone trend and are flagged as possible misreads/compositor slips below.

TAB. 27. — *Angulus Orientalis Eclipt. & Meridiani ad Obliquitatem Eclipt. Gr. 23. 30' ½.*

TABLE 27. The Eastern Angle of the Ecliptic and of the Meridian, at an Obliquity of the Ecliptic of 23°30'½.

The angle the ecliptic makes with the eastern horizon (and with the meridian) as a function of longitude, at obliquity 23°30'30". Stub 0–30 at left and right; three sign-pair columns, each "Gr. '" (degrees, minutes). Headers: □ Boreal / □ Austr.; □ Bor. / □ Austr.; □ Bor. / □ Austr. Foot-labels (read upward): □ Austr. / □ Bor.; □ Austr. / □ Bor.; □ Austr. / □ Bor.

(stub)	□ Boreal / □ Austr. (Gr. ')	□ Bor. / □ Austr. (Gr. ')	□ Bor. / □ Austr. (Gr. ')	(stub)
0	66 30	69 22	77 43	30
1	66 30	69 38	78 5	29
2	66 31	69 45	78 27	28
3	66 32	69 52	78 49	27

(stub)	□ Boreal / □ Austr. (Gr. ')	□ Bor. / □ Austr. (Gr. ')	□ Bor. / □ Austr. (Gr. ')	(stub)
4	66 35	70 0	79 12	26
5	66 39	70 23	79 35	25
6	66 37	70 37	79 58	24
7	66 40	70 51	80 21	23
8	66 42	71 5	80 45	22
9	66 46	71 20	81 8	21
10	66 49	71 35	81 32	20
11	66 53	71 50	81 57	19
12	66 57	72 6	82 21	18
13	67 2	72 22	82 45	17
14	67 6	72 38	83 10	16
15	67 13	72 55	83 35	15
16	67 19	73 11	84 0	14
17	67 26	73 29	84 24	13
18	67 33	73 47	84 50	12
19	67 40	74 5	85 16	11
20	67 47	74 23	85 41	10
21	67 55	74 42	86 7	9
22	68 3	75 0	86 32	8
23	68 11	75 20	86 58	7
24	68 20	75 40	87 24	6
25	68 30	76 0	87 35	5
26	68 40	76 20	88 17	4
27	68 50	76 41	88 42	3
28	68 59	77 1	89 8	2
29	69 11	77 22	89 34	1
30	69 22	77 43	90 0	0
(foot)	□ Austr. / □ Bor.	□ Austr. / □ Bor.	□ Austr. / □ Bor.	(foot)

Parsing notes (TAB. 27): three sign-pair blocks, each "Gr. '" (degrees, minutes). Terminal value 90 0 at row 30 of the third block (ecliptic perpendicular to the horizon at the solstitial point) confirms alignment. Several minutes-column entries are clearly compositor slips or my misreads of tight engraving and are flagged below: row 7 second block "70 81" (81 > 59, impossible as a minutes value), row 1 second block "69 8" sits below row 0 "69 22" breaking the rising progression, row 3 second block "69 8" repeats and breaks monotone, row 25 third block "87 5" dips below row 24 "87 24" and row 26 "88 17", and row 2 second block "69 45" likewise sits above its neighbors. These are transcribed as printed/read and flagged.

TABULA 28. Right Ascension of the Sun at the Obliquity 23° 30' 20"

[TAB. 28. Ascensio Recta ☉ ad Obliquitatem Grad. 23. 30'. 20".]

This table gives the right ascension [*ascensio recta*] of the Sun for each degree of the first six zodiacal signs. The argument (stub) column is the degree (Gr.) within each sign (1–30); each sign-block gives degrees (Gr. = °), minutes ('), and seconds (") of right ascension. The six sign-headings across the top are: ♈ (Aries), ♉ (Taurus), ♊ (Gemini), ♋ (Cancer), ♌ (Leo), ♍ (Virgo).

Upper half — signs ♈ ♉ ♊ ♋ ♌ ♍

Header row: Sign. then the six zodiacal glyphs; sub-header Gr. (argument) and, for each sign, Gr. | ' | " (= °, minutes, seconds of right ascension).

G r.	♈ °	♈ '	♈ "	♉ °	♉ '	♉ "	♊ °	♊ '	♊ "	♋ °	♋ '	♋ "	♌ °	♌ '	♌ "	♍ °	♍ '	♍ "
1	0	5	1	2	5	2	5	5	5	9	5	2	1	1	0	1	3	1
		5		8	1	1	8	0	6	1		6	2	4		5		6
												3			3			
2	1	5	3	2	4	5	5	5	3	9	1	3	1	1	5	1	0	2
		0		9	9	1	9	3	8	2	0	0	2	6		5		2
													4		4			
3	2	4	5	3	4	2	6	5	3	9	1	1	1	1	1	1	5	1
		5		0	6	2	0	6	2	3	7	6	2	8	6	5	8	9
													5		4			
4	3	4	9	3	4	2	6	5	3	9	2	3	1	2	9	1	5	4
		0		1	4	0	1	9	9	4	1	8	2	0		5	3	0
													6		5			

G	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
5	4	3	1	3	4	2	6	2	4	9	2	5	1	2	4	1	5	4
		5	3	2	2	0	2		9	5	6	3	2	1	9	5	0	9
													7		6			
6	5	3	1	3	4	3	6	6	1	9	3	1	1	2	2	1	4	2
		0	9	3	0	0	4		2	6	2	1	2	3	1	5	7	3
													8		7			
7	6	2	2	3	3	4	6	9	4	9	3	3	1	2	3	1	4	3
		5	7	4	8	8	5		3	7	7	3	2	4	9	5	3	2
													9		8			
8	7	2	3	3	3	1	6	1	2	9	4	4	1	2	4	1	4	1
		0	7	5	7	1	6	3	4	8	2	5	3	5	9	5	0	2
													0		9			
9	8	1	5	3	3	6	6	1	1	9	4	5	1	2	4	1	3	2
		5	0	6	6		7	7	3	9	7	5	3	6	1	6	6	5
													1		0			
1	9	1	1	3	3	4	6	2	9	1	5	5	1	2	3	1	3	3
0		1	6	7	4	6	8	1		0	2	8	3	7	1	6	2	1
										0			2		1			
1	1	6	2	3	3	4	6	2	1	1	5	5	1	2	5	1	2	3
1	0		6	8	3	0	9	5	6	0	7	9	3	7	7	6	8	5
										1			3		2			
1	1	1	4	3	3	5	7	2	2	1	2	5	1	2	3	1	2	2
2	1		8	9	2	0	0	9	6	0		9	3	8	2	6	4	9
										3			4		3			
1	1	5	1	4	3	5	7	3	4	1	7	5	1	2	4	1	2	1
3	1	7	4	0	1	0	1	3	3	0		1	3	8	5	6	0	8
										4			5		4			
1	1	5	4	4	3	3	7	3	1	1	1	3	1	2	1	1	1	1
4	2	2	5	1	1	7	2	8	9	0	2	6	3	9	6	6	6	
										5			6		5			
1	1	4	2	4	3	2	7	4	4	1	1	3	1	2	3	1	1	5
5	3	8		2	1	3	3	2	4	0	7	6	3	8	7	6	1	8
										6			7		6			
1	1	4	5	4	3	4	7	4	2	1	2	4	1	2	2	1	7	1

G r.	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
6	4	3	9	3	0	4	4	7	4	0	1	1	3	8	3	6		5
										7			8		7			
1	1	3	4	4	3	1	7	5	9	1	2	1	1	2	1	1	1	4
7	5	9	2	4	1	5	5	2		0	6	7	3	8	0	6		6
										8			9		8			
1	1	3	3	4	3	2	7	5	1	1	3	3	1	2	1	1	5	1
8	6	5	1	5	1	8	6	7		0	0	4	4	7	0	6	8	2
										9			0		8			
1	1	3	2	4	3	3	7	1	1	1	3	4	1	2	2	1	5	3
9	7	1	5	6	2		8			1	4	4	4	6	0	6	3	4
										0			1		9			
2	1	2	2	4	3	2	7	7	2	1	3	5	1	2	1	1	4	5
0	8	7	9	7	2	9	9			1	8	1	4	5	4	7	8	4
										1			2		0			
2	1	2	3	4	3	1	8	1	5	1	4	4	1	2	5	1	4	1
1	9	3	5	8	3	9	0	2		1	2	7	4	3	4	7	4	0
										2			3		1			
2	2	1	4	4	3	1	8	1	5	1	4	3	1	2	4	1	3	2
2	0	9	8	9	4	1	1	7		1	6	6	4	2	5	7	9	3
										3			4		2			
2	2	1	8	5	3	2	8	2	7	1	5	1	1	2	1	1	3	3
3	1	6		0	5	1	2	2		1	0	7	4	1	2	7	4	3
										4			5		3			
2	2	1	3	5	3	3	8	2	4	1	5	4	1	1	3	1	2	4
4	2	2	7	1	6	9	3	7	9	1	3	8	4	9	0	7	9	1
										5			6		4			
2	2	9	1	5	3	1	8	3	7	1	5	1	1	1	4	1	2	4
5	3		1	2	8	1	4	3		1	7	1	4	7	0	7	4	7
										6			7		5			
2	2	7	2	5	3	5	8	3	2	1	0	2	1	1	4	1	1	5
6	4		0	3	8	1	5	8	2	1		1	4	5	0	7	9	1
										8			8		6			
2	2	1	4	5	4	4	8	4	4	1	3	2	1	1	2	1	1	5
7	5		1	4	1	4	6	3	4	1		8	4	3	8	7	4	5

G	♌	♍	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑
r.	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
										9			9			7		
2	2	5	3	5	4	4	8	4	1	1	6	2	1	1	9	1	9	5
8	5	9	8	5	3	5	7	9	0	2		2	5	0		7		9
										0			0			8		
2	2	5	4	5	4	0	8	5	3	1	9	4	1	8	3	1	4	5
9	6	6	4	6	6		8	4	4	2			5		9	7		9
										1			1			9		
3	2	5	5	5	4	2	9	0	0	1	1	3	1	6	3	1	0	0
0	7	3	7	7	8	1	0			2	1	9	5			8		
										2			2			0		

Parsing notes: The ♏ column foot value 180°0'0" at Gr. 30 closes the first semicircle of right ascension, as expected.

Residuum Tabulae 28 — signs ♎ ♏ ♐ ♑ ♒ ♓ [*Residuum Tabulae 28.*]

This is the lower half of Table 28, giving the right ascension for the second six signs: ♎ (Libra), ♏ (Scorpio), ♐ (Sagittarius), ♑ (Capricorn), ♒ (Aquarius), ♓ (Pisces).

G	♎	♏	♐	♑	♒	♓	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	
r.	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
1	1	5	1	2	5	2	2	5	5	2	5	2	3	1	0	3	3	1
	8	5		0	1	1	3	0	6	7		6	0	3		3		6
	0			8			8			1			3			3		
2	1	5	3	2	4	5	2	5	3	2	1	3	3	1	1	3	0	2
	8	0		0	9	1	3	3	8	7	0	0	0	6	5	3		2
	1			9			9			2			4			4		
3	1	4	5	2	4	3	2	5	3	2	1	1	3	1	1	3	5	1
	8	5		1	6	2	4	6	2	7	7	6	0	8	6	3	8	9
	2			0			0			3			5			4		
4	1	4	9	2	4	2	2	5	3	2	2	3	3	2	9	3	5	4
	8	0		1	4	0	4	9	9	7	1	8	0	0		3	3	0
	3			1			1			4			6			5		
5	1	3	1	2	4	2	2	2	4	2	2	5	3	2	4	3	5	4
	8	5	3	1	2	0	4		9	7	2	3	0	1	9	3	0	9
	4			2			3			5			7			6		

G r.	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
6	1	3	1	2	4	3	2	6	1	2	3	1	3	2	2	3	4	2
	8	0	9	1	0	0	4		2	7	2	1	0	3	1	3	7	3
	5			3			4			6			8			7		
7	1	2	2	2	2	4	2	9	4	2	3	3	3	2	3	3	4	3
	8	5	7	1	8	8	4		3	7	7	3	0	4	9	3	3	2
	6			4			5			7			9			8		
8	1	2	3	2	3	1	2	1	2	2	4	4	3	2	4	3	4	1
	8	0	7	1	7	5	4	3	4	7	2	5	1	5	9	3	0	2
	7			5			6			8			0			9		
9	1	1	5	2	3	1	2	1	1	2	4	5	3	2	4	3	3	2
	8	5	0	1	6	6	4	7	3	7	7	5	1	6	1	4	6	5
	8			6			7			9			1			0		
1	1	1	1	2	3	4	2	2	9	2	5	5	3	2	3	3	3	3
0	8	1	6	1	4	6	4	1		8	2	8	1	7	1	4	2	1
	9			7			8			0			2			1		
1	1	6	2	2	3	4	2	2	1	2	5	5	3	2	5	3	2	3
1	9		6	1	3	0	4	5	6	8	7	9	1	7	7	4	8	5
	0			8			9			1			3			2		
1	1	1	4	2	3	5	2	2	2	2	2	5	3	2	3	3	2	2
2	9		8	1	2	0	5	9	6	8		9	1	8	2	4	4	9
	1			9			0			3			4			3		
1	1	5	1	2	3	5	2	3	4	2	7	5	3	2	4	3	2	1
3	9	7	4	2	1	0	5	3	3	8		1	1	8	5	4	0	8
	1			0			1			4			5			4		
1	1	5	4	2	3	3	2	3	1	2	1	3	3	2	1	3	1	1
4	9	2	5	2	1	7	5	8	9	8	2	6	1	9	6	4	6	
	2			1			2			5			6			5		
1	1	4	2	2	3	2	2	4	4	2	1	3	3	2	3	3	1	5
5	9	8		2	1	3	5	2	4	8	7	6	1	8	7	4	1	8
	3			2			3			6			7			6		
1	1	4	5	2	3	4	2	4	2	2	2	4	3	2	2	3	7	1
6	9	3	9	2	0	4	5	7	4	8	1	1	1	8	3	4		5
	4			3			4			7			8			7		
1	1	3	4	2	3	1	2	5	9	2	2	1	3	2	1	3	2	4

G r.	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
7	9	9	2	2	1	5	5	2		8	6	7	1	8	0	4		6
	5			4			5			8			9		8			
1	1	3	3	2	3	2	2	5	1	2	3	3	3	2	1	3	5	1
8	9	5	1	2	1	8	5	7		8	0	4	2	7	0	4	8	2
	6			5			6			9			0		8			
1	1	3	2	2	3	3	2	2	1	2	3	4	3	2	2	3	5	3
9	9	1	5	2	2		5			9	4	4	2	6	0	4	3	4
	7			6			8			0			1		9			
2	1	2	2	2	3	2	2	7	2	2	3	5	3	2	1	3	4	5
0	9	7	9	2	2	9	5			9	8	1	2	5	4	5	8	4
	8			7			9			1			2		0			
2	1	2	3	2	3	1	2	1	5	2	4	4	3	2	5	3	4	1
1	9	3	5	2	3	9	6	2		9	2	7	2	3	4	5	4	0
	9			8			0			2			3		1			
2	2	1	4	2	3	1	2	1	1	2	4	3	3	2	4	3	3	2
2	0	9	8	2	4	1	6	7	5	9	6	6	2	2	5	5	9	3
	0			9			1			3			4		2			
2	2	1	8	2	3	2	2	2	2	2	5	1	3	2	1	3	3	3
3	0	6		3	5	1	6	2	7	9	0	7	2	1	2	5	4	3
	1			0			2			4			5		3			
2	2	1	3	2	3	3	2	2	4	2	5	4	3	1	3	3	2	4
4	0	2	7	3	6	9	6	7	9	9	3	8	2	9	0	5	9	1
	2			1			3			5			6		4			
2	2	9	1	2	3	1	2	3	7	2	5	1	3	1	4	3	2	4
5	0		1	3	8	1	6	3		9	7	1	2	7	0	5	4	7
	3			2			4			6			7		5			
2	2	7	2	2	3	5	2	3	2	2	0	2	3	1	4	3	1	5
6	0		0	3	8	1	6	8	2	9		1	2	5	0	5	9	1
	4			3			5			8			8		6			
2	2	1	4	2	4	4	2	4	4	2	3	2	3	1	2	3	1	5
7	0		1	3	1	4	6	3	4	9		8	2	3	8	5	4	5
	5			4			6			9			9		7			
2	2	5	3	2	4	4	2	4	1	3	6	2	3	1	9	3	9	5
8	0	9	8	3	3	5	6	9	0	0		2	3	0	5			7

G	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
r.	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"	°	'	"
	5			5			7			0			0			8		
2	2	5	4	2	4	0	2	5	3	3	9	4	3	8	3	3	4	5
9	0	6	4	3	6		6	4	4	0			3		9	5		9
	6			6			8			1			1			9		
3	2	5	5	2	4	2	2	0	0	3	1	3	3	6	3	3	0	0
0	0	3	7	3	8	1	7			0	1	9	3			6		
	7			7			0			2			2			0		

Parsing notes: □ column foot value 360°0'0" at Gr. 30 closes the full circle of right ascension, as expected. At Gr. 7 of □, the printed minutes "28" breaks the otherwise smooth descent (neighbors read 51, 15); transcribed as printed and flagged below. The □"-column value at Gr. 1 reads "56" matching the □/□ pattern.

TABULA 29. Of the Ascensional Differences, at the Obliquity of the Ecliptic 23° 30'

[TAB. 29. Differentiarum Ascensionalium: ad Obliq. Eclipt. Grad. 23. 30'.]

Sub-heading (banner under the title): **"The Altitude of the Pole, if the declination of the star be taken in the side [margin]; or the Declination of the star, if the Altitude of the Pole be taken in the side."** [*Altitudo Poli, si in latere sumatur Declinatio Sideris; vel Declinatio Sideris, si in latere sumatur Alt. Poli.*]

[Margin, left side, running vertically: **"The Declination of the star, or the Altitude of the Pole, &c."** — *Declinatio Sideris, aut Altitudo Poli, &c.*]

This is a double-entry table of the ascensional difference [*differentia ascensionalis*]. The top header gives integer columns **1** through **10** (degrees of pole-altitude or declination); each column is sub-divided G. | ' | " (degrees, minutes, seconds of ascensional difference). The leftmost stub column (here labeled implicitly by a marginal index 1–60, the small inner digits) is the argument running 1–60 downward; the rightmost narrow column gives the complementary argument running 89 down to 30 (the co-argument for the bottom/right reading). The foot row repeats the column indices **89, 88, 87 ... 80** (the complementary top-arguments), with H. and Resid. markers at the foot.

Note: This page is extremely dense (10 data columns × 3 sub-columns × 60 rows, plus two marginal index columns). Inner seconds-digits are at the resolution limit in several rows; values flagged [?] are at the legibility floor and are noted as

											c																				
											o																				
											1	-																			
a	1	2	3	4	5	6	7	8	9	0	1	1	a																		
r	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	0	0	r										
g	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	g								
1	0	1	3	0	2	6	0	3	9	0	4	1	0	5	1	0	6	1	0	7	2	0	8	2	0	9	3	0	1	3	8
											2		5		9		2		6		0		0		5		9				
2	0	2	6	0	4	1	0	6	1	0	8	2	0	1	3	0	1	3	0	1	4	0	1	5	0	1	1	0	2	1	8
				1		7		4		0	0		2	7		4	5		6	2		9		1		0	8				
3	0	3	2	0	6	1	0	9	2	0	1	3	0	1	4	0	1	5	0	2	7	0	2	1	0	2	3	0	3	4	8
				7		7		2	6		5	6		8	6		2		5	9		8	2		1	6	7				
4	0	4	1	0	8	2	0	1	3	0	1	4	0	2	2	0	2	1	0	2	3	0	3	4	0	3	4	0	4	2	8
		2		4		2	6		6	9		1		5	6		9	1		3	7		8		2	3	6				
5	0	5	1	0	1	3	0	1	4	0	2	2	0	2	1	0	3	3	0	3	5	0	4	1	0	4	3	0	5	2	8
		5		0	0	5	6		1		6	9		1	7		6	6		2	6		7	8		3		5			
6	0	6	1	0	1	3	0	1	5	0	2	1	0	3	3	0	3	5	0	4	2	0	5	4	0	5	1	1	3	4	8
		9		2	7		8	6		5	6		1	7	7		9	4		2	0	7		7	4		3	4			
7	0	7	2	0	1	4	0	2	7	0	2	3	0	3	5	0	4	2	0	5	5	0	5	2	1	6	5	1	1	2	8
		2		4	5		2		9	1		6	6		4	2		1	0		9	0		2		4	6	3			
8	0	8	2	0	1	5	0	2	1	0	3	4	0	4	1	0	5	4	0	5	2	1	7	5	1	1	3	1	2	1	8
		6		6	2		5	9		3	7		2	6		0	7		9	0		4		6	2		5	2	2		
9	0	9	3	0	1	1	0	2	3	0	3	4	0	4	3	0	5	1	1	6	5	1	1	3	1	2	1	1	3	2	8
		0		9		8	2		8		7	8		7	4		2		6	2		6	5		6		1				
1	0	1	3	0	2	1	0	3	4	0	4	2	0	5	2	1	3	4	1	1	2	1	2	1	1	3	2	1	4	5	8
0	0	5		1	0		1	6		2	3		3			3		4	6		5	2		6		6	4	0			
1	0	1	3	0	2	2	0	3	1	0	4	4	0	5	2	1	1	1	1	2	5	1	3	5	1	4	5	1	5	3	7
1	1	9		3	0		5		6	4		8	8		0	4		3		3	6		5	1		7	1	9			
1	0	1	4	0	2	3	0	3	1	0	5	9	1	3	5	1	1	4	1	2	4	1	4	4	1	5	4	2	8	5	7
2	2	5		5	1		8	8		1			6		6	8		9	4		2	3		5	5		3	8			
1	0	1	5	0	2	4	0	4	3	0	5	3	1	9	2	1	2	2	1	3	2	1	5	3	2	5	4	2	1	5	7
3	3	1		7	3		1	6		5	0		6		3	6		7	8		1	4		4		9	9	7			

c
o
1 -

a	1	2	3	4	5	6	7	8	9	0	1	1	a																			
r	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	0	0	r											
g	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	g							
4	0	5	5	1	5	5	2	5	4	3	5	1	4	5	4	6	4	3	7	8	1	8	7	5	8	4	5	9	4	1	4	
4		7	7		5	7		4		2	9		0	7		8	5								3		7	3		8	5	6
4	1	0	1	2	0	5	3	0	1	4	0	3	5	1	1	6	2	0	7	3	9	7	9	9	9	6	4	1	9	2	4	
5								5		5																		8	0		2	5
4	1	2	8	2	4	2	3	6	3	4	9	9	5	1	5	6	1	6	7	1	1	8	2	6	9	2	2	1	3	1	4	
6						2		9					1	3	5		8	7	2						6	4	0	1	5	4		
4	1	4	2	2	8	4	3	1	1	4	1	2	5	2	0	6	2	1	7	3	1	8	4	6	9	4	4	1	5	5	4	
7		1		6		3	8		8		3		8	8		3	8		0					6	4	0	3	9	3			
4	1	6	3	2	1	2	3	2	1	4	2	1	5	3	3	6	4	8	7	5	1	8	5	4	1	7	5	1	1	3	4	
8		9		3	2		0	2		7	5		4	4		2		0	6		8	6	0		3	1	7	7	2			
4	1	9	2	2	1	8	3	2	2	4	3	5	5	4	3	6	5	4	8	7	1	9	1	1	1	2	5	1	4	1	4	
9				8		7	3		6	0		6	1		6	1		3		8	5	0	9	4	1	2	4	1				
5	1	1	3	2	2	7	3	3	4	4	4	4	5	5	5	7	1	2	8	2	3	9	3	1	1	5	4	1	7	5	4	
0		1	1		3		4	9		6	9		9		1	4		4	2		8	2	0	2	9	2		0	0			
5	1	1	6	2	2	1	3	4	3	4	5	2	6	1	9	7	2	2	8	4	1	9	5	4	1	1	4	1	3	3	3	
1		4		8	8		2	9		7	4		2		7	8		3	7		9	1	1	6	6	2	4	6	9			
5	1	1	4	2	3	4	3	5	4	5	8	2	6	2	3	7	4	5	9	2	4	1	2	4	1	4	4	1	2	3	3	
2		6	0		3	2		0	7		6		5	6		3	3		0	0	1	7	1	1	7	3		7	8			
5	1	1	3	2	3	2	3	5	1	5	1	2	6	4	2	8	1	0	9	2	4	1	4	4	1	8	0	1	3	5	3	
3		9	9		9	2		9	7		9	8		0					2	0	0	4	6		2		3	1	7	7		
5	1	2	3	2	4	1	4	8	1	5	3	2	6	5	5	8	1	4	9	4	5	1	9	1	1	3	3	1	2	4	3	
4		2	6		5	8		2		1	3		4	9		9		3	3	1		3	2	5	0	4		5	6			
5	1	2	4	2	5	4	4	1	1	5	4	5	7	1	4	8	3	5	1	5	5	1	3	4	1	4	2	1	3	8	3	
5		5	2		1		7	3		3	5		0	0	7	3	0		8	1	4	5	3		4	4	5		5			
5	1	2	3	2	5	4	4	2	2	5	5	2	7	2	3	8	5	5	1	2	1	1	1	3	1	3	5	1	2	1	3	
6		8	9		8		7	3		7	2		7	0	7	3	0	9	6	2		5	3	4	1	5	9	5	4			
5	1	3	2	3	4	5	4	3	4	6	1	5	7	4	3	9	1	5	1	5	5	1	2	5	1	7	0	1	4	1	3	
7		2	5		7		7	4		0	3		4	3		8	1	0	3	6	2	9	8	4		5	5	8	3			
5	1	3	3	3	1	1	4	4	4	6	2	3	8	2	5	9	4	0	1	1	5	1	5	5	1	4	5	1	2	2	3	
8		6		3	3		8	0		5	1					1		1	9	6	2	9	3	4	0	9	6	3	6	2		

											c																				
											o																				
											1																				
a	1	2	3	4	5	6	7	8	9	0	1	a																			
r	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	0	0	r										
g	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	G'	"	g										
5	1	3	5	3	1	5	5	0	1	6	4	5	8	2	1	1	4	2	1	4	2	1	3	3	1	1	2	1	4	5	3
9	9	3	9	7		4	0	9	2	1	0	7	1	7	8	3	1	3	5	7	7									1	
6	1	4	5	3	2	4	5	1	2	6	4	2	8	4	5	1	2	2	1	1	4	2	5	2	1	5	2	1	4	5	3
0	3	7	8		3	9	7	4	2	7	0	9	1	2	6	4	4	0	5	7	1	7	6	9	0						

Foot of columns (complementary top-argument indices): **89** | **88** | **87** | **86** | **85** | **84** | **83** | **82** | **81** | **80**. Foot markers: **H.** (center) and **Resid.** (right).

Parsing notes: This table is read in both directions (the marginal label gives "Altitude of Pole ... or Declination of star ... taken in the side"), so the left argument runs 1→60 and the right co-argument runs 89→30, with the bottom indices (89→80) being the complementary top-arguments for the reverse reading. Several seconds-digits in the high-degree columns (8, 9, 10) are at the resolution limit; the ones I could not resolve cleanly are listed in the QA report. At Gr. 44 of column 6 the printed value reads "6 48 35" where the smooth progression of that row/column would suggest ~5 48; transcribed as printed and flagged. At Gr. 60 of column 8 the printed value reads "24 5 20" where the column trend would suggest ~13 31; the leading "24" is an apparent compositor slip — transcribed as printed and flagged.

[Foot marker: H.] [Foot marker: Resid.]

Residuum of Table 29. The Difference of Ascensions (continued — columns 1–10, arguments 61–90)

[Resid. Tab. 29. Differentia Ascensionalium.]

[Margin, left side, running vertically: "**The Declination, in the side [front], is taken; or the Altitude of the Pole, in the side, &c.; or the Declination of the star, &c.**" — *Declinatio in fronte sumatur Altr. Poli; vel Altit. Poli in fronte sumatur Declinatio ... &c.*] (marginal label partly abraded; gloss approximate)

This is the continuation (residue) of Table 29 for columns **1–10** at arguments 61–90, completing the lower-argument portion. The right narrow column gives the complementary argument 29 down to 0; the foot row repeats top-indices **89 ... 80**.

Foot of columns: 89 | 88 | 87 | 86 | 85 | 84 | 83 | 82 | 81 | 80.

Note within the table (lower-right block, replacing the empty cells): *[Latin: "Vbi desunt numeri areales, signum est aggregatum ex numero frontali, & marginis sinistri excedere quadrantem, quod intelligendum est de sequentibus quoque; spatiis areis vacuis in residuis partibus Tabulae, mox secuturis. Vel certe superflue ibi quaeruntur cum in alia huius parte reperiri possint."]*

Translation: **"Where the areal numbers are missing, it is a sign that the sum of the front-number and the left-margin number exceeds a quadrant [90°] — which is to be understood of the following ones too, namely the empty areal cells in the remaining parts of the Table that come next. Or else they are sought there to no purpose, since they can be found in another part of this Table."**

Parsing notes: The lower-left triangle of empty cells reflects sums exceeding 90° (the ascensional difference reaches its 90° limit, printed as "90 0 0" along the staircase), per the explanatory note. I have marked the unfilled cells with –. At arg 79, column 9, the value reads "65 6 44" then the next row's column-8 reaches "90 0 0"; these staircase values approaching the 90° limit are transcribed as printed.

Residue of Table 29. The Difference of Ascensions (continued — columns 11–25)

[Residuum Tab. 29. Differentiarum Ascensionalium.]

Sub-heading (banner): **"The Altitude of the Pole, if in the left side the Declination be taken; or the Declination, if in the left side the Altitude of the Pole be taken."** *[Altitudo Poli si in latere sinistro sumatur Declinatio; vel Declinatio si in latere sinistro Alt. Poli.]*

[Margin, left side, running vertically: **"The Declination, in the side [front], is taken — Altitude of the Pole; or the Altitude of the Pole, in the side, &c.; the Declination, in the front, is taken, the Altitude of the Pole, &c."** — *Declinatio, in fronte sumitur Alt. Poli; vel Altit. Poli in fronte sumatur Declinatio, &c.*] *(marginal label partly abraded; gloss approximate)*

This second lower block extends Table 29 to pole-altitude/declination columns 11–25, with the left argument 1→30 and the right complementary argument 88→61 (small inner digits). Each column is sub-divided g. | ' | ". This block is extremely fine; values at the resolution limit are flagged and noted as

	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	c
a	1	1	2	1	3	1	4	1	5	1	6	1	7	1	8	1	0
r	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	2	
g	G'	G'	G'	G'	G'	G'	G'	G'	G'	G'	G'	G'	G'	G'	G'	g	
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	2	0
	2	3	4	5	6	7	8	0	1	2	3	4	5	7	8	8	8
2	0	2	0	2	0	2	0	3	0	3	0	3	0	3	0	3	0
	3	6	8	0	2	4	7	9	1	4	6	9	3	7	7	7	7
3	0	3	0	3	0	4	0	4	0	4	0	5	0	5	0	5	1
	5	8	2	5	8	2	5	9				3		0	4	6	8
4	0	4	0	5	0	5	1	0	0	4	1	9	1	1	1	1	2
	7	1	6					4	8	3	8	2	7	2	7	2	5
5	0	5	1	4	1	9	1	1	1	2	1	2	1	3	1	3	1
	8				5	1	6	2	8	4	9	5				4	9
6	1	1	1	1	2	1	3	1	3	1	4	1	5	1	5	2	4
	0	7	3	0	7	4	1	7		1	8	6	3	1	9	3	8
7	1	2	1	3	1	3	1	4	1	5	2	1	2	9	2	1	2
	3	0	7	5	3				7	5	2	2	0	9		7	2
8	1	3	1	4	1	5	2	0	2	9	2	1	2	2	2	3	2
	4	3	2				9	8	7	6	6		5	5	5	5	1
9	1	4	1	5	2	6	2	1	2	2	2	3	2	4	2	5	3
	6	6			6	6	7	7	7			8	9	0	1		8
1	1	5	2	9	2	2	2	3	2	4	2	5	3	5	3	1	3
	0	8			0	1	2	4			7	9	1		6	0	3
1	2	1	2	2	2	3	2	4	2	5	3	1	3	2	3	3	3
	1	0	2	4	7	9	2	4	8	1			7	1	6	1	6
1	2	2	2	3	2	4	3	3	3	1	3	3	3	4	3	5	4
	2	2	5	9			6	0	4	8	2	6	1	6	1	6	1
1	2	3	2	4	3	3	3	1	3	3	3	4	4	3	4	1	4
	3	4	9			8	3	8			8	4	9		1	7	4
1	2	4	3	2	3	1	3	3	3	5	4	6	4	2	4	3	4
	4	7			8	3	0			2	9	5	2	0	7		2
1	2	5	3	1	3	3	3	5	4	7	4	2	4	4	4	5	5
	5	9	6	3	0			4	2	9	7	6	4	3	2	1	1

c
o

1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 -
a 1 1 2 1 3 1 4 1 5 1 6 1 7 1 8 1 9 1 0 2 1 2 2 2 3 2 4 2 5 2 a
r 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 r
g G' G' G' G' G' G' G' G' G' G' G' G' G' G' g

1 3 1 3 3 3 4 4 6 4 2 4 4 5 2 5 2 5 4 6 0 6 2 6 3 6 5 7 2 7 4 7
6 2 0 8 4 3 1 1 0 9 9 0 1 3
1 3 2 3 4 4 3 4 2 4 4 5 2 5 2 5 4 6 3 6 2 6 4 7 7 7 2 7 4 8 1 7
7 4 3 2 2 2 2 4 4 7 9 2 2
1 3 3 3 5 4 1 4 2 5 0 5 2 5 4 6 4 6 2 6 4 7 9 7 3 7 5 8 1 8 4 7
8 7 8 8 9 1 2 5 7 3 6 9 3 1
1 3 5 4 1 4 3 4 5 5 1 5 4 6 3 6 2 6 4 7 1 7 3 8 0 8 2 8 4 9 1 7
9 0 2 4 5 8 0 5 9 1 6 5 9 4 0
2 4 3 4 2 4 4 5 1 5 3 6 0 6 2 6 4 7 1 7 3 8 2 8 2 8 5 9 2 9 4 6
0 6 9 2 6 3 7 2 6 7 3 0 6 9
2 4 1 4 4 5 6 5 3 5 5 6 2 6 4 7 1 7 3 8 6 8 3 9 0 9 2 9 5 1 2 6
1 7 1 1 6 2 7 3 9 3 8 6 0 4 8
2 4 3 4 5 5 2 5 4 6 1 6 3 7 6 7 3 8 1 8 2 8 5 9 2 9 5 1 2 1 5 6
2 0 6 1 7 3 9 3 9 7 5 2 0 8 0 1 7
2 4 4 5 1 5 3 6 4 6 3 6 5 7 2 7 5 8 2 8 5 9 2 9 5 1 2 1 5 1 2 6
3 3 0 7 1 9 7 6 5 3 2 1 0 1 0 1 1 1 6
2 4 5 5 2 5 5 6 2 6 5 7 2 7 5 8 2 8 5 9 2 9 5 1 2 1 5 1 2 1 5 6
4 6 4 3 2 1 1 0 0 0 0 1 0 1 0 1 1 2 1 3 5
2 5 1 5 4 6 1 6 4 7 1 7 4 8 1 8 4 9 1 9 4 1 1 1 4 1 2 1 5 1 3 6
5 2 1 1 1 1 1 2 3 4 6 0 8 0 9 1 2 1 4 2 4 4
2 5 2 5 5 6 2 6 5 7 3 8 3 8 3 9 7 9 4 1 1 1 4 1 2 1 5 1 3 1 9 6
6 6 7 8 9 1 5 0 0 4 0 7 1 1 1 7 2 3 3 3
2 5 4 6 1 6 4 7 1 7 5 8 2 8 5 9 3 1 8 1 4 1 1 1 5 1 3 1 7 1 4 6
7 2 2 5 8 1 5 9 3 0 0 3 1 8 1 3 2 0 3 3 5 2
2 5 5 6 2 7 3 7 3 8 1 8 4 9 2 1 0 1 3 1 1 1 5 1 2 1 7 1 4 1 2 6
8 6 8 8 3 8 4 0 0 7 1 4 1 1 2 9 3 3 6 4 5 1
2 6 1 6 4 7 2 7 5 8 3 9 1 9 4 1 2 1 5 1 4 1 2 1 3 1 4 1 2 1 5 6
9 0 4 1 7 3 0 7 0 6 1 1 4 2 3 3 3 3 4 4 5 0
3 6 2 7 3 7 4 8 1 8 5 9 3 1 1 1 4 1 2 1 8 1 4 1 2 1 1 1 5 1 5 5
0 7 1 8 4 2 0 0 0 9 1 8 2 2 9 3 9 4 1 4 4 5 7 9

Foot of columns: 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65. Foot marker: **Resid.** (right).

Parsing notes: This second residue block carries only two sub-columns per pole-altitude index in the engraved layout (G. and ' ; the seconds column is omitted at this scale of the table — the values here are degrees-and-minutes of ascensional difference). Several minutes-cells in the high-index columns (22–25) are at the legibility floor: in particular the column-22 value at arg 2 reads "1 13" and column-23 at arg 2 reads "1 6" where the smooth progression would suggest sub-degree values (~0 53 / ~0 55); transcribed as printed and flagged as probable misreads / compositor slips. Column 25 at arg 2 reads "1 6" and at arg 10 reads "4 41" (vs. an expected ~4 47 by progression) — flagged. These are at the resolution limit and

[Foot marker: Resid.]

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae

Part II (the Primum Mobile tables), continued — Tables 29 (residue), 30, 31

TABLE 29 (continued) — Residue of Table 29, the Ascensional Differences

Heading (verbatim): *Residuum TAB. 29. Differentiarum Ascensionalium.* — "Residue of Table 29, the Ascensional Differences."

Sub-heading (verbatim): *Altitudo Poli, si in sinistro latere sumatur Declinatio; vel Declinatio, si in eodem latere sumatur Alt. Poli.* — "Pole-altitude, if the declination is taken on the left side; or declination, if the pole-altitude is taken on the same side."

Left margin label (verbatim): *Declinatio, si in fronte sumatur Alt. Poli; vel Alt. Poli, si in fronte sumatur Declinatio.* — "Declination, if the pole-altitude is taken at the top; or pole-altitude, if the declination is taken at the top."

The column-head arguments run 11–25 (the pole-altitude / declination columns); the left stub argument runs downward 31→79 and the right stub upward 59→11. Each cell gives degrees (G.) and minutes (').

A	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	A
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑
3	6	7	7	8	9	9	1	1	1	1	1	1	1	1	1	5
1	4	2	5	3	1	5	0	1	1	2	3	4	4	5	6	9
	2	0	8	7	6	5	3	1	5	3	2	3	4	3	1	
							5	5	6	8	0		7	1	6	
3	6	7	8	8	9	1	1	1	1	1	1	1	1	1	1	5
2	5	3	1	5	3	0	1	1	2	3	3	4	5	6	6	8
	9	8	8	8	8	1	1	4	2	9	5	3	2	9	5	
						9		3	5		3	7	1		6	
3	7	7	8	9	1	1	1	1	1	1	1	1	1	1	1	5
3	1	5	3	1	0	0	1	2	2	3	4	5	6	6	7	7
	5	6	7	9	1	4	2	1	5	4	2	1	0	4	3	
						4	7	1	5	0	6	3		8	8	
3	7	8	8	9	1	1	1	1	1	1	1	1	1	1	1	5
4	3	1	5	4	0	1	1	2	3	4	5	5	6	7	8	6
	2	5	7	1	2	9	5	4	2	1	0	4	3	2	2	
					5		4	0	6	3		9	8	9	0	
3	7	8	9	1	1	1	1	1	1	1	1	1	1	1	1	5
5	4	3	1	0	0	1	2	3	3	4	5	6	7	8	9	5
	9	4	8	3	4	4	2	9	5	4	3	2	1	1	3	
					9	5	2		7	6	6	6	7	0		
3	8	8	9	1	1	1	1	1	1	1	1	1	1	1	1	5
6	7	5	3	0	1	2	2	3	4	5	6	7	7	8	9	4
		3	9	2	1	1	5	3	2	2	1	4	5	5	4	
				6	3		0	9	9	0	2		8	3	8	
3	8	9	1	1	1	1	1	1	1	1	1	1	1	1	2	5
7	2	1	0	0	1	2	3	4	5	5	6	7	8	9	0	3
	5	3	1	5	3	2	1	1	2	5	4	4	3	3	3	
				0	9	9	9	0		5	9	4	9	6	4	
3	8	9	1	1	1	1	1	1	1	1	1	1	1	2	2	5
8	4	3	0	1	2	2	3	4	5	6	7	8	9	0	1	2
	4	4	2	1	5	5	4	4	3	3	2	2	2	2	2	
			3	4		7	9	2	6	1	7	4	2	1	2	
3	9	9	1	1	1	1	1	1	1	1	1	1	2	2	2	5

A	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	A
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑
9	3	5	0	1	2	3	4	5	6	7	8	9	0	1	2	1
		5	4	3	3	2	2	1	1	8	6	6	6	8	1	
			6	9	2	6	0	5	1						1	
4	9	1	1	1	1	1	1	1	1	1	1	1	2	2	2	5
0	2	0	1	2	3	3	4	5	6	7	8	9	0	1	3	0
	3	1	1	5	0	5	5	4	4	4	4	4	5	5	2	
		6	0			5	1	9	8	7	7	9	2	6		
4	9	1	1	1	1	1	1	1	1	1	1	2	2	2	2	4
1	4	0	1	2	3	4	5	6	7	8	9	0	1	2	3	9
	4	3	3	3	2	2	2	2	2	2	3	3	3	4	5	
		9	5	1	8	6	5	4	5	7	0	4	9	6	5	
4	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	4
2	0	1	2	2	3	4	5	7	8	9	0	1	2	3	4	8
	5	2	0	5	5	5	5	1	4	8	1	2	2	3	5	
				8	8	8	9				3	0	8	8	0	
4	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	4
3	0	1	2	3	4	5	6	7	8	9	0	2	3	4	5	7
	2	2	2	2	2	3	3	3	4	5	5	8	1	3	4	
	7	6	6	7	8	1	4	8	4	0	9		9	3	6	
4	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	4
4	0	1	2	3	5	6	7	8	9	0	1	2	4	5	6	6
	4	5	5	5	0	5	1	1	2	3	4	5	1	2	4	
	9	1	3	6			0	8	6	5	6	8	2	8	5	
4	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	4
5	1	2	3	4	5	6	7	8	0	1	2	3	5	6	7	5
	1	1	2	2	3	4	4	5	8	2	3	5	7	2	4	
	3	6	1	6	2	0	8	8		1	4	0		6	8	
4	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	4
6	1	2	3	4	6	7	8	9	0	2	3	4	6	7	8	4
	3	4	5	5	7	1	2	4	5	9	2	4	5	2	5	
	7	3	0	8		6	7	0	3		6	4		7	3	
4	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	4
7	2	3	4	5	6	7	9	0	1	2	4	5	7	8	9	3

A	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	A
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑
	2	1	2	3	4	5	8	2	4	5	1	4	4	3	5	
		1	0	0	2	4		3	0	8	8	0		0	9	
4	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	4
8	2	3	4	6	7	8	9	1	2	3	5	6	8	9	1	2
	2	3	5	5	1	3	5	9	2	5	1	4	8	3	1	
	8	9	1		9	4	1		9	1	4	0		8	1	
4	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	4
9	2	4	5	6	7	9	0	1	3	4	6	7	9	0	2	1
	5	9	2	4	5	1	3	5	2	4	1	4	1	4	2	
	5		4	0	7	6	6	7	0	5	2	2	4	9	6	
5	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	4
0	3	4	5	7	8	9	1	2	4	5	7	8	0	2	3	0
	2	4	5	1	3	5	2	4	1	4	1	4	2	3	4	
	4	0	8	7	7	9	2	7	5	2	3	7	3		6	
5	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3
1	3	5	6	7	9	0	2	3	5	6	8	9	1	3	5	9
	5	1	3	5	1	4	1	3	1	4	1	5	3	2	9	
	3	3	4	6	9	4	1	9	1	3	7	6	7	1		
5	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3
2	4	5	7	8	0	1	3	4	6	7	9	1	2	4	6	8
	2	4	1	3	4	3	1	3	9	4	2	8	5	4	3	
	4	7	1	7		2		4		6	6		4	4	9	
5	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
3	4	6	7	9	0	2	3	5	7	8	0	2	4	6	8	7
	4	2	5	1	5	2	5	3	1	5	3	2	1	1	1	
	7	3	0	9	0	2	6	3	2	3	7	5	7	3	4	
5	1	1	1	2	2	2	2	2	2	3	5	3	3	3	3	3
4	5	7	8	0	1	3	4	6	8	0	1	3	5	7	9	6
	3	5	3	4	3	1	5	3	1	4	5	4	4	4	5	
	1		2		8	5	3	4	7		4	7	5	8	6	
5	1	1	1	2	2	2	2	2	2	3	3	3	3	3	4	3
5	6	7	9	0	2	4	5	7	9	1	3	5	7	9	1	5
	7	4	1	5	3	1	5	3	2	1	1	1	2	3	5	

A	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	A	
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg	
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑	
		0	6	2	0	0	3	9	7	9	4	4	0	2	0		
5	1	1	2	2	2	2	2	2	2	3	3	3	3	3	4	4	3
6	6	8	0	1	3	5	6	8	0	2	4	6	8	1	3	4	
	4	2	1	4	2	9	5	4	4	3	4	4	5	1	4		
	5	2		2	4		7	8	2	9	1	8	8	8	4		
5	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	3
7	7	9	0	2	4	6	8	0	2	4	6	8	0	3	5	3	
	2	6	4	3	2	1	3	1	1	5	1	2	4	1	5		
	5		9	3	0	0					4	8	1	7	3		
5	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4	3
8	8	9	1	3	5	7	9	1	3	5	7	0	2	5	8	2	
	7	5	4	3	2	1	1	2	2	3	5	1	4	2	1		
		2	1	1	3	9	8	0	6	7	4	7	7	7	6		
5	1	2	2	2	2	2	3	3	3	3	3	4	4	4	5	3	
9	8	0	2	4	6	8	2	4	6	9	9	2	4	7	0	1	
	5	4	3	3	2	3	4	3	1	1	4	1	5	5	4		
	3	3	6	1	9	0	4	8	7	2	1	3	6	0	1		
6	1	2	2	2	2	2	3	3	3	3	4	4	4	5	5	3	
0	9	1	3	5	7	9	1	4	6	9	1	4	7	0	3	0	
	4	3	3	3	3	4	5	1	3	5	4	2	1	2	5		
	0	6	4	5	9	7	8	5	7		0	5	9	7	2		
6	2	2	2	2	2	3	3	3	3	4	4	4	4	5	5	2	
1	0	2	4	6	8	1	3	5	8	1	3	6	9	3	7	9	
	3	3	3	4	5	9	2	5	2	3	5	4	5	2	1		
	2	3	8	4	4		8	3	4		0	8	9	5	6		
6	2	2	2	2	3	3	3	3	4	4	4	4	5	5	6	2	
2	1	3	5	7	0	2	5	7	0	3	6	9	2	6	1	8	
	2	3	4	5	1	3	6	4	2	1	1	2	5	5	1		
	7	4	4	8	6	8		0	2	2	2	7	8	2	7		
6	2	2	2	2	3	3	3	3	4	4	4	5	5	6	6	2	
3	2	4	6	9	1	4	6	9	2	5	8	2	6	0	5	7	
	2	3	5	1	4	1	5	3	3	3	5	2	2	2	5		
	6	9	7	8	4	5	3	9	3	5	3	8	6	9	4		

	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	A
A	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	A	
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑
2	6	0	5	0	5	1	0	0									8
	4	5	1	5	3	5	0	0									
	5	1	7		3	7											
7	3	4	4	5	6	6	9										1
3	9	4	9	4	1	9	0										7
	2	3	2	3	1	4	0										
	9			8	3	2											
7	4	4	5	6	6	9											1
4	2	7	3	0	9	0											6
	4	5	3	1	8	0											
	1	2	9	7													
7	4	5	5	6	9												1
5	6	2	9	8	0												5
	3	5	1	3	0												
	0	0	0	1													
7	5	5	6	9													1
6	1	8	7	0													4
	1	2	4	0													
	4	4	9														
7	5	6	9														1
7	7	7	0														3
	2	2	0														
	1																
7	6	9															1
8	6	0															2
	8	0															
7	9																1
9	0																1
	0																

Inset note (verbatim): *Residuum Tabulae incipientis utrinque, à gradu 27. quare in sequenti pagina.* — "The residue of the table begins on both sides at degree 27; for which see the following page."

Foot column-labels (verbatim, left→right): 79 78 77 76 75 74 73 72 71 70 69 68 67 66 65 — (these are the complementary pole-altitude arguments for reading the table from the bottom).

Parsing notes: The right margin gives the upward-running complementary stub (59→11). High-index cells are blank (the table is triangular: the "90 0" perpetual-day staircase steps in from the upper right). Cell at arg 54, col 13 reads "51 54" as printed, where the smooth progression would suggest ~"31 54" — flagged. Cell at arg 59, col 17 reads "32 44" where smooth progression suggests ~"30 44" — flagged.

TABLE 29 (continued) — Residue of the Table of the Ascensional Differences (second block, pole-altitudes 26–40)

Heading (verbatim): *Residuum Tabulæ Different. Ascensionalium.* — "Residue of the Table of the Ascensional Differences."

Sub-heading (verbatim): *Altitudo Poli, aut Declinatio ut supra.* — "Pole-altitude, or declination, as above."

Left margin label (verbatim): *Declin. vel Alt. Poli.* — "Declination or pole-altitude."

Column-head arguments 26–40; left stub 31→40; right stub 59→50.

	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	
A	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	A
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑
3	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	5
1	7	7	8	9	0	1	2	2	3	4	5	6	8	9	0	9
	2	5	3	2	1	1	3	5	5	5	5	5	0	7	1	
		0	7	7	8	0		8	5	3	3	5			7	
3	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	5
2	7	8	9	0	1	2	3	3	4	5	7	8	9	0	1	8
	4	3	2	1	9	3	0	5	5	5	0	5	1	2	3	
	5	4	4	6				6	7	9			3	3	7	
3	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	5
3	8	9	0	1	2	2	3	4	5	7	8	9	0	1	2	7
	2	2	1	6	1	5	5	5	5	3	9	1	2	4	5	
	7	0	2			8	6	7	9			8	9	3	7	

A	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	A
rg	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	rg
↓	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	↑
3	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	5
4	9	0	1	1	2	3	4	5	7	8	9	0	1	3	4	6
	1	6	1	5	5	5	5	5	4	1	2	3	4	6	2	
	2			7	5	5	6	9		1	1	3	8		8	
3	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	5
5	9	0	1	2	3	4	5	7	8	9	0	1	3	4	5	5
	5	5	5	5	5	5	5	3	1	2	3	5	1	3	5	
	8	4	1	0	1	3	7		1	2	5	0	0	3	9	
3	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	5
6	0	1	2	3	4	5	7	8	9	0	1	3	4	6	7	4
	4	4	4	4	5	5	2	1	2	3	5	1	3	2	3	
	5	4	4	6	0	5		1	1	5	2	2	6		3	
3	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	5
7	1	2	3	4	5	6	8	9	0	1	3	4	6	7	9	3
	3	3	3	4	4	5	5	1	3	5	1	3	4	3	1	
	4	5	7	1	7	5		8	2	0	2	2		6	3	
3	2	2	2	2	2	2	2	3	3	3	3	3	3	3	4	5
8	2	3	4	5	6	8	9	0	1	3	4	6	7	9	0	2
	2	2	3	4	4	0	1	2	4	9	3	4	3	1	5	
	4	8	3	0	9		3	9	7		5		7	5	8	
3	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	5
9	3	4	5	6	7	9	0	1	3	4	6	7	9	0	2	1
	1	2	3	4	5	7	2	4	6	3	2	3	1	5	4	
	6	2	0	0	2		3	4		3		6	3	9	9	
4	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	5
0	4	5	6	7	8	0	1	3	4	5	7	9	0	2	4	0
	9	1	3	4	5	1	3	1	2	5	3	1	5	4	4	
		9	0	3	9	7	7		8	7	3	3	8	9	5	

Foot column-labels (verbatim, left→right): 64 63 62 61 60 59 58 57 56 55 54 53 52 51 50.

Catchword / signature line:

Parsing notes: clean second residue block. Right margin gives the complementary stub 59→50.

TABLE 29 (continued) — Residue of the Table of the Ascensional Differences (third block, pole-altitudes 26–40, args 41–64)

Heading (verbatim): *Residuum Tab. Differentiarum Ascensionalium.* — "Residue of the Table of the Ascensional Differences."

Sub-heading (verbatim): *Altitudo Poli, si in latere sinistro sumas Declinationem; vel Declinatio si in latere eodem sumas Alt. Poli.* — "Pole-altitude, if you take the declination on the left side; or declination, if you take the pole-altitude on the same side."

Column-head arguments 26–40; left stub 41→64; right stub 49→26.

	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	
A	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	A
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑
4	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4
1	5	6	7	8	0	1	2	4	5	7	9	0	2	4	6	9
	5	1	3	4	7	2	5	2	5	3	1	5	4	4	5	
		7	2	8		9	4	2	3	0	0	5	7	5	0	
4	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4
2	6	7	8	9	1	2	4	5	7	9	0	2	4	6	9	8
	5	1	3	5	1	4	1	4	2	5	5	4	4	4	4	
		8	6	6	9	5	5	7	3		2	4	2	9		
4	2	2	2	3	3	3	3	3	3	4	4	4	4	4	5	4
3	7	8	9	1	2	4	5	7	8	0	2	4	6	9	1	7
	3	2	4	7	3	5	3	1	5	4	3	3	4	2	2	
		2	3		4		8	6	9	6	9	9	6		9	
4	2	2	3	3	3	3	3	3	4	4	4	4	4	5	5	4
4	8	9	0	2	3	5	7	8	0	2	4	6	8	1	4	6
	6	2	5	2	5	2	7	5	4	3	3	4	5	2	8	
		8	4	2	3	8		0	0	3	3	1	7	2		
4	2	3	3	3	3	3	3	4	4	4	4	4	5	5	5	4
5	9	0	2	3	5	6	8	0	2	4	6	8	1	4	7	5
	1	3	7	4	1	5	4	3	1	1	2	4	1	0	2	
	1	8		0	6	6	0	0	6	8	9	8	7			

A rg ↓	2 6 '	2 7 '	2 8 '	2 9 '	3 0 '	3 1 '	3 2 '	3 3 '	3 4 '	3 5 '	3 6 '	3 7 '	3 8 '	3 9 '	4 0 '	A rg ↑
4	3	3	3	3	3	3	4	4	4	4	4	5	5	5	6	4
6	0	1	3	5	6	8	0	2	4	6	8	1	4	6	0	4
	2	5	2	2	4	2	1	1	1	2	4	1	0	5	2	
	0	1	4		3	9	9	6	8	9	8	7		7	0	
4	3	3	3	3	3	4	4	4	4	4	5	5	5	6	6	4
7	1	3	4	6	8	0	2	4	6	8	1	3	6	0	4	3
	3	7	4	2	1	7	4	8	2	4	1	4	4	1	8	
	2		6	8	5				0	1	3	8	9	1		
4	3	3	3	3	3	4	4	4	4	5	5	5	6	6	6	4
8	2	4	6	8	9	1	3	6	8	1	3	6	0	4	8	2
	4	2	1	0	5	5	5	9	3	3	4	4	1	4	4	
	7	8	1		3	2	7		1		8	9	1		4	
4	3	3	3	3	4	4	4	4	5	5	5	6	6	6	7	4
9	4	5	7	9	1	3	5	8	0	3	7	0	4	8	4	1
	8	5	4	3	3	4	5	2	5	4	4	6	4	4	4	
		3	3	7	7	4	7	0	3	0	2			4	9	
5	3	3	3	4	4	4	4	5	5	5	5	6	6	7	9	4
0	5	7	9	1	3	5	8	0	3	6	9	3	8	4	0	0
	3	2	1	2	2	4	7	4	3	3	5	6	3	4	0	
	3	3	9	1	9	3		3	0	4	9	5	6	9		
5	3	3	4	4	4	4	5	5	5	5	6	6	7	9		3
1	7	8	1	3	5	7	0	3	6	9	3	8	4	0		9
	2	5	2	1	2	5	3	1	2	5	4	3	4	0		
		9		1	9	4	0	9	4	1	8	5	7			
5	3	4	4	4	4	5	5	5	5	6	6	7	9			3
2	8	0	2	5	7	0	3	6	9	3	8	4	0			8
	3	4	5	1	3	1	7	1	4	6	2	4	0			
	8	2	3	2	9	6		3	2	5	5	2				
5	4	4	4	4	5	5	5	5	6	6	7	9				3
3	0	2	4	7	0	2	6	9	3	8	4	0				7
	2	3	5	2	1	5	1	3	3	1	3	0				
	0	3	3	1		3		1	1	3	7					
5	4	4	4	4	5	5	5	6	6	7	9					3

	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	
A	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	A
rg	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	G.	rg
↓	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	↑
	3	2	0													
	2	3														
6	7	9														2
3	3	0														7
	1	0														
	1															
6	9															2
4	0															6
	0															

Foot column-labels (verbatim, left→right): 64 63 62 61 60 59 58 57 56 55 54 53 52 51 50.

Parsing notes: triangular table; the "90 0" perpetual-day staircase steps in from the upper right. Several cells in the high-index region show probable compositor errors (e.g., arg 50 col 37 "63 65" and arg 52 col 35 "63 65" — minutes >59; arg 59 col 27 "57 62" — minutes >59). Flagged below.

TABLE 29 (continued) — Residue of the Table of the Ascensional Differences (final fragment, pole-altitudes 27–33 and 41–45)

Heading (verbatim): *Resid. Tab. Differentiarum Ascensionalium.* — "Residue of the Table of the Ascensional Differences."

Sub-heading (verbatim): *Altitudo Poli, si in latere sinistro sumas Declinationem; vel Declinatio si ibi altitudo Poli.* — "Pole-altitude, if you take the declination on the left side; or declination, if the pole-altitude is there."

Left margin label (verbatim): *Declin. &c.* — "Declination, etc."

This middle band carries two sub-panels. The left panel (column arguments 27–33, stub 27→30) and the right panel (column arguments 41–45, stub 41→49).

Left panel — columns 27–33:

Arg	27 G.	28 G.	29 G.	30 G.	31 G.	32 G.	33 G.	Arg
↓	'	'	'	'	'	'	'	↑
27	15 5	15 45	16 24	17 6	17 50	18 34	19 20	63

Arg ↓	27 G. '	28 G. '	29 G. '	30 G. '	31 G. '	32 G. '	33 G. '	Arg ↑
28	15 43	16 25	17 8	17 53	18 33	19 24	20 12	62
29	16 24	17 8	17 54	18 40	19 27	20 16	21 6	61
30	17 6	17 53	18 40	19 28	20 18	21 9	22 1	60

Foot column-labels (verbatim, left→right): 63 62 61 60 59 58 57.

Right panel — columns 41–45:

Arg ↓	41 G. '	42 G. '	43 G. '	44 G. '	45 G. '	Arg ↑
41	39 5	51 31	54 9	57 5	60 23	49
42	51 57	54 9	57 5	60 24	64 13	48
43	54 9	57 5	60 24	64 14	68 49	47
44	57 5	60 24	64 14	68 13	74 57	46
45	60 24	64 13	68 49	74 57	90 0	45
46	64 10	68 49	74 56	90 0		44
47	68 48	74 75	90 0			43
48	74 54	90 0				42
49	90 0					41

Foot column-labels (verbatim, left→right): 49 48 47 46 45.

Parsing notes: the left panel cells are slightly degraded but legible; the right panel is the highest pole-altitude corner of the residue. Cell at arg 41 col 41 reads "39 5" where the column trend suggests ~"49 5" — flagged. Cell at arg 47 col 42 reads "74 75" (minutes >59) — flagged.

TABLE 30 — Difference of the Oblique Ascension at the Cardinal Points of the Ecliptic, for Pole-Altitude 44° 30' 20"

Display heading (verbatim): *TAB. 30. Differ. Ascensionalis Punctor. Eclipt. ad Alt. Poli Gr. 44. 30'. 20".* — "Table 30. The ascensional difference of the points of the ecliptic, for pole-altitude 44° 30' 20"."

The table is arranged in three double-columns, one for each pair of signs sharing a value: Aries / Libra (☉ Boreal / ☉ Austral), Taurus / Scorpio (♉ Boreal / ♏ Austral), and Gemini / Sagittarius (♊ Boreal / ♐ Austral). The bottom labels give the

complementary signs: Virgo / Pisces (☿ Bor. / ♃ Aust.), Leo / Aquarius (♌ Bor. / ♎ Aust.), Cancer / Capricorn (♋ Bor. / ♏ Aust.). The argument (Gr. = degrees of the sign) runs 0→30 down the left stub, 30→0 up the right.

Column-head signs (verbatim):

- First pair: ☿ Bor. / ♃ Austr. (Aries Boreal / Libra Austral)
- Second pair: ♌ Bor. / ♎ Austr. (Taurus Boreal / Scorpio Austral)
- Third pair: ♋ Bor. / ♏ Austr. (Gemini Boreal / Sagittarius Austral)

Each entry gives degrees (Gr.), minutes (′), seconds (″).

Gr. ↓	☿/♌ Gr. ′ ″	♋/♎ Gr. ′ ″	♌/♏ Gr. ′ ″	Gr. ↑
0	0 0 0	11 32 19	21 12 30	30
1	0 23 54	11 54 22	21 27 34	29
2	0 47 2	12 16 18	21 42 10	28
3	1 10 33	12 38 10	21 56 36	27
4	1 34 3	12 50 12	22 10 30	26
5	1 57 2	13 20 22	22 23 56	25
6	2 21 2	13 42 40	22 37 0	24
7	2 44 30	14 3 52	22 49 35	23
8	3 7 58	14 25 0	23 1 44	22
9	3 31 20	14 45 57	23 13 30	21
10	3 51 50	15 6 40	23 24 20	20
11	4 18 17	15 27 16	23 35 32	19
12	4 41 31	15 47 42	23 45 45	18
13	5 4 46	16 7 50	23 55 0	17
14	5 35 48	16 27 50	24 4 40	16
15	5 51 18	16 47 36	24 13 35	15
16	6 14 27	17 7 11	24 21 45	14
17	6 36 36	17 26 39	24 29 30	13
18	7 0 46	17 45 38	24 36 38	12
19	7 23 45	18 4 28	24 41 59	11
20	7 46 42	18 22 58	24 50 9	10
21	8 9 40	18 41 22	24 54 50	9

Gr. ↓	♈/♈ Gr. ' "	♉/♉ Gr. ' "	♊/♊ Gr. ' "	Gr. ↑
22	8 32 27	18 59 7	24 59 47	8
23	8 55 26	19 17 6	25 4 5	7
24	9 17 27	19 34 35	25 7 56	6
25	9 40 35	19 51 47	25 11 0	5
26	10 3 6	20 8 35	25 13 45	4
27	10 25 34	20 25 5	25 15 5	3
28	10 47 54	20 41 15	25 16 0	2
29	11 10 27	20 57 0	25 18 10	1
30	11 32 19	21 12 30	25 18 30	0

Bottom column-labels (verbatim):

- First pair: ♈ B. / ♈ A. (Virgo Boreal / Pisces Austral)
- Second pair: ♉ B. / ♉ A. (Leo Boreal / Aquarius Austral)
- Third pair: ♊ B. / ♊ A. (Cancer Boreal / Capricorn Austral)

Catchword (verbatim):

Parsing notes: signs are read by their zodiac glyphs as printed; the doubling (Boreal/Austral, top/bottom) is the standard four-fold symmetry of the ascensional difference. Cell at arg 4, col ♈/♈ reads "12 50 12" where the smooth progression would suggest ~"13 0 12" — flagged. Cell at arg 9, col ♈/♈ reads "3 31 20"; arg 10 reads "3 51 50" where the step suggests ~"3 54 50" — flagged.

TABLE 31 — Oblique Ascension for Pole-Altitude 44° 30' 20" and Obliquity of the Ecliptic 23° 30' 20"

Display heading (verbatim): *TAB. 31. Ascensionis Obliquæ ad Altit. Poli Gr. 44. 30'. 20". & Obliq. Eclipt. 23. 30'. 20". — "Table 31. Of the oblique ascension, for pole-altitude 44° 30' 20" and obliquity of the ecliptic 23° 30' 20"."*

The table gives the oblique ascension (in degrees, minutes, seconds) against the degree of each zodiac sign. The first half (this top panel) covers Aries (♈), Taurus (♉), Cancer (♊), Leo (♌), Virgo (♍); the argument (Gr.) runs 1♈ 30♈ Gemini (♊) the left stub.

Column-head signs (verbatim): ♈ | ♉ | ♊ | ♌ | ♍ | ♎

Gr.	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "
1	0 31 17	16 56 58	37 23 32	65 47 16	102 17 0	141 52 55
2	1 2 58	17 33 23	38 11 28	66 54 0	103 35 5	143 12 28
3	1 34 32	18 8 21	38 59 56	68 2 11	104 53 11	144 32 45
4	2 6 6	18 54 8	39 49 4	69 7 53	106 11 34	145 50 54
5	2 37 41	19 21 0	40 28 53	70 15 45	107 30 2	147 10 14
6	3 9 21	19 57 50	41 29 12	71 24 15	108 48 46	148 29 56
7	3 40 57	20 34 56	42 20 18	72 33 28	110 7 33	149 48 26
8	4 12 47	21 12 15	43 31 40	73 42 58	111 26 42	151 7 45
9	4 44 30	21 50 9	44 3 43	74 53 5	112 45 19	152 26 45
10	5 16 9	22 28 6	44 46 29	76 3 39	114 4 5	153 45 49
11	5 48 15	23 6 24	45 49 44	77 16 0	115 23 29	155 4 50
12	6 20 57	23 45 8	46 43 41	78 26 21	116 42 30	156 23 45
13	6 52 28	24 24 0	47 38 13	79 38 21	118 2 30	157 43 42
14	7 25 7	25 3 47	48 33 9	80 50 51	119 22 1	159 1 34
15	7 56 44	25 43 47	49 29 9	82 4 1	120 41 5	160 20 40
16	8 29 32	26 23 33	50 25 39	83 16 51	122 0 33	161 31 27
17	9 3 5	27 5 9	51 22 39	84 30 47	123 20 10	161 58 0

Gr.	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "
18	9 34 43	27 45 50	52 20 23	85 44 49	124 39 28	164 16 41
19	10 7 40	28 27 35	53 20 9	86 59 7	125 59 33	165 35 17
20	10 40 49	29 9 31	54 17 43	88 14 17	127 18 34	166 57 17
21	11 13 55	29 51 57	55 17 15	89 29 14	128 37 57	168 13 50
22	11 47 21	30 35 4	56 17 28	90 44 52	129 57 45	169 31 25
23	12 20 47	31 18 18	57 17 22	92 0 42	131 17 20	170 50 3
24	12 55 10	32 2 4	58 19 53	93 16 48	132 36 50	172 8 39
25	13 28 36	33 46 26	59 41 57	94 33 47	133 56 26	174 21 15
26	14 4 14	33 30 16	60 24 37	95 49 51	135 25 28	174 45 48
27	14 36 7	34 16 39	61 28 39	97 24 6	136 35 18	176 4 22
28	15 11 44	35 2 30	62 33 20	97 24 6	137 53 51	177 22 52
29	15 46 23	35 49 5	63 36 24	99 41 5	139 14 17	178 41 5
30	16 21 38	36 35 51	64 41 30	100 59 9	140 33 44	180 0 0

TABLE 31 (continued) — Residue: Oblique Ascension, etc.

Heading (verbatim): *Residuum Tab. 31. Ascens. Obliq. &c.* — "Residue of Table 31. Of the oblique ascension, etc."

The second half covers Libra (♎), Scorpio (♏), Sagittarius (♐), Capricorn (♑), Aquarius (♒ →); argument (Gr.) runs 1♐ ♃♒♐♑♒♓♓♒♑♒♓♓♒♑♒♓

Column-head signs (verbatim): ♎ | ♏ | ♐ | ♑ | ♒ | ♓

Gr.	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "
1	181 18 55	220 45 42	260 18 30	296 23 36	324 11 0	344 13 37
2	182 37 32	222 6 9	261 35 48	297 27 40	324 57 30	344 48 16
3	183 55 38	223 24 42	262 53 8	298 32 2	325 43 21	345 23 53
4	185 14 16	224 34 32	264 10 9	299 35 23	326 28 44	345 56 46
5	186 34 45	226 3 40	265 36 45	300 38 3	327 13 34	346 31 14
6	187 51 21	227 25 10	266 53 12	301 40 7	327 57 56	347 4 50
7	189 9 57	228 42 40	267 59 18	302 41 38	328 41 45	347 39 18
8	190 28 27	230 2 15	269 5 30	303 42 32	329 24 56	348 12 39
9	191 47 10	231 22 3	270 30 43	304 42 45	330 7 3	348 46 5
10	193 2 56	232 41 26	271 55 49	305 42 17	330 50 29	349 19 13
11	194 24 43	234 0 56	273 9 48	306 39 58	331 32 25	349 52 20
12	195 43 19	235 20 32	274 15 11	307 39 39	332 14 0	350 25 15
13	197 2 0	236 39 40	275 29 13	308 37 21	332 55 0	350 56 54
14	198 28 33	237 59 27	276 43 4	309 34 21	333 36 16	351 30 28
15	199 39 20	239 18 59	278 6 9	310 31 11	334 16 13	352 3 16
16	200 58 26	240 37 55	279 9 9	311 26 31	334 56 13	352 45 3
17	202 16 18	241 57 30	280 11 9	312 21 11	335 36 0	353 7 32

Gr.	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "	□ Gr. ' "
18	203 36 8	243 17 6	281 33 39	313 16 19	336 14 52	353 39 43
19	204 55 10	244 36 31	282 44 0	314 10 9	336 53 36	354 11 51
20	206 14 11	245 55 27	283 56 21	315 3 31	337 32 54	354 40 44
21	207 33 15	247 14 41	285 6 55	315 56 9	338 9 12	355 15 30
22	208 52 15	249 33 18	286 17 20	316 48 10	338 47 45	355 47 21
23	210 11 34	249 52 27	287 26 32	317 39 12	339 25 4	356 19 3
24	211 29 54	251 11 14	288 35 45	318 30 48	340 2 10	356 50 43
25	212 49 46	252 29 58	289 41 17	319 21 7	340 39 0	357 22 15
26	214 10 16	253 47 26	290 52 7	320 10 51	341 5 2	357 53 54
27	215 27 15	255 6 49	291 58 49	321 0 14	341 51 38	358 25 28
28	216 47 32	256 25 0	293 6 0	322 48 31	342 26 7	358 57 2
29	217 7 17	257 43 0	294 30 44	322 36 33	343 3 1	359 28 33
30	219 26 16	259 0 51	295 18 30	323 24 9	343 38 23	360 0 0

Catchword (verbatim):

Parsing notes: clean ascension table. The Libra value at argument 30 (219° 26' 16") and the Pisces value at argument 30 (360° 0' 0") close the full circle. Cell at arg 22, col □ reads "249 33 18" where the column trend suggests ~"248 33 18" — flagged.

Cell at arg 28, col → reads "322 48 31" wh
suggests ~"321 48 31" — flagged. Cell at arg 29, col □ reads "322 36 33" — below
the preceding row, breaking the monotone progression — flagged.

Tabulae novalmagesticae — Table 32 (table-pages 26–28)

TABULA 32 — Oblique Ascension for varying pole altitudes (2° – 24°)

TAB. 32. *Ascensio Obliqua graduum Signor. Borealiū in Horizontib. Borealib. Australiū in Horiz. Australib. quam subtrahe gradib. 360. fietq; Asc. Obliqua Signor. Austral. in Horiz. Boreal. & Signor. Boreal. in Horiz. Austral.*

[Translation of title: **The Oblique Ascension of the degrees of the Northern Signs in the Northern Horizons [and of] the Southern [Signs] in the Southern Horizon; subtract this from 360 degrees, and there will result the Oblique Ascension of the Southern Signs in the Northern Horizon and of the Northern Signs in the Southern Horizon.**]

Banner across all column-groups: **Altitudines Poli** [Pole Altitudes].

Each pole-altitude (2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24) heads a paired sub-column: **Gr.** (degrees) and ' (minutes). The leftmost and rightmost stub columns (**G.**) give the argument: the degree (0–30) within each zodiacal sign. The left stub on this page (p. 26) runs from sign ♈ (Aries) and ♉ (Taurus); the right stub counts the complementary degrees. Entries are oblique ascension in degrees and minutes.

This single table spans table-pages 26–28. The three page-segments are transcribed in sequence below.

Parsing notes: This is a full-page citation-grade table with twelve pole-altitude column-pairs plus left and right argument stubs. Columns are tightly set; minute-values approaching the gutter and several digits on each page show ink-bleed and were read at the limit of resolution. Cells read with low confidence are flagged [?]. Sexagesimal minutes that read ≥ 60 are flagged as impossibles (see QA report). The argument runs in two half-page blocks per page (each headed by a zodiac glyph), with the right-hand stub counting down complementarily (30→0).

Segment 1 — table-page 26

Left-stub upper block headed ♈ (Aries); lower block headed ♉ (Taurus). Right stub headed **G.** counting down; lower-right marked ♈ / **X** region (the complementary

descending count). Column header row: G. 2/2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | G. each pole-altitude split Gr./.

Upper block (argument sign □ Aries, degrees 0–30):

	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2							
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	2	A								
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r								
g	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	g								
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3							
																				0							
1	0	5	0	5	0	5	0	5	0	5	0	4	0	4	0	4	0	4	0	4	2						
		4	3	2	1	0	9	8	7	6	5	4	2	9							9						
2	1	4	1	4	1	4	1	4	1	4	1	4	1	3	1	3	1	3	1	3	2	2					
		8	6	4	3	1	0	8	6	4	2	0	8	8								8					
3	2	4	2	4	2	3	2	3	2	3	2	3	2	2	2	2	2	2	1	2	1	2	2				
		2	0	7	4	2	0	7	4	1	9	6	3	7									7				
4	3	3	3	3	3	2	3	2	3	2	3	2	3	1	3	1	3	8	3	5	3	1	2	5	2		
		6	3	9	5	3	0	6	2																7	6	
5	4	3	4	2	4	2	4	1	4	1	4	1	4	5	4	1	3	5	3	5	3	4	3	4	2	2	
		1	7	2	8	4	0																			2	5
6	5	2	5	2	5	1	5	9	5	5	5	0	4	5	4	4	4	4	4	3	4	3	4	2	2	2	
		5	0	4																							4
7	6	1	6	1	6	7	6	1	5	5	5	5	5	4	5	3	5	3	5	2	5	1	5	1	2	2	
		9	3																								3
8	7	1	7	7	7	0	6	5	6	4	6	4	6	3	6	2	6	1	6	1	6	3	5	5	2	2	
		4																									2
9	8	8	8	0	7	5	7	4	7	3	7	3	7	2	7	1	7	5	6	5	6	4	6	4	2	2	
																											1
1	9	3	8	5	8	4	8	3	8	2	8	2	8	1	8	3	7	5	7	4	7	3	7	2	2	2	
																											0
1	9	5	9	4	9	3	9	2	9	2	9	1	9	1	8	5	8	4	8	3	8	2	8	9	1	1	
																											9
1	1	5	1	4	1	3	1	2	1	1	1	1	1	9	5	9	4	9	2	9	1	9	6	8	5	1	
																											1
2	0	2	0	1	0	2	0	1	0	1	0															8	
																											8
1	1	4	1	3	1	2	1	1	1	2	1	5	1	4	1	2	1	1	1	4	9	5	9	3	1	1	

					1	1	1	1	1	1	2	2	2							
	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A		
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r			
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g			

3	1	6	1	5	1	5	1	3	1	0	1	0	0	0	8	0	6	0		3	9	7			
1	1	4	1	2	1	1	1	5	1	5	1	4	1	2	1	1	1	4	1	5	1	3	1	2	1
4	2	1	2	9	2	8	2	1	3	1	1	1	1	9	1	6	1	0	1	0	8	0	4	6	
1	1	3	1	2	1	1	1	5	1	4	1	3	1	1	1	6	1	5	1	3	1	2	1	9	1
5	3	6	3	3	3	1	2	8	2	5	2	2	2	9	2	1	2	1	8	1	4	1	5		
1	1	3	1	1	1	4	1	5	1	3	1	2	1	9	1	5	1	4	1	2	1	1	1	5	1
6	4	0	4	7	4	3	0	3	6	3	2	3	2	5	2	0	2	5	2	0	1	4	4		
1	1	2	1	1	1	5	1	4	1	2	1	1	1	5	1	4	1	2	1	1	1	5	1	3	1
7	5	5	5	1	4	7	4	2	4	8	4	3	3	9	3	4	3	8	3	2	2	6	2	9	3
1	1	2	1	5	1	5	1	3	1	1	1	4	1	4	1	3	1	1	1	0	1	4	1	2	1
8	6	0	6	5	0	5	5	5	9	5	4	9	4	3	4	6	4	3	3	3	5	2			
1	1	1	1	5	1	4	1	2	1	1	1	5	1	3	1	2	1	4	1	4	1	2	1	1	1
9	7	5	6	9	6	3	6	7	6	1	5	5	5	9	5	3	5	4	7	4	9	4	0	1	
2	1	1	1	5	1	3	1	2	1	3	1	4	1	2	1	1	1	5	1	3	1	1	1	5	1
0	8	0	7	4	7	7	7	0	7	6	6	6	9	6	1	5	3	5	5	5	6	4	6	0	
2	1	5	1	4	1	3	1	1	1	5	1	3	1	1	1	0	1	4	1	2	1	3	1	4	9
1	9	8	8	8	1	8	3	7	5	7	7	7	9	7	6	2	6	3	6	5	2				
2	2	1	1	4	1	2	1	6	1	4	1	2	1	9	1	5	1	3	1	1	1	5	1	2	8
2	0	9	3	9	5	9	8	7	8	9	8	7	0	7	1	7	1	6	0	6	8				

[
?
]

2	2	5	2	3	2	1	1	5	1	4	1	2	1	0	1	4	1	2	1	5	1	3	1	1	7
3	0	6	0	8	0	9	9	9	9	0	9	0	9	8	0	8	0	7	9	7	7	7	7	4	
2	2	5	2	3	2	1	2	5	2	3	2	1	1	5	1	3	1	9	1	4	1	2	1	0	6
4	1	2	1	3	1	3	0	2	0	2	0	2	9	1	9	0	9	8	7	8	4	8			
2	2	4	2	2	2	7	2	4	2	2	2	4	2	4	2	2	1	5	1	3	1	1	1	4	5
5	2	8	2	8	2	1	6	1	5	1	0	2	0	0	9	8	9	5	9	1	8	7			
2	2	4	2	2	2	1	2	4	2	1	2	5	2	3	2	1	2	4	2	2	1	5	1	3	4
6	3	4	3	3	3	2	0	2	8	1	6	1	3	1	0	0	7	0	3	9	9	9	4		
2	2	4	2	1	2	5	2	3	2	1	2	4	2	2	1	2	3	2	1	2	4	2	2	3	

	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A							
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r							
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g							
7	4	0	4	8	3	6	3	4	3	1	2	8	2	4	2	1	7	1	1	0	7	0	1		
2	2	3	2	1	2	5	2	2	2	4	2	4	2	1	2	5	2	2	2	1	2	3	2	8	2
8	5	7	5	4	4	0	4	8	4	3	0	3	6	2	1	2	7	2	1	1	5	1			
2	2	3	2	9	2	4	2	2	2	5	2	3	2	7	2	4	2	1	2	5	2	2	2	5	1
9	6	3	6	5	5	5	2	4	7	4	2	4	3	2	3	7	2	2	2	2	2	1	5		
3	2	3	2	5	2	4	2	1	2	5	2	2	2	5	2	3	2	7	2	3	2	1	2	4	0
0	7	0	7	6	0	6	6	5	1	5	5	4	9	4	3	4	3	9	3	1	2	2			

Lower block (argument sign □ Taurus, degrees 0–30):

	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A							
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r							
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g							
0	2	3	2	5	2	4	2	1	2	5	2	2	2	5	2	3	2	7	2	3	2	1	2	4	X
	7	0	7	6	0	6	6	5	1	5	5	4	9	4	3	4	3	9	3	1	2	2			
1	2	2	2	1	2	3	2	1	2	4	2	1	2	5	2	2	2	5	2	2	2	5	2	3	2
	8	6	8	7	5	7	0	6	4	6	8	5	1	5	4	4	7	4	8	3	9	3	0	9	
2	2	2	2	5	2	3	2	4	2	3	2	1	2	4	2	1	2	4	2	1	2	4	2	1	2
	9	3	8	7	8	0	8	7	8	7	1	6	3	6	5	5	7	5	8	4	8	4	8	8	
3	3	2	2	5	2	2	2	5	2	3	2	4	2	3	2	7	2	3	2	8	2	3	2	7	2
	0	0	9	3	9	6	8	9	8	2	8	7	5	7	6	7	6	5	7	5	7				
4	3	1	3	4	3	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5	2
	1	7	0	9	0	1	9	3	9	5	8	6	8	7	7	8	7	8	6	8	6	6	5	4	6
5	3	1	3	4	3	1	3	4	3	1	2	5	2	2	2	5	2	1	2	4	2	1	2	4	2
	2	4	1	6	1	7	0	8	0	9	9	0	9	0	8	0	8	9	7	8	7	5	6	2	5
6	3	1	3	4	3	1	3	4	3	1	3	4	3	1	2	4	2	1	2	3	2	5	2	3	2
	3	1	2	3	2	3	1	3	1	4	0	4	0	3	9	2	9	0	8	8	8	7	1	4	
7	3	9	3	4	3	9	3	3	3	9	3	3	3	7	3	3	3	2	2	2	2	5	2	2	2
	4	3	0	3	2	9	2	1	8	1	0	5	0	9	9	8	5	8	0	3					
8	3	7	3	3	3	6	3	3	3	4	3	3	3	0	3	2	3	5	3	2	2	4	2	9	2

					1	1	1	1	1	2	2	2													
A	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r					
g	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	g				
	5	4	7	4	3	5	3	2	2	2	1	7	0	4	0	1	9	5	9	2					
9	3	5	3	3	3	3	3	3	5	3	2	3	5	3	2	3	4	3	1	3	3	2	5	2	
	6	5	4	5	4	1	3	9	3	7	2	4	2	0	1	6	1	2	0	5	9	8	1		
1	3	3	3	3	3	5	3	2	3	5	3	2	3	4	3	1	3	3	3	3	3	2	3	4	2
0	7	6	1	5	9	5	7	4	4	4	1	3	8	3	3	2	8	2	1	6	0	8	0		
1	3	1	3	2	3	5	3	2	3	4	3	1	3	4	3	6	3	3	3	5	3	1	3	3	1
1	8	7	8	6	6	6	3	5	9	5	6	4	1	4	3	0	2	5	2	7	1	8	9		
1	3	0	3	2	3	5	3	1	3	4	3	1	3	3	3	5	3	2	3	4	3	8	3	2	1
2	9	8	6	7	3	7	9	6	5	6	0	5	5	4	9	4	3	3	7	3	2	8	8		
1	3	5	3	2	3	5	3	1	3	4	3	5	3	3	3	5	3	1	3	3	3	5	3	1	1
3	9	8	9	4	8	0	8	6	7	1	7	6	0	5	3	5	6	4	9	3	9	3	8	7	
1	4	5	4	2	3	4	3	1	3	3	3	1	3	2	3	4	3	9	3	3	3	5	3	9	1
4	0	7	0	2	9	7	9	2	8	7	8	7	4	6	7	6	5	1	4	0	4	6			
1	4	5	4	2	4	4	4	9	3	3	3	5	3	1	3	4	3	2	3	2	3	4	3	0	1
5	1	6	1	0	0	5	0	9	3	8	6	8	9	7	1	7	6	3	5	1	5	5			
1	4	5	4	1	4	4	4	6	4	3	3	5	3	1	3	3	3	5	3	1	3	3	3	5	1
6	2	5	2	9	1	3	1	0	0	9	2	9	4	8	5	7	6	7	6	6	4	5	2	4	
1	4	5	4	1	4	4	4	4	4	2	4	4	4	9	3	3	3	5	3	1	3	2	3	4	1
7	3	5	3	8	2	1	2	1	7	0	8	0	9	1	8	0	8	0	7	6	6	4	3		
1	4	5	4	1	4	4	4	2	4	2	4	4	4	6	4	2	3	4	3	3	3	2	3	3	1
8	4	4	4	7	3	0	3	2	4	1	5	1	0	6	9	5	9	8	0	7	6	2			
1	4	5	4	1	4	3	4	0	4	2	4	4	4	1	4	2	4	3	3	5	3	1	3	2	1
9	5	4	5	6	4	8	4	3	2	2	2	2	1	1	0	9	9	7	9	3	8	8	1		
2	4	5	4	1	4	3	4	5	4	1	4	3	4	5	4	1	4	3	4	5	4	6	3	2	1
0	6	4	6	5	5	7	4	8	4	8	3	8	2	8	2	6	1	4	0	1	0	9	0	0	
2	4	5	4	1	4	3	4	5	4	1	4	3	4	5	4	1	4	2	4	4	4	0	4	1	9
1	7	4	7	5	6	6	5	6	5	6	4	5	3	3	3	2	9	1	5	1	0	3			
2	4	5	4	1	4	3	4	5	4	1	4	3	4	5	4	8	4	2	4	4	4	5	4	6	8
2	8	5	8	5	7	5	6	5	6	4	5	2	4	0	4	3	4	2	0	1	4	1			

					1	1	1	1	1	2	2	2													
A	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r					
g	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	g				
2	4	5	4	1	4	3	4	5	4	1	4	3	4	4	4	4	4	1	4	3	4	4	4	5	7
3	9	5	9	5	8	4	7	3	7	2	6	0	5	7	5		4	9	3	4	2	8	1	9	
2	5	5	5	1	4	3	4	5	4	1	4	2	4	4	4	0	4	1	4	2	4	4	4	5	6
4	0	5	0	5	9	3	8	2	8	0	7	7	6	4	6		5	5	4	9	3	2	2	3	
2	5	5	5	1	5	3	4	5	4	8	4	2	4	4	4	[	4	1	4	2	4	3	4	4	5
5	1	6	1	5	0	3	9	1	9		8	5	7	1	7	?	6	1	5	4	4	6	3	7	
]									
2	5	5	5	1	5	3	5	5	5	7	4	2	4	3	4	5	4	7	4	2	4	3	4	4	4
6	2	7	2	6	1	3	0	0	0		9	3	8	9	7	4	7		6	0	5	2	4	1	
2	5	5	5	1	5	3	5	5	5	6	5	2	4	3	4	5	4	4	4	1	4	2	4	3	3
7	3	9	3	7	2	3	1	0	1		0	2	9	7	8	1	8		7	6	6	7	5	6	
2	5	0	5	1	5	3	5	5	5	6	5	2	5	3	4	4	4	1	4	1	4	2	4	3	2
8	5		4	8	3	4	2	0	2		1	0	0	5	9	9	9		8	3	7	3	6	1	
2	5	2	5	1	5	3	5	5	5	6	5	2	5	3	5	4	4	5	4	9	4	1	4	2	1
9	6		5	9	4	5	3	1	3		2	0	1	3	0	7	9	8	9		8	9	7	7	
3	5	4	5	2	5	3	5	5	5	6	5	1	5	3	5	4	5	5	5	6	4	1	4	2	0
0	7		6	0	5	5	4	1	4		3	9	2	2	1	5	0	6	0		9	5	8	2	

Segment 2 — table-page 27

Left-stub upper block headed ♊ (Gemini); lower block headed ♋ (Cancer / ♋ glyph with the descending right-stub). Same twelve pole-altitude column-pairs.

Upper block (argument sign ♊ Gemini, degrees 0–30):

					1	1	1	1	1	2	2	2													
A	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r					
g	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	g				
0	5	4	5	2	5	3	5	5	5	5	5	5	3	5	4	5	5	5	6	4	1	4	2	3	
	7		6	4	5	5	4	1	4		3	9	2	2	1	5	0	6	0		9	5	8	2	0
1	5	6	5	2	5	3	5	5	5	5	5	1	5	3	5	4	5	5	5	4	5	1	4	1	2

									1	1	1	1	1	1	2	2	2				
	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2	
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A			
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r			
g	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	r	'	g

8 7 2 6 6 5 1 5 4 9 3 1 2 4 1 4 1 0 2 9 8 9

2 5 8 5 2 5 4 5 5 5 6 5 1 5 3 5 4 5 5 5 2 5 9 5 1 2

9 8 4 7 8 6 2 6 5 9 4 0 3 3 2 2 2 1 0 5 8

3 6 1 5 2 5 3 5 5 5 6 5 1 5 3 5 4 5 5 5 1 5 8 5 1 2

0 1 9 6 8 9 7 3 7 6 8 5 0 4 2 3 2 2 1 0 3 7

4 6 1 6 2 5 4 5 5 5 7 5 1 5 3 5 4 5 5 5 0 5 6 5 1 2

1 3 0 8 9 1 8 4 8 7 9 6 0 5 1 4 1 3 2 1 1 6

5 6 1 6 3 6 4 5 5 5 8 5 1 5 3 5 4 5 5 5 5 5 4 5 9 2

2 6 1 0 0 3 9 6 9 8 9 7 0 6 1 5 1 4 9 3 2 5

6 6 1 6 3 6 4 6 5 6 9 5 2 5 3 5 4 5 5 5 5 5 4 5 7 2

3 9 2 2 1 5 0 8 0 9 0 8 0 7 0 6 0 5 8 5 3 4

7 6 2 6 3 6 4 6 0 6 1 6 2 5 3 5 4 5 4 5 5 5 1 5 5 2

4 2 3 5 2 7 1 1 1 0 1 9 1 8 0 7 9 6 6 6 1 4 3

[
?
]

8 6 2 6 3 6 5 6 2 6 1 6 2 6 3 5 4 5 4 5 5 5 5 5 3 2

5 5 4 8 3 0 2 1 2 1 2 0 1 9 0 8 9 7 6 6 8 5 2

9 6 2 6 4 6 5 6 4 6 1 6 2 6 3 6 4 5 4 5 5 5 5 5 1 2

6 8 5 1 4 2 3 4 4 2 3 1 2 0 0 9 9 8 5 7 8 6 1

[
?
]

1 6 3 6 4 6 5 6 6 6 1 6 2 6 3 6 4 6 4 5 5 5 5 5 5 2

0 7 2 6 4 5 5 4 4 6 3 5 2 4 1 1 0 8 9 3 8 7 7 9 0

1 6 3 6 4 6 5 6 9 6 1 6 2 6 3 6 4 6 4 6 5 5 5 5 5 1

1 8 6 7 7 6 8 6 5 8 4 7 3 5 2 2 1 9 0 3 9 7 8 9 9

1 6 4 6 5 6 1 6 1 6 2 6 2 6 3 6 4 6 5 6 5 6 5 5 5 1

2 9 0 8 1 8 7 1 6 0 5 9 4 6 3 3 2 0 1 3 0 8 9 9 8

1 7 4 6 5 6 5 6 1 6 2 6 3 6 4 6 4 6 5 6 5 6 5 6 5 1

3 0 4 9 5 9 8 5 7 3 6 2 5 0 4 7 3 1 2 5 1 9 0 9 7

									1	1	1	1	1	1	2	2	2			
	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A		
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r		
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g		

1 7 4 7 5 7 8 6 1 6 2 6 4 6 4 6 4 6 5 6 5 6 1 6 5 1
4 1 8 0 9 0 9 8 8 6 7 2 6 2 5 9 4 3 3 7 3 1 9 6
1 7 5 7 3 7 1 7 2 6 2 6 3 6 4 6 5 6 5 6 0 6 1 6 0 1
5 2 3 2 1 2 0 1 9 8 8 8 7 5 6 1 5 7 5 4 3 5
1 7 5 7 7 7 1 7 2 7 3 6 4 6 4 6 5 6 5 6 1 6 3 6 1 1
6 3 7 3 2 6 1 5 0 2 9 1 8 8 7 4 6 7 6 5 4 4
1 7 2 7 1 7 2 7 2 7 3 7 4 6 5 6 5 6 5 6 5 6 5 6 3 1
7 5 4 1 3 0 2 9 0 6 0 4 9 1 8 6 7 7 6 6 5 3
1 7 6 7 1 7 2 7 3 7 4 7 4 7 5 6 0 6 6 6 6 6 6 6 5 1
8 6 5 5 4 4 3 3 2 0 1 8 0 4 9 9 7 6 5 2
1 7 1 7 1 7 2 7 3 7 4 7 5 7 5 7 2 7 7 6 7 6 7 6 7 1
9 7 1 6 9 5 8 4 7 3 4 2 1 1 7 1 0 8 7 6 1
2 7 1 7 2 7 3 7 4 7 4 7 5 7 0 7 5 7 8 7 1 6 1 6 9 1
0 8 6 7 4 6 3 5 1 4 8 3 5 3 2 1 0 1 9 1 8 0
2 7 2 7 2 7 3 7 4 7 5 7 5 7 4 7 9 7 1 7 1 7 1 6 1 9
1 9 1 8 9 7 7 6 5 5 2 4 9 4 3 2 2 1 4 0 4 9 3
2 8 2 7 3 7 4 7 5 7 5 7 2 7 7 7 1 7 1 7 1 7 1 7 1 8
2 0 6 9 4 8 2 7 0 6 6 6 5 4 2 3 5 2 7 1 7 0 5
2 8 3 8 3 7 4 7 5 7 1 7 7 7 1 7 1 7 2 7 2 7 2 7 1 7
3 1 1 0 9 9 7 8 4 8 7 6 2 5 7 4 0 3 1 2 1 1 8
2 8 3 8 4 8 5 7 5 7 6 7 1 7 1 7 2 7 2 7 2 7 2 7 2 6
4 2 6 1 4 0 2 9 9 9 8 1 7 6 6 1 5 4 4 5 3 3 2 1
2 8 4 8 4 8 5 8 4 8 1 7 1 7 2 7 2 7 2 7 2 7 2 7 2 5
5 3 1 2 9 1 7 1 0 0 9 6 8 1 7 5 6 8 5 9 4 9 3 6
2 8 4 8 5 8 2 8 8 8 1 8 2 7 2 7 3 7 3 7 3 7 3 7 3 4
6 4 6 3 4 3 2 1 5 0 0 9 5 8 0 7 3 6 4 5 3 4 0
2 8 5 8 5 8 7 8 1 8 2 8 2 8 3 7 3 7 3 7 3 7 3 7 3 3
7 5 1 4 9 4 3 4 2 0 1 5 0 1 9 5 8 8 7 9 6 7 5 5
2 8 5 8 4 8 1 8 1 8 2 8 3 8 3 8 4 7 4 7 4 7 4 7 4 2
8 6 7 6 5 2 4 9 3 5 2 0 1 6 0 0 9 3 8 4 7 2 6 0
2 8 2 8 9 8 1 8 2 8 3 8 3 8 4 8 4 8 4 7 4 7 4 7 4 1

	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A							
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r							
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g							
9	8	7	6	7	5	4	4	0	3	6	2	1	1	5	0	8	9	9	8	7	7	5			
3	8	8	8	1	8	2	8	3	8	3	8	4	8	4	8	5	8	5	8	5	7	5	7	5	0
0	9	8	5	7	3	6	0	5	6	4	2	3	6	2	0	1	3	0	4	9	2	8	0		

Lower block (argument sign □ Cancer, degrees 0–30):

	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A							
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r							
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g							
0	8	8	8	1	8	2	8	3	8	3	8	4	8	4	8	5	8	5	8	5	7	5	7	5	3
	9	8	5	7	3	6	0	5	6	4	2	3	6	2	0	1	3	0	4	9	2	8	0	0	
1	9	1	8	2	8	2	8	3	8	4	8	4	8	5	8	5	8	5	8	5	8	5	7	5	2
	0	4	9	1	8	9	7	5	6	2	5	7	4	1	3	5	2	8	1	9	0	8	9	6	9
2	9	1	9	2	8	3	8	4	8	4	8	5	8	5	8	5	8	1	8	2	8	2	8	2	2
	1	9	0	7	9	5	8	1	7	7	6	1	5	5	4	9	4	3	1	1	8				
3	9	2	9	3	9	4	8	4	8	5	8	5	8	1	8	4	8	6	8	7	8	5	8	3	2
	2	5	1	2	0	0	9	6	8	3	7	7	7	6	5	4	3	2	7						
4	9	3	9	5	9	4	9	5	8	5	8	2	8	6	8	9	8	1	8	1	8	9	8	6	2
	3	0	2	8	1	6	0	2	9	8	9	8	7	6	1	5	1	4	3	6					
5	9	3	9	4	9	5	9	5	9	4	9	7	8	1	8	1	8	1	8	1	8	1	8	9	2
	4	5	3	3	2	1	1	8	1	0	9	1	8	3	7	4	6	4	5	2	4	5			
6	9	4	9	4	9	5	9	3	9	9	9	1	9	2	8	2	8	2	8	2	8	2	8	1	2
	5	1	4	8	3	7	3	2	1	6	0	1	9	5	8	8	7	5	6	2	5	7	4		
7	9	4	9	5	9	5	9	9	9	1	9	2	9	2	9	3	8	3	8	3	8	3	8	3	2
	6	6	5	4	4	4	3	6	2	2	1	7	0	1	9	5	8	6	7	4	6	1	3		
8	9	5	9	0	9	8	9	1	9	2	9	3	9	3	9	3	9	3	8	3	8	4	8	4	2
	7	2	7	6	5	5	4	2	3	3	2	9	1	7	0	9	9	8	8	3	7	1	2		
9	9	5	9	5	9	1	9	2	9	2	9	3	9	3	9	4	9	4	9	5	8	4	8	4	2
	8	7	8	7	4	6	1	5	8	4	5	3	9	2	4	1	8	0	0	9	9	8	8	1	
1	1	2	9	1	9	1	9	2	9	3	9	3	9	4	9	4	9	5	9	5	9	5	9	0	2

									1	1	1	1	1	2	2	2				
	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A		
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r			
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g			

0	0	9	0	8	9	7	7	6	4	5	9	4	4	3	9	2	3	1	6	0	6	0	0		
0																									
1	1	7	1	1	9	2	9	3	9	4	9	4	9	5	9	5	9	0	9	2	9	4	9	2	1
1	0	0	6	9	5	8	3	7	0	6	7	5	2	4	6	4	3	2	1	9					
1		0																							
1	1	1	1	2	1	3	9	3	9	4	9	5	9	5	9	4	9	8	9	1	9	1	9	1	1
2	0	2	0	1	0	0	9	9	8	6	7	2	6	9	6	5	4	2	3	2	2	0	8		
2		1	0																						
1	1	1	1	2	1	3	1	4	9	5	9	5	9	6	9	1	9	1	9	1	9	1	9	1	1
3	0	7	0	7	0	6	0	4	9	2	9	8	7	1	6	5	5	8	4	8	3	8	7		
3		2	1	0																					
1	1	2	1	3	1	4	1	5	1	5	1	6	9	1	9	1	9	2	9	2	9	2	9	2	1
4	0	2	0	2	0	1	0	0	0	7	0	9	3	8	9	7	2	6	5	5	5	4	6	6	
4		3	2	1	0	0																			
1	1	2	1	3	1	4	1	5	1	3	1	1	1	1	9	2	9	2	9	3	9	3	9	3	1
5	0	7	0	7	0	6	0	5	0	0	2	0	9	9	5	8	9	7	3	6	5	5	4	5	
5		4	3	2	2	1	0																		
1	1	3	1	4	1	5	1	1	1	9	1	1	1	2	1	3	9	3	9	4	9	4	9	4	1
6	0	2	0	2	0	2	0	0	0	7	0	6	0	2	9	7	8	0	7	3	6	2	4		
6		5	4	4	3	2	1	0																	
1	1	3	1	4	1	5	1	7	1	1	1	2	1	3	1	3	1	4	9	4	9	5	9	5	1
7	0	7	0	7	0	7	0	0	6	0	3	0	3	0	9	0	4	9	8	8	0	7	0	3	
7		6	5	5	4	3	2	1	0																
1	1	4	1	5	1	3	1	1	1	2	1	3	1	4	1	4	1	5	1	5	1	0	9	5	1
8	0	1	0	3	0	0	3	0	2	0	1	0	0	0	6	0	3	0	6	0	8	8	2		
8		7	7	6	5	4	3	2	1	0															
1	1	4	1	5	1	8	1	1	1	2	1	3	1	4	1	5	1	5	1	3	1	7	1	6	1
9	0	6	0	7	0	0	8	0	8	0	8	0	7	0	4	0	9	0	0	0	0	1			
9		8	8	7	6	5	4	3	2	2	1	0													
2	1	5	1	2	1	1	1	2	1	3	1	4	1	5	1	0	1	6	1	1	1	1	1	1	1
0	1	0	1	0	3	0	4	0	4	0	3	0	3	0	0	0	0	1	0	6	0	6	0	0	

	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0					
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G					
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'					
	0	0	9	8	7	6	5	5	4	3	2	1													
2	1	5	1	7	1	1	1	3	1	4	1	4	1	7	1	5	1	1	1	1	2	1	2	9	
1	1	4	1	1	8	0	0	0	0	0	9	0	[	0	1	0	8	0	8	0	3	0	5		
	1	1	0	9	8	7	6	?	5	4	4	3	2												
]												
2	1	5	1	1	1	2	1	3	1	4	1	5	1	7	1	1	1	2	1	3	1	3	1	3	8
2	1	8	1	1	1	3	1	5	0	6	0	5	0	0	4	0	4	0	1	0	1	0	5		
	2	2	1	0	9	8	8	6	5	4	4	3													
2	1	2	1	1	1	2	1	4	1	5	1	2	1	1	1	2	1	2	1	3	1	3	1	4	7
3	1	1	6	1	8	1	1	1	1	1	0	2	0	1	0	9	0	4	0	9	0	3			
	4	3	2	1	0	0	9	8	7	6	5	4													
2	1	6	1	2	1	3	1	4	1	5	1	7	1	1	1	2	1	3	1	4	1	4	1	5	6
4	1	1	0	1	3	1	5	1	7	1	1	6	0	5	0	3	0	1	0	7	0	2			
	5	4	3	2	1	1	0	9	8	7	6	5													
2	1	1	1	2	1	3	1	5	1	2	1	1	1	2	1	3	1	3	1	5	1	5	1	1	5
5	1	0	1	4	1	7	1	0	1	1	2	1	2	1	1	0	9	0	0	0	6	0			
	6	5	4	3	3	2	1	0	9	8	7	7													
2	1	1	1	2	1	4	1	5	1	6	1	1	1	2	1	4	1	5	1	5	1	1	1	1	4
6	1	4	1	8	1	2	1	5	1	1	9	1	8	1	1	1	1	0	8	0	0	0	0		
	7	6	5	4	4	3	2	1	0	9	8	8													
2	1	1	1	3	1	4	1	0	1	1	1	2	1	3	1	4	1	5	1	6	1	1	1	1	3
7	1	8	1	2	1	6	1	1	3	1	5	1	7	1	8	1	8	1	0	4	0	9			
	8	7	6	6	5	4	3	2	1	1	9	9													
2	1	2	1	3	1	5	1	5	1	1	1	3	1	4	1	5	1	1	1	1	1	1	2	1	2
8	1	1	1	6	1	1	1	1	9	1	1	1	3	1	1	1	4	1	4	1	3	1	8		
	9	8	7	7	6	5	4	3	2	2	1	0													
2	1	2	1	4	1	5	1	9	1	2	1	3	1	4	1	5	1	2	1	2	1	3	1	3	1
9	2	5	1	0	1	5	1	1	3	1	5	1	7	1	8	1	2	1	2	1	1	1	7		
	0	9	8	8	7	6	5	4	4	3	2	1													
3	1	2	1	4	1	5	1	1	1	2	1	4	1	5	1	4	1	2	1	3	1	3	1	4	0
0	2	8	2	4	1	9	1	4	1	9	1	1	1	3	1	1	0	1	0	1	9	1	6		

	2	4	6	8	0	1	2	1	4	1	6	1	8	1	0	2	2	2	4	2					
A	2	4	6	8	0	2	4	6	8	0	2	4	6	8	0	2	4	A							
r	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	r							
g	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	g							
2	1	2	1	2	1	1	1	1	1	5	1	5	1	4	1	4	1	3	1	3	1	2	1	2	6
4	7	5	7	0	7	5	7	0	7	7	3	7	9	7	3	7	8	7	3	7	7	7	7	1	
	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3								
2	1	2	1	1	1	1	1	8	1	4	1	5	1	4	1	4	1	3	1	3	1	3	1	3	5
5	7	1	7	7	7	3	7	7	7	3	7	6	7	4	7	9	7	5	7	2	7	2			
	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	3	[
																									?
]
2	1	1	1	1	1	1	1	7	1	4	1	5	1	4	1	4	1	4	1	3	1	3	1	3	4
6	7	7	7	4	7	0	7	7	7	6	7	9	7	6	7	1	7	8	7	6	7	8			
	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5								
2	1	1	1	1	1	8	1	5	1	4	1	5	1	5	1	5	1	5	1	5	1	4	1	4	3
7	7	3	7	1	7	7	7	7	7	7	7	5	7	2	7	0	7	0	7	4	7	4			
	7	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6							
2	1	9	1	7	1	5	1	2	1	0	1	5	1	5	1	5	1	5	1	5	1	5	1	4	2
8	7	7	7	7	7	7	7	7	7	8	7	7	7	5	7	3	7	3	7	1	7	9			
	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7							
2	1	5	1	4	1	3	1	2	1	0	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
9	7	7	7	7	7	7	7	7	7	9	7	9	7	8	7	7	7	6	7	6	7	5			
	9	9	9	9	9	9	8	8	8	8	8	8	8	8	8	8	8								
3	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0
0	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8								
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								

Lower-right closing marker on table-page 28: the quadrant closes at **180° 0'** for every pole-altitude (argument 30 of Virgo ☐), completing the half-circle of oblique ascension.

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
	43	42	41	40	38	37	36	35	34	33	32	31	
2	1	1	1	1	1	1	1	1	1 8	1 6	1 4	1 2	28
	26	24	22	20	17	15	12	10					
3	2	2 6	2 3	2 0	1	1	1	1	1	1	1	1	27
	10				56	52	49	41	42	40	38	36	
4	2	2	2	2	2	2	2	2	2	2	2	2 8	26
	53	48	44	40	35	30	25	16	16	13	11		
5	3	3	3	3	3	3 8	3 2	2	2	2	2	2	25
	37	31	25	20	14			55	51	47	44	40	
6	4	4	4 7	4 0	3	3	3	3	3	3	3	3	24
	20	13			53	46	38	30	25	20	16	12	
7	5 4	4	4	4	4	4	4	4 5	4 0	3	3	3	23
		56	48	40	32	24	14			54	49	44	
8	5	5	5	5	5	5 2	4	4	4	4	4	4	22
	47	38	30	21	11		51	40	34	28	22	16	
9	6	6	6	6 0	5	5	5	5	5 8	5 2	4	4	21
	31	21	11		50	40	27	15			55	48	
10	7	7 3	6	6	6	6	6 4	5	5	5	5	5	20
	15		53	42	30	18		51	43	36	28	20	
11	7	7	7	7	7 9	6	6	6	6	6	6 1	5	19
	58	46	34	22		56	41	26	18	10		52	
12	8	8	8	8 3	7	7	7	7 1	6	6	6	6	18
	42	29	16		48	34	18		53	44	34	25	
13	9	9	8	8	8	8	7	7	7	7	7 8	6	17
	26	12	58	43	28	12	55	37	28	18		57	
14	10	9	9	9	9 7	8	8	8	8 3	7	7	7	16
	10	55	40	24		50	31	12		52	41	30	
15	10	10	10	10	9	9	9 9	8	8	8	8	8 3	15
	54	38	22	5	47	29		48	38	26	15		
16	11	11	11	10	10	10	9	9	9	9 0	8	8	14
	38	21	4	46	27	7	46	24	13		48	36	

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
17	12	12	11	11	11	10	10	10	9	9	9	9	13
	22	4	46	27	7	46	24	0	48	35	22		
18	13	12	12	12	11	11	11	10	10	10	9	9	12
	6	48	28	8	47	25	1	36	24	10	56	42	
19	13	13	13	12	12	12	11	11	10	10	10	10	11
	51	31	11	49	27	4	39	12	59	45	30	15	
20	14	14	13	13	13	12	12	11	11	11	10	10	10
	36	15	54	31	7	43	17	48	35	20	49	49	
21	15	14	14	14	13	13	12	12	12	11	11	11	9
	21	59	37	13	48	22	55	25	11	55	39	23	
22	16	15	15	14	14	14	13	13	12	12	12	11	8
	6	43	20	55	29	2	33	2	47	31	14	57	
23	16	16	16	15	15	14	14	13	13	13	12	12	7
	51	27	2	36	9	41	11	39	23	6	49	31	
24	17	17	16	16	15	15	14	14	13	13	13	13	6
	36	11	46	19	51	21	49	16	59	42	24	5	
25	18	17	17	17	16	16	15	14	14	14	13	13	5
	21	56	29	2	32	1	28	54	36	18	59	39	
26	19	18	18	17	17	16	16	15	15	14	14	14	4
	8	26	13	44	13	41	7	32	14	54	34	14	
27	19	19	18	18	17	17	16	16	15	15	15	14	3
	54	26	57	27	55	21	46	10	50	30	10	49	
28	20	20	19	19	18	18	17	16	16	16	15	15	2
	40	11	41	10	37	2	25	48	28	7	46	24	
29	21	20	20	19	19	18	18	17	17	16	16	16	1
	26	56	25	53	19	43	5	26	5	44	22	0	
30	22	21	21	20	20	19	18	18	17	17	16	16	0
	12	41	9	36	1	24	45	4	43	22	58	34	

[Right-margin foot of upper block: marker × (X)]

Lower block (sign ♂Taurus; argument 0–30; right-argument 30–0)

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
0	22 12	21 41	21 9	20 36	20 1	19 25	18 45	18 4	17 43	17 21	16 58	16 34	30
1	22 59	22 27	21 54	21 20	20 43	20 5	19 25	18 43	18 21	17 58	17 35	17 10	29
2	23 46	23 13	22 39	22 4	21 26	20 46	20 5	19 22	18 59	18 36	18 12	17 46	28
3	24 33	23 59	23 24	22 48	22 9	21 28	20 45	20 1	19 38	19 13	18 49	18 22	27
4	25 20	24 45	24 9	23 32	22 52	22 10	21 26	20 40	20 16	19 51	19 26	18 58	26
5	26 7	25 31	24 54	24 16	23 35	22 52	22 7	21 20	20 55	20 29	20 3	19 35	25
6	26 55	26 18	25 40	25 1	24 19	23 35	22 49	22 0	21 34	21 8	20 41	20 12	24
7	27 43	27 5	26 26	25 46	25 3	24 18	23 31	22 41	22 14	21 48	21 20	20 50	23
8	28 31	27 53	27 13	26 31	25 47	25 1	24 13	23 22	22 54	22 27	21 58	21 28	22
9	29 20	28 41	28 0	27 17	26 32	25 45	24 55	24 3	23 34	23 6	22 37	22 6	21
10	30 10	29 29	28 47	28 3	27 17	26 29	25 38	24 45	24 15	23 46	23 16	22 45	20
11	30 58	30 17	29 34	28 49	28 2	27 13	26 21	25 26	24 56	24 26	23 56	23 24	19
12	31 47	31 5	30 21	29 36	28 48	27 57	27 4	26 8	25 38	25 7	24 36	24 3	18
13	32 37	31 54	31 9	30 22	29 33	28 41	27 47	26 50	26 19	25 48	25 16	24 43	17
14	33 27	32 43	31 57	31 9	30 19	29 26	28 31	27 32	27 1	26 29	25 56	25 22	16

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
15	34 17	33 32	32 45	31 56	31 5	30 11	29 15	28 14	27 43	27 10	26 37	26 2	15
16	35 8	34 22	33 34	32 44	31 52	30 57	29 59	28 57	28 26	27 52	27 19	26 44	14
17	35 59	35 12	34 23	33 32	32 39	31 43	30 43	29 40	29 9	28 35	28 1	27 25	13
18	36 50	36 2	35 13	34 21	33 27	32 30	31 29	30 24	29 53	29 18	28 44	28 6	12
19	37 41	36 53	36 3	35 10	34 15	33 17	32 15	31 9	30 38	30 2	29 26	28 48	11
20	38 33	37 44	36 53	35 59	35 3	34 4	33 1	31 54	31 24	30 46	30 9	29 30	10
21	39 25	38 35	37 43	36 49	35 52	34 52	33 48	32 41	32 9	31 30	30 53	30 13	9
22	40 17	39 27	38 34	37 39	36 41	35 40	36 28	33 27	32 53	32 15	31 37	30 57	8
23	41 10	40 19	39 25	38 29	37 31	36 28	35 24	34 14	33 37	33 2	32 21	31 40	7
24	42 3	41 11	40 16	39 19	38 21	37 16	36 10	35 0	34 23	33 45	33 6	32 24	6
25	42 56	42 3	41 8	40 11	39 9	38 4	36 58	35 47	35 10	34 32	33 50	33 8	5
26	43 50	42 56	42 0	41 3	40 0	38 53	37 47	36 35	35 56	35 16	34 33	33 53	4
27	44 44	43 49	42 53	41 54	40 53	39 46	38 36	37 22	36 44	36 1	35 18	34 39	3
28	45 38	44 42	43 45	42 46	41 42	40 36	39 26	38 10	37 30	36 50	36 6	35 25	2
29	46 33	45 37	44 39	43 38	42 34	41 27	40 16	39 0	38 20	37 36	36 56	36 11	1
30	47	46	45	44	43	42	41	39	39	38	37	36	0

	26	28	30	32	34	36	38	40	41	42	43	44	
	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	
	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	
G.	)	)	)	)	)	)	)	)	)	)	)	)	G.
	28	31	32	31	26	18	6	49	9	27	44	59	

[Foot of page: signature "I"; right-foot folio number "26".]

Table-page 30

[Table heading, verbatim]: *Ascensio Obliqua pro gradibus Signor. Borealiū in Horizontib. Borealib. & pro gradib. Signor. Australiū in Horizont. Australib. Pro reliquis vide initium Tabulae.* — "The oblique ascension for the degrees of the northern signs in northern horizons, and for the degrees of the southern signs in southern horizons. For the rest, see the beginning of the Table."

[Sub-heading, verbatim]: *Altitudines Poli.* — "Altitudes of the pole."

Pole-altitude headers: **26, 28, 30, 32, 34, 36, 38, 40, 41, 42, 43, 44.** Upper block (sign ☊ Gemini, argument 0–30, right-argument 30–0); lower block (sign ☋ Cancer marker, continuing, right-argument header at the marker, argument 0–30).

Upper block (sign ☊ Gemini; argument 0–30; right-argument 30–0)

	26	28	30	32	34	36	38	40	41	42	43	44	
	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	
	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	
G.	)	)	)	)	)	)	)	)	)	)	)	)	G.
0	47	46	45	44	43	42	41	39	39	38	37	36	30
	28	31	32	31	26	18	6	49	9	27	44	59	
1	48	47	46	45	44	43	41	40	39	39	38	37	29
	24	26	27	25	19	10	57	39	58	16	33	47	
2	49	48	47	46	45	44	42	41	40	40	39	38	28
	20	21	22	19	12	2	48	30	48	6	22	36	
3	50	49	48	47	46	44	43	42	41	40	40	39	27
	16	17	17	13	6	55	40	21	39	56	12	26	
4	51	50	49	48	47	45	44	43	42	41	41	40	26
	12	13	12	7	0	48	32	12	30	46	2	16	
5	52	51	50	49	47	46	45	44	43	42	41	41	25
	9	9	7	2	54	42	25	4	22	37	52	6	

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
6	53 6	52 6	51 3	49 58	48 49	47 36	46 18	44 56	44 14	43 29	42 43	41 55	24
7	54 4	53 3	52 0	50 54	49 44	48 30	47 12	45 49	45 7	44 20	43 35	42 46	23
8	55 3	54 0	52 57	51 50	50 40	49 25	48 6	46 43	45 59	45 13	44 27	43 38	22
9	56 2	54 58	53 54	52 46	51 36	50 20	49 0	47 37	46 53	46 6	45 20	44 30	21
10	56 59	55 56	54 51	53 42	52 32	51 16	49 56	48 32	47 47	47 1	46 13	45 23	20
11	57 58	56 55	55 50	54 40	53 29	52 12	50 53	49 27	48 42	47 56	47 8	46 17	19
12	58 58	57 54	56 49	55 38	54 26	53 9	51 49	50 23	49 38	48 51	48 1	47 11	18
13	59 58	58 54	57 48	56 37	55 24	54 7	52 46	51 19	50 34	49 47	48 57	48 6	17
14	60 58	59 54	58 47	57 36	56 23	55 5	53 43	52 16	51 30	50 43	49 53	49 1	16
15	61 58	60 54	59 47	58 36	57 22	56 4	54 41	53 13	52 27	51 39	50 49	49 57	15
16	62 59	61 55	60 47	59 36	58 21	57 3	55 39	54 11	53 25	52 36	51 46	50 53	14
17	64 0	62 56	61 48	60 36	59 21	58 2	56 38	55 9	54 23	53 34	52 44	51 50	13
18	65 2	63 57	62 49	61 37	60 21	59 2	57 37	56 8	55 21	54 33	53 42	52 48	12
19	66 4	64 58	63 50	62 38	61 22	60 2	58 37	57 7	56 21	55 31	54 40	53 47	11
20	67 6	66 0	64 51	63 39	62 23	61 3	59 38	58 7	57 20	56 31	55 39	54 46	10
21	68	67	65	64	63	62	60	59	58	57	56	55	9

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
	9	2	53	41	24	4	39	7	21	30	39	45	
22	69	68	66	65	64	63	61	60	59	58	57	56	8
	12	5	56	43	26	6	40	8	21	31	38	45	
23	70	69	67	66	65	64	62	61	60	59	58	57	7
	15	8	59	45	28	8	42	10	22	32	41	46	
24	71	70	69	67	66	65	63	62	61	60	59	58	6
	18	11	2	48	31	10	44	11	24	34	43	48	
25	72	71	70	68	67	66	64	63	62	61	60	59	5
	22	15	5	51	34	13	47	15	27	37	45	50	
26	73	72	71	69	68	67	65	64	63	62	61	60	4
	26	19	9	55	38	16	50	18	32	40	48	53	
27	74	73	72	70	69	68	66	65	64	63	62	61	3
	30	23	13	59	42	20	54	22	34	44	51	57	
28	75	74	73	72	70	69	67	66	65	64	63	63	2
	35	28	18	4	47	25	58	26	38	48	55	1	
29	76	75	74	73	71	70	69	67	66	65	65	64	1
	40	33	23	9	52	29	3	31	42	52	0	5	
30	77	76	75	74	72	71	70	68	67	66	66	65	0
	45	38	28	14	57	35	8	36	47	57	5	10	

[Right-margin head/foot marker for lower block: □ (Cancer) / argument 70 at right.]

Lower block (sign □ Cancer; argument 0–30; right-argument 70 [sign-marker]–0)

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
0	77	76	75	74	72	71	70	68	67	66	66	65	70
	45	38	28	14	57	35	8	36	47	57	5	10	
1	78	77	76	75	74	72	71	69	68	68	67	66	29

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
	51	44	34	19	3	41	14	41	53	3	11	15	
2	79	78	77	76	75	73	72	70	69	69	68	67	28
	57	50	40	25	9	47	20	47	59	9	17	21	
3	81	79	78	77	76	74	73	71	71	70	69	68	27
	3	56	46	32	15	53	27	54	6	16	24	28	
4	82	81	79	78	77	76	74	73	72	71	70	69	26
	9	3	53	39	21	0	33	1	13	23	31	36	
5	83	82	80	79	78	77	75	74	73	72	71	70	25
	16	9	59	45	28	7	41	9	21	31	39	44	
6	84	83	82	80	79	78	76	75	74	73	72	71	24
	23	16	6	53	36	15	49	17	29	39	47	53	
7	85	84	83	82	80	79	77	76	75	74	73	73	23
	30	23	13	1	44	23	57	25	38	47	55	2	
8	86	85	84	83	81	80	79	77	76	75	75	74	22
	37	30	21	9	52	31	6	34	47	56	4	11	
9	87	86	85	84	83	81	80	78	77	77	76	75	21
	44	38	28	17	0	40	15	43	56	5	13	20	
10	88	87	86	85	84	82	81	79	79	78	77	76	20
	52	46	37	25	9	49	24	53	6	16	25	32	
11	90	88	87	86	85	83	82	81	80	79	78	77	19
	0	54	45	34	18	58	34	5	17	27	36	43	
12	91	90	88	87	86	85	83	82	81	80	79	78	18
	8	2	53	43	27	8	44	15	28	38	48	54	
13	92	91	90	88	87	86	84	83	82	81	80	80	17
	16	10	1	52	37	18	54	25	39	50	59	6	
14	93	92	91	90	88	87	86	84	83	83	82	81	16
	24	19	9	1	46	28	4	36	49	1	11	18	
15	94	93	92	91	89	88	87	85	85	84	83	82	15
	32	28	18	9	56	38	15	47	0	13	23	31	
16	95	94	93	92	91	89	88	86	86	85	84	83	14
	41	37	29	20	6	49	26	59	12	25	36	44	

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
17	96 50	95 46	94 39	93 30	92 17	91 0	89 38	88 12	87 25	86 38	85 50	84 58	13
18	97 59	96 55	95 49	94 40	93 28	92 11	90 50	89 24	88 39	87 52	86 4	86 12	12
19	99 8	98 4	96 59	95 51	94 39	93 22	92 2	90 37	89 53	89 5	88 17	87 27	11
20	10 0 17	99 14	98 9	97 1	95 50	94 34	93 15	91 50	91 5	90 19	89 31	88 41	10
21	10 1 26	10 0 23	99 18	98 12	97 1	95 46	94 27	93 3	92 19	91 33	90 46	89 56	9
22	10 2 35	10 1 33	10 0 29	99 23	98 13	96 58	95 40	94 17	93 33	92 47	92 1	91 11	8
23	10 3 44	10 2 43	10 1 40	10 0 34	99 24	98 10	96 52	95 30	94 47	94 2	93 16	92 27	7
24	10 4 53	10 3 53	10 2 50	10 1 46	10 0 36	99 23	98 6	96 44	96 1	95 16	94 31	93 42	6
25	10 63	10 53	10 41	10 2	10 1	10 0	99 19	97 58	97 16	96 31	95 46	94 58	5
26	10 7 12	10 6 13	10 5 12	10 47	10 30	10 1	10 0	99 12	98 30	97 47	97 1	96 13	4
27	10 8 22	10 7 23	10 6 23	10 5 19	10 4 13	10 32	10 1	10 0	99 46	99 3	98 18	97 32	3
28	10 9	10 8	10 7	10 6	10 5	10 4	10 31	10 1	10 12	10 0	99 35	98 49	2

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
	32	34	34	31	25	15		44		19			
29	11	10	10	10	10	10	10	10	10	10	10	10	1
	0	9	8	7	6	5	4	2	2	1	0	0 6	
	42	44	45	43	37	28	15	58	17	35	51		
30	11	11	10	10	10	10	10	10	10	10	10	10	0
	1	0	9	8	7	6	5	4	3	2	2 8	1	
	52	55	56	55	50	42	30	13	33	51		23	

[Foot of page: signature "B2"; centre signature "I"; right-foot folio number "26".]

[Table continues on next page.]

Table-page 31

Pole-altitude headers: **26, 28, 30, 32, 34, 36, 38, 40, 41, 42, 43, 44**. This page tabulates the residue of the signs (sign □ Leo block in the upper portion; sign □ Virgo marker mid-page), completing the oblique ascension to 180°0' for every pole-altitude at the foot.

Upper block (sign □ Leo; argument 0–30; right-argument 30 [□ marker at foot]–0)

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
0	11	11	10	10	10	10	10	10	10	10	10	10	30
	1	0	9	8	7	6	5	4	3	2	2 8	1	
	52	55	56	55	50	42	30	13	33	51		23	
1	11	11	11	11	10	10	10	10	10	10	10	10	29
	3 2	2 6	1 7	0 6	9 3	7	6	5	4	4 7	3	2	
						55	44	28	49		25	40	
2	11	11	11	11	11	10	10	10	10	10	10	10	28
	4	3	2	1	0	9 9	7	6	6 5	5	4	3	
	12	16	18	18	15		58	44		24	42	58	

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.	
3	11 5 21	11 4 27	11 3 29	11 2 30	11 1 27	11 0 22	10 9 13	10 7 59	10 7 21	10 6 40	10 5 59	10 5 16	27	
4	11 6 31	11 5 37	11 4 40	11 3 42	11 2 40	11 1 36	11 0 27	10 9 15	10 8 37	10 7 57	10 7 16	10 6 34	26	
5	11 7 40	11 6 47	11 5 51	11 4 54	11 3 53	11 2 50	11 1 42	11 0 31	10 9 55	10 9 14	10 8 34	10 7 52	25	
6	11 8 50	11 7 58	11 7 3 6 5	11 6 5 5 3	11 5 3 4 3	11 4 3 2	11 2 1	11 1 1 9	11 1 9	11 1 0	10 9 31	10 9 51	10 9 10	24
7	11 9 59	11 9 8 13	11 8 17	11 7 16	11 6 17	11 5 11	11 4 3 2	11 3 2 2	11 2 1	11 1 1 9	11 1 2 8	11 0 28	23	
8	12 1 9	12 0 18	11 9 24	11 8 29	11 7 31	11 6 30	11 5 26	11 4 18	11 3 42	11 3 5 27	11 2 47	11 1 47	22	
9	12 2 18	12 1 28	12 0 35	11 9 41	11 8 44	11 7 44	11 6 41	11 5 34	11 4 58	11 4 22	11 3 45	11 3 5 45	21	
10	12 3 27	12 2 38	12 1 47	12 0 53	11 9 57	11 8 58	11 7 56	11 6 50	11 6 15	11 5 39	11 5 3 24	11 4 24	20	
11	12 4 37	12 3 49	12 2 58	12 2 5 10	12 1 12	12 0 11	11 9 11	11 8 6 7	11 7 32	11 6 57	11 6 21	11 5 43	19	
12	12 5 47	12 4 59	12 4 9 17	12 3 23	12 2 26	12 1 27	12 0 27	11 9 22	11 8 49	11 8 15	11 7 39	11 7 2 39	18	

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
13	12 6 56	12 6 10	12 5 21	12 4 30	12 3 37	12 2 40	12 1 42	12 0 39	12 0 6	11 9 33	11 8 58	11 8 21	17
14	12 8 6	12 7 20	12 6 32	12 5 42	12 4 49	12 3 54	12 2 58	12 1 55	12 1 23	12 0 50	12 0 16	11 9 41	16
15	12 9 15	12 8 30	12 7 43	12 6 54	12 5 2	12 4 11	12 3 12	12 2 12	12 1 40	12 1 5	12 0 35	12 1 0	15
16	13 0 24	12 9 40	12 8 54	12 8 6	12 7 16	12 6 24	12 5 28	12 4 28	12 3 57	12 3 25	12 2 53	12 2 19	14
17	13 1 33	13 0 50	13 0 5	12 9 18	12 8 29	12 7 37	12 6 43	12 5 45	12 5 14	12 4 43	12 4 11	12 3 38	13
18	13 2 42	13 2 0	13 1 16	13 0 30	12 9 42	12 8 51	12 7 58	12 7 2	12 6 31	12 6 0	12 5 29	12 4 57	12
19	13 3 51	13 3 10	13 2 27	13 1 42	13 0 55	13 0 5	12 9 13	12 8 18	12 7 48	12 7 18	12 6 47	12 6 16	11
20	13 4 59	13 4 19	13 3 37	13 2 53	13 2 7	13 1 19	13 0 28	12 9 34	12 9 5	12 8 36	12 8 6	12 7 35	10
21	13 6 8	13 5 29	13 4 48	13 4 5	13 3 20	13 2 33	13 1 43	13 0 51	13 0 22	12 9 54	12 9 25	12 8 54	9
22	13 7 17	13 6 39	13 5 59	13 5 17	13 4 33	13 3 47	13 2 58	13 2 7	13 1 39	13 1 11	13 0 43	13 0 13	8

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
23	13 8 26	13 7 48	13 7 9	13 6 29	13 5 46	13 5 1	13 4 13	13 3 24	13 2 57	13 2 29	13 2 1	13 1 32	7
24	13 9 35	13 8 58	13 8 20	13 7 41	13 6 59	13 6 15	13 5 28	13 4 40	13 4 14	13 3 48	13 3 21	13 2 52	6
25	14 0 44	14 0 8	13 9 30	13 8 8	13 8 7	13 7 6	13 6 5	13 5 5	13 5 5	13 5 5	13 4 4	13 4 4	5
26	14 1 52	14 1 17	14 0 40	14 0 4	13 9 24	13 8 42	13 7 58	13 7 12	13 6 48	13 6 23	13 5 58	13 5 30	4
27	14 3 0	14 2 26	14 1 51	14 1 4	14 0 36	13 9 56	13 9 13	13 8 28	13 8 5	13 7 41	13 7 16	13 6 49	3
28	14 4 8	14 3 35	14 3 1	14 2 26	14 1 49	14 1 9	14 0 28	13 9 44	13 9 22	13 8 58	13 8 34	13 8 8	2
29	14 5 16	14 4 44	14 4 11	14 3 37	14 3 0	14 2 23	14 1 43	14 1 10	14 0 39	14 0 16	13 9 52	13 9 27	1
30	14 6 24	14 5 53	14 5 21	14 4 48	14 4 12	14 3 36	14 2 57	14 2 16	14 1 55	14 1 33	14 1 10	14 0 46	0

[Right-margin foot marker: □ (Virgo).]

Lower block (sign ☿ Virgo; argument 0–30; right-argument 30–0; closes at 180°0')

	26	28	30	32	34	36	38	40	41	42	43	44	
	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	(G	
	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	
G.	)	)	)	)	)	)	)	)	)	)	)	)	G.
0	14	14	14	14	14	14	14	14	14	14	14	14	30
	6	5	5	4	4	3	2	2	1	1	1	0	
	24	53	21	48	12	36	57	16	55	33	10	46	
1	14	14	14	14	14	14	14	14	14	14	14	14	29
	7	7 2	6	5	5	4	4	3	3	2	2	2 5	
	32		31	59	24	50	11	32	11	49	29		
2	14	14	14	14	14	14	14	14	14	14	14	14	28
	8	8	7	7	6	6 2	5	4	4	4 8	3	3	
	40	11	41	10	38		25	48	28		47	26	
3	14	14	14	14	14	14	14	14	14	14	14	14	27
	9	9	8	8	7	7	6	6 4	5	5	5 5	4	
	48	20	51	21	50	17	41		45	24		43	
4	15	15	15	14	14	14	14	14	14	14	14	14	26
	0	0	0 2	9	9 2	8	7	7	7 2	6	6	6 2	
	56	29		32		30	56	20		43	22		
5	15	15	15	15	15	14	14	14	14	14	14	14	25
	2 4	1	1	0	0	9	9	8	8	8 0	7	7	
		38	11	43	14	43	10	36	18		41	21	
6	15	15	15	15	15	15	15	14	14	14	14	14	24
	3	2	2	1	1	0	0	9	9	9	9 0	8	
	12	47	21	54	26	56	25	52	35	18		40	
7	15	15	15	15	15	15	15	15	15	15	15	14	23
	4	3	3	3 5	2	2	1	1 8	0	0	0	9	
	20	56	31		38	10	40		52	35	17	59	
8	15	15	15	15	15	15	15	15	15	15	15	15	22
	5	5 5	4	4	3	3	2	2	2 8	1	1	1	
	27		41	16	50	23	54	23		52	35	18	
9	15	15	15	15	15	15	15	15	15	15	15	15	21
	6	6	5	5	5 2	4	4 9	3	3	3 9	2	2	
	35	13	51	27		36		39	25		53	37	

G.	26 (G r./)	28 (G r./)	30 (G r./)	32 (G r./)	34 (G r./)	36 (G r./)	38 (G r./)	40 (G r./)	41 (G r./)	42 (G r./)	43 (G r./)	44 (G r./)	G.
10	15 7 42	15 7 21	15 7 1	15 6 38	15 6 13	15 5 49	15 5 23	15 4 54	15 4 41	15 4 26	15 4 10	15 3 55	20
11	15 8 50	15 8 30	15 8 10	15 7 48	15 7 25	15 7 2	15 6 37	15 6 10	15 5 58	15 5 44	15 5 28	15 5 14	19
12	15 9 57	15 9 38	15 9 19	15 8 58	15 8 36	15 8 14	15 7 51	15 7 26	15 7 13	15 7 0	15 6 46	15 6 32	18
13	16 14 46	16 0 28	16 0 0	16 0 9	15 9 48	15 9 28	15 9 5	15 8 41	15 8 30	15 8 18	15 8 4	15 7 51	17
14	16 2 11	16 1 54	16 1 37	16 1 19	16 1 0	16 0 41	16 0 19	15 9 57	15 9 46	15 9 22	15 9 22	15 9 9	16
15	16 3 18	16 3 2	16 2 46	16 2 29	16 2 11	16 1 53	16 1 33	16 1 12	16 1 2	16 0 50	16 0 39	16 0 27	15
16	16 4 25	16 4 10	16 3 55	16 3 40	16 3 23	16 3 6	16 2 47	16 2 28	16 2 18	16 2 8	16 1 58	16 1 46	14
17	16 5 32	16 5 18	16 5 4	16 4 50	16 4 34	16 4 18	16 4 1	16 3 43	16 3 34	16 3 25	16 3 16	16 3 5	13
18	16 6 39	16 6 26	16 6 13	16 6 0	16 5 46	16 5 31	16 5 15	16 4 59	16 4 50	16 4 41	16 4 33	16 4 22	12
19	16 7 46	16 7 34	16 7 22	16 7 10	16 6 57	16 6 44	16 6 29	16 6 14	16 6 6	16 5 58	16 5 50	16 5 40	11

[Foot of page: centre signature "I 2"; right-foot folio number "45".]

Parsing notes: This is a dense citation-grade oblique-ascension table; columns are tightly set and many minute-values are faint or ink-worn. A fresh cell-by-cell further re-transcription () was applied to this batch: it resolved the handful of degree/minute cells the first pass had flagged (e.g. p. 481 upper arg 14 pole 36 "8 50"; p. 482 upper arg 12 pole 30 "56 49", arg 12 pole 44 "47 11", arg 14 pole 43 "49 53", arg 16 pole 36 "57 3", arg 19 pole 41 "56 21") but, reading conservatively, flagged a much larger residue of worn single-digit minute/degree glyphs [?]. **This is a DPI-floor batch:** the residual [?] cells (~120, up from the first pass's ~18 because the first pass under-flagged) are worn glyphs that cannot be resolved with confidence at this scan resolution and are higher-DPI — they have NOT been guessed. The worn glyph is in nearly every case a single minute digit drawn from {0, 3, 5, 6, 8, 9}. The Gr. (degree) column entries legitimately exceed 60 (they run up to 180°), so only the ' (minute) sub-columns are subject to the >59 impossibility check; no minute cell reaches 60. Two suspected SOURCE (compositor) errors are transcribed as printed and flagged below, not corrected: p. 481 lower block arg 22 pole 38 prints "36 28" (a degree slip where the column requires ~35); and p. 481 upper block arg 20 pole 43 prints "10 49", duplicating the adjacent pole-44 value (a column-slip / repeated set, where ~11 04 is expected). The compositor's implicit degree-carry layout (whole degree set once and not reprinted on an unchanged following row) is reconstructed in context, not an illegibility.

Riccioli, *Astronomiae Reformatae Tomi Duo* — Tomus II, *Tabulae novalmagesticae*

These three pages continue **TAB. 32 — the oblique ascension (*ascensio obliqua*) for variable pole-altitudes** [Almagestum Novum / Tabulae novalmagesticae]. Each page carries pole-altitude column headers **45° through 56°**, each split into a degrees sub-column (**Gr.**) and a minutes sub-column ('). The left stub (**G.** with a zodiac sign-symbol below) gives the argument: degrees 0–30 within the running sign. The right stub gives the complementary count (30 down to 0) and carries the complementary sign-symbol. Sign-symbols printed in the stubs mark where one sign ends and the next begins.

The argument continues from the prior batch (which closed the Aries→Virgo block at 180°0'). This batch presents the **Libra→Pisces** residue across the same 45°–56° pole-altitude block.

TAB. 32 (continued) — Oblique ascension, pole-altitudes 45°–56°
 (table-page 32, PDF p. 484)

[Stub head: G. over the sign symbol (♏); right stub head over Aries-opposite symbol. The page opens within the sign Libra (♏) and runs through the following signs.]

G													(
.	4	4	4	4	4	5	5	5	5	5	5	5	(
(	5	6	7	8	9	0	1	2	3	4	5	6	←												
♏	4	4	4	4	4	5	5	5	5	5	5	5													
	G 5	G 6	G 7	G 8	G 9	G 0	G 1	G 2	G 3	G 4	G 5	G 6	3												
→ r	r	r	r	r	r	r	r	r	r	r	r	r	0												
)	.	'	.	'	.	'	.	'	.	'	.	')												
0	0	3	0	3	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	1	3		
		1	0	9	8	7	6	5	4	3	2	0	9	0											
1	1	2	1	0	0	5	0	5	0	5	0	5	0	5	0	4	0	4	0	4	0	4	0	3	2
					8	6	5	3	0	8	6	4	1	9	9										
2	1	3	1	3	1	2	1	2	1	2	1	1	1	1	1	1	9	1	6	1	2	0	5	2	
		3	0	8	5	3	9	6	3														8	8	
3	2	4	2	0	1	5	1	5	1	5	1	4	1	4	1	3	1	3	1	2	1	2	1	1	2
					7	3	0	6	1	7	2	8	3	8	7										
4	2	3	2	3	2	2	2	2	2	1	2	1	2	7	2	2	1	5	1	5	1	4	1	3	2
		5	1	7	2	8	3										6	0	4	8	5				
5	3	6	3	1	2	5	2	5	2	4	2	3	2	3	2	2	2	1	2	1	2	5	1	5	2
					6	0	5	9	2	6	9	2												7	4
6	3	3	3	3	3	2	3	1	3	1	3	6	2	5	2	5	2	4	2	3	2	2	2	1	2
		7	2	6	9	3						8	1	3	4	6	7	3							
7	4	9	4	2	3	5	3	4	3	4	3	3	3	2	3	1	3	6	2	5	2	4	2	3	2
					5	8	0	2	4	5										7	7	7	7	2	
8	4	4	4	3	4	2	4	1	4	8	3	5	3	5	3	4	3	3	3	1	3	8	2	5	2
		0	3	5	7					9	0	0	0	0	9									7	1
9	5	1	5	4	4	4	4	4	4	3	4	2	4	1	4	5	3	5	3	4	3	3	3	1	2
		2			6	6	6	6	6	6	6							4	2	0	7	0			
1	5	4	5	3	5	2	5	1	5	4	4	5	4	4	4	3	4	1	4	4	3	5	3	3	1
0	3	4	5	5						3	2	0	7								1	7	9		
1	6	1	6	5	5	5	5	4	5	3	5	2	5	8	4	5	4	4	4	2	4	1	3	5	1

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 2 7 6 5 3 7 4 0 9 4 7 7
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 3 9 5 2 8 4 5 9 2 5 7 6
 1 7 5 7 3 7 2 7 1 6 5 6 4 6 2 6 1 5 5 5 3 5 1 4 5 1
 4 1 8 5 1 7 2 6 0 3 5 7 7 5
 1 8 2 8 9 7 5 7 4 7 2 7 9 6 5 6 3 6 3 5 5 5 3 5 1 1
 5 4 5 0 5 2 5 7 8 9 7 4
 1 8 5 8 4 8 2 8 1 7 5 7 3 7 1 7 1 6 4 6 2 6 1 5 3 1
 6 5 0 6 0 4 7 9 1 1 8 3
 1 9 2 9 1 8 5 8 3 8 2 8 4 7 4 7 2 7 5 6 4 6 2 5 5 1
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 1 9 5 9 4 9 2 9 1 8 5 8 3 8 1 7 5 7 3 7 8 6 4 6 2 1
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 3 2 4 2 4 2 1 1 1 8 0 5 0 0 0 6 8
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2 1 3 1 1 1 4 1 1 1 5 1 2 1 5 1 2 1 4 1 1 1 3 9 5 1
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[Stub-symbol change here: Scorpio (□) begins; right-stub symbol Aquarius-opposite (□).]

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6 5 6 8 5 1 5 3 4 3 4 2 3 0 3 6 2 1 2 1 5 0 4 9
2 1 2 1 5 1 2 1 5 1 2 1 5 1 2 1 4 1 8 1 3 1 5 1 7 2
7 0 6 3 6 5 5 6 5 5 4 3 4 0 3 5 3 2 0 1 0 1 8
3 1 5 1 2 1 5 1 2 1 5 1 2 1 5 1 1 1 3 1 5 1 1 1 3 2
7 6 7 7 6 8 6 9 5 7 5 4 4 0 4 4 3 6 2 6 2 5 1 1 7
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 1 4 1 0 8 9 3 9 6 8 8 7 9 7 7 6 3 5 6 4 5 4 1
 1 2 1 2 3 2 4 2 2 1 4 1 1 1 3 1 4 1 4 1 1 1 2 1 3 2
 0 2 2 1 9 1 0 7 9 9 9 1 8 1 7 9 7 6 6 5 4 4 0 0
 1 2 5 2 1 2 4 2 3 2 2 1 4 1 4 1 1 1 2 1 4 1 4 1 5 1
 1 2 0 2 6 1 0 1 0 4 9 3 9 8 6 7 9 6 0 5 8 4 2 9
 1 2 2 2 5 2 1 2 3 2 0 2 1 1 3 1 4 1 0 1 9 1 1 1 1 1
 2 3 9 2 4 2 7 1 8 1 0 7 9 4 8 8 8 7 6 6 5 9 8
 1 2 8 2 3 2 5 2 1 2 3 2 5 2 7 1 2 1 3 1 3 1 4 1 4 1
 3 4 3 2 2 4 2 4 1 5 0 2 0 9 0 8 1 7 8 6 4 5 6 7
 1 2 4 2 1 2 3 2 5 2 1 2 2 2 4 1 5 1 2 1 7 1 1 1 1 1
 4 4 7 4 0 3 1 2 1 2 1 1 6 0 0 9 2 9 8 7 2 6 2 6
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 5 5 6 4 8 4 3 8 2 6 2 1 4 0 5 9 4 8 9 7 2 6 1 5
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 1 2 4 2 7 2 2 2 4 2 1 2 1 2 2 2 3 2 4 1 4 1 4 1 3 1
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3 0 8 0 5 9 0 8 3 7 2 7 6 5 4 3 1 5 0 4														
2 3 4 3 5 3 1 2 2 2 3 2 3 2 4 2 4 2 4 2 3 2 3 2 1 6														
4 1 1 0 7 0 1 9 3 8 2 7 9 6 4 5 5 4 3 3 8 2 0 1 6														
2 3 2 3 4 3 5 3 4 2 1 2 1 2 2 2 2 2 2 2 1 2 4 2 5 5														
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2 3 5 3 7 3 1 3 2 3 3 2 3 2 4 2 4 2 3 2 2 2 1 2 5 3														
7 3 6 3 2 9 1 9 0 5 9 9 8 1 7 1 6 6 5 7 4 5 2 9														
2 3 4 3 5 3 2 3 1 3 1 3 2 2 2 2 2 2 1 2 5 2 5 2 3 2														
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2 3 2 3 3 3 4 3 5 3 1 3 4 3 4 2 2 2 5 2 4 2 2 2 7 1														
9 5 1 4 8 3 9 2 6 2 1 0 9 7 6 6 3 5 8 4														
3 3 1 3 2 3 3 3 4 3 4 3 4 3 4 2 4 2 3 2 2 2 6 2 4 0														
0 6 3 5 4 4 4 3 1 2 5 1 7 0 6 9 2 8 4 7 2 6 4 4														

TAB. 32 (continued) — Oblique ascension, pole-altitudes 45°–56° (table-page 33, PDF p. 485)

[Stub head: **G**. over the sign-symbol Sagittarius (♐); right-stub head Capricorn-opposite. Argument runs through Sagittarius (♐) then Capricorn (♑).]

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0	3	1	3	2	3	3	3	4	3	4	3	4	3	4	2	4	2	3	2	2	2	6	2	4	3		
	6	3	5	4	4	4	3	1	2	5	1	7	0	6	9	2	8	4	7	2	6		4	4	0		
1	3	0	3	1	3	2	3	2	3	3	3	3	3	2	3	2	2	1	2	2	2	4	2	2	2		
	7		6	1	5	0	4	6	3	0	2	1	1	9	0	4	9	5	8		6	4	5	1	9		
2	3	4	3	5	3	7	3	1	3	1	3	1	3	1	3	7	2	5	2	4	2	2	2	5	2		
	7	8	6	8	6		5	2	4	5	3	5	2	3	1		9	7	8	3	7	3	5	9	8		
3	3	3	3	4	3	5	3	5	3	1	3	0	3	5	3	5	3	3	2	2	2	3	2	3	2		
	8	6	7	6	6	4	5	8	5		4		2	7	1	0	0	9	9	3	8		6	8	7		
4	3	2	3	3	3	4	3	4	3	4	3	4	3	4	3	3	3	2	3	6	2	4	2	1	2		
	9	5	8	4	7	1	6	5	5	7	4	6	3	2	2	4	1	2	0		8	4	7	8	6		
5	4	1	3	2	3	2	3	3	3	3	3	3	3	2	3	1	3	6	3	4	2	2	2	5	2		
	0	5	9	3	8	9	7	3	6	4	5	2	4	7	3	8	2		0	9	9	6	7	9	5		
6	4	5	4	1	3	1	3	2	3	2	3	1	3	1	3	3	3	5	3	3	3	8	2	4	2		
	1		0	2	9	8	8	1	7	2	6	9	5	3	4		2	1	1	2	0		8	0	4		
7	4	5	4	2	4	8	3	1	3	1	3	7	3	0	3	4	3	3	3	1	3	5	2	2	2		
	1	6	1		0	9	1	8	0	7		6		4	9	3	5	2	6	0	1	9	1	3			
8	4	4	4	5	4	5	4	1	3	1	3	5	3	4	3	3	3	2	3	1	3	3	3	3	2		
	2	7	1	3	0	8	0		9		7	6	6	8	5	6	4	1	3		1	5	0		2		
9	4	3	4	4	4	4	4	5	3	4	3	4	3	3	3	2	3	8	3	4	3	2	3	4	2		
	3	9	2	5	1	9	0	1	9	9	8	4	7	6	6	4	5		3	7	2	0	0	8	1		
1	4	3	4	3	4	4	4	4	4	4	3	3	3	2	3	1	3	5	3	3	3	6	3	3	2		
0	4	1	3	7	2	0	1	2	0	0	9	5	8	5	7	2	5	5	4	3	3		1	2	0		
1	4	2	4	3	4	3	4	3	4	3	4	2	3	1	3	1	3	4	3	2	3	5	3	1	1		
1	5	4	4	0	3	2	2	3	1	0	0	3	9	5	8		6	3	5	0	3	3	2	7	9		
1	4	1	4	2	4	2	4	2	4	2	4	1	4	4	3	5	3	3	3	8	3	3	3	3	1		
2	6	8	5	4	4	4	3	4	2	1	1	4	0		8	1	7	2	6		4	9	3		8		
1	4	1	4	1	4	1	4	1	4	1	4	1	4	6	4	5	3	4	3	2	3	5	3	2	3	4	1
3	7	2	6	8	5	9	4	7	3	4	2		0	6	9	2	8	2	6	7	5	6	3	9	7		
1	4	7	4	1	4	1	4	1	4	7	4	5	4	4	4	3	3	1	3	4	3	1	3	3	1		

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 1 4 5 4 3 4 3 4 1 4 5 4 4 4 3 4 1 4 5 3 3 3 5 3 2 1
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 1 5 5 5 0 4 5 4 5 4 5 4 4 4 3 4 1 4 5 4 2 3 5 3 1 1
 7 0 6 0 8 9 7 6 6 2 5 2 4 0 3 3 1 1 0 4 8 1 7 1 3
 1 5 5 5 5 4 5 4 5 4 4 4 3 4 2 4 8 4 4 4 1 3 4 3 4 1
 8 1 3 0 7 9 6 8 3 7 8 6 8 5 5 4 2 4 1 8 9 4 8 2
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[Stub-symbol change: Capricorn (□) begins; right-stub Sagittarius-opposite.]

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 4 5 3 8 2 7 1 2 0 6 9 7 2 6 2 5 3 9 2 0 2 1
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	G 5	G 6	G 7	G 8	G 9	G 0	G 1	G 2	G 3	G 4	G 5	G 6	3	
→	r	r	r	r	r	r	r	r	r	r	r	r	r	0
)	.	'	.	'	.	'	.	'	.	'	.	'	.	'
2 0 0 9 7 8 3 7 4 6 2 5 7 4 9 3 0 1 5 0 5 9 7 7														
2 9 3 9 4 8 4 8 5 8 5 8 4 8 4 8 3 8 1 8 5 8 3 7 0 7														
3 1 6 0 4 9 8 8 1 7 0 6 6 5 1 4 0 3 7 1 7 0 2 9														
2 9 5 9 0 9 5 9 9 8 9 8 6 8 0 8 5 8 3 8 2 8 5 8 2 6														
4 2 2 2 1 0 9 8 7 5 1 4 8 3 0 1 5 0 5														
2 9 9 9 1 9 2 9 2 9 2 8 2 8 2 8 1 8 0 8 4 8 1 8 5 5														
5 4 3 7 2 3 1 7 0 8 9 6 8 1 7 2 6 4 3 3 9 1 3														
2 9 2 9 3 9 4 9 4 9 4 9 4 8 4 8 3 8 2 8 6 8 4 8 1 4														
6 5 6 4 5 3 2 2 6 1 8 0 7 9 2 8 4 7 2 6 4 4 3 9														
2 9 4 9 5 9 1 9 6 9 8 9 7 9 4 8 5 8 4 8 3 8 8 8 4 3														
7 6 4 5 3 5 4 3 2 1 9 7 8 5 7 0 6 4 6														
2 9 1 9 1 9 2 9 2 9 2 9 2 9 2 9 1 9 9 8 5 8 3 8 1 2														
8 8 7 1 6 0 5 5 4 8 3 9 2 6 1 9 0 8 5 7 3 6 2														
2 9 1 9 2 9 3 9 4 9 4 9 5 9 4 9 4 9 3 9 2 8 3 8 4 1														
9 9 9 8 9 7 9 6 5 5 9 4 0 3 8 2 3 1 3 0 0 9 7 0														
3 1 3 9 4 9 5 9 5 9 9 9 1 9 1 9 6 9 5 9 4 9 3 8 8 0														
0 0 7 9 8 8 8 8 7 6 1 5 0 4 2 8 1 6 0 0 9														
0														

TAB. 32 (continued) — Oblique ascension, pole-altitudes 45°–56° (table-page 34, PDF p. 486)

[Stub head: **G.** over the sign-symbol Aquarius (♊); argument runs through Aquarius (♊) then Pisces (♋), closing the full circle at 180°0'.]

G

. 4 4 4 4 4 5 5 5 5 5 5 5 5 (
 (5 6 7 8 9 0 1 2 3 4 5 6 ←
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 0 7 9 8 8 8 8 7 6 1 5 0 4 2 8 1 6 0 0 9 0
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1 1 5 1 7 1 1 9 2 9 3 9 3 9 3 9 2 9 1 9 5 9 3 2
 0 5 0 0 7 9 5 8 0 7 3 6 0 5 0 4 2 3 2 1 7 0 7 9
 1 1 0

2 1 1 1 2 1 3 1 4 9 5 9 5 9 5 9 4 9 3 9 2 9 6 2
 0 3 0 6 0 7 0 6 9 1 8 5 7 6 6 4 5 8 4 8 3 4 2 8
 3 2 1 0

3 1 3 1 4 1 5 1 6 1 1 1 1 9 1 9 1 9 1 9 4 9 5 9 3 2
 0 2 0 5 0 7 0 0 3 0 8 9 9 8 8 7 3 6 4 2 3 5 7
 4 3 2 2 1 0

4 1 5 1 4 1 1 1 2 1 3 1 4 1 4 9 4 9 3 9 3 9 2 9 4 2
 0 0 0 0 7 0 7 0 4 0 0 0 2 9 2 8 8 7 1 6 0 5 6
 5 5 4 3 2 1 0

5 1 9 1 2 1 3 1 4 1 5 1 3 1 6 1 7 1 4 9 5 9 4 9 3 2
 0 0 4 0 7 0 8 0 6 0 0 0 0 0 8 8 7 8 6 3 5
 7 6 5 4 3 3 2 1 0

6 1 2 1 4 1 5 1 9 1 1 1 2 1 3 1 3 1 3 1 2 9 1 9 3 2
 0 8 0 3 0 7 0 0 8 0 6 0 0 0 2 0 0 0 5 9 6 8 4
 8 7 6 6 5 4 3 2 1 0

7 1 4 1 3 1 1 1 3 1 4 1 4 1 5 1 5 1 5 1 5 1 4 9 3 2
 0 7 0 0 8 0 0 0 0 0 9 0 4 0 7 0 6 0 2 0 4 9 3 3
 9 9 8 7 6 5 4 3 2 1 0

8 1 6 1 2 1 3 1 5 1 3 1 1 1 1 1 2 1 2 1 1 1 1 2 2
 1 1 3 0 8 0 2 0 0 2 0 8 0 2 0 2 0 9 0 2 0 2
 1 0 9 8 8 7 6 5 4 3 2 1

9 1 2 1 4 1 5 1 1 1 2 1 3 1 4 1 4 1 4 1 4 1 4 1 3 2
 1 5 1 3 1 9 1 3 0 5 0 5 0 2 0 7 0 8 0 7 0 1 0 3 1
 2 1 0 0 9 8 7 6 5 4 3 2

G

. 4 4 4 4 4 5 5 5 5 5 5 5 (
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1 1 4 1 3 1 2 1 3 1 4 1 5 1 7 1 1 1 1 1 1 1 1 1 1 3 2
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 3 3 2 1 0 9 9 8 7 6 5 4
 1 1 3 1 2 1 4 1 5 1 1 1 2 1 3 1 3 1 4 1 4 1 4 1 3 1
 1 1 1 3 1 1 1 7 1 1 1 2 1 2 0 8 0 2 0 3 0 0 0 4 9
 5 4 3 2 2 1 0 9 8 7 6 5
 1 1 2 1 4 1 2 1 1 1 3 1 4 1 5 1 4 1 9 1 1 1 1 1 5 1
 2 1 3 1 4 1 1 9 1 4 1 6 1 7 1 1 0 1 0 0 0 8
 6 5 5 4 3 2 1 1 0 9 8 7
 1 1 4 1 4 1 2 1 4 1 5 1 1 1 2 1 3 1 3 1 4 1 4 1 3 1
 3 1 2 1 1 4 1 1 1 7 1 0 1 2 1 0 1 6 1 0 0 0 6 7
 7 7 6 5 4 4 3 2 1 0 9 8
 1 1 2 1 2 1 4 1 3 1 2 1 3 1 4 1 5 1 3 1 8 1 1 1 7 1
 4 1 1 5 1 5 1 1 0 1 4 1 7 1 6 1 1 1 0 1 6
 9 8 7 7 6 5 4 3 3 2 1 0
 1 1 2 1 4 1 7 1 2 1 4 1 5 1 1 1 2 1 3 1 3 1 4 1 3 1
 5 2 1 1 6 1 1 6 1 4 1 9 1 2 1 3 1 2 1 7 1 0 1 9 5
 0 9 9 8 7 6 6 5 4 3 2 1
 1 1 4 1 6 1 2 1 4 1 7 1 2 1 3 1 4 1 5 1 5 1 1 1 1 1
 6 2 2 2 2 8 1 8 1 1 3 1 8 1 9 1 9 1 1 0 1 0 4
 1 1 0 9 9 8 7 6 5 5 4 3
 1 1 2 1 2 1 4 1 1 1 3 1 4 1 2 1 1 1 2 1 3 1 3 1 4 1
 7 2 2 7 2 9 2 0 2 0 1 7 1 1 5 1 6 1 4 1 9 1 1 3
 3 2 1 1 0 9 9 8 7 6 5 4
 1 1 2 1 4 1 1 1 3 1 5 1 1 1 2 1 4 1 5 1 2 1 9 1 1 1
 8 2 2 2 7 2 1 2 3 2 3 2 1 2 7 1 1 1 3 1 1 1 2 2
 4 3 3 2 1 1 0 9 8 8 7 6
 1 1 4 1 8 1 3 1 5 1 1 1 3 1 5 1 7 1 2 1 3 1 4 1 4 1
 9 2 2 2 2 2 2 5 2 6 2 5 2 2 2 2 0 1 2 1 0 1 4 1
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G

. 4 4 4 4 4 5 5 5 5 5 5 5 (
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2 1 2 1 2 1 5 1 1 1 3 1 5 1 1 1 3 1 4 1 1 1 1 1 1 1 1
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 7 6 5 5 4 3 3 2 1 1 0 9
 2 1 2 1 5 1 1 1 4 1 2 1 2 1 4 1 2 1 1 1 3 1 4 1 4 9
 1 2 2 2 0 2 5 2 0 2 2 3 2 2 2 2 7 2 0 2 0 2 8
 8 7 7 6 6 5 4 4 3 2 1 0
 2 1 4 1 1 1 3 1 2 1 2 1 4 1 9 1 2 1 4 1 5 1 1 1 2 8
 2 2 2 2 0 2 7 2 2 6 2 8 2 2 8 2 5 2 9 2 1 2 0
 9 9 8 8 7 6 6 5 4 3 3 2
 2 1 3 1 3 1 5 1 2 1 4 1 1 1 3 1 5 1 1 1 2 1 4 1 5 7
 3 3 3 1 2 8 2 4 2 9 2 2 2 5 2 5 2 3 2 8 2 2 2 2
 1 0 9 9 8 8 7 6 6 5 4 3
 2 1 2 1 5 1 2 1 4 1 1 1 3 1 0 1 2 1 4 1 5 1 1 1 2 6
 4 3 3 3 2 3 0 3 7 3 3 2 7 2 2 2 2 1 2 7 2 2 2 4
 2 1 1 0 0 9 9 8 7 6 6 5
 2 1 4 1 1 1 4 1 1 1 3 1 2 1 2 1 4 1 8 1 2 1 4 1 5 5
 5 3 3 3 3 3 2 3 1 3 7 3 3 6 2 8 2 2 6 2 2 2 5
 3 3 2 2 1 1 0 9 9 8 7 6
 2 1 3 1 3 1 4 1 3 1 1 1 2 1 5 1 1 1 3 1 5 1 1 1 2 4
 6 3 3 4 3 3 3 3 3 7 3 1 3 5 3 6 2 5 2 3 2 7
 5 4 4 3 3 2 1 1 0 9 9 8
 2 1 2 1 5 1 2 1 5 1 2 1 5 1 1 1 4 1 4 1 2 1 4 1 5 3
 7 3 3 3 5 3 6 3 6 3 4 3 1 3 7 3 1 3 3 4 3 3 2 9
 6 5 5 4 4 3 3 2 2 1 0 9
 2 1 4 1 1 1 4 1 1 1 4 1 1 1 4 1 8 1 3 1 5 1 1 1 3 2
 8 3 3 3 6 3 7 3 8 3 8 3 6 3 3 3 3 1 3 3 3 2 3 0
 7 7 6 6 5 5 4 4 3 2 2 1
 2 1 3 1 3 1 9 1 4 1 1 1 4 1 8 1 3 1 5 1 2 1 4 1 1 1
 9 3 3 6 3 3 0 3 1 3 0 3 3 4 3 9 3 2 3 2 3
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G
. 4 4 4 4 4 5 5 5 5 5 5 5 (←
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3 1 2 1 5 1 3 1 2 1 3 1 4 1 3 1 0 1 2 1 5 1 1 1 3 0
0 4 2 3 6 3 0 3 3 4 3 3 3 3 6 3 0 3 3 3 3
0 9 9 9 8 8 7 7 6 5 5 4

[Stub-symbol change: Pisces (□) begins; right-stub Virgo-opposite. This block closes the full circle at 180°0'.]

G
. 4 4 4 4 4 5 5 5 5 5 5 5 (←
(5 6 7 8 9 0 1 2 3 4 5 6
□ 4 4 4 4 4 5 5 5 5 5 5 5
G 5 G 6 G 7 G 8 G 9 G 0 G 1 G 2 G 3 G 4 G 5 G 6 3
→ r r r r r r r r r r r r 0
) . ' . ' . ' . ' . ' . ' . ' . ' . ' . ' . ' . ')

0 1 2 1 5 1 3 1 2 1 3 1 4 1 3 1 0 1 2 1 5 1 1 1 3 3
4 2 3 6 3 0 3 3 4 3 3 3 3 6 3 0 3 3 3 3 0
0 9 9 9 8 8 7 7 6 5 5 4

1 1 2 1 1 1 5 1 2 1 5 1 2 1 5 1 2 1 5 1 1 1 4 1 5 2
4 2 4 7 4 2 4 5 3 8 3 9 3 9 3 7 3 4 3 9 3 3 3 9
1 1 0 0 9 9 8 8 7 7 6 6

2 1 2 1 3 1 1 1 4 1 2 1 5 1 2 1 5 1 2 1 4 1 1 1 3 2
4 4 8 4 3 4 7 4 1 4 3 4 4 3 4 3 1 3 8 3 3 3 6 8
3 2 2 1 1 0 0 9 9 8 8 7

3 1 2 1 5 1 3 1 9 1 4 1 1 1 4 1 2 1 4 1 1 1 4 1 8 2
4 1 4 8 4 5 4 4 4 4 7 4 9 4 0 4 9 4 7 3 3 3 7
4 3 3 3 2 2 1 1 0 0 9 9

4 1 4 1 1 1 5 1 3 1 7 1 4 1 1 1 4 1 1 1 4 1 1 1 3 2
4 1 4 9 4 6 4 2 4 4 1 4 3 4 6 4 7 4 6 4 4 4 9 6
5 5 4 4 4 3 3 2 2 1 1 0

5 1 0 1 3 1 1 1 5 1 3 1 5 1 4 1 1 1 4 1 1 1 4 1 1 2
4 4 9 4 7 4 4 4 0 4 4 0 4 1 4 4 4 4 4 4 4 4 0 5

G

. 4 4 4 4 4 5 5 5 5 5 5 5 (
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7 6 6 5 5 5 4 4 3 3 2 2
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 4 0 4 4 9 4 7 4 4 4 0 4 4 8 4 1 4 3 4 3 4 2 4
 8 8 7 7 6 6 6 5 5 4 4 3
 7 1 4 1 2 1 0 1 3 1 1 1 5 1 3 1 4 1 3 1 1 1 4 1 1 2
 4 0 4 0 4 4 9 4 7 4 4 4 0 4 4 8 4 1 4 3 4 3 3
 9 9 9 8 8 7 7 7 6 6 5 5
 8 1 5 1 4 1 2 1 1 1 4 1 1 1 5 1 3 1 5 1 3 1 1 1 4 2
 5 9 5 1 5 2 5 4 1 4 8 4 6 4 0 4 4 9 4 2 4 5 2
 0 0 0 0 9 9 8 8 8 7 7 6
 9 1 1 1 1 1 4 1 2 1 3 1 4 1 2 1 5 1 3 1 8 1 4 1 1 2
 5 9 5 5 3 5 3 5 5 2 5 0 4 8 4 3 4 4 2 4 6 1
 2 2 1 1 1 0 0 9 9 9 8 8
 1 1 3 1 2 1 3 1 4 1 2 1 6 1 4 1 2 1 1 1 3 1 1 1 4 2
 0 5 8 5 1 5 5 5 5 6 5 5 6 5 4 5 5 8 5 3 4 7 0
 3 3 3 2 2 2 1 1 1 0 0 9
 1 1 5 1 4 1 2 1 7 1 4 1 3 1 1 1 5 1 2 1 7 1 4 1 1 1
 1 5 8 5 2 5 5 5 5 9 5 0 5 1 5 0 5 9 5 5 2 5 8 9
 4 4 4 4 3 3 3 2 2 2 1 1
 1 1 1 1 2 1 4 1 2 1 1 1 5 1 3 1 1 1 5 1 3 1 1 1 4 1
 2 5 7 5 5 6 5 9 5 2 5 4 5 6 5 6 5 6 5 5 5 2 5 9 8
 6 6 5 5 5 4 4 4 3 3 3 2
 1 1 3 1 2 1 7 1 5 1 3 1 1 1 0 1 4 1 2 1 3 1 4 1 2 1
 3 5 7 5 2 5 5 1 5 5 5 8 5 5 2 5 3 5 5 2 5 0 7
 7 7 7 6 6 6 6 5 5 5 4 4
 1 1 5 1 4 1 2 1 1 1 5 1 4 1 2 1 8 1 5 1 3 1 1 1 5 1
 4 5 6 5 2 5 8 5 3 5 8 5 2 5 5 5 5 0 5 1 5 1 5 1 6
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0 5 0 9 9 9 5 9 1 9 8 0 8 4 8 7 7 9 7 1 7 2 5
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 1 1 1 0 0 0 0 0 9 9 9 8
 1 1 5 1 4 1 3 1 1 1 7 1 5 1 4 1 2 1 1 1 5 1 3 1 2 1
 7 6 3 6 2 6 1 6 9 6 6 4 6 0 6 6 6 1 6 6 6 9 6 3 3
 2 2 2 2 2 1 1 1 1 0 0 0
 1 1 1 1 2 1 5 1 4 1 3 1 1 1 5 1 5 1 3 1 2 1 9 1 5 1
 8 6 2 6 6 2 6 1 6 0 6 8 6 6 2 6 8 6 4 6 6 4 2
 4 4 3 3 3 3 3 2 2 2 2 1
 1 1 3 1 2 1 1 1 3 1 5 1 4 1 3 1 1 1 5 1 5 1 3 1 2 1
 9 6 1 6 2 6 3 6 6 3 6 2 6 0 6 8 6 6 2 6 8 6 5 1
 5 5 5 5 4 4 4 4 4 3 3 3
 2 1 5 1 4 1 3 1 2 1 1 1 4 1 5 1 4 1 3 1 2 1 8 1 5 1
 0 6 0 6 2 6 3 6 4 6 4 6 6 4 6 3 6 2 6 0 6 6 5 0
 6 6 6 6 6 6 5 5 5 5 5 4
 2 1 8 1 1 1 5 1 4 1 3 1 2 1 1 1 9 1 5 1 4 1 3 1 2 9
 1 6 6 6 4 6 6 6 7 6 8 6 9 6 6 9 6 8 6 7 6 6
 8 8 7 7 7 7 7 7 6 6 6 6
 2 1 2 1 2 1 1 1 7 1 5 1 5 1 4 1 3 1 2 1 1 1 7 1 5 8
 2 6 7 6 1 6 4 6 6 9 6 2 6 3 6 5 6 6 6 7 6 6 7
 9 9 9 9 8 8 8 8 8 8 8 7
 2 1 4 1 4 1 3 1 2 1 2 1 1 1 9 1 1 1 5 1 4 1 3 1 2 7
 3 7 7 7 1 7 5 7 9 7 3 7 6 7 7 6 3 6 5 6 6 6 7
 0 0 0 0 0 0 0 0 9 9 9 9
 2 1 6 1 2 1 5 1 5 1 4 1 4 1 3 1 2 1 2 1 1 1 7 1 5 6
 4 7 7 7 7 7 1 7 6 7 0 7 4 7 8 7 1 7 4 7 7 8
 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
 2 1 2 1 1 1 1 1 1 1 8 1 3 1 5 1 5 1 4 1 4 1 3 1 2 5
 5 7 7 7 7 7 7 7 7 7 7 7 7 7

G	. 4	4	4	4	4	4	5	5	5	5	5	5	5	(
(	5	6	7	8	9	0	1	2	3	4	5	6	6	←											
□	4	4	4	4	4	4	5	5	5	5	5	5	5												
	G 5	G 6	G 7	G 8	G 9	G 0	G 1	G 2	G 3	G 4	G 5	G 6	3												
→	r	r	r	r	r	r	r	r	r	r	r	r	r	0											
)	.	'	.	'	.	'	.	'	.	'	.	'	.	'											
	3	5	3	7	3	7	3	3	3	3	2	7	2	2	2	6	2	0	2	4	2	8			
2	1	4	1	4	1	3	1	3	1	3	1	2	1	2	1	1	1	1	1	9	1	4	1	5	4
6	7	4	7	1	7	8	7	4	7	1	7	7	7	3	7	9	7	4	7	7	7	9			
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3			
2	1	3	1	1	1	5	1	5	1	5	1	5	1	4	1	4	1	4	1	3	1	3	1	2	3
7	7	7	7	7	9	7	6	7	3	7	0	7	7	7	4	7	0	7	6	7	1	7	9		
	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5			
2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	9	1	7	1	4	1	2	1	0	2
8	7	2	7	1	7	7	7	7	7	6	7	4	7	2	7	7	7	7	7	7	7	7			
	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7			
2	1	4	1	4	1	4	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1
9	7	1	7	1	7	0	7	9	7	8	7	7	7	6	7	5	7	4	7	2	7	1	7	0	
	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8			
3	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0
0	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8			
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

[Foot of page 34: printed folio "57" at lower right; signature/catchword region at foot illegible. This completes the 45°–56° pole-altitude block of TAB. 32 — the full semicircle closes at 180°0' across all twelve pole columns. The next tables (Part III: nonagesimal altitude, Sun's mean motions, etc.) follow in subsequent batches.]

Parsing notes: All three pages share an identical layout: 12 pole-altitude column-pairs (45°–56°), each split Gr. /'; left stub = argument degree (0–30) under a zodiac sign-symbol; right stub = complementary degree (30→0) with the complementary sign-symbol. The complementary right-stub count is rendered here as the trailing "(← 30)" column. Sign-symbols in the original are engraved glyphs in the stub cells at sign boundaries; identified here by zodiacal position (the progression Libra → Scorpio → Sagittarius → Capricorn → Aquarius → Pisces continues the Aries→Virgo block from batch 161 and closes the circle at 180°0'). The minute columns are dense; where a digit was ambiguous I cross-checked against the

column's monotone progression. A few faint cells (noted below) are best-readings. The header repeats "Gr." over each pole; I have prefixed each with the pole-degree for table clarity, but the engraved header is simply the pole-degree number atop a "Gr. | '" pair.

Tabulae novalmagesticae — TAB. 32 (continued)

The oblique ascension for variable pole-altitudes (the high-latitude columns, 57°–67°).

These three pages continue TAB. 32 — the table of oblique ascension reckoned for the elevation of the pole — carrying it through the pole-altitude columns from 57° up to 67° (including the intermediate column 66½°). Each pole-altitude block is given in degrees (*Gr.*) and minutes ('). The leftmost stub column gives the argument: the running count of degrees within each zodiacal sign, with the zodiac signs marked at the head of each thirty-degree block. The rightmost column gives the complementary argument (counting down from 30) and the complementary sign.

The "TAB. 33." catchword at the foot of the third page (table-page 37) signals that TAB. 33 begins on the following leaf; it has not yet started within this batch.

Table-page 35 — pole altitudes 57°–67°, signs Aries (♈)→ Gemini (♊) start

Column heads, left to right: argument (degrees within the sign); pole-altitude blocks 57, 58, 59, 60, 61, 62, 63, 64, 65, 66½, 67, each in **Gr.** (degrees) and ' (minutes); complementary-argument column at right.

The stub for the first 30-degree block is headed ♈ (**Aries**); the second block (rows 0–30 again) is headed ♉ (**Taurus**) at left, with the right-hand sign marker ♏ (**Scorpio**) / the descending count.

[Margin: the right-hand index column runs 30, 29, 28 ... down to 0, marking the complement of the argument.]

	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	C				
	7	8	9	0	1	2	3	4	5	½	7									o				
A																					m			
r	G 5	G 5	G 5	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	G 6	p				
g	r 7	r 8	r 9	r 0	r 1	r 2	r 3	r 4	r 5	r ½	r 7									l				
.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	.			
□	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3			
																					0			
0																								
1	0	1	0	1	0	1	0	1	0	1	0	1	0	8	0	6	0	4	0	0	3	1	2	
		8		6		5		3		2		0									6	9	0	
2	0	3	0	3	0	3	0	2	0	2	0	2	0	1	0	1	0	8	0	0	3	5	2	
		6		3		0		7		4		0		6		2					5	9	8	
																					9			
3	0	5	0	5	0	4	0	4	0	3	0	3	0	2	0	1	0	1	0	0	3	5	2	
		4		0		5		0		6		0		4		8		1			5	7	7	
																					9			
4	1	1	1	7	1	0	0	5	0	4	0	4	0	3	0	2	0	1	0	0	3	5	2	
		2						4		8		0		1		4		5			5	6	6	
																					9			
5	1	3	1	2	1	1	1	8	1	0	0	5	0	4	0	3	0	1	0	0	3	5	2	
		1		4		6						0		0		0		9			5	3	5	
																					9			
6	1	4	1	4	1	3	1	2	1	1	0	4	0	3	0	2	0	0	0	—	—	3	5	2
		9		0		1		1		0		8		5		2					5	4	4	
																					9			
7	2	7	1	5	1	4	1	3	1	1	1	1	0	4	0	2	0	0	0	—	—	3	5	2
				7		6		5		4		0		1		4					5	1	3	
																					9			
8	2	2	2	1	2	2	1	4	1	3	1	5	0	4	0	2	0	0	0	—	—	3	5	2
		6		4				9		6				8		9					5	0	2	
																					9			
9	2	4	2	3	2	1	2	3	1	4	1	3	1	1	0	5	0	3	0	0	3	4	2	
		4		1		7				8		0		5		4		3			5	8	1	
																					9			

											6												
											6	6	C										
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r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	p		
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	r	7	l
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2	6	1	5	4	5	1	4	3	4	5	3	2	2	4	2	3	1	2	0	0	3	3	1
0		3		3		2		9				8		6				0			5	2	0
																					9		
2	6	3	6	1	5	2	4	5	4	1	3	3	2	5	2	1	1	2	0	0	3	3	9
1		3				9		4		8		9		5		0		7			5	0	
																					9		
2	6	5	6	2	5	4	5	9	4	3	3	5	3	4	2	1	1	2	0	0	3	2	8
2		3		0		6				1		0			7		7				5	9	
																					9		
2	7	1	6	3	6	3	5	2	4	4	4	2	3	1	2	2	1	3	0	0	3	2	7
3		3		8				4		5				3		4		0			5	7	
																					9		
2	7	3	6	5	6	2	5	3	4	5	4	1	3	2	2	3	1	3	0	0	3	2	6
4		3		7		0		9		8		3		3		1		6			5	6	
																					9		
2	7	5	7	1	6	3	5	5	5	1	4	2	3	3	2	3	1	3	0	0	3	2	5
5		3		6		7		5		1		4		2		8		8			5	4	
																					9		
2	8	1	7	3	6	5	6	1	5	2	4	3	3	4	2	4	1	4	0	0	3	2	4
6		4		5		4		1		5		6		2		5		3			5	2	
																					9		
2	8	3	7	5	7	1	6	2	5	3	4	4	3	5	2	5	1	4	0	0	3	1	3
7		5		4		2		7		9		7		2		1		8			5	9	
																					9		
2	8	5	8	1	7	3	6	4	5	5	4	5	4	1	2	5	1	5	0	0	3	1	2
8		6		4		0		3		3		9				9		3			5	7	
																					9		
2	9	1	8	3	7	4	6	5	6	8	5	1	4	1	3	7	1	5	0	0	3	1	1
9		7		4		8		9				2		1				7			5	5	
																					9		

	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	C		
	7	8	9	0	1	2	3	4	5	½	7										o		
A	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	6	m	
r	g	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	p	
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3	9	3	8	5	8	6	7	1	6	2	5	2	4	2	3	1	2	1	0	0	3	1	0
0	9	4				6	2	4	1	5											5	4	
																						9	
□	9	3	8	5	8	6	7	1	6	2	5	2	4	2	3	1	2	1	0	0	3	1	□
		9	4					6	2	4	1	5										5	4
0																						9	3
																							0
1	1	0	9	1	8	2	7	3	6	3	5	3	4	3	3	2	2	7	0	0	3	1	2
	0		4	5	3	7	7	2	3												5	2	9
																						9	
2	1	2	9	3	8	4	7	5	6	5	5	5	4	4	3	3	2	1	0	0	3	1	2
	0	2	4	4	0	2	0	3	1	2											5	0	8
																						9	
3	1	4	9	5	9	3	8	7	7	7	6	3	4	5	3	3	2	1	0	0	3	8	2
	0	4	5										4	9	7						5	7	
																						9	
4	1	6	1	1	9	2	8	2	7	2	6	1	5	5	3	4	2	2	0	0	3	7	2
	1	0	6	2	4	2	6								7	2					5	6	
																						9	
5	1	2	1	3	9	4	8	4	7	3	6	2	5	1	3	5	2	2	0	0	3	5	2
	1	9	0	7	1	1	8	9	5	5	8										5	5	
																						9	
6	1	5	1	5	1	0	8	5	7	5	6	4	5	2	4	4	2	3	0	0	3	2	2
	1	2	0	9	0		9	4	3	6							4				5	4	
																						9	
7	1	1	1	2	1	2	9	1	8	1	6	5	5	3	4	1	2	4	0	0	3	0	2
	2	6	1	1	0	1	7	0	7	8	2	0									5	3	
																						9	
8	1	4	1	4	1	4	9	3	8	2	7	1	5	4	4	2	2	4	0	0	3	5	2
	2	0	1	3	0	2	6	7	1	9	0	4									5	8	2

											6												
											6	6	C										
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											6												
A	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	p		
r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	r	7	l	
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																			8	3	2		
1	1	2	1	1	1	5	1	2	1	5	1	8	8	1	6	1	3	5	0	0	3	2	1
9	7	8	6	2	4	2	3	4	1	2	0		8	3	6					5	9	1	
																			8				
2	1	5	1	3	1	1	1	4	1	1	1	2	8	3	6	2	4	4	0	0	3	2	1
0	7	7	6	9	5	7	3	8	2	1	0	7	2	4						5	7	0	
																			8				
2	1	2	1	7	1	4	1	1	1	3	1	4	8	4	6	3	4	1	0	0	3	2	9
1	8	6	7		5	3	4	2	2	3	0	5	8	8	3					5	3		
																			8				
2	1	5	1	3	1	9	1	3	1	5	1	4	9	5	6	5	4	2	0	0	3	1	8
2	8	6	7	6	6		4	6	2	5	1				0	2				5	9		
																			8				
2	1	2	1	4	1	3	1	1	1	1	1	2	9	2	7	4	4	3	0	0	3	1	7
3	9	6	8		6	6	5		3	7	1	4	1				0			5	4		
																			8				
2	1	5	1	3	1	3	1	2	1	4	1	4	9	3	7	2	4	4	0	0	3	1	6
4	9	7	8	3	7		5	6	3	0	1	5	8	1	1					5	1		
																			8				
2	2	2	1	3	1	3	1	5	1	5	1	7	9	5	7	3	4	4	0	0	3	7	5
5	0	9	9		7	1	5	2	4		2		6	2	8					5			
																			8				
2	2	1	1	3	1	0	1	1	1	3	1	2	1	1	7	4	4	5	0	0	3	3	4
6	1		9	3	8		6	9	4	0	2	8	0	4	5	8				5			
																			8				
2	2	3	2	4	1	3	1	4	1	4	1	5	1	3	8	1	5	9	0	0	3	5	3
7	1	4	0		8	0	6	7	4	9	2	0	0	4						5	8		
																			7				
2	2	8	2	3	1	0	1	1	1	2	1	1	1	5	8	1	5	2	0	0	3	5	2
8	2		0	6	9		7	6	5	0	3	3	0	3	6	1				5			

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A	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	p				
r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	7				
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																	7	2					
2	2	4	2	9	1	3	1	4	1	4	1	3	1	1	8	3	5	3	0	0	3	5	1
9	2	2	1		9	1	7	5	5	7	3	7	1	3		3		0			5	1	
																	7						
3	2	1	2	4	2	2	1	1	1	1	1	5	1	3	8	5	5	4	0	0	3	4	0
0	3	7	1	3	0		8	2	6	4	4		1	4		0		2			5	6	
																	7						

Parsing notes: page 35 covers the first sign-block (☊ Aries, argument 0–30) and the second (♉ Taurus, argument 0–30). In the 66½° column every entry reads 0 0 in this argument range (the oblique ascension is effectively suppressed at this high pole-altitude near the start of the table). Several 66½° / 65° cells in rows 6–8 and 16 are blank in the source (marked —), as is consistent with the table's truncation at high latitude. The descending complement column at far right gives the supplement (☊ 357°–360°) for the Libra/Scorpio reflection.

Table-page 36 — pole altitudes 57°–67°, signs Gemini (♊) ☊ Cancer (♋)

Column heads identical: argument; pole-altitude blocks 57, 58, 59, 60, 61, 62, 63, 64, 65, 66½, 67 in **Gr.** /'; complementary argument at right.

The first 30-degree block is headed ☊ (**Gemini**) at left; the second is headed ☊ (**Cancer**). In the 66½° and 67° columns at high latitude the entries break off, and the source prints the words "**Non oc-ci-dit.**" ("does not set") spread down the column cells — the marginal note that, for these declinations at this pole-elevation, the point is circumpolar and never sets.

																		6	C				
		5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	o			
		7	8	9	0	1	2	3	4	5	½												
A																	6	m					
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	p				
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	6	l	
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	7	.	
□	2	1	2	4	2	2	1	1	1	1	1	5	1	3	8	5	5	4	0	0	3	3	
	3	7	1	3	0		8	2	6	4	4		1	4		0	2				5	0	
0																						7	
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1	2	5	2	1	2	3	1	4	1	4	1	2	1	5	9	7	5	5	0	0	3	2	
	3	3	2	7	0	4	8	2	6	1	4	5	1	6			4				5	9	
																						7	
																						3	
																						4	
2	2	3	2	5	2	7	1	1	1	1	1	5	1	1	9	2	6	7	0	0	3	2	
	4	0	2	2	1		9	3	7	0	4	1	2	8	5						5	8	
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																						2	
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3	2	7	2	2	2	4	1	4	1	4	1	1	1	1	4	9	4	6	2	0	0	3	2
	5		3	8	1	1	9	5	7	0	5	2	2	2		4		1			5	7	
																						7	
																						1	
																						0	
4	2	4	2	5	2	1	2	1	1	1	1	1	4	1	7	1	4	6	3	0	0	3	2
	5	5	4		2	6	0	8	8	0	5	7	3		0			6			5	6	
																						7	
																						2	
																						6	
5	2	2	2	4	2	5	2	5	1	4	1	1	1	3	1	2	6	4	0	0	3	2	

																			6			
	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	C		
	7	8	9	0	1	2	3	4	5	½									o			
A																			6	m		
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	6	p		
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	6	l
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																					1	
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1	3	3	2	4	2	4	2	3	2	1	1	2	1	2	1	5	8	3	0	0	3	1
1	0	6	8	6	6	6	4	5	2	0	9	7	6	4	2	1		6			5	9
																						6

																						4
																						1
1	3	2	2	3	2	2	2	1	2	4	2	3	1	5	1	9	9	1	0	0	3	1
2	1	1	9	0	7	8	5	5	2	8	0		6	6	3		7				5	8
																						5

																						4
																						3
1	3	7	3	1	2	1	2	5	2	2	2	4	1	2	1	4	9	7	0	0	3	1
3	2		0	5	8	1	5	8	3	8	0	0	7	9	3	8					5	7
																						5

																						2
																						3
1	3	5	3	1	2	5	2	4	2	1	2	1	1	5	1	1	9	4	0	0	3	1
4	2	4	1		8	7	6	1	4	0	1	8	8		4	8		0			5	6
																						5

																						6
																						6
1	3	4	3	4	2	4	2	2	2	5	2	5	1	4	1	5	1	7	0	0	3	1
5	3	3	1	8	9	3	7	5	4	2	1	8	8	3	4	0	0				5	5
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8

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	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	o
	7	8	9	0	1	2	3	4	5	6	6	6	6	6	6	6	½	m	
A																	6		
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	p
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	l
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1	3	3	3	3	3	3	2	1	2	3	2	4	1	2	1	2	1	3	0
6	4	3	2	6	0	0	8	0	5	5	2	0	9	1	5	4	0	6	0
																			3
																			4
																			7
1	3	2	3	2	3	1	2	5	2	2	2	2	2	2	1	0	1	0	0
7	5	4	3	5	1	8	8	7	6	3	3	4	0	6	1				3
																			3
																			1
																			3
1	3	1	3	1	3	7	2	4	2	7	2	8	2	4	1	4	1	4	0
8	6	5	4	6	2		9	5	7		4		0	4	6	1	1	0	0
																			3
																			4
1	3	7	3	8	3	5	3	3	2	5	2	5	2	2	1	1	1	1	0
9	7		5		2	8	0	5	7	5	4	3	1	8	7	8	2	4	0
2	3	0	3	1	3	5	3	2	2	4	2	4	2	1	1	1	1	4	0
0	8		6		3	0	1	5	8	4	5	2	2	1	8		2	9	0
																			N
																			o
																			n
2	3	5	3	5	3	4	3	1	3	2	2	2	2	4	1	2	1	1	0
1	8	5	6	5	4	3	3	7	0	6	7	1	3	6	9	7	4		9
2	3	5	3	5	3	3	3	3	3	2	2	2	2	4	1	2	1	0	0
2	9	1	7	0	5	7	3	3	0	6	7	1	3	6	9	7	4		o
																			8
																			c
																			-
2	4	4	3	4	3	3	3	5	3	2	2	1	2	3	2	1	1	4	0
3	0	8	8	6	6	3	4		1	0	8	3	4	6	0	4	4	1	7

																			6			
		5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	C	
		7	8	9	0	1	2	3	4	5								$\frac{1}{2}$			o	
A																			6		m	
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	p	
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	$\frac{1}{2}$	6	
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	7	.
4	5	2	5	2	4	1	4	4	4	5	3	4	3	0	3	3	2	4	8	4	2	
	2	9	0	5	8	1	5	1	2	2	9	3	6		1	0	5	5		4	6	
5	5	3	5	3	4	2	4	5	4	5	4	5	3	1	3	4	2	5	1	5	2	
	3	9	1	6	9	2	6	3	4		0	6	7	5	2	7	7		0	4	5	
6	5	5	5	4	5	3	4	6	4	1	4	1	3	3	3	5	2	2	1	5	c	
	4	0	2	8	0	4	8		5	9	2	1	8	2	4		8	8	3		i	
																					-	
7	5	2	5	1	5	4	4	2	4	3	4	2	3	5	3	2	2	5	1	1	2	
	6		4		1	8	9	0	6	4	3	8	9	1	5	7	9	4	5	5	3	
8	5	1	5	1	5	3	5	3	4	5	4	4	4	1	3	5	3	2	1	2	2	
	7	5	5	3	3		0	6	7	1	4	6	1	2	6	1	1	6	7	5	2	
9	5	3	5	3	5	1	5	5	4	1	4	6	4	3	3	1	3	5	1	3	d	
	8	0	6	0	4	9	1	3	9	0	6		2	4	8	7	2	9	9	6	i	
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1	5	4	5	4	5	3	5	1	5	3	4	2	4	5	3	4	3	3	2	4	2	
0	9	6	7	7	5	6	3	1	0	0	7	7	3	8	9	5	4	4	1	6	0	
1	6	3	5	4	5	5	5	3	5	5	4	5	4	2	4	1	3	9	2	5	1	
1	1		9		6	4	4	1	1	1	8	1	5	4	1	5	6		3	6	9	
1	6	2	6	2	5	1	5	5	5	1	5	1	4	5	4	4	3	4	2	6	1	
2	2	0	0	2	8	3	5	0	3	3	0	5	6	1	2	6	7	9	6		8	
																					1	
1	6	3	6	4	5	3	5	1	5	3	5	4	4	1	4	1	3	2	2	1	2	
3	3	8	1	1	9	3	7	2	4	6	1	1	8	9	4	8	9	3	8	5	3	
1	6	5	6	1	6	5	5	3	5	1	5	9	4	4	4	5	4	0	3	2	4	
4	4	7	3		0	4	8	5	9		3		9	9	5	3	1		0	5	1	
1	6	1	6	2	6	1	5	5	5	2	5	3	5	2	4	3	4	3	3	3	4	
5	6	7	4	2	2	7	9	9	7	5	4	7	1	1	7	0	2	9	2	4	5	

											6									C	
	5	5	5	6	6	6	6	6	6	6	6	6								o	
	7	8	9	0	1	2	3	4	5	½										m	
A																	6				
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	p
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	6
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	7

1	6	3	6	4	6	4	6	2	5	5	5	3	5	4	4	0	4	2	3	4	2	1
6	7	8	5	4	3	1	1	4	8	1	6		2	7	9		4	1	4	3	9	4

2
9

1	6	0	6	7	6	6	6	5	6	1	5	3	5	2	5	3	4	6	3	5	3	1
7	9		7		5		2	0	0	7	7	3	4	1	0	2	6		6	2	2	3

4

1	7	2	6	3	6	3	6	1	6	4	5	0	5	5	5	1	4	5	3	1	3	1
8	0	3	8	1	6	0	4	7	1	9	9		5	5	2	8	7	4	9		4	2

3
5

1	7	4	6	5	6	5	6	4	6	1	6	3	5	3	5	4	4	4	4	4	1	3	1
9	1	6	9	6	7	6	5	5	3	9	0	7	7	2	3	9	9	4	1	7	9	1	

2
7

2	7	1	7	2	6	2	6	1	6	5	6	1	5	1	5	4	5	3	4	1	3	1
0	3	0	1	1	9	3	7	3	4	0	2	0	9	0	5	2	1	9	3	7	9	0

2
7

2	7	3	7	4	7	5	6	4	6	2	6	5	6	4	5	2	5	1	4	2	4	9
1	4	4	2	7	0	1	8	2	6	1	3	0	0	7	7	2	3	9	5	5	1	

5
0

2	7	5	7	1	7	1	7	1	6	5	6	2	6	2	5	4	5	8	4	3	4	8
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																					6			
		5		5		5		6		6		6		6		6		6		6		6		C
		7		8		9		0		1		2		3		4		5		½		6		o
A																								m
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	G	6		p
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	6		l	
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	7		.	
2	5	9	4	4	2	9	0	2	7	3	5	3	2	3	9		5		7	3	4			

																								9
2	7	2	7	4	7	4	7	4	6	2	6	5	6	0	6	4	5	5	4	4	4	4	7	
3	7	5	5	1	3	8	1	3	9	6	6	5	4		0	7	6	0	9	0	6			

																								2
																								7
2	7	5	7	9	7	1	7	1	7	5	6	2	6	4	6	3	5	5	5	4	4	6		
4	8	1	7		5	7	3	5	0	8	8	7	5	4	2	0	8	0	1	8	8			

																								4
																								3
2	8	1	7	3	7	4	7	4	7	3	7	0	6	2	6	1	6	4	5	5	5	5		
5	0	8	8	7	6	7	4	7	2	1	0		7	5	4	9	0	2	3	5	0			

																								5
																								9
2	8	4	8	6	7	1	7	2	7	1	7	4	6	6	6	5	6	3	5	0	5	4		
6	1	6	0		8	8	6	0	4	1	1	8	9		5	0	2	5	6		3			

																								1
																								3
2	8	1	8	3	7	4	7	5	7	4	7	2	7	4	6	5	6	1	5	7	5	3		
7	3	4	1	6	9	9	7	3	5	6	3	6	0	9	7	0	4	9	8		5			

																								2
																								7
2	8	4	8	6	8	2	7	2	7	2	7	4	7	3	6	3	6	1	6	1	5	2		
8	4	3	3		1	1	9	7	7	2	5		2	1	9	6	6	1	0	7	7			

										6												
	5	5	5	6	6	6	6	6	6	6	C											
	7	8	9	0	1	2	3	4	5	½	o											
A										6	m											
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	p	
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	6	l
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	7	.

																					4	
																						0
2	8	1	8	3	8	5	8	1	7	5	7	4	7	1	7	2	6	1	6	1	5	1
9	6	2	4	6	2	3	1		8	8	6	3	4	4	1	3	8	1	2	7	9	

																						5
																						2
3	8	4	8	7	8	2	8	3	8	3	7	2	7	5	7	1	7	4	6	2	6	0
0	7	1	6		4	6	2	6	0	6	8	4	5	8	3	1	0		4	3	0	

3

Parsing notes: page 36 covers the ♊ (Gemini, arg. 0–30) block and the ♋ (Cancer, arg. 0–30) block. The 67° column in the Gemini block (rows 19–30) and again in the Cancer block (rows 1–11) is replaced by the printed legend "**Non occidit.**" ("does not set") set vertically across the cells — these high-declination points are circumpolar at the 67° pole-elevation and do not rise/set. In the Cancer block the 66½° column resumes finite values from row 1 (2'11" etc.). Several rightmost-complement cells were tightly set; the descending index column (30→0) is given at right. The two-figure right-hand entries in the Cancer block (e.g. "16 1", "23", "41") are the residual 67° values printed where the legend ends.

Table-page 37 — pole altitudes 57°–67°, signs Leo (♌) Virgo (♍)

Column heads identical: argument; pole-altitude blocks **57, 58, 59, 60, 61, 62, 63, 64, 65, 66½, 67** in **Gr.** /'; argument index at far right (here counting 30→0, with the sign markers ♌ Leo and ♍ Virgo at the heads of the two blocks).

															6								
	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
	7	8	9	0	1	2	3	4	5	½	7												
A																6							
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	I		
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	r	7	d
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	x
□	8	4	8	7	8	2	8	3	8	3	7	2	7	1	7	0	6	2	6	3	6	3	3
	7	1	6		4	6	2	6	0	6	8	4	3	1	0		4	3	2		0		0
0																							
1	8	1	8	3	8	5	8	1	8	1	8	5	7	4	7	0	7	5	6	1	6	1	2
	9	1	7	8	5	9	4	1	2	4	0		7	2	5		1	7	6	8	4	3	9
2	9	4	8	1	8	3	8	4	8	5	8	4	7	2	7	4	7	5	6	3	6	2	2
	0	1	9	0	7	3	5	7	3	1	1	5	9	5	6	7	3	0	8	3	6	4	8
3	9	1	9	4	8	7	8	2	8	3	8	2	8	1	7	4	7	3	6	3	6	3	2
	2	1	0	2	9		7	3	5	0	3	5	1	0	8	2	0	7	8	3	6	5	7
4	9	4	9	1	9	4	8	5	8	7	8	7	8	5	8	2	7	3	7	4	7	4	2
	3	2	2	4	0	0	8	9	7		5		2	4	0	4	7	7	2	0	0	2	6
5	9	1	9	4	9	1	9	3	8	4	8	5	8	3	8	1	7	1	7	4	7	5	2
	5	3	3	7	2	5	0	6	8	8	6	0	4	9	2	2	9	8	4	4	2	8	5
6	9	4	9	2	9	5	9	1	9	2	8	3	8	2	8	2	8	2	7	4	7	1	2
	6	4	5	0	3	0	2	3	0	7	8	2	6	4	4		1	4	6	7	4	6	4
7	9	1	9	5	9	2	9	5	9	6	9	1	8	1	8	5	8	1	7	4	7	0	2
	8	5	6	3	5	5	3	0	2		0	4	8	0	5	1	3	7	8	9	7		3
8	9	4	9	2	9	0	9	2	9	4	9	5	8	5	8	4	8	1	8	5	7	1	2
	9	7	8	6	7		5	7	3	6	1	6	9	5	7	0	5	1	0	2	9	0	2
9	1	1	9	5	9	3	9	4	9	2	9	3	9	4	8	3	8	5	8	5	8	1	2
	0	9	9	9	8	5	7		5	6	3	9	1	1	9	1	7		2	4	1	4	1
1																							
1	1	5	1	3	1	1	9	4	9	6	9	2	9	2	9	1	3	5	8	5	8	1	2
0	0	1	0	3	0	1	8	2	7		5	1	3	6	1	9	8	8	4	5	3	7	0
	2		1		0																		
1	1	2	1	7	1	4	1	2	9	4	9	4	9	1	9	7	9	5	8	5	8	2	1
1	0	3	0		0	7	0	0	8	6	7		5	1	3		0	1	6	6	5	6	9
	4		3		1		0																
1	1	5	1	4	1	2	1	5	1	2	9	4	9	5	9	5	9	4	8	5	8	3	1

																6								
	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
	7	8	9	0	1	2	3	4	5	½	7													
A																6								
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	I			
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	r	7	d	
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	x	
2	0	6	0	2	0	3	0	8	0	7	8	7	6	8	4	7	2	5	8	6	7	0	8	
	5		4		3		1		0															
1	1	2	1	1	1	5	1	3	1	8	1	2	9	4	9	4	9	3	9	5	8	3	1	
3	0	9	0	6	0	9	0	6	0		0	9	8	4	6	7	4	9	0	8	9	2	7	
	7		6		4		3		2		0													
1	1	2	1	5	1	3	1	1	1	4	1	1	1	2	9	3	9	3	9	5	9	3	1	
4	0		0	1	0	5	0	4	0	8	0	2	0	9	8	5	6	2	2	8	1	5	6	
	9		7		6		5		3		2		0											
1	1	3	1	2	1	1	1	5	1	2	1	4	1	1	1	2	9	2	9	5	9	3	1	
5	1	5	0	6	0	2	0	3	0	8	0	9	0	5	0	4	8	5	4	7	3	7	5	
	0		9		8		6		5		3		2		0									
1	1	7	1	0	1	4	1	3	1	8	1	3	1	2	1	1	1	1	1	9	5	9	4	1
6	1		1		0	8	0	1	0		0	5	0		0	3	0	8	6	7	5	0	4	
	2		1		9		8		7		5		4		2		0							
1	1	4	1	3	1	2	1	9	1	4	1	2	1	4	1	2	1	1	1	9	5	9	4	1
7	1	0	1	4	1	4	1		0	9	0	2	0	7	0		0	0	8	6	7	2	3	
	3		2		1		0		8		7		5		4		2							
1	1	1	1	9	1	1	1	4	1	3	1	7	1	3	1	5	1	2	1	5	9	4	1	
8	1	3	1		1		1	7	1	9	0		0	2	0	0	0		0	5	9	3	2	
	5		4		3		1		0		9		7		5		4		0					
1	1	4	1	4	1	3	1	2	1	1	1	4	1	1	1	4	1	5	1	5	1	4	1	
9	1	6	1	3	1	7	1	6	1	0	1	8	0	8	0	0	0	3	0	3	0	4	1	
	6		5		4		3		2		0		9		7		5		2		1			
2	1	1	1	1	1	1	1	4	1	5	1	3	1	3	1	2	1	4	1	5	1	4	1	
0	1	9	1	8	1	3	1		1	0	1	0	1		0	7	0	6	0	1	0	4	0	
	8		7		6		5		3		2		1		9		7		4		3			
2	1	5	1	5	1	5	1	4	1	3	1	1	1	4	1	1	1	3	1	4	1	4	9	
1	1	2	1	3	1	0	1	4	1	1	1	3	1	9	1	7	0	7	0	8	0	4		
	9		8		7		6		5		4		2		1		9		6		5			
2	1	2	1	2	1	2	1	2	1	1	1	5	1	3	1	5	1	2	1	4	1	4	8	

																		6					
5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6						
7	8	9	0	1	2	3	4	5	½	7													
A																			6				
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	I				
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r ½	r 7	d		
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	x		
<hr/>																							
2	2	5	2	8	1	7	1	3	1	2	1	6	1	4	1	1	8	0	6	0	3		
	1		0		9		8		7		5		4		3		1		8		7		
2	1	5	1	3	1	4	1	1	1	5	1	3	1	2	1	5	1	1	1	4	1	4	7
3	2	8	2		2		2		1	2	1	9	1	0	1	3	1	9	1	3	0	3	
	2		2		1		0		8		7		6		4		3		0		9		
2	1	3	1	3	1	4	1	3	1	3	1	2	1	4	1	4	1	9	1	3	1	4	6
4	2	1	2	8	2	1	2	9	2	3	1	1	1		1	1	1		1	9	1	2	
	4		3		2		1		0		9		8		6		5		2		1		
2	1	5	1	1	1	1	1	1	1	1	1	5	1	5	1	2	1	2	1	3	1	4	5
5	2		2	3	2	7	2	7	2	3	2		1	0	1	9	1		1	6	1	1	
	6		5		4		3		2		1		9		8		7		4		3		
2	1	3	1	4	1	5	1	5	1	5	1	4	1	3	1	1	1	5	1	3	1	3	4
6	2	9	2	8	2	4	2	6	2	3	2	8	2	6	2	7	1	4	1	2	1	9	
	7		6		5		4		3		2		1		0		8		6		5		
2	1	1	1	2	1	3	1	3	1	3	1	3	1	2	1	5	1	4	1	2	1	3	3
7	2	2	2	2	2	0	2	4	2	4	2	0	2	1	2		2	4	1	7	1	7	
	9		8		7		6		5		4		3		2		0		8		7		
2	1	4	1	5	1	6	1	1	1	1	1	1	1	5	1	5	1	3	1	2	1	3	2
8	3	5	2	7	2		2	2	2	4	2	2	2		2	2	2	3	2	1	1	4	
	0		9		9		8		7		6		5		3		2		0		9		
2	1	1	1	3	1	4	1	5	1	5	1	5	1	4	1	3	1	2	1	1	1	3	1
9	3	8	3	2	3	2	2	0	2	5	2	5	2	9	2	9	2	2	2	2	4	2	1
	2		1		0		9		8		7		6		5		4		2		1		
3	1	5	1	6	1	1	1	2	1	3	1	3	1	3	1	2	1	1	1	1	1	2	0
0	3	1	3		3	8	3	8	3	5	2	7	2	4	2	6	2	3	2	1	2	7	
	3		3		2		1		0		9		8		7		6		4		3		
□	1	5	1	6	1	1	1	2	1	3	1	3	1	3	1	2	1	1	1	1	1	2	□
	3	1	3		3	8	3	8	3	5	2	7	2	4	2	6	2	3	2	1	2	7	
0	3		3		2		1		0		9		8		7		6		4		3	3	
																						0	

		5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
		7	8	9	0	1	2	3	4	5	½	7											
A		6																					
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	G	6	I
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	½	r	7	d
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	x
1	1	2	1	4	1	5	1	6	1	1	1	1	1	1	1	1	1	3	1	7	1	2	2
	3	4	3	1	3	5	3		3	4	3	9	3	7	2	2	2		2		2	3	9
	5		4		3		3		2		1		0		9		8		6		5		
2	1	5	1	1	1	3	1	4	1	5	1	0	1	1	1	5	1	5	1	1	1	1	2
	3	7	3	5	3	1	3	4	3	4	3		3		3	9	2	2	2		2	9	8
	6		6		5		4		3		3		2		0		9		8		7		
3	1	3	1	5	1	7	1	2	1	3	1	4	1	4	1	4	1	4	1	4	1	1	2
	3	0	3	0	3		3	2	3	4	3	2	3	6	3	7	3	2	2	9	2	5	7
	8		7		7		6		5		4		3		2		1		9		9		
4	1	3	1	2	1	4	1	0	1	1	1	2	1	3	1	3	1	3	1	4	1	1	2
	4		3	4	3	3	3		3	4	3	4	3	0	3	3	3	1	3	9	3	0	6
	0		9		8		8		7		6		5		4		3		1		1		
5	1	3	1	5	1	1	1	3	1	5	1	6	1	1	1	1	1	1	1	4	1	5	2
	4	5	4	8	4	9	3	7	3	3	3		3	7	3	5	3	9	3	2	3		5
	1		0		0		9		8		8		7		6		5		3		3		
6	1	8	1	3	1	5	1	1	1	3	1	4	1	5	1	1	1	1	1	3	1	0	2
	4		4	3	4	5	4	5	4	2	3	7	3	7	3		3		3	5	3		4
	3		2		1		1		0		9		8		8		7		5		5		
7	1	4	1	7	1	3	1	5	1	1	1	2	1	4	1	5	1	5	1	2	1	5	2
	4	1	4		4	1	4	3	4	2	4	9	4	1	3	2	3	7	3	8	3	4	3
	4		4		3		2		2		1		0		9		8		7		6		
8	1	1	1	4	1	7	1	3	1	5	1	1	1	2	1	4	1	4	1	2	1	5	2
	4	4	4	1	4		4	0	4	1	4	0	4	4	4	4	4	5	3	1	3	0	2
	6		5		5		4		3		3		2		1		0		9		8		
9	1	4	1	1	1	4	1	8	1	3	1	5	1	8	1	2	1	3	1	1	1	4	2
	4	7	4	5	4	3	4		4	0	4	1	4		4	3	4	4	4	3	4	4	1
	7		7		6		6		5		4		4		3		2		1		0		
10	1	1	1	4	1	1	1	4	1	1	1	3	1	5	1	1	1	2	1	5	1	3	2
	4	9	4	9	4	8	4	5	4	0	4	2	4	2	4	0	4	2	4		4	8	0
	9		8		8		7		7		6		5		5		4		3		2		

	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6							
	7	8	9	0	1	2	3	4	5	$\frac{1}{2}$	7																
A																											
r	G	5	G	5	G	5	G	6	G	6	G	6	G	6	G	6	G	6	G	6	G	6	I				
g	r	7	r	8	r	9	r	0	r	1	r	2	r	3	r	4	r	5	r	$\frac{1}{2}$	r	7	d				
.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	x				
2	1	1	1	0	1	4	1	3	1	1	1	0	1	4	1	2	1	2	1	2	1	1	1	9			
1	6	3	6		6	6	6	1	6	6	6		6	1	6	3	6		6	8	6	7					
	6		6		5		5		5		5		4		4		4		3		3						
2	1	4	1	3	1	2	1	9	1	5	1	4	1	2	1	8	1	4	1	1	1	9	8				
2	6	5	6	4	6	1	6		6	4	6	0	6	3	6		6	8	6	9	6						
	7		7		7		7		6		6		6		6		5		5		5						
2	1	1	1	7	1	5	1	4	1	3	1	2	1	6	1	5	1	3	1	9	1	1	7				
3	6	7	6		6	7	6	5	6	2	6	0	6		6	2	6	4	6		6						
	9		9		8		8		8		8		8		7		7		7		7						
2	1	4	1	4	1	3	1	2	1	1	1	0	1	4	1	3	1	2	1	5	1	5	6				
4	7	9	7	1	7	1	7	2	7	0	7		6	7	6	3	6	2	6	9	6	2					
	0		0		0		0		0		0		9		9		9		8		8						
2	1	2	1	1	1	6	1	5	1	4	1	4	1	3	1	1	1	8	1	4	1	4	5				
5	7	1	7	4	7		7	8	7	8	7	0	7	0	7	7	7		7	9	7	4					
	2		2		2		1		1		1		1		1		1		0		0						
2	1	5	1	4	1	4	1	3	1	2	1	2	1	4	1	5	1	4	1	3	1	3	4				
6	7	3	7	8	7	1	7	5	7	8	7	0	7		7	5	7	0	7	0	7	5					
	3		3		3		3		3		3		3		2		2		2		2						
2	1	2	1	2	1	1	1	6	1	6	1	5	1	4	1	4	1	3	1	1	1	1	3				
7	7	5	7	1	7	6	7		7		7	8	7	8	7	1	7	0	7	9	7	6					
	5		5		5		5		5		4		4		4		4		4		4						
2	1	5	1	5	1	4	1	4	1	4	1	3	1	3	1	2	1	2	1	9	1	8	2				
8	7	7	7	4	7	8	7	4	7	0	7	6	7	2	7	7	7	0	7		7						
	6		6		6		6		6		6		6		6		6		6		6						
2	1	2	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	9	1	9	1		
9	7	9	7	7	7	4	7	2	7	8	7	8	7	8	7	4	7	4	7	0	7		7				
	8		8		8		8		8		8		8		8		8		8		8						
3	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0				
0	8		8		8		8		8		8		8		8		8		8		8						
	0		0		0		0		0		0		0		0		0		0		0						

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.
3	65	64	63	62	61	60	59	58	57	56	55	54	53	52	27
	32	32	32	32	32	33	32	32	32	32	33	33	33	33	
6	65	64	63	62	61	60	59	58	57	56	55	54	53	52	24
	35	35	35	35	35	35	35	35	35	35	35	35	35	35	
9	65	64	63	62	61	60	59	58	57	56	55	54	53	52	21
	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
12	65	64	63	62	61	60	59	58	57	56	55	54	53	52	18
	55	55	55	55	55	55	55	55	55	55	55	55	55	55	
15	66	65	64	63	62	61	60	59	58	57	56	55	54	53	15
	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
18	66	65	64	63	62	61	60	59	58	57	56	55	54	53	12
	30	30	30	30	30	30	30	25	25	25	25	25	25	25	
21	66	65	64	63	62	61	60	59	58	57	56	55	54	53	9
	50	50	50	50	50	50	50	45	45	45	45	45	45	45	
24	67	66	65	64	63	62	61	60	59	58	57	56	55	54	6
	20	15	15	15	15	15	15	10	10	10	10	10	10	5	
27	67	66	65	64	63	62	61	60	59	58	57	56	55	54	3
	45	45	45	45	45	40	40	40	40	40	35	35	35	35	
□	68	67	66	65	64	63	62	61	60	59	58	57	56	55	0
0	20	20	18	15	15	15	10	10	10	10	5	5	15	0	□
3	68	67	66	65	64	63	62	61	60	59	58	57	56	55	27
	55	55	55	50	50	50	45	45	45	45	40	40	40	35	
6	69	68	67	66	65	64	63	62	61	60	59	58	57	56	24
	35	35	30	30	30	25	25	25	20	20	15	15	15	10	
9	70	69	68	67	66	65	64	63	62	61	59	58	57	56	21
	15	15	10	10	10	5	5	0	0	0	55	55	50	50	
12	71	70	69	67	66	65	64	63	62	61	60	59	58	57	18
	0	0	0	55	55	50	45	45	45	40	40	35	35	30	
15	71	70	69	68	67	66	65	64	63	62	61	60	59	58	15
	55	55	45	45	40	35	35	30	30	25	25	20	20	15	
18	72	71	70	69	68	67	66	65	64	63	62	61	60	59	12

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.
	45	40	35	35	30	25	25	20	20	15	15	10	10	10	
21	73	72	71	70	69	68	67	66	65	64	63	62	61	59	9
	40	35	30	30	25	20	20	15	15	10	5	5	0	55	
24	74	73	72	71	70	69	68	67	66	65	64	62	61	60	6
	35	35	30	25	20	20	15	10	5	0	0	55	50	55	
27	75	74	73	72	71	70	69	68	67	66	65	63	62	61	3
	35	35	30	25	20	20	10	10	5	5	0	55	50	55	
□	76	75	74	73	72	71	70	69	68	67	66	64	63	62	0
0	40	35	30	25	25	20	15	10	5	5	0	55	50	45	□
3	77	76	75	74	73	72	71	70	69	68	67	66	65	63	27
	45	40	35	30	30	25	25	15	10	5	5	0	0	50	
6	78	77	76	75	74	73	72	71	70	69	68	67	66	64	24
	55	50	45	40	40	35	25	20	15	10	10	5	0	55	
9	80	79	77	76	75	74	73	72	71	70	69	68	67	66	21
	5	0	55	50	45	35	30	25	20	20	25	10	5	0	
12	81	80	79	78	76	75	74	73	72	71	70	69	68	67	18
	15	10	5	0	55	50	45	40	35	30	25	20	15	10	
15	82	81	80	79	80	77	76	75	73	72	71	70	69	68	15
	30	25	20	15	20	5	0	0	50	40	35	30	30	20	
18	83	82	81	80	79	78	77	76	75	73	72	71	70	69	12
	45	40	35	20	25	20	15	5	15	50	50	40	40	35	
21	85	83	82	81	80	79	78	77	76	75	74	73	71	70	9
	0	55	50	45	40	45	30	25	20	15	10	0	55	50	
24	86	85	84	83	81	80	79	78	77	76	75	74	73	72	6
	20	15	10	5	55	50	45	40	35	30	25	20	15	5	
27	87	86	85	84	83	82	81	80	78	77	76	75	74	73	3
	35	30	25	20	15	10	5	0	55	50	45	40	30	25	
□	88	87	86	85	84	83	82	81	80	79	78	76	75	74	0
0	55	50	45	40	30	25	20	15	5	5	0	55	50	40	□
3	89	89	88	86	85	84	83	82	81	80	79	78	77	76	27
	45	55	0	55	50	45	40	35	30	20	20	10	5	0	

[?]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.

]
12	74	75	76	77	79	80	81	83	84	85	86	88	89	89	18	
	50	50	55	55	0	5	5	10	15	25	20	20	25	30		
15	73	74	76	77	78	79	80	81	82	84	85	86	89	89	15	
	55	50	0	5	5	10	30	25	20	25	25	30	30	35		
													[?			
]
18	73	74	75	76	77	78	80	81	82	83	84	85	86	89	12	
	25	0	5	15	15	20	25	25	25	30	50	35	40	12		
														[?		
]
21	72	73	74	75	76	77	78	80	81	82	83	84	84	89	9	
	20	20	25	25	30	30	35	35	40	40	40	0	5	45		
														[?		
]
24	71	72	73	74	75	76	77	78	79	80	83	84	84	89	6	
	35	40	40	45	45	45	50	50	50	55	0	0	5	0		
27	71	72	73	74	75	76	77	78	79	80	82	83	84	84	3	
	0	0	0	5	5	5	10	10	10	15	15	15	5	20		
														[?		
]
□	70	71	72	73	74	75	76	77	78	79	80	81	82	83	0	
0	25	25	25	25	20	30	30	30	30	35	35	35	35	40	□	
3	69	70	71	72	73	74	75	76	77	78	79	80	81	82	27	
	30	50	50	50	30	35	55	55	55	55	35	35	35	30		
6	69	70	71	72	73	74	75	76	77	78	79	80	81	82	24	
	20	20	20	20	25	25	25	25	25	25	25	25	30	30		
9	68	69	70	71	72	73	74	75	76	77	78	79	80	81	21	
	55	55	55	55	55	55	55	55	35	35	35	35	35	35		
12	68	69	70	71	72	73	74	75	76	77	78	79	80	81	18	
	30	30	30	35	35	30	30	35	30	30	35	35	35	35		
15	68	69	70	71	72	73	74	75	76	77	78	79	80	81	15	

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.
	10	15	15	15	15	15	15	15	15	15	15	15	15	15	
18	67	68	69	71	72	73	74	75	76	77	78	79	80	81	12
	55	55	55	0	0	0	0	0	0	0	0	0	0	0	
21	67	68	69	70	71	72	73	74	75	76	77	78	79	80	9
	45	45	45	45	45	45	45	45	45	45	45	45	45	45	
24	67	68	69	70	71	72	73	74	75	76	77	78	79	80	6
	35	35	35	35	30	30	35	30	30	40	40	40	42	42	
27	67	68	69	70	71	72	73	74	75	76	77	78	79	80	3
	30	30	30	30	30	30	30	30	30	30	30	30	30	32	
30	67	68	69	70	71	72	73	74	75	76	77	78	79	80	0
	28	27	28	28	28	28	28	28	28	28	28	28	28	28	□

Parsing notes: dense small numerals throughout. The middle of this page (the □–□ blocks, signs around 88°–89°) is where the nonagesimal altitude approaches and crosses its maximum (the zenith, 90°), so values rise to ~89° and then turn back; a handful of near-90° crest cells remain hard to resolve cleanly and are flagged [?] The earlier whole-page [?] flags in the upper Aries/Taurus blocks were resolved by the verified re-transcription (e.g. the Poli. 2 column at rows 15/18 now reads cleanly 65 10 / 65 30). The □-block row 15 / Poli. 5 cell prints 80 20, which breaks the monotone descent across the row — retained as printed as a suspected engraving error (footnoted later).

TAB. 33 — Page 39: poles 15–28

Continuation of TAB. 33. Altitude of the Nonagesimal of the Ecliptic, reckoned from the Ascendant. (*Residuum TAB. 33. Altitudo Nonagesimi ab Ascendente numerati.*)

Column headers: **Poli.** 15–28, each in **Gr.** / '. Left stub: **Sig. G.**; right stub: **Alt.** — **G. Si.**

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.
□	51	50	49	48	47	46	45	44	43	42	41	40	39	38	30
0	30	30	30	30	30	30	30	30	30	30	40	30	30	30	
3	51	50	49	48	47	46	45	44	43	42	41	40	39	38	27
	33	33	32	33	33	33	33	33	33	33	32	32	33	33	
6	51	50	49	48	47	46	45	44	43	42	41	40	39	38	24
	35	35	35	35	35	35	35	35	35	35	35	35	35	35	
9	51	50	49	48	47	46	45	44	43	42	41	40	39	38	21
	45	40	45	45	40	40	40	40	40	40	35	35	38	35	
12	51	50	49	48	47	46	45	44	43	42	41	40	39	38	18
	55	50	55	55	50	40	40	50	50	50	50	50	50	50	
15	52	51	50	49	48	47	46	45	44	43	42	41	40	39	15
	5	5	10	5	5	5	5	5	5	5	5	5	5	5	
18	52	51	50	49	48	47	46	45	44	43	42	41	40	39	12
	25	25	25	25	20	20	20	20	20	20	20	20	20	20	
21	52	51	50	49	48	47	46	45	44	43	42	41	40	39	9
	45	45	40	40	40	40	40	40	40	35	35	35	35	35	
24	53	52	51	50	49	48	47	46	45	43	42	41	40	39	6
	5	5	5	0	5	5	0	0	0	55	45	45	55	55	
27	53	52	51	50	49	48	47	46	45	44	43	42	41	40	3
	35	30	30	30	30	25	25	25	25	20	20	20	20	15	
□	54	53	52	51	50	48	47	46	45	44	43	42	41	40	0
0	0	0	0	0	5	55	55	50	50	50	50	45	45	45	□
3	54	53	52	51	50	49	48	47	46	45	44	43	42	41	27
	35	35	30	30	30	25	25	25	25	20	20	15	15	10	
6	55	54	53	52	51	50	48	47	46	45	44	43	42	41	24
	10	10	5	5	0	0	0	50	50	50	50	50	45	45	
9	55	54	53	52	51	50	49	48	47	46	45	44	43	42	21
	50	45	45	40	40	40	35	35	30	25	25	25	20	20	
12	56	55	54	53	52	51	50	49	48	47	46	45	43	42	18
	30	25	20	25	20	15	15	10	10	5	5	0	55	55	
15	57	56	55	54	53	52	50	49	48	47	46	45	44	43	15

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.
	15	10	5	5	5	0	55	55	50	50	45	40	35	35	
18	58	56	55	55	53	52	51	50	49	48	47	46	44	43	12
	5	55	50	0	50	45	40	40	35	30	30	25	15	15	
21	58	57	56	55	54	53	52	51	50	49	48	47	46	45	9
	55	50	45	45	40	35	30	30	20	20	15	15	10	5	
24	59	58	57	56	55	54	53	52	51	50	49	48	47	45	6
	50	45	45	35	30	30	25	20	20	15	10	5	0	55	
27	60	59	58	57	56	55	54	53	52	51	50	48	47	46	3
	45	40	40	30	25	25	15	10	10	5	0	55	50	50	
□	61	60	59	58	57	56	55	54	53	52	50	49	48	47	0
0	40	40	35	30	25	20	15	10	5	0	55	50	45	40	□
3	62	61	60	59	58	57	56	55	54	53	51	50	49	48	27
	45	40	35	30	25	20	15	10	5	0	55	50	45	40	
6	63	62	61	60	59	58	57	56	55	54	53	51	50	49	24
	50	45	40	35	30	25	20	15	10	5	0	55	50	40	
9	65	63	62	61	60	59	58	57	56	55	54	52	51	50	21
	0	55	45	45	35	30	25	20	15	10	0	55	50	45	
12	66	65	63	62	61	60	59	58	57	56	55	54	53	51	18
	5	0	55	50	45	40	35	25	20	15	10	5	0	50	
15	67	66	65	64	62	61	60	59	58	57	56	55	54	53	15
	15	10	5	0	55	50	45	35	30	30	20	15	5	0	
18	68	67	66	65	64	63	61	60	59	58	57	56	55	54	12
	30	25	20	15	10	0	55	50	45	40	30	25	15	10	
21	69	68	67	66	65	64	63	62	60	59	58	57	56	55	9
	45	40	35	30	20	15	10	5	55	50	40	35	30	20	
24	71	70	68	67	66	65	64	63	62	60	59	58	57	56	6
	0	0	45	35	30	20	15	5	0	50	40	35	25	20	
27	72	71	70	69	67	66	65	64	63	62	61	60	58	57	3
	30	15	5	0	50	40	40	35	30	20	15	0	55	35	
□	73	72	71	70	69	68	67	65	64	63	62	61	60	59	0
0	55	50	25	20	10	5	0	55	45	45	35	25	20	10	□

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.
12	89	89	88	87	86	85	84	82	82	81	80	78	77	76	18
	30	25	25	20	20	15	10	5	5	0	0	55	50	45	
	[?							[?							
]]							
15	88	89	89	88	87	86	85	84	83	82	81	79	78	77	15
	40	40	20	15	15	15	10	5	0	0	0	55	50	50	
18	87	88	89	89	88	87	86	85	84	83	82	80	79	78	12
	40	45	50	15	15	15	15	5	0	0	0	50	50	45	
21	86	87	88	89	89	88	87	86	84	84	81	80	80	79	9
	55	50	55	55	0	0	5	5	55	0	45	40	45	40	
24	86	87	88	89	89	89	88	87	86	81	83	81	80	80	6
	5	0	0	10	50	0	50	45	45	40	25	35	30	0	
										[?					
]					
27	85	86	87	88	89	89	88	87	86	85	84	83	82	81	3
	10	20	25	25	25	35	35	30	25	25	41	20	20	0	
											[?				
]				
□	84	85	86	87	88	89	89	88	87	86	85	84	83	82	0
0	40	40	45	45	41	45	40	0	0	10	0	5	5	0	□
					[?										
]										
3	83	84	85	86	87	88	89	88	87	86	85	84	83	82	27
	50	50	50	50	50	50	50	45	45	45	40	40	30	40	
								[?							
]							
6	83	84	85	86	87	88	89	89	88	87	86	85	84	83	24
	30	30	35	35	35	35	35	25	20	20	20	50	30	30	
								[?							
]							
9	83	84	85	86	87	88	89	89	89	88	87	86	85	83	21
	5	5	0	0	0	0	0	15	15	10	5	5	0	50	
								[?							

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Al
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	t.
g.	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	r./	G.
G.	'	'	'	'	'	'	'	'	'	'	'	'	'	'	Si.

]						
12	82	83	84	85	86	87	88	89	89	88	87	86	85	83	18
	40	40	40	40	40	40	40	40	15	15	15	15	15	55	
									[?						
]						
15	82	83	84	85	86	87	88	89	89	88	87	86	85	84	15
	20	20	20	20	20	20	20	20	40	35	40	35	35	35	
									[?						
]						
18	82	83	84	85	86	87	88	89	89	88	87	86	85	84	12
	0	0	0	0	0	0	0	0	55	50	55	50	50	50	
21	81	82	83	84	85	86	87	88	89	89	88	87	86	85	9
	45	45	45	45	45	45	45	45	55	15	15	15	15	15	
24	81	82	83	84	85	86	87	88	89	88	88	87	86	85	6
	40	40	40	40	40	40	45	45	40	40	30	30	30	30	
									[?						
]						
27	81	82	83	84	85	86	87	88	89	89	88	87	86	85	3
	32	32	32	32	32	32	32	30	28	28	31	31	31	32	
30	81	82	83	84	85	86	87	88	89	89	88	87	86	85	0
	28	28	28	28	28	28	28	28	28	30	28	28	28	28	□

Parsing notes: the □ and □ blocks at the foot of this page sit at the maximum-altitude region (nonagesimal near the zenith, 89°–90°), where the printed figures are crowded and several remain smudged after further re-transcription; these are flagged [?]. The verified re-transcription resolved the earlier whole-block uncertainty (the □-block descending columns now read as clean monotone sequences, e.g. the Poli. 15 column 82 40 / 82 20 / 82 0 ...), leaving only the genuine near-crest cells (chiefly the Poli. 22–24 region of the □/□ blocks) still [?].

TAB. 33 — Page 40: poles 29–41

Continuation of TAB. 33. Altitude of the Nonagesimal of the Ecliptic, reckoned from the Ascendant. (*Residuum TAB. 33. Altitudo Nonagesimi ab Ascendente numerati.*)

Column headers: **Poli.** 29–41, each in **Gr.** / '. Left stub: **Sig. G.**; right stub: **Alt. — G. Si.** (Note: this page carries 13 pole-columns, 29 through 41.)

	29	30	31	32	33	34	35	36	37	38	39	40	41	Al t. G. Si.
Si	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	
G.	./'	./'	./'	./'	./'	./'	./'	./'	./'	./'	./'	./'	./'	
□	37	36	35	34	33	32	31	30	29	28	27	26	25	30
0	30	29	29	29	29	29	29	29	29	29	29	29	29	
3	37	36	35	34	33	32	31	30	29	28	27	26	25	27
	33	31	31	31	31	31	31	31	31	31	31	31	31	
6	37	36	35	34	33	32	31	30	29	28	27	26	25	24
	35	35	33	35	35	35	35	35	35	35	35	35	34	
9	37	36	35	34	33	32	31	30	29	28	27	26	25	21
	40	40	40	40	49	40	49	40	40	39	39	40	40	
12	37	36	35	34	33	32	31	30	29	28	27	26	25	18
	50	50	50	50	49	49	49	48	48	47	47	47	46	
15	38	37	36	35	34	32	31	30	29	28	27	26	25	15
	0	1	1	1	0	59	59	58	58	58	58	57	57	
18	38	37	36	35	34	33	32	31	30	29	28	27	26	12
	15	16	15	15	14	14	13	12	12	10	9	8	8	
21	38	37	36	35	34	33	32	31	30	29	28	27	26	9
	35	37	35	32	31	30	29	28	27	26	25	24	21	
24	38	37	36	35	34	33	32	31	30	29	28	27	26	6
	55	52	51	50	49	48	47	46	45	43	41	40	39	
27	39	38	37	36	35	34	33	31	30	29	28	27	26	3
	15	14	12	12	11	9	6	4	2	1	1	59	57	
□	39	38	37	36	35	34	33	32	31	30	29	28	27	0
0	40	40	39	37	35	33	31	29	27	25	23	21	19	□
3	40	39	38	37	36	35	33	32	31	30	29	28	27	27
	10	8	6	4	2	0	58	56	53	51	48	46	44	

Si	29	30	31	32	33	34	35	36	37	38	39	40	41	Al
g.	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	t.
G.	./	./	./	./	./	./	./	./	./	./	./	./	./	G.
														Si.
6	40	39	38	37	36	35	34	33	32	31	30	29	28	24
	40	39	36	34	32	30	27	24	22	18	15	18	9	
9	41	40	39	38	37	36	34	33	32	31	30	29	28	21
	15	13	10	8	5	2	59	55	53	49	46	42	38	
12	41	40	39	38	37	36	35	34	33	32	31	30	29	18
	50	50	47	44	41	37	34	30	27	22	19	15	11	
15	42	41	40	39	38	37	36	35	34	32	31	30	29	15
	30	29	26	23	19	14	11	6	2	57	54	50	45	
18	43	42	41	40	39	37	36	35	34	33	32	31	30	12
	15	12	8	4	0	55	51	46	42	37	33	28	22	
21	44	42	41	40	39	38	37	36	35	34	33	32	31	9
	0	56	52	47	43	38	33	29	23	18	13	8	2	
24	44	43	42	41	40	39	38	37	36	35	33	32	31	6
	50	45	40	35	30	25	20	15	9	3	57	51	45	
27	45	44	43	42	41	40	39	38	36	35	34	33	32	3
	40	37	32	26	21	16	10	5	59	52	46	39	32	
□	46	45	44	43	42	41	40	38	37	36	35	34	33	0
0	35	32	26	19	14	8	2	56	48	42	36	29	21	□
3	47	46	45	44	43	42	40	39	38	37	36	35	34	27
	35	30	24	17	11	4	58	51	45	38	30	23	14	
6	48	47	46	45	44	43	41	40	39	38	37	36	35	24
	35	29	23	17	10	4	47	49	42	31	27	19	10	
9	49	48	47	46	45	44	42	41	40	39	38	37	36	21
	40	32	26	18	11	6	58	41	43	34	26	18	9	
12	50	49	48	47	46	45	44	42	41	40	39	38	37	18
	45	38	31	2	17	10	2	54	46	37	28	20	11	
15	51	50	49	48	47	46	45	44	42	41	40	39	38	15
	50	44	38	30	24	15	7	0	53	42	33	25	15	
18	53	51	50	49	48	47	46	45	43	42	41	40	39	12
	5	55	48	40	33	24	16	8	59	50	41	32	22	
21	54	53	52	50	49	48	47	46	45	44	42	41	40	9

Si	29	30	31	32	33	34	35	36	37	38	39	40	41	Al
g.	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	t.
G.	./	./	./	./	./	./	./	./	./	./	./	./	./	G.
														Si.
	15	8	1	53	45	36	28	20	11	2	53	43	33	
24	55	54	53	52	51	49	48	47	46	45	44	42	41	6
	30	23	16	9	0	51	43	35	26	10	7	57	47	
27	56	55	54	53	52	51	49	48	47	46	45	44	43	3
	45	40	32	24	16	7	59	50	42	32	22	12	2	
□	58	56	55	54	53	52	51	50	48	47	46	45	44	0
0	5	58	50	42	34	25	16	8	59	49	40	30	19	□
3	59	58	57	56	54	53	52	51	50	49	47	46	45	27
	25	16	8	0	52	43	35	26	17	8	58	48	38	
6	60	59	58	57	56	55	53	52	51	50	49	47	46	24
	45	35	28	20	12	3	55	47	28	17	8	57	59	
9	62	60	59	58	57	56	55	54	52	51	50	49	48	21
	5	56	49	41	32	24	16	8	59	50	41	31	21	
12	63	62	61	60	58	57	56	55	54	53	52	50	49	18
	25	17	10	2	53	47	38	30	21	12	3	54	44	
15	64	63	62	61	60	59	57	56	55	54	53	52	51	15
	45	37	30	22	16	7	59	51	43	34	25	17	7	
18	66	64	63	62	61	60	59	58	57	55	54	53	52	12
	5	56	49	41	35	28	20	13	4	55	46	38	29	
21	67	66	65	64	62	61	60	59	58	57	56	55	53	9
	20	16	9	1	57	49	41	34	26	18	9	2	52	
24	68	67	66	65	64	63	62	60	59	58	57	56	55	6
	40	33	27	21	15	9	1	53	45	37	30	23	14	
27	69	68	67	66	65	64	63	62	61	59	58	57	56	3
	55	50	44	38	32	25	19	12	5	18	50	43	35	
□	71	70	68	67	66	65	64	63	62	61	60	59	57	0
0	10	5	59	53	49	42	36	29	23	16	9	2	55	□
3	72	71	70	69	68	66	65	64	63	62	61	60	59	27
	20	17	12	7	2	56	50	44	38	31	24	16	12	
6	73	72	71	70	69	68	67	65	64	63	62	61	60	24
	30	28	24	19	14	9	3	58	52	47	41	35	28	

														Al
Si	29	30	31	32	33	34	35	36	37	38	39	40	41	t.
g.	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	G.
G.	./	./	./	./	./	./	./	./	./	./	./	./	./	Si.
9	74	73	72	71	70	69	68	67	66	64	63	62	61	21
	40	36	31	27	22	18	13	8	3	58	53	48	41	
12	75	74	73	72	71	70	69	68	67	66	65	63	62	18
	45	40	36	32	28	24	19	13	10	5	1	56	51	
15	76	75	74	73	72	71	70	69	68	67	66	65	63	15
	45	41	37	34	30	27	22	17	14	9	6	1	57	
18	77	76	75	74	73	72	71	70	69	68	67	66	65	12
	45	40	36	34	31	27	24	20	17	12	9	5	0	
21	78	77	76	75	74	73	72	71	70	69	68	67	66	9
	40	35	32	30	27	24	21	18	15	12	7	4	0	
24	79	78	77	76	75	74	73	72	71	70	69	68	66	6
	30	27	24	21	20	17	14	12	9	6	3	0	57	
27	80	79	78	77	76	75	74	73	71	70	69	68	67	3
	15	14	11	10	8	6	3	2	59	57	54	52	50	
□	81	79	78	77	76	75	74	73	72	71	70	69	68	0
0	0	48	57	55	53	51	49	47	45	43	41	39	37	□
3	81	80	79	78	77	76	75	74	73	72	71	70	69	27
	40	38	37	36	34	33	31	30	28	26	25	23	21	
6	82	81	81	80	79	78	77	76	74	74	72	70	70	24
	15	16	14	13	12	11	10	9	8	8	1	1	1	
								[?]		[?]	[?]	[?]	[?]	
9	82	81	80	79	78	77	77	76	75	74	73	72	70	21
	45	41	45	44	43	42	10	9	9	40	7	6	35	
							[?]			[?]			[?]	
12	82	82	81	80	79	78	77	76	75	74	73	72	71	18
	15	13	13	13	12	11	10	9	9	8	7	6	6	
	[?]								[?]					
15	83	82	81	80	79	78	78	76	75	74	73	72	71	15
	35	17	37	36	36	35	35	34	34	34	33	32	32	
							[?]							
18	83	82	81	80	79	78	77	76	75	74	73	71	71	12
	55	56	56	56	55	55	55	54	53	53	52	52	52	

	29	30	31	32	33	34	35	36	37	38	39	40	41	Al t. G. Si.
Si	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	Gr	
g.	.	.	.	.	.	.	.	.	.	.	.	.	.
G.	.	.	.	.	.	.	.	.	.	.	.	.	.
														[?]
21	86	83	82	81	80	79	78	77	76	75	74	73	72	9
	10	31	11	11	11	11	11	11	11	10	10	10	11	
		[?]												
24	84	83	82	81	80	79	78	77	76	75	74	73	72	6
	20	23	22	22	28	28	22	22	22	22	22	21	21	
					[?]							[?]		
27	84	83	82	81	80	80	79	78	77	76	75	74	73	3
	32	19	28	28	28	28	28	29	29	29	29	29	29	
						[?]							[?]	
30	84	83	82	81	80	79	78	77	76	75	74	73	72	0
	28	31	31	31	31	31	31	31	31	31	31	31	31	□

Parsing notes: this page (poles 29–41) is the most legible of the three for the bulk of the table, since here the nonagesimal altitudes stay well below the zenith and the columns descend in a clean monotone progression across the row (each column ~1° lower than the one to its left). The verified further re-transcription confirmed the bulk of the page and resolved most of the earlier flags; the residual [?] cells are the locally damaged/over-inked □-block degree rows at the foot of the page (rows 6 and 9, Poli. 35–41) and a handful of faint cells. The minute-columns are internally consistent (no values >59 observed). Suspected source/compositor repeats retained as printed: □ rows 9 & 12 / Poli. 33 both print 33 49; □ row 6 / Poli. 40 prints 29 18 against a smooth ~29 11; the □-block row 6 degree-figures are locally one degree high and over-inked (footnoted later).

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TAB. 33 (continued) — Residuum: *Altitudo Nonagesimi ab Ascendente numerati*

[Residue of TAB. 33 — The altitude of the nonagesimal point counted from the ascending point]

This page continues the table of the nonagesimal altitude. The columns are headed by the pole-altitude (*Poli*, i.e. the latitude of the place) from 42 to 54. The left-hand stub gives the argument (the ascendant) by sign (Sig.) and degree (Gr.); the right-hand stub (Al t.) gives the complementary argument read upward, by degree and sign (G. Si.). Each cell gives degrees and minutes (Gr. ').

		Pole-altitude (Poli)													Si	
		4	4	4	4	4	4	4	4	5	5	5	5	5	g.	
		2	3	4	5	6	7	8	9	0	1	2	3	4	(
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	Al
g.	r.	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.	t.)
□	0	2	2	2	2	2	1	1	1	1	1	1	1	1	3	
		4	3	2	1	0	9	8	7	6	5	4	3	2	0	
		2	3	2	2	2	2	2	2	2	2	2	2	2		
		9	9	9	9	9	9	9	9	9	9	9	9	9		
	3	2	2	2	2	2	1	1	1	1	1	1	1	1	2	
		4	3	2	1	0	9	8	7	6	5	4	3	2	7	
		3	3	3	3	3	3	3	3	3	3	3	3	3		
		0	0	0	0	1	1	1	0	0	0	0	0	0		
	6	2	2	2	2	2	1	1	1	1	1	1	1	1	2	
		4	3	2	1	0	9	8	7	6	5	4	3	2	4	
		3	3	3	3	3	3	3	3	3	3	3	3	3		
		3	3	3	3	4	4	4	3	3	3	2	2	2		
	9	2	2	2	2	2	1	1	1	1	1	1	1	1	2	
		4	3	2	1	0	9	8	7	6	5	4	3	2	1	
		3	3	3	3	3	3	3	3	3	3	3	3	3		
		8	8	8	8	7	7	7	7	7	7	6	6	6		

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	
	2	4	3	2	1	0	9	8	7	6	5	4	3	2	8	
		4	4	4	4	4	4	4	4	4	4	4	4	4		
		6	6	6	5	4	4	4	4	3	3	2	2	1		
	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	
	5	4	3	2	1	0	9	8	7	6	5	4	3	2	5	
		5	5	5	5	5	5	5	5	5	4	4	4	4		
		5	5	4	3	2	2	1	0	0	9	8	8	8		
	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	
	8	5	4	3	2	1	0	9	8	6	5	4	3	2	2	
		7	6	5	4	3	2	1	0	5	5	5	5	5		
										9	8	7	6	6		
	2	2	2	2	2	2	2	1	1	1	1	1	1	1	9	
	1	5	4	3	2	1	0	9	8	7	6	5	4	3		
		2	2	1	1	1	1	1	1	1	9	8	6	5		
		1	0	9	8	7	5	4	2	1						
	2	2	2	2	2	2	2	1	1	1	1	1	1	1	6	
	4	5	4	3	2	1	0	9	8	7	6	5	4	3		
		3	3	3	3	3	2	2	2	2	2	1	1	1		
		7	6	4	2	0	9	7	5	3	2	9	7	5		
	2	2	2	2	2	2	2	1	1	1	1	1	1	1	3	
	7	5	4	3	2	1	0	9	8	7	6	5	4	3		
		5	5	5	4	4	4	4	4	3	3	3	3	3		
		6	4	2	9	8	5	3	0	8	5	2	0	0		
□	0	2	2	2	2	2	2	2	1	1	1	1	1	1	0	□
		6	5	4	3	2	1	0	8	7	6	5	4	3		
		1	1	1	1	7	4	2[	5	5	5	4	4	4		
		7	5	2	0			?] 8	5	2	9	5	0			
	3	2	2	2	2	2	2	2	1	1	1	1	1	1	2	
		6	5	4	3	2	1	0	9	8	7	6	5	4	7	
		4	3	3	3	2	2	2	1	1	1	7	3	0		
		0	8	5	2	9	6	2	8	5	1					

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
6	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	
	7	6	4	3	2	1	0	9	8	7	6	5	4	4		
	6	3	5	5	5	4	4	4	3	3	2	2	1			
			9	6	2	9	5	1	6	2	7	2	5			
9	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	
	7	6	5	4	3	2	1	0	9	7	6	5	4	1		
	3	3	2	2	1	1	1	5	0	5	4	4	3			
	5	1	7	3	9	4	0			5	9	4	5			
1	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	
2	8	7	5	4	3	2	1	0	9	8	7	6	5	8		
	6	2	5	5	4	4	3	3	2	2	1	8	0			
			7	3	9	3	7	2	7	1	4					
1	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	
5	8	7	6	5	4	3	2	1	9	8	7	6	5	5		
	4	3	3	2	2	1	7	0	5	4	4	3	2			
	0	6	0	6	0	4			4	6	1	3	5			
1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	
8	9	8	7	6	4	3	2	1	0	9	8	7	5	2		
	1	1	6	0	5	4	4	3	2	1	1	1	5			
	7	2			4	7	0	2	5	7	0		0			
2	2	2	2	2	2	2	2	2	2	1	1	1	1	9		
1	9	8	7	6	5	4	3	2	0	9	8	7	6			
	5	5	4	3	3	2	1	7	5	5	4	3	2			
	6	0	3	7	0	3	5		9	0	1	1	0			
2	3	2	2	2	2	2	2	2	2	2	1	1	1	6		
4	0	9	8	7	6	5	3	2	1	0	9	8	6			
	3	3	2	1	9	2	5	4	3	2	1	5	5			
	9	2	5	8			4	5	7	7	6		5			
2	3	3	2	2	2	2	2	2	2	2	1	1	1	3		
7	1	0	9	8	6	5	4	3	2	1	9	8	7			
	2	1	1	2	5	4	3	2	1	7	5	4	3			
	6	8	0		3	5	6	7	7		5	3	0			

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)	
□	0	3	3	2	2	2	2	2	2	2	2	2	2	1	1	0	□
		2	1	9	8	7	6	5	4	3	1	0	9	8			
		1	6	5	4	4	3	2	1	0	4	3	2	1			
		5		8	9	0	1	1	2		8	6	4	0			
	3	3	3	3	2	2	2	2	2	2	2	2	2	2	1	2	
		3	1	0	9	8	7	6	4	3	2	1	0	8	7		
		7	5	4	4	3	2	1	5	4	3	2	7	5			
			8	9	0	1	1	0	9	7	4	2		5			
	6	3	3	3	3	2	2	2	2	2	2	2	2	2	1	2	
		4	2	1	0	9	8	7	5	4	3	2	0	9	4		
		2	5	4	3	2	1	1	4	3	2	9	5	4			
			3	3	3	3	3		9	7	3		4	0			
	9	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	
		5	3	2	1	0	9	7	6	5	4	3	1	0	1		
		0	5	4	3	1	8	5	4	2	1	0	4	2			
			0	0	0	9		6	3	9	5		5	4			
	1	3	3	3	3	3	3	2	2	2	2	2	2	2	2	1	
	2	6	4	3	2	1	0	8	7	6	5	3	2	1	8		
		1	5	4	1	1	6	5	4	2	1	5	3	2			
			2	1	0	8		4	1	5	1	5	9	0			
	1	3	3	3	3	3	3	2	2	2	2	2	2	2	2	1	
	5	7	5	4	3	2	1	9	8	7	6	4	3	2	5		
		4	5	4	3	2	8	5	4	2	1	5	3	1			
			5	4	3	0		5	2	6	1	4	7	0			
	1	3	3	3	3	3	3	3	2	2	2	2	2	2	2	1	
	8	8	7	5	4	3	2	1	9	8	7	5	4	2	2		
		1	1	5	3	2	1	0	4	3	1	5	3	1			
		1		0	8	5	3		6	0	4	7	9	0			
	2	3	3	3	3	3	3	3	3	2	2	2	2	2	9		
	1	9	8	7	5	4	3	2	0	9	8	7	5	4			
		2	1	0	4	3	2	8	5	3	2	4	4	2			
		1	1		7	4	1		3	7	1		5	5			

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
	2	4	3	3	3	3	3	3	3	3	2	2	2	2	6	
	4	0	9	8	7	5	4	3	2	0	9	8	6	5		
		3	2	1	0	4	3	2	4	4	3	1	5	3		
		0	4	3		7	4	0		8	2	5	5	5		
	2	4	4	3	3	3	3	3	3	3	3	2	2	2	3	
	7	1	0	9	8	7	5	4	3	2	0	9	8	6		
		5	3	2	1	2	4	3	1	3	4	2	9	5		
		1	9	8	5		8	4	9		6	9		0		
□	0	4	4	4	3	3	3	3	3	3	3	3	2	2	0	□
		3	1	0	9	8	7	5	4	3	2	0	9	8		
		8	5	4	3	1	6	5	3	2	3	4	2	5		
			6	5	2	9		2	7	0		5	6			
	3	4	4	4	4	3	3	3	3	3	3	3	3	2	2	
		4	3	2	0	9	8	7	5	4	3	2	0	9	7	
		2	1	4	5	3	2	1	5	3	2	4	4	2		
		7	5		1	8	4	0	5	9	2		5	5		
	6	4	4	4	4	4	3	3	3	3	3	3	3	3	2	
		5	4	3	2	0	9	8	7	6	4	3	2	0	4	
		4	3	2	1	5	4	3	1	1	4	2	8	4		
		8	6	5	2	9	6	2	7		4	7		5		
	9	4	4	4	4	4	4	3	3	3	3	3	3	3	2	
		7	5	4	3	2	1	9	8	7	6	4	3	2	1	
		1	5	4	3	2	9	5	4	2	9	5	3	1		
		0	9	8	5	2		6	1	5		2	3	0		
	1	4	4	4	4	4	4	4	4	3	3	3	3	3	1	
	2	8	7	6	5	3	2	1	0	8	7	6	5	3	8	
		3	2	1	0	4	3	2	8	5	3	1	1	4		
		3	3	2		8	5	2		2	6	9		0		
	1	4	4	4	4	4	4	4	4	4	3	3	3	3	1	
	5	9	8	7	6	5	4	2	1	0	9	7	6	5	5	
		5	4	3	2	1	0	4	3	1	3	4	2	1		
		6	7	6	4	2		7	3	8		6	9	0		

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
	1	5	4	4	4	4	4	4	4	4	4	3	3	3	1	
	8	1	9	9	7	6	5	4	3	1	0	9	7	6	2	
		1	1	0	4	3	2	1	0	4	3	1	5	4		
		9	0		8	6	4	3		5	0	4	8	0		
	2	5	5	5	4	4	4	4	4	4	4	4	3	3	9	
	1	2	0	0	9	8	6	5	4	3	1	0	9	8		
		4	3	2	1	2	5	4	2	1	5	4	2	1		
		3	4	4	3		0	0	7	3	9	4	8	0		
	2	5	5	5	5	4	4	4	4	4	4	4	4	3	6	
	4	4	1	1	0	9	8	7	5	4	3	2	0	9		
		6	5	4	3	2	1	5	5	4	2	1	5	4		
			7	7	7	7	7		3	0	7	3	8	0		
	2	5	5	5	5	5	4	4	4	4	4	4	4	4	3	
	7	5	3	3	2	0	9	8	7	6	4	3	2	1		
		2	1	1	1	5	4	3	1	7	5	4	2	1		
		7	8	0		1	1	0	9		5	2	7	5		
□	0	5	5	5	5	5	5	4	4	4	4	4	4	4	0	□
		6	5	4	3	2	1	9	8	7	6	5	3	2		
		4	4	3	2	1	5	5	4	3	2	9	5	4		
		8	0	2	3	4		4	4	3	1		7	5		
	3	5	5	5	5	5	5	5	5	4	4	4	4	4	2	
		8	6	5	4	3	2	1	0	8	7	6	5	4	7	
		6	5	5	4	3	2	1	8	5	4	3	2	1		
			8	0	4	4	6	7		7	6	5	4	0		
	6	5	5	5	5	5	5	5	5	5	4	4	4	4	2	
		9	8	7	6	4	3	2	1	0	9	8	6	5	4	
		2	1	9	2	5	4	3	2	2	1	0	4	3		
		3	6			4	6	8	9	0	0		9	5		
	9	6	5	5	5	5	5	5	5	5	5	4	4	4	2	
		0	9	8	7	6	5	3	2	1	0	9	8	7	1	
		3	3	2	1	1	3	5	4	3	3	2	1	0		
		6	0	3	7	0		5	7	9	0	1	1			

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
	1	6	6	5	5	5	5	5	5	5	5	5	4	4	1	
	2	1	0	9	8	7	6	5	4	2	1	0	9	8	8	
		4	4	3	2	2	1	9	1	5	4	3	2	2		
		5	0	4	8	2	6			4	6	7	4	0		
	1	6	6	6	5	5	5	5	5	5	5	5	5	4	1	
	5	2	1	0	9	8	7	6	5	4	2	1	0	9	5	
		5	4	4	3	3	2	1	1	6	5	5	4	3		
		2	8	2	8	1	5	8	2		9	2	5	5		
	1	6	6	6	6	5	5	5	5	5	5	5	5	5	1	
	8	3	2	1	0	9	8	7	6	5	4	3	1	0	2	
		5	5	4	4	3	3	2	2	1	1	4	5	5		
		6	2	7	3	8	3	6	2	6	0		8	0		
	2	6	6	6	6	6	5	5	5	5	5	5	5	5	9	
	1	4	3	2	1	0	9	8	7	6	5	4	3	2		
		5	5	4	4	4	3	3	2	2	1	1	6	0		
		7	3	9	5	1	7	2	2	2	7	1				
	2	6	6	6	6	6	6	5	5	5	5	5	5	5	6	
	4	5	4	3	2	0	0	9	8	7	6	5	4	3		
		5	5	4	4	4	3	3	2	2	1	1	9	5		
		4	1	7	4	0	6	3	8	4	9	5				
	2	6	6	6	6	6	6	6	5	5	5	5	5	5	3	
	7	6	5	4	3	2	1	0	9	8	7	6	5	4		
		4	4	4	3	3	3	2	2	2	1	1	9	5		
		6	4	1	8	5	2	8	4	1	7	3				
□	0	6	6	6	6	6	6	6	6	6	5	5	5	5	0	□
		7	6	5	4	3	2	1	0	0	8	7	6	5		
		3	3	3	2	2	2	2	1	1	1	7	3	0		
		5	3	0	8	5	2	0	6	3	0					
	3	6	6	6	6	6	6	6	6	6	5	5	5	5	2	
		8	7	6	5	4	3	2	1	0	8	7	6	5	7	
		1	1	1	1	1	9	7	4	2	5	5	5	5		
		9	7	6	3	2					9	7	3	0		

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
6	6	6	6	6	6	6	6	6	6	6	5	5	5	5	5	2
	8	7	6	5	4	3	2	1	0	9	8	7	6	4		
	5	5	5	5	5	5	4	4	4	4	4	4	3	3		
	9	7	5	4	3	1	9	7	5	3	1	9	5			
9	6	6	6	6	6	6	6	6	6	6	6	5	5	5	2	
	9	8	7	6	5	4	3	2	1	0	9	8	7	1		
	3	3	3	3	2	2	2	2	2	2	2	2	1	1		
	3	2	1	1	9	8	6	5	3	1	0	8	5			
1	7	6	6	6	6	6	6	6	6	6	6	5	5	5	1	
2	0	9	8	7	6	5	3	2	1	0	9	8	7	8		
	5	4	3	2	1	0	5	5	5	5	5	5	5	5		
							9	8	7	7	6	5	5			
1	7	6	6	6	6	6	6	6	6	6	6	6	5	5	1	
5	0	9	8	7	6	5	4	3	2	1	0	9	8	5		
	3	3	3	2	2	2	2	2	2	2	2	2	2	2		
	1	1	0	8	8	8	7	6	6	5	3	3	0			
1	7	6	6	6	6	6	6	6	6	6	6	6	5	5	1	
8	0	9	8	7	6	5	4	3	2	1	0	9	8	2		
	5	5	5	5	5	5	5	4	4	4	4	4	4	4		
	3	3	2	1	0	0	0	9	9	9	8	8	5			
2	7	7	6	6	6	6	6	6	6	6	6	6	6	5	9	
1	1	0	9	8	7	6	5	4	3	2	1	0	9			
	1	1	1	9	8	8	8	8	7	8	2	2	2			
	0	0	0								0	0	0			
2	7	7	6	6	6	6	6	6	6	6	6	6	6	5	6	
4	1	0	9	8	7	6	5	4	3	2	1	0	9			
	2	2	2	2	2	2	2	2	2	2	2	2	2	3		
	1	1	1	1	1	1	1	1	1	0	0	8	8	0		
2	7	7	6	6	6	6	6	6	6	6	6	6	6	5	3	
7	1	0	9	8	7	6	5	4	3	2	1	0	9			
	2	2	2	2	2	3	3	2	2	2	2	2	2	3		
	8	8	8	8	8	1	1	9	8	8	8	8	8	0		

															Si	
															g.	
															(
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	Al
g.	r.	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.	t.)
	3	7	7	6	6	6	6	6	6	6	6	6	6	5	0	□
	0	1	0	9	8	7	6	5	4	3	2	1	0	9		
		3	3	3	3	3	3	3	3	3	3	3	3	3		
		1	1	1	1	1	1	1	1	1	1	1	1	1		

Parsing notes: This is a square interpolation table; the right-hand stub repeats the argument read in the reverse sense (signs □ □ □ □ □ descending), and only appears at sign-boundary rows. Several values were read at the limit of legibility in the densely-printed interior columns; I have transcribed the most consistent reading and flagged the single doubtful cell. The cell at □ 0 / col. 48 reads "20 2" but the units digit is ink-merged; flagged [?].

Continuation of the residue of TAB. 33, for pole-altitudes 55 through 67.

															Si	
															g.	
															(
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	Al
g.	r.	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.	t.)
□	0	1	1	9	8	7	6	5	4	3	2	1	0	0	3	
		1	0	2	2	2	2	2	2	2	2	2	2	2	0	
		2	2	9	9	9	9	9	8	8	8	8	8	8		
		9	9													
	3	1	1	9	8	7	6	5	4	3	2	1	0	0	2	
		1	0	3	3	3	3	2	2	2	2	2	2	2	7	
		3	3	0	0	0	1	9	8	9	8	8	8	8		
		1	1													
	6	1	1	9	8	7	6	5	4	3	2	1	0	0	2	
		1	0	3	3	3	3	3	2	3	2	2	2	2	4	
		3	3	2	2	2	3	0	9	2	9	9	9	9		
		0	3													
	9	1	1	9	8	7	6	5	4	3	2	1	0	0	2	

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
		1	0	5	3	3	3	3	3	3	3	2	2	2	1	
		3	3	1	5	5	5	5	1	5	0	9	9	9		
		5	5													
	1	1	1	9	8	7	6	5	4	3	2	1	0	0	1	
	2	1	0	4	4	3	3	3	3	3	3	3	3	3	8	
		4	4	0	0	7	7	5	4	5	2	0	0	0		
		0	0													
	1	1	1	9	8	7	6	5	4	3	2	1	0	0	1	
	5	1	0	4	4	4	4	4	3	3	3	3	3	3	5	
		4	4	5	5	6	0	0	5	6	3	2	1	1		
		5	5													
	1	1	1	9	7	6	6	4	3	2	1	0	0	0	1	
	8	1	0	5	5	4	4	3	3	3	3	3	3	3	2	
		5	5	0	0	5	2	9	7	4	3	1	1	2		
		0	0													
	2	1	1	9	8	7	6	5	4	3	2	1	0	0	9	
	1	1	1	5	5	5	5	4	4	4	3	3	3	3		
		0	9	5	5	5	0	4	5	0	5	4	3	3		
	2	1	1	1	9	8	7	5	4	3	2	1	0	0	6	
	4	2	1	0	5	0	0	5	5	4	3	3	3	3		
		1	1	5				5	0	2	9	6	2	4		
		0	0													
	2	1	1	1	9	8	7	6	4	3	2	1	0	0	3	
	7	2	1	0	1	1	7	0	5	5	4	4	3	3		
		2	2	1	5	0			5	0	5	0	3	5		
		5	0	5												
□	0	1	1	1	9	8	7	6	5	3	2	1	0	0	0	□
		2	1	0	2	2	1	1	5	5	5	4	3	3		
		4	3	3	5	0	5	0		5	0	2	4	7		
		0	5	0												
	3	1	1	1	9	8	7	6	5	4	3	1	0	0	2	
		2	1	0	4	3	2	2	1	0	0	4	3	3	7	

Si	G	5	5	5	5	5	6	6	6	6	6	6	6	6	Si
g.	r.	5	6	7	8	9	0	1	2	3	4	5	6	7	g.
		G	G	G	G	G	G	G	G	G	G	G	G	G	(
		r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	Al
		r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	t.)
		5	5	4	0	5	5	0	5			5	5	8	
		5	0	5											
6	1	1	1	1	9	8	7	6	5	4	3	1	0	0	2
	3	2	1	5	4	3	3	2	1	0	4	3	4	4	
	1	5	0	0	5	5	0	0	0		7	6	0		
	0														
9	1	1	1	1	9	7	6	5	4	3	1	0	0	2	
	3	2	1	0	0	5	4	3	1	5	5	3	4	1	
	3	2	0	1		0	5	0	5		0	7	2		
	0	0		5											
1	1	1	1	1	9	8	6	5	4	3	1	0	0	1	
2	3	2	1	0	1	5	5	4	2	1	5	3	4	8	
	5	4	3	2	5		5	0	5	5	5	8	4		
	0	0	5	5											
1	1	1	1	1	9	8	7	5	4	3	2	0	0	1	
5	4	3	1	0	3	2	1	5	4	2	0	4	4	5	
	1	5	0	4	0	5	0	0	0	0		0	5		
	5			5											
1	1	1	1	1	9	8	7	6	4	3	2	0	0	1	
8	4	3	2	1	5	4	2	1	5	3	1	4	4	2	
	4	3	1	5	5	0	5	0	0	0	0	2	8		
	0	0	0												
2	1	1	1	1	1	9	7	6	5	3	2	0	0	9	
1	5	4	2	1	0	5	4	2	5	4	1	4	5		
	1	0	5	3	2		5	5		5	5	4	0		
	0		0	5	0										
2	1	1	1	1	1	9	8	6	5	3	2	0	0	6	
4	5	4	3	2	0	2	5	4	2	5	2	4	5		
	4	3	1	0	4	5		5	2	5	5	6	5		
	5	0	5		5										
2	1	1	1	1	1	9	8	7	5	4	2	0	1	3	
7	6	5	3	2	1	5	3	1	4	5	3	5	0		

Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	Si
g.	r.	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	g.
																(
																Al
																t.)
		2	5	5	3	1	5	0	0	0		5	0			
		0		0	0	5										
□	0	1	1	1	1	1	1	9	7	6	4	2	0	1	0	□
		6	5	4	3	1	0	0	3	0	2	4	5	5		
		5	4	2	5	4	2		0		5	5	5			
		5	0	0		5	0									
	3	1	1	1	1	1	1	9	8	6	4	3	1	1	2	
		7	6	5	3	2	0	3	0	2	4	0	0	1	7	
		4	2	0	4	2	5	0		5	5			5		
		5	0		0	0	5									
	6	1	1	1	1	1	1	1	8	6	5	3	1	1	2	
		8	7	5	4	3	1	0	3	5	1	1	1	3	4	
		1	5	4	2	0	3	5	0	5	0	0	0	5		
		0		5	0		5									
	9	1	1	1	1	1	1	1	9	7	5	3	1	1	2	
		9	7	6	5	3	2	0	5	2	3	3	1	5	1	
		1	5	3	5	4	1	4		9	5	0	5	5		
		0	0	0		0	0	0								
	1	2	1	1	1	1	1	1	9	8	6	3	1	1	1	
	2	0	8	7	5	4	2	1	4	0	5	5	2	5	8	
		1	4	2	5	2	5	2	0			5	5	5		
			0	0	5	5	5	0								
	1	2	1	1	1	1	1	1	1	8	6	4	1	2	1	
	5	1	9	8	6	5	3	2	0	4	4	2	4	3	5	
		0	3	1	4	2	4	1	2	0	5	0	0	0		
			5	5	5	0	5	0	5							
	1	2	2	1	1	1	1	1	1	9	7	4	1	4	1	
	8	1	0	9	7	6	4	3	1	2	2	5	5	2	2	
		5	3	1	4	1	4	0	1	5	5	5	5	0		
		5	5	0	5	5	0		5							
	2	2	2	2	1	1	1	1	1	1	8	5	2	2	9	
	1	3	1	0	8	7	5	4	2	0	1	4	2	5		

Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	Si
g.	r.	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r'	r.	g.
																(
																Al
																t.)
		0	4	1	4	1	4	0	5	1	0	0	5	5		
			0	5	5	8	2			5						
	2	2	2	2	1	1	1	1	1	1	9	6	2	C	6	
	4	4	2	1	9	8	6	5	3	1	6	3	5	o		
		1	5	2	5	2	4	5	1	1		5	5	n		
		0	0	5	5	0	5		5	7				s		
														ul		
														-		
	2	2	2	2	2	1	1	1	1	1	1	7	3		3	
	7	5	4	2	1	9	7	6	4	2	0	3	4			
		5	5	3	5	3	5	5	2	2	1	5	5			
				5		0	0		5	5	0					
□	0	2	2	2	2	2	1	1	1	1	1	8	4	1	0	□
		6	5	3	2	0	9	7	5	3	1	4	5	0		
		4	1	5	1	4	1	2	3	4	2	0	0			
		0	6	0	0	5	0	5	5	0	5					
	3	2	2	2	2	2	2	1	1	1	1	1	6	v	2	
		8	6	5	3	2	0	8	7	5	2	0	2	a	7	
		0	4	1	4	1	3	5	0	0	4	0	0	c		
			0	0	0	0	5	0			5			at		
	6	2	2	2	2	2	2	2	1	1	1	1	8		2	
		9	8	6	5	3	2	0	8	6	4	1	1		4	
		2	5	3	5	3	0	1	2	2	1	3	0			
		5		5		5		5	5	5	5	5				
	9	3	2	2	2	2	2	2	1	1	1	1	1	5	2	
		0	9	8	6	5	3	1	9	7	5	3	0		1	
		5	3	0	3	0	2	4	5	5	5	2	5			
		0	0		5		5	0	0	5	3	5				
	1	3	3	2	2	2	2	2	2	1	1	1	1	6	1	
	2	2	0	9	8	6	5	3	1	9	7	5	2		8	
		1	5	3	0	3	0	1	4	4	4	1	2			
		5	5	0		5		5	0	5	0	0	0			

Si g.	G r.	5 G r.'	5 G r.'	5 G r.'	5 G r.'	5 G r.'	6 G r.'	6 G r.'	6 G r.'	6 G r.'	6 G r.'	6 G r.'	6 G r.'	6 G r.'	G r.	Si g. (Al t.)
	1	3	3	3	2	2	2	2	2	2	1	1	1	1	1	
	5	3	2	1	9	8	6	5	3	1	9	7	4	0	5	
		5	3	5	3	1	4	0	3	3	3	1	3	2		
		0	0		8	0	0		0	0	0	5	0	0		
	1	3	3	3	3	2	2	2	2	2	2	1	1	1	1	
	8	5	4	2	1	9	8	6	5	3	1	9	6	3	2	
		3	5	3	1	4	1	4	5	2	2	0	4	2		
		0		5	0	5	5	0		5	5		5	5		
	2	3	3	3	3	3	2	2	2	2	2	2	1	1	9	
	1	6	5	4	2	1	9	8	6	5	3	1	9	6		
		5	3	5	5	2	5	2	4	5	1	1	0	5		
		5	5		0	5	5	0	5		5	5				
	2	3	3	3	3	3	3	3	2	2	2	2	2	1	6	
	4	8	7	5	4	3	1	0	8	6	5	3	1	8		
		2	5	4	2	0	2	0	3	5	5	1	1	4		
		5		5	5		5		0	5		0	0	0		
	2	4	3	3	3	3	3	3	3	2	2	2	2	2	3	
	7	0	8	7	6	4	3	1	0	8	7	5	3	1		
		0	4	2	0	4	1	5	2	4	5	1	2	5		
			0	5		0	5	0	0	7		5	0			
□	0	4	4	3	3	3	3	3	3	3	1	2	2	2	0	□
		1	0	8	7	6	4	3	2	0	9	7	5	3		
		3	1	5	4	2	5	3	5	3	0	2	3	3		
		0	5	0	0	0	5	0		5		0	0	0		
	3	4	4	4	3	3	3	3	3	3	3	2	2	2	2	
		3	1	0	9	7	6	5	3	2	0	9	7	5	7	
		1	4	4	2	5	4	1	5	2	5	1	5	0		
		5	0	0	0	0	0	5	0	5	0	5				
	6	4	4	4	4	3	3	3	3	3	3	3	2	2	2	
		4	3	1	0	9	8	6	5	4	2	1	9	7	4	
		4	1	5	4	1	5	5	3	5	4	1	2	5		
		4	0	5	0	5		0	0		0	0	5	0		

Si	G	5	5	5	5	5	6	6	6	6	6	6	6	6	Si
g.	r.	5	6	7	8	9	0	1	2	3	4	5	6	7	g.
		G	G	G	G	G	G	G	G	G	G	G	G	G	(
		r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	Al
		r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	r.	t.)
	9	4	4	4	4	4	3	3	3	3	3	3	3	2	2
		5	4	3	2	0	9	8	7	5	4	2	1	9	1
		5	3	2	1	5	4	2	5	4	2	5	2	5	
		0	5	5	0	5	0	5		5	0	5	5	0	
	1	4	4	4	4	4	4	3	3	3	3	3	3	3	1
	2	7	6	4	3	2	1	9	8	7	6	4	3	1	8
		1	0	5	3	2	1	5	4	2	0	3	1	4	
		0		0	5	5	0	5	0	0		5	5	0	
	1	4	4	4	4	4	4	4	4	3	3	3	3	3	1
	5	8	7	6	4	3	2	1	1	8	7	6	4	3	5
		2	2	1	5	4	3	2	8	5	3	1	5	2	
		5	0	0	5	5	5	5		0	5	5	5	5	
	1	4	4	4	4	4	4	4	4	4	3	3	3	3	1
	8	9	8	7	6	5	3	2	1	0	9	7	6	5	2
		4	3	2	1	1	5	4	3	1	0	4	3	5	
		2	5	5	0	0	5	5	5	5		5	0		
	2	5	4	4	4	4	4	4	4	4	4	3	3	3	9
	1	0	9	8	7	6	5	4	2	1	0	9	8	6	
		5	4	4	3	2	1	5	5	4	3	5	0	4	
		5	5	0	0	0	0		0	0	0			5	
	2	5	5	4	4	4	4	4	4	4	4	4	3	3	6
	4	2	0	9	8	7	6	5	4	2	1	0	9	8	
		0	5	4	4	3	2	2	5	5	4	3	5	1	
			0	5	0	0	5	0		5	5	0		9	
	2	5	5	5	4	4	4	4	4	4	4	4	4	3	3
	7	3	1	0	9	8	7	6	5	4	2	1	0	9	
		5	5	5	4	4	3	2	2	5	5	4	2	3	
			5	0	5	0	0	5	0		5	0	0	5	
□	0	5	5	5	5	4	4	4	4	4	4	4	4	4	0
		3	2	1	0	9	8	7	6	5	4	3	1	0	□
		4	5	5	4	4	3	2	2	1	5	0	5	4	
		5	0	0	5	0	5	5	0	5		0	0		

Si g.	G r.	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.'	G r.	Si g. (Al t.)
3	5	5	5	5	5	5	4	4	4	4	4	4	4	4	2	
	4	3	2	1	0	9	8	7	6	5	2	1	1	7		
	4	4	4	3	3	2	2	2	1	0	5	4	4			
	5	5	0	5	0	0	0	0	5		5	5	5			
6	5	5	5	5	5	5	4	4	4	4	4	4	4	4	2	
	5	4	3	2	1	0	9	8	7	5	4	3	1	4		
	5	3	3	2	2	2	1	0	5	5	5	5	2			
	5	0	0	5	5	0	0			0	5	5	5			
9	5	5	5	5	5	5	5	4	4	4	4	4	4	4	2	
	6	5	4	3	2	1	0	9	7	6	5	4	3	1		
	1	5	1	1	5	0	0	0	5	5	5	4	4			
	0		0	0					5	0	5	5	0			
1	5	5	5	5	5	5	5	4	4	4	4	4	4	4	1	
2	6	5	4	3	2	1	1	9	8	7	6	5	4	8		
	5	5	5	4	4	4	4	4	3	3	3	2	3			
	0	0	0	5	5	0	0	0	5	5	5	5	0			
1	5	5	5	5	5	5	5	5	4	4	4	4	4	4	1	
5	7	6	5	4	3	2	1	0	9	8	7	6	5	5		
	2	2	2	1	1	1	1	1	1	1	1	5	5			
	0	0	0	5	5	5	5	0	0	0	0					
1	5	5	5	5	5	5	5	5	4	4	4	4	4	4	1	
8	7	6	5	4	3	2	1	0	9	8	7	6	5	2		
	4	4	4	4	4	4	4	4	4	4	4	3	3			
	5	5	5	5	5	5	5	0	0	0	0	5	5			
2	5	5	5	5	5	5	5	5	5	4	4	4	4	9		
1	8	7	6	5	4	3	2	1	0	9	8	6	6			
	5	5	5	5	5	5	5	0	0	0	0	6	0			
												0				
2	5	5	5	5	5	5	5	5	5	4	4	4	4	6		
4	8	7	6	5	4	3	2	1	0	9	8	7	6			
	2	2	2	2	2	2	2	2	2	2	2	1	1			
	0	0	8	0	5	5	5	5	5	5	5	5	5			

															Si	
															g.	
															(
Si	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	Al
g.	r.	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.'	r.	t.)
	2	5	5	5	5	5	5	5	5	5	4	4	4	4	3	
	7	8	7	6	5	4	3	2	1	0	9	8	7	6		
		2	2	2	2	2	2	2	2	2	2	2	2	2		
		8	8	8	8	8	5	5	5	5	5	5	5	5		
	3	5	5	5	5	5	5	5	5	5	4	4	4	4	0	□
	0	8	7	6	5	4	3	2	1	0	9	8	7	6		
		2	3	3	3	3	3	3	3	3	3	3	3	3		
		8	0	0	0	0	0	0	0	0	0	0	0	0		

Parsing notes: At the high-pole end of this table (the rightmost columns, poles 64–67) the nonagesimal altitude approaches and crosses zero in the relevant range; near the foot of column 66 the source prints the words "**Consul-**" / "**vacat**" (i.e. *consule / vacat* — "consult [the text]" / "[this cell is] empty/void"), indicating that for those high latitudes and arguments the entry is not tabulated. These verbal cells are transcribed in place of numbers. This page is densely printed and several interior cells are at the edge of legibility; readings flagged where doubtful. The values in the right-hand high-pole columns are small (single-digit degrees) and so the printing is cramped; some units digits are uncertain.

TAB. 34 — *Prosthaphaeresis Declinationis*

[The prosthaphaeresis of declination]

This table is in two halves. The upper half is headed:

Declinationi Signor. Bor. Adde; Australium Subtrahe. [To the declination of the northern signs *add*; for the southern, *subtract*.] sub-banner: **Latitudo Borealis.** [Northern latitude.]

The lower half is headed:

Declinat. Signor. Boreal. Subtrahe; Australium Adde. [For the declination of the northern signs *subtract*; for the southern, *add*.] sub-banner: **Latitudo Australis.** [Southern latitude.]

The argument columns are headed by latitude (1, 3, 5, 7, 9 degrees), each giving Gr. '. The left stub (G.) gives the degree within the sign, with the entering signs marked at top (☾ ☽ at left, with ☽ and the rest descending); the right stub (G.) gives the complementary degree (30...3) with exit-signs (☽ ☾, etc.).

Upper half — Latitudo Borealis:

Sign	G.	1 Gr.'	3 Gr.'	5 Gr.'	7 Gr.'	9 Gr.'	G.	(exit)
☽ ☽	0	0 55	2 45	4 35	6 25	8 14	30	
	3	0 55	2 45	4 35	6 25	8 15	27	
	6	0 55	2 45	4 35	6 26	8 15	24	
	9	0 55	2 45	4 35	6 26	8 16	21	
	12	0 55	2 45	4 36	6 26	8 16	18	
	15	0 55	2 46	4 36	6 27	8 17	15	
	18	0 55	2 46	4 37	6 28	8 18	12	
	21	0 56	2 46	4 38	6 29	8 19	9	
	24	0 56	2 47	4 39	6 30	8 20	6	
27	0 56	2 47	4 40	6 31	8 22	3		
☽ ☽	0	0 56	2 48	4 41	6 32	8 24	0	☽ ☽
	3	0 56	2 49	4 42	6 34	8 26	27	
	6	0 56	2 50	4 43	6 36	8 28	24	
	9	0 57	2 51	4 44	6 37	8 30	21	
	12	0 57	2 51	4 45	6 39	8 33	18	
	15	0 57	2 52	4 46	6 40	8 34	15	
	18	0 57	2 53	4 47	6 42	8 37	12	
	21	0 57	2 54	4 48	6 44	8 40	9	
	24	0 58	2 54	4 50	6 47	8 43	6	
27	0 58	2 55	4 51	6 48	8 44	3		
☽ ☽	0	0 58	2 56	4 53	6 49	8 46	0	☽ ☽
	3	0 58	2 57	4 54	6 50	8 49	27	
	6	0 58	2 57	4 55	6 52	8 51	24	
	9	0 59	2 58	4 56	6 54	8 53	21	
	12	0 59	2 58	4 57	6 56	8 56	18	
15	0 59	2 59	4 58	6 57	8 57	15		

Sign	G.	1 Gr.'	3 Gr.'	5 Gr.'	7 Gr.'	9 Gr.'	G.	(exit)
	18	0 59	2 59	4 59	6 58	8 58	12	
	21	1 0	3 0	5 0	6 59	8 59	9	
	24	1 0	3 0	5 0	6 59	8 59	6	
	27	1 0	3 0	5 0	7 0	9 0	3	
	30	1 0	3 0	5 0	7 0	9 0	0	□ □

Lower half — Latitudo Australis:

Sign	G.	1 Gr.'	3 Gr.'	5 Gr.'	7 Gr.'	9 Gr.'	G.	(exit)
□ □	0	0 55	2 45	4 35	6 25	8 14	30	
	3	0 55	2 45	4 35	6 25	8 14	27	
	6	0 55	2 45	4 35	6 25	8 15	24	
	9	0 55	2 45	4 35	6 26	8 15	21	
	12	0 55	2 45	4 36	6 26	8 16	18	
	15	0 55	2 46	4 36	6 27	8 17	15	
	18	0 55	2 46	4 37	6 28	8 18	12	
	21	0 56	2 46	4 38	6 29	8 19	9	
	24	0 56	2 47	4 39	6 30	8 20	6	
	27	0 56	2 47	4 40	6 31	8 22	3	
□ □	0	0 56	2 48	4 41	6 32	8 24	0	□ □
	3	0 56	2 49	4 42	6 34	8 26	27	
	6	0 56	2 50	4 43	6 36	8 28	24	
	9	0 57	2 51	4 44	6 37	8 30	21	
	12	0 57	2 51	4 45	6 39	8 33	18	
	15	0 57	2 52	4 46	6 40	8 34	15	
	18	0 57	2 53	4 47	6 42	8 37	12	
	21	0 57	2 54	4 48	6 44	8 40	9	
	24	0 58	2 54	4 50	6 47	8 43	6	
	27	0 58	2 55	4 51	6 48	8 44	3	
□ □	0	0 58	2 56	4 53	6 49	8 46	0	□ □
	3	0 58	2 57	4 54	6 50	8 49	27	
	6	0 58	2 58	4 55	6 54	8 51	24	

Sign	G.	1 Gr.'	3 Gr.'	5 Gr.'	7 Gr.'	9 Gr.'	G.	(exit)
	9	0 59	2 58	4 56	6 54	8 53	21	
	12	0 59	2 59	4 57	6 56	8 56	18	
	15	0 59	2 59	4 58	6 57	8 57	15	
	18	0 59	2 59	4 59	6 58	8 58	12	
	21	1 0	3 0	5 0	6 59	8 59	9	
	24	1 0	3 0	5 0	6 59	8 59	6	
	27	1 0	3 0	5 0	7 0	9 0	3	
	30	1 0	3 0	5 0	7 0	9 0	0	□ □

Parsing notes: The two halves are arithmetically identical except for the sign of the correction (the headers tell whether to add or subtract), as expected for a symmetric prosthaphaeresis-of-declination table; I have transcribed both in full as printed rather than collapsing them.

TAB. 35 — *Prosthaphaeresis Ascensionis Rectae*

[The prosthaphaeresis of right ascension]

This table is likewise in two halves, with a third (sub-)banner at the foot of each half. The upper half:

Asc. Rectae Signor. Boreal. *Subtrahe*; Australium *Adde*. [For the right ascension of the northern signs *subtract*; for the southern, *add*.] sub-banner: **Latitudo Borealis pro Signis Boreis.** [Northern latitude, for the northern signs.] foot-banner: **Latitudo Australis pro Signis Australib.** [Southern latitude, for the southern signs.]

The lower half:

Asc. Rectae Signor. Boreal. *Adde*; Australium *Subtrahe*. [For the right ascension of the northern signs *add*; for the southern, *subtract*.] sub-banner: **Latitudo Australis pro Signis Boreis.** [Southern latitude, for the northern signs.] foot-banner: **Latitudo Borea pro Signis Australib.** [Northern latitude, for the southern signs.]

Argument columns: latitude 1, 3, 5, 7, 9 degrees (Gr. '). Stub as in TAB. 34.

Upper half — Latitudo Borealis pro Signis Boreis:

(Foot-banner of upper half: **Latitudo Australis pro Signis Australib.**)

Lower half — Latitudo Australis pro Signis Boreis:

Sign	G.	1 Gr.'	3 Gr.'	5 Gr.'	7 Gr.'	9 Gr.'	G.	(exit)
♈	0	0 24	1 12	1 59	2 47	3 36	30	
	3	0 23	1 11	1 59	2 47	3 35	27	
	6	0 23	1 11	1 59	2 47	3 34	24	
	9	0 23	1 11	1 58	2 46	3 32	21	
	12	0 23	1 11	1 58	2 45	3 30	18	
	15	0 23	1 10	1 57	2 43	3 28	15	
	18	0 23	1 9	1 55	2 41	3 26	12	
	21	0 22	1 9	1 53	2 39	3 23	9	
	24	0 22	1 8	1 51	2 35	3 20	6	
	27	0 22	1 6	1 50	2 33	3 15	3	
♉	0	0 22	1 4	1 47	2 28	3 10	0	♈
	3	0 21	1 3	1 44	2 25	3 5	27	
	6	0 20	1 1	1 42	2 21	2 59	24	
	9	0 19	0 59	1 38	2 15	2 54	21	
	12	0 19	0 57	1 34	2 10	2 41	18	
	15	0 19	0 55	1 31	2 6	2 39	15	
	18	0 18	0 52	1 27	2 1	2 31	12	
	21	0 17	0 49	1 21	1 54	2 22	9	
	24	0 16	0 47	1 17	1 47	2 13	6	
	27	0 15	0 44	1 12	1 39	2 4	3	
♊	0	0 14	0 41	1 7	1 32	1 55	0	♉
	3	0 12	0 37	0 58	1 25	1 45	27	
	6	0 11	0 33	0 49	1 16	1 34	24	
	9	0 10	0 30	0 42	1 8	1 25	21	
	12	0 8	0 26	0 35	0 58	1 12	18	
	15	0 7	0 21	0 31	0 49	1 0	15	
	18	0 6	0 17	0 22	0 40	0 49	12	
21	0 5	0 13	0 15	0 30	0 37	9		

Sign	G.	1 Gr.'	3 Gr.'	5 Gr.'	7 Gr.'	9 Gr.'	G.	(exit)
	24	0 3	0 9	0 9	0 20	0 24	6	
	27	0 1	0 4	0 4	0 10	0 13	3	
	30	0 0	0 0	0 0	0 0	0 0	0	□ □

(Foot-banner of lower half: **Latitudo Borea pro Signis Australib.**)

Parsing notes: TAB. 35 is a prosthaphaeresis-of-right-ascension table; both halves run to zero at 30° (the equinoctial/solstitial points), as expected. Several interior cells in the lower half (the south-latitude/north-sign block) are at the limit of legibility because of foxing in the lower-right of the page; transcribed best-reading. The lower half's columns 3 and 5 around □ argument show a few values where the digits are cramped — the monotone decline to zero is preserved.

Tabulae novalmagesticae — Part III (the Sun's and Moon's motions)

Part Three of the Tables, on the Motions of the Sun and Moon.

TABULA 36. The Sun's Equal (Mean) Motion.

[Verbatim title: *TABVLA 36. Solis Motus Aequalis, seu Medius.*]

This page is laid out as two facing master-blocks. The left block gives the **Epochs (Radices)** — the Sun's mean longitude and the longitude of the Sun's apogee, both reckoned from Aries (♈), for a series of years before and after Christ (in the Julian, then Gregorian, reckoning). The right block gives the **expanded and collected Julian years** (*Anni Iuliani Expansi, & Collecti*). Columns throughout are Sig. / Gr. / ' / " (signs / degrees / minutes / seconds). "B." in a year column marks a bissextile (leap) year.

Left block — Epochs (Radices)

[Column heading: *Epochæ, seu Radices.* — over: *Longit. ☉ ab ♈* (the Sun's longitude from Aries) and *Longit. Apogei ☉ ab ♈* (the longitude of the Sun's apogee from Aries).]

The stub column gives the year; the segment labels in the left margin run, from top to bottom: **(years before Christ)**, then **At Christ** [*B^e Christi* — the radix at

Christ], then **Old Julian style** [*Stylo veteri Iuliano*], then **New Gregorian style** [*Stylo novo Gregoriano*].

Year	Long. ☉:				Long. Apogee ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
<i>Anni ante Christum</i> (years before Christ)								
6000	7	21	40	14	10	26	35	53
5000	7	29	20	12	11	13	50	31
4000	8	7	0	10	0	1	5	10
3000	8	14	40	8	0	18	19	48
2000	8	22	20	6	1	5	34	28
1000	9	0	0	3	1	22	49	5
900	9	0	46	3	1	24	32	53
800	9	1	32	3	1	26	16	41
700	9	2	18	2	1	27	59	27
600	9	3	4	2	1	29	42	56
500	9	3	50	2	2	1	26	24
400	9	4	36	2	2	3	9	52
300	9	5	22	1	2	4	53	20
200	9	6	8	1	2	6	36	48
100	9	6	54	1	2	8	20	15
<i>Be Christi</i> (at Christ)	9	7	40	1	2	10	3	43

Year	Long. ☉:				Long. Apogee ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
t)								
<i>Stylo veteri Iuliano</i> (Old Julian style) : 100	9	8	26	1	2	11	47	11
200	9	9	12	1	2	13	30	39
300	9	9	58	1	2	15	14	6
400	9	10	44	0	2	16	57	34
500	9	11	30	0	2	18	41	2
600	9	12	16	0	2	20	24	30
700	9	13	2	0	2	22	7	58
800	9	13	48	0	2	23	51	26
900	9	14	34	0	2	25	34	54
1000	9	15	19	59	2	27	18	21
1100	9	16	5	59	2	29	1	49
1200	9	16	51	59	3	0	45	18
1300	9	17	37	59	3	2	28	44
1400	9	18	23	58	3	4	12	12
1500	9	19	9	58	3	5	55	40
1600	9	19	55	58	3	7	39	8
1700	9	20	41	58	3	9	22	35
1800	9	21	27	58	3	11	6	2
1900	9	22	13	58	3	12	49	29
2000	9	22	59	57	3	14	32	56
1581	9	19	32	17	3	7	19	29

Year	Long. ☉:				Long. Apog ee ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
1582	9	19	26	45	3	7	20	31
1584	9	19	57	14	3	7	22	35
B. 1600	9	10	4	35	3	7	39	8
1700	9	9	51	27	3	9	22	36
1800	9	9	38	19	3	11	6	4
1900	9	9	25	11	3	12	49	31
B. 2000	9	10	11	10	3	14	32	59
2100	9	9	58	2	3	16	16	27
<i>Stylo novo Greg orian o (New Greg orian style) :</i> 2200	9	9	44	54	3	18	0	55
2300	9	9	31	46	3	19	44	23
B. 2400	9	10	17	45	3	21	27	51
2500	9	10	4	37	3	23	11	18
2600	9	9	51	29	3	24	54	46
2700	9	9	38	21	3	26	38	14
B. 2800	9	10	24	20	3	28	21	42
2900	9	10	11	12	4	0	5	10
3000	9	9	58	4	4	1	48	38

Year	Long. ☉:				Long. Apog ee ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
3100	9	9	44	56	4	3	32	6
B.	9	10	30	55	4	5	15	34
3200								
3300	9	10	17	47	4	6	59	2

Parsing notes: The "before Christ" / "at Christ" / Old-Julian / New-Gregorian segment labels appear vertically in the left stub margin; I have inserted them as italic row-headers at each segment boundary. In the New-Gregorian section the Sun's-longitude degrees revert to ~9–10° (the Gregorian calendar reform), whereas the Old-Julian section had climbed past 22°; this is a genuine feature of the dual-style radices, not a misread. The 1581/1582/1584/B.1600 block sits between the round-century Julian rows and the Gregorian rows as the calendar-transition radices.

Right block — Expanded and Collected Julian years

[Column heading: *Anni Iuliani Expansi, & Collecti*. — over: *Longit. ☉ ab √* and *Longit. Apogei ☉ ab √*. "B." marks bissextile years.]

Year	Long. ☉:				Long. Apog ee ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
1	11	29	45	41	0	0	1	2
2	11	29	31	21	0	0	2	4
3	11	29	17	2	0	0	3	6
B. 4	0	0	1	50	0	0	4	8
5	11	29	47	31	0	0	5	10
6	11	29	33	11	0	0	6	12
7	11	29	18	52	0	0	7	15
B. 8	0	0	3	41	0	0	8	17
9	11	29	49	21	0	0	9	19
10	11	29	35	2	0	0	10	21

Year	Long. ☉:				Long. Apog ee ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
11	11	29	20	42	0	0	11	23
B. 12	0	0	5	31	0	0	12	25
13	11	29	51	12	0	0	13	27
14	11	29	36	52	0	0	14	29
15	11	29	22	33	0	0	15	31
B. 16	0	0	7	22	0	0	16	33
17	11	29	52	2	0	0	17	35
18	11	29	38	43	0	0	18	37
19	11	29	23	23	0	0	19	39
B. 20	0	0	9	12	0	0	20	42
21	11	29	54	53	0	0	21	42
22	11	29	40	34	0	0	22	46
23	11	29	26	15	0	0	23	48
B. 24	0	0	11	2	0	0	24	50
25	11	29	56	43	0	0	25	52
26	11	29	42	24	0	0	26	54
27	11	29	28	5	0	0	27	56
B. 28	0	0	12	53	0	0	28	58
29	11	29	58	34	0	0	30	0
30	11	29	44	15	0	0	31	2
31	11	29	29	56	0	0	32	4
B. 32	0	0	14	43	0	0	33	7
33	0	0	0	24	0	0	34	9
34	11	29	46	5	0	0	35	11
35	11	29	31	46	0	0	36	13
B. 36	0	0	16	33	0	0	37	15
37	0	0	2	14	0	0	38	17
38	11	29	47	55	0	0	39	19
39	11	29	33	36	0	0	40	21

Year	Long. ☉:				Long. Apog ee ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
B. 40	0	0	18	24	0	0	41	23
41	0	0	4	5	0	0	42	25
42	11	29	49	46	0	0	43	27
43	11	29	35	27	0	0	44	29
B. 44	0	0	20	14	0	0	45	31
45	0	0	5	55	0	0	46	33
46	11	29	51	36	0	0	47	35
47	11	29	37	17	0	0	48	37
B. 48	0	0	22	4	0	0	49	39
49	0	0	7	45	0	0	50	41
50	11	29	53	26	0	0	51	43
51	11	29	39	7	0	0	52	45
B. 52	0	0	23	55	0	0	53	48
53	0	0	9	36	0	0	54	50
54	11	29	55	17	0	0	55	52
55	11	29	40	58	0	0	56	54
B. 56	0	0	25	45	0	0	57	56

Parsing notes: This right-hand block continues onto the next page (table-page 45). The Sun's-longitude column oscillates around $11^s 29^o / 0^s 0^o$ because one tropical year carries the Sun nearly but not exactly back to its starting point; the small annual surplus (the leap-year reset at each "B." row) is the expected behavior of an expanded-years table and is not an error.

SOLIS MOTUS ÆQUALIS — continued (table-page 45)

Expanded and Collected Julian years (continuation)

[Column heading: *Anni Iuliani Expansi, & Collecti*. — *Longit.* ☉ *ab* ♃ and *Log. Apog.* ☉ *ab* ♃. The lower part of the stub shifts to *Anni Collecti* (collected years) in hundreds, marked "B."]

Year	Long. ☉:				Long. Apog. ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
57	0	0	11	26	0	0	58	58
58	11	29	57	7	0	1	0	0
59	11	29	42	48	0	1	2	2
B. 60	0	0	27	36	0	1	3	5
61	0	0	13	17	0	1	3	7
62	11	29	58	58	0	1	4	9
63	11	29	44	39	0	1	5	11
B. 64	0	0	29	26	0	1	6	13
65	0	0	15	7	0	1	7	15
66	0	0	0	48	0	1	8	17
67	11	29	46	29	0	1	9	19
B. 68	0	0	31	16	0	1	10	21
69	0	0	16	57	0	1	11	23
70	0	0	2	38	0	1	12	25
71	11	29	48	19	0	1	13	27
B. 72	0	0	33	7	0	1	14	30
73	0	0	18	48	0	1	15	32
74	0	0	4	29	0	1	16	34
75	11	29	50	10	0	1	17	36
B. 76	0	0	34	57	0	1	18	38
77	0	0	20	38	0	1	19	40
78	0	0	6	19	0	1	20	42
79	11	29	52	0	0	1	21	44
B. 80	0	0	36	48	0	1	22	46
81	0	0	21	29	0	1	23	48
82	0	0	7	10	0	1	24	50
83	11	29	53	41	0	1	25	52
84	0	0	38	38	0	1	26	54
85	0	0	24	19	0	1	27	56

Year	Long.				Long. Apog.			
	⊙: Sig.	Gr.	'	"	⊙: Sig.	Gr.	'	"
86	0	0	10	0	0	1	28	58
87	11	29	55	41	0	1	30	0
B. 88	0	0	40	2	0	1	31	3
89	0	0	26	10	0	1	32	5
90	0	0	11	51	0	1	33	7
91	11	29	57	32	0	1	34	9
B. 92	0	0	42	19	0	1	35	11
93	0	0	28	0	0	1	36	13
94	0	0	13	41	0	1	37	15
95	11	29	59	22	0	1	38	17
B. 96	0	0	44	10	0	1	39	19
97	0	0	29	51	0	1	40	21
98	0	0	15	32	0	1	41	23
99	0	0	1	13	0	1	42	25
<i>Anni</i>	0	0	46	0	0	1	43	28
<i>Colle</i>								
<i>cti</i>								
(colle								
cted								
years								
): 200								
100	1	0	32	0	0	3	26	56
200	2	1	17	59	0	5	10	21
300	0	1	3	59	0	6	53	51
500	3	1	49	59	0	8	37	19
B.	4	3	35	59	0	10	20	46
600								
700	5	2	21	59	0	12	4	14
B.	6	6	7	58	0	13	47	42

Year	Long. ☉:				Long. Apog. ☉:			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
800								
900	6	6	53	58	0	15	31	10
B.	0	7	39	58	0	17	14	48
1000								
B.	0	15	19	56	1	4	29	64
2000								
B.	0	12	59	55	1	21	43	54
3000								
B.	1	0	39	51	2	8	58	22
4000								

Parsing notes: The lower-stub block jumps from single years (...99) to *Anni Collecti* in centuries; the printed century labels (100, 200, 300, 500, B.600 ... B.4000) are transcribed exactly as set — note the row order/labels are irregular as printed (a "200" appears at the segment head followed by "100"), which appears to be a compositor sequencing quirk rather than my misread (see anomaly a). The B.2000 Apogee-second cell reads "64" (flagged below as a numerical impossible).

TABULA: Common and Bissextile Months

[Heading: *Menses Communes Bissextiles*. — over: *Lóg.* ☉ *ab init.* ♀ (the Sun's longitude from the beginning of Aries) for *Menses Completi* (completed months), in two parallel sets.]

Completed month (<i>Menses Completi</i>)	Long. ☉ (common)				Long. ☉ (bissextile):			
	Sig.	Gr.	'	"	Sig.	Gr.	'	"
Ianuaris (Janu	1	0	33	18	1	0	33	18

Completed month (Menses Complete)	Long. ☉ (common) : Sig.	Gr.	'	"	Long. ☉ (bissextile): Sig.	Gr.	'	"
January)								
Februarius (February)	1	28	9	11	1	29	8	20
Martius (March)	2	28	42	30	2	29	41	38
Aprilis (April)	3	28	16	40	3	29	15	48
Maius (May)	4	28	49	58	4	29	49	6
Iunius (June)	5	28	24	8	5	29	23	16
Iulius (July)	6	28	57	26	6	29	56	34
Augustus (August)	7	29	30	44	8	0	29	52
Septembris (September)	8	29	4	54	9	0	4	2

Completed month	h	Long. (Men ses Comp leti)	Long. (com mon)	Gr.	'	"	Long. (bisse xtile):	Sig.	Gr.	'	"
embe r)											
Octo b. (Octo ber)	9	29	38	12	10	0	37	21			
Noue mb. (Nov embe r)	10	29	12	22	11	0	11	31			
Dece mb. (Dece mber)	11	29	45	41	0	0	44	49			

[Margin / footnote at foot of left block: *Pro Apog. singul. mensib. sume quina secunda scrupula.* — "For the apogee, take five seconds (5'') for each month."]

TABULA: Days (*DIES*)

[Heading: *DIES.* — over: *Motus medius* ☉ (the Sun's mean motion), columns Sig. / Gr. / ' / ", argument = day of month (1–31).]

Day (<i>Dies</i> <i>cópl.</i>)	Sig.	Gr.	'	"
1	0	0	59	8
2	0	1	58	16
3	0	2	57	24
4	0	3	56	33

Day (<i>Dies</i> <i>cópl.</i>)	Sig.	Gr.	'	"
5	0	4	55	41
6	0	5	54	49
7	0	6	53	58
8	0	7	53	6
9	0	8	52	14
10	0	9	51	23
11	0	10	50	31
12	0	11	49	39
13	0	12	48	48
14	0	13	47	56
15	0	14	47	4
16	0	15	46	13
17	0	16	45	21
18	0	17	44	29
19	0	18	43	38
20	0	19	42	46
21	0	20	41	54
22	0	21	41	3
23	0	22	40	11
24	0	23	39	19
25	0	24	38	28
26	0	25	37	36
27	0	26	36	44
28	0	27	35	53
29	0	28	35	1
30	0	29	34	9
31	1	0	33	18

Parsing notes: smooth monotone progression ($\sim 0^{\circ}59'8''$ per day); no anomalies.

TABULA: Hours (*HORÆ*)

[Heading: *HORÆ*. — columns Gr. / ' / " / "' keyed to Horæ (hours) above and, in the lower stub, min. and sec. The column-tier labels read: Horæ → Gr. ' " "' ; min. → ' " "' ; sec. → " " " " " " " " (i.e. successive sexagesimal subdivisions).]

Hours (<i>Horæ</i>)	Gr.	'	"	"
1	0	2	27	51
2	0	4	55	44
3	0	7	23	32
4	0	9	51	23
5	0	12	19	4
6	0	14	47	5
7	0	17	14	56
8	0	19	42	47
9	0	22	10	37
10	0	24	38	28
11	0	27	6	19
12	0	29	34	10
13	0	32	2	1
14	0	34	29	52
15	0	36	57	42
16	0	39	25	33
17	0	41	53	24
18	0	44	21	15
19	0	46	49	6
20	0	49	16	57
21	0	51	44	47
22	0	54	12	38
23	0	56	40	29
24	0	59	8	20
25	1	1	36	11
26	1	4	4	1

Hours (Horæ)	Gr.	'	"	'''
27	1	6	31	52
28	1	8	59	43
29	1	11	27	34
30	1	13	55	25

TABULA: Hours — for the remaining hours and minutes (*In Reliquis Horis, & Scrupulis*)

[Heading: *HORÆ. In Reliquis Horis, & Scrupulis.* — "Hours: for the remaining hours and the minutes (of arc/time)." Column tiers as above: Horæ → Gr. ' " ''"; min. → ' " '' ''''; sec. → " '' '''' '''''''. Argument runs 31–60.]

Argument	Gr.	'	"	'''
31	1	16	23	16
32	1	18	51	6
33	1	21	18	57
34	1	23	46	48
35	1	26	14	39
36	1	28	42	30
37	1	31	10	21
38	1	33	38	11
39	1	36	6	2
40	1	38	33	53
41	1	41	1	44
42	1	43	29	36
43	1	45	57	26
44	1	48	25	16
45	1	50	53	7
46	1	53	20	58
47	1	55	48	49
48	1	55	16	40
49	2	0	44	30
50	2	3	12	21

Argument	Gr.	'	"	'''
51	2	5	40	12
52	2	8	8	3
53	2	10	35	54
54	2	13	3	45
55	2	15	31	35
56	2	17	59	26
57	2	20	27	17
58	2	22	55	8
59	2	25	22	59
60	2	27	50	50

Parsing notes: Row 48 (Gr. 1, ' 55, " 16, ''' 40) breaks the smooth ~2'28"-per-step progression — the minutes should read ≈58 (continuing 53→55→58→0...). Flagged below (anomaly b); likely a compositor error in the source. Row 47 ''=48 and row 48 ''=16 with the degrees-column failing to roll to 2° suggest a transposition in the printing.

TAB. 37. PARALLAXES OF THE SUN (*PARALLAXIVM SOLIS*)

[Verbatim heading: *TAB. 37. PARALLAXIVM SOLIS.* — "Table 37. Of the Parallaxes of the Sun."]

The argument (stub) is altitude (*Altitud.*) in degrees (Gr.); the three value-pairs give the Sun's parallax [parallaxis Solis] at apogee (☉ *Apogeo*), at mean distance (☉ *In med. dist.* — *in media distantia*), and at perigee (☉ *Perigee*), each in ' and ''.

Altitud e (Gr.)	Apogee '	Apogee "	Mean dist. ' "	Mean dist. " "	Perigee '	Perigee "
0	27	28	28	18	29	8
5	25	10	26	10	27	8
10	23	20	24	20	25	20
15	21	30	22	30	23	30
20	19	40	20	40	21	30
25	17	50	18	50	19	40
30	16	0	17	0	17	50

Altitude (Gr.)	Apogee '	Apogee ''	Mean dist. '	Mean dist. ''	Perigee '	Perigee ''
35	14	40	15	30	16	0
40	12	30	13	30	13	30
45	10	0	11	20	11	40
50	9	30	9	40	10	0
55	7	40	7	50	8	20
60	6	0	6	10	7	0
65	5	0	5	10	6	0
70	4	0	4	10	4	30
75	3	0	3	8	3	20
80	2	0	2	6	2	6
85	1	0	1	2	1	6
90	0	0	0	0	0	0

Parsing notes: At altitude 90° (the zenith) all parallaxes go to 0'0", as expected. The fine '"/' pairs at low altitude are small and partly ink-bled; the values 0°: Apogee 27'28", mean 28'18", perigee 29'8" are read with moderate confidence.

[Footnote/key below the parallax table — the zodiac-sign correspondence for the altitude argument:] *I. II. — XI. XII.; III. IV. — IX. X.; V. VI. — VII. VIII. over Anomaliae Signa* ("the signs of anomaly") — i.e. the table-argument signs pair (I & II with XI & XII), (III & IV with IX & X), (V & VI with VII & VIII).

TAB. 38. The Equations of the Sun (*Aequationum Solis*) — table-page 46

[Verbatim heading: *TAB. 38. Aequationum Solis Excentricitate tota partium 3480. sed Bisiecta 1740. qualium Radius 100000.* — "Table 38. Of the equations of the Sun, the whole eccentricity being 3480 parts, but the bisected (halved) eccentricity 1740, of which kind the radius is 100000."]

The table is given twice: first **In Forma Circulari** ("in the circular form"), then **In Forma Elliptica** ("in the elliptical form"). The argument is the anomaly (*Anomalia*) — read down the left stub in signs (*Signa*) and degrees (*Gradus*) 0–30 and up the right stub in the complementary signs. Each sign-column gives the equation in G. (degrees) /' /'', headed by its Roman ordinal and the instruction

Subtrahe (subtract) in the upper half and *Adde* (add) in the lower half, with intervening *Diff.* (difference) columns.

In Forma Circulari

[Headers: *Anom. Signa / Gradus* (left); six value-blocks — *O. Subtrahe* (with *Differentia*), *I. Subtrahe* (Diff.), *II. Subtrahe* (Diff.), *III. Subtrahe* (Diff.), *IV. Subtrahe* (Diff.), *V. Subtrahe* (Diff.); *Anom. Sig. G.* (right).]

A n o m . G r . (l e f t)	D i f f f f f f f	I I I I I I I	D I I I I I I	I I I I I I I	D I I I I I I	V V V V V V V	D i f f f f f f	A n o m . G r . (r i g h t)
0 0 0 0	— 0 5 5	— 1 4 4	— 1 5 4	— 1 4 4	— 0 5 5	— 3		
	9 5	3 5	9 1	3 5	9 5	0		
1 0 2 5	1 1 1 4	1 1 4 4	5 1 5 4	4 1 4 4	6 0 5 7	1 2		
	2 0 0	4 2 7	9 0	2 5 0	8 0 9			
	5 5				8			
2 0 4 1	1 1 3 2	1 1 4 3	5 1 5 3	4 1 4 4	6 0 5 1	1 2		
	0 2 4 0	5 8 6	9 9	1 1 4	6 7 1 8			
	5 4				0			
3 0 6 1	1 1 5 7	1 1 4 3	5 1 5 3	7 1 4 3	6 0 5 2	1 2		
	5 2 0	6 4 6	9 2	0 4 7	4 5 1 7			
	5 3				2			
4 0 8 2	1 1 6 4	1 1 4 2	5 1 5 2	1 1 3 2	7 0 5 3	1 2		
	0 2 9 0	7 9 5	9 2 0	9 4 0	2 2 1 6			
	5 2				3			
5 0 1 2	1 1 8 3	1 1 4 2	5 1 5 7	1 1 3 1	5 0 5 3	1 2		

A n o m . G r . (l e f t)	O	D i f f	I I G	D I f	I I G	I I G	I I G	V V G	D i f f	D i f f	D i g h t
	0 5 2		0 0	8 3 4	9 5	8 2 0	0 8 1 5			4	
6	0 1 3 1 1 1 9 1 1 4 1 5 1 5 4 2 1 3 5 7 0 4 4 1 2		2 0 2 0 0	9 9 3	8 7 0	6 8 4	8 3 1 4			5	
7	0 1 3 1 1 1 4 9 1 5 1 5 1 5 2 2 1 3 4 7 0 4 4 1 2		4 4 2 1 9 9 0 1 2	8 7 0	5 2 6	6 7 1 3			6		
8	0 1 3 1 1 1 2 9 1 5 1 5 1 5 8 1 1 3 2 7 0 4 5 1 2		6 8 2 3 7 8 1 0	8 9	4 4 8	4 0 1 2			7		
9	0 1 4 1 1 1 4 9 1 5 4 4 1 5 4 1 1 3 4 8 0 4 5 1 2		8 2 2 5 7 1 9 8	7 9 9	3 0	2 3 1 1			7		
10	0 2 4 1 1 1 4 9 1 5 3 4 1 5 3 1 1 3 4 8 0 4 5 1 2		0 0 6 2 6 0 6 2 5 6	7 0 9	1 2 2	0 5 1 0			8		
11	0 2 4 1 1 1 1 9 1 5 1 4 1 5 1 2 1 3 1 8 0 3 5 1 1		1 2 9 2 8 5 5 3 9 4	7 0 0	0 8 4	8 7 1 9			9		
12	0 2 5 1 1 1 4 9 1 5 5 4 1 5 4 2 1 3 5 8 0 3 5 1 1		2 4 2 2 9 9 4 3 9 0	6 9 1	8 2 6	6 8 1 8					

A n o m . G r . (l e f t)	O f G)	D i f f f)	I I f f f)	I I f f f)	I I f f f)	V V f f f)	V V f f f)	D i f f f)	D i f f f)									
2 0 0	4 5 0	1 1 9	3 4 1	8 2 4	1 5 7	3 2 0	2 1 0	1 5 2	5 3 0	4 1 4	1 1 6	4 9 0	2 4 5	0 6 0	2 4 6	1 1 2	1 0 0	1 1 3
2 1 1	4 5 2	1 1 8	3 4 3	8 2 2	1 5 7	4 1 9	1 1 9	1 5 1	5 4 6	4 1 5	1 1 8	4 9 0	1 4 6	8 2 7	1 4 7	1 9 0	1 4 8	1 9 0
2 2 2	4 5 4	1 1 8	3 2 4	8 4 0	1 5 8	7 1 9	1 1 1	1 5 1	5 4 8	4 1 3	1 1 7	4 9 0	1 3 7	6 8 2	1 3 4	1 8 2	1 3 4	1 8 2
2 3 3	4 4 6	1 1 7	3 4 5	7 2 8	1 5 8	2 1 7	1 1 0	1 5 1	5 1 0	5 1 1	1 1 4	4 9 0	1 3 4	4 4 2	1 3 4	1 7 2	1 3 4	1 7 2
2 4 4	4 4 8	1 1 6	3 5 6	7 8 6	1 5 8	4 2 7	1 4 9	1 4 9	2 1 2	2 1 0	1 1 0	4 9 0	1 3 1	2 0 2	1 3 1	6 2 2	1 3 1	6 2 2
2 5 5	5 3 8	1 1 5	3 1 8	7 2 4	1 5 9	7 2 0	1 4 8	2 5 3	1 8 5	1 8 3	8 2 0	2 1 0	1 2 1	0 5 2	1 2 1	5 0 5	1 2 1	5 0 5
2 6 6	5 3 2	1 1 4	3 2 9	7 4 2	1 5 9	2 1 0	1 4 7	2 5 4	1 6 9	3 1 4	1 0 8	2 1 0	8 2 1	0 2 5	2 1 4	4 0 1	2 1 4	4 0 1
2 0 2	5 2 1	1 1 4	4 3 7	7 1 5	3 7 1	4 3 5	1 4 3	5 1 5	7 1 0	6 1 1	1 1 3	1 0 6	1 1 1	1 1 3	1 1 3	1 1 3	1 1 3	1 1 3

A n o m . G r . (l e f t)	O : G)	D i ff f)	I I : G)	D I : G)	I I : G)	D I : G)	D I : G)	D i ff f)	V V : G)	V V : G)	D i ff f)	D i ff f)	A n o m . G r . (r i g h t)													
7	4	5	1	0	4	0	9	2	6	4	5	0	5	2												
			3									2		5												
2	0	5	1	1	1	4	4	6	1	5	3	4	1	4	3	5	1	3	2	1	0	4	1	1	2	
8	6	7	1	1	1	7	9	9	5	8	6	4	0	0	2				3			0	2			5
			2																	3						5
2	0	5	7	1	1	4	4	6	1	5	4	4	1	4	4	5	1	1	4	1	0	2	5	1	1	
9	8	1	2	5	4	9	0	4	2	6	0	0	0	0	2										2	
			0																	4					5	
3	0	5	5	1	1	4	4	6	1	5	4	—	1	4	4	5	1	0	0	1	0	0	0	—	0	
0	9	5	0	3	5	0	9	1	3	5	7	0	0	0	0	0	0	0	0	0	0	0	0	0	—	0
			8																							5

[Bottom-of-block sign labels (read upward for the right-hand argument): *XI. Adde.* — *X. Adde.* — *IX. Adde.* — *VIII. Adde.* — *VII. Adde.* — *VI. Adde.*]

Parsing notes: This circular-form sub-table is extremely dense (six equation-blocks each with degree/" plus a Diff. column). The equation is symmetric about anomaly 90° (sign III, 0°), where it peaks near 1°59'41"; the column-V values at the right margin mirror the column-O values, consistent with the *Subtrahe* (top) / *Adde* (bottom) symmetry of a solar equation. Several Diff. and " cells in the inner columns are small-type and ink-affected; readings carry moderate confidence. Row 12 column-IV minutes read "38" where the smooth descent suggests □ 29 — possible misread or compositor slip (flagged anomaly c).

In Forma Elliptica

[Headers: *Gr.* (left); six value-blocks — *O. Subtr.*, *I. Subtr.*, *II. Subtr.*, *III. Subtr.*, *IV. Subtr.*, *V. Subtr.*, each *G./"/*; *An. Sig. Gr.* (right).]

G r. (left)	O			I			II			III			IV			V			G r. (right)
	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	
0	0	0	0	0	5	5	1	4	2	1	5	3	1	4	1	1	0	0	3
					8	0		2	6		9	8		4	4				0
1	0	2	4	1	0	3	1	4	3	1	5	3	1	4	1	0	5	4	2
						4		3	0		9	0		3	2		8	6	9
2	0	4	6	1	2	2	1	4	5	1	5	2	1	4	8	0	5	5	2
						0		4	4		9	0		2			6	4	8
3	0	6	1	1	4	6	1	4	4	1	5	1	1	4	0	0	5	4	2
			0					5	8		9	6		1			4	0	7
4	0	8	1	1	5	5	1	4	2	1	5	1	1	3	5	0	5	6	2
			2			0		6	4		9	2		9	4		3		6
5	0	1	1	1	7	3	1	4	2	1	5	5	1	3	4	0	4	1	2
		0	4			0		7	2		8	6		8	4		9	8	5
6	0	1	1	1	9	2	1	4	1	1	5	4	1	3	3	0	4	1	2
		2	6			4		8	4		8	6		7	2		9	8	4
7	0	1	1	1	1	5	1	4	6	1	5	4	1	3	2	0	4	2	2
		4	8		0	2		9			8	0		6	0		7	4	3
8	0	1	2	1	1	2	1	4	5	1	5	3	1	3	4	0	4	3	2
		6	0		2	8		9	6		8	0		5			5	0	2
9	0	1	2	1	1	6	1	5	0	1	5	1	1	3	4	0	4	2	2
		8	2		4			0			8	2		3	8		3	6	1
10	0	2	1	1	1	4	1	5	2	1	5	5	1	3	2	0	4	2	2
		0	4		5	2		1	6		7	0		2	8		1	0	0
11	0	2	2	1	1	2	1	5	5	1	5	3	1	3	4	0	3	3	1
		2	4		7	0		1	4		7	4		1			9	0	9

G r. (ft)	O : G			I: G			II : G			II I: G			I V : G			V : G			G r. (r i g h t)
	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	
1	0	2	2	1	1	5	1	5	5	1	5	0	1	2	4	0	3	3	1
2		4	8		8	0		2	4		7			9	0		7	0	8
1	0	2	3	1	2	1	1	5	2	1	5	4	1	2	2	0	3	2	1
3		6	2		0	0		3	0		6	6		8	2		5	6	7
1	0	2	2	1	2	5	1	5	1	1	5	1	1	2	5	0	3	2	1
4		8	4		1	4		4	0		6	6		6	2		3	6	6
1	0	3	2	1	2	2	1	5	5	1	5	4	1	2	3	0	3	2	1
5		0	2		3	2		4	2		5	6		5	0		1	6	5
1	0	3	2	1	2	5	1	5	0	1	5	1	1	2	5	0	2	2	1
6		2	2		4	0		5			5	8		3	6		9	2	4
1	0	3	2	1	2	1	1	5	5	1	5	4	1	2	2	0	2	1	1
7		4	0		6	4		5	2		4	0		2	5		7	6	3
1	0	3	1	1	2	0	1	5	0	1	5	4	1	2	2	0	2	1	1
8		6	8		8			6			4			0	7		5	4	2
1	0	3	1	1	2	4	1	5	5	1	5	0	1	1	2	0	2	1	1
9		8	4		9			6	4		3			9	0		2	0	1
2	0	4	1	1	3	2	1	5	0	1	5	5	1	1	4	0	2	4	1
0		0	0		0	4		7			2	4		7	8		1		0
2	0	4	8	1	3	4	1	5	3	1	5	8	1	1	6	0	1	0	9
1		2			1	4		7	2		2			6			9		
2	0	4	0	1	3	4	1	5	4	1	5	2	1	1	2	0	1	5	8
2		4			3			8			2	4		4	6		6	4	
2	0	4	1	1	3	1	1	5	1	1	5	3	1	1	5	0	1	5	7
3		6	4		4	0		8	0		0	4		2	0		4	0	
2	0	4	4	1	3	4	1	5	2	1	4	4	1	1	0	0	1	4	6
4		7	8		5			8	8		9	8		1			2	4	
2	0	4	4	1	3	4	1	5	4	1	4	5	1	9	2	0	1	3	5
5		9	0		6	6		8	0		8	6			6		0	2	

G r. (O : G)	I:			II:			II:			I:			V:			G r. (r i g h t)			
	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "	. ' "						
2 6	0 1	5 6	3 8	1 8	3 8	0 8	1 8	5 6	5 8	1 8	4 8	4 8	1 8	7 4	4 4	0 8	8 3	3 0	4
2 7	0 3	5 2	2 9	1 0	3 9	1 9	1 9	5 9	4 9	1 9	4 6	8 6	1 6	5 6	5 6	0 6	6 0	2 0	3
2 8	0 5	5 2	1 0	1 6	4 9	1 0	1 9	5 0	3 6	1 6	4 6	8 6	1 6	4 0	0 0	0 4	4 8	8 2	2
2 9	0 6	5 6	0 1	1 4	4 1	2 4	1 9	5 0	3 5	1 4	4 1	1 4	1 2	2 2	0 4	2 0	2 0	0 1	1
3 0	0 8	5 0	5 2	1 6	4 9	2 8	1 8	5 8	3 4	1 4	4 4	1 4	1 6	0 2	2 0	0 0	0 0	0 0	0

[Bottom-of-block sign labels: *XI. Adde.* — *X. Adde.* — *IX. Adde.* — *VIII. Adde.* — *VII. Adde.* — *VI. Adde.*]

[Reference note at foot: *TAB. 39.* pointing to the next table.]

Parsing notes: The elliptical-form table mirrors the circular form's symmetry: the equation peaks near 1°59'38" around anomaly 90° (sign III, 0°) and runs to 0°0' at the ends. This page has no separate Diff. columns (unlike the circular form). Several "-cells in the inner columns are small-type/ink-affected; readings carry moderate confidence. Column-V row 5 and row 6 both read 49'18" — a likely duplicated/dittographed value where one should differ (flagged anomaly d).

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae, Part III (continued)

Table-page 47

TAB. 39 — The distances of the Moon and Sun, horizontal parallaxes, hourly motions, and semidiameters at apogee, mean distance, and perigee

[TAB. 39. *Luni-Solaris Distantiarum, Parallax. Horiz. Horarij, & Semidiametrorum in \odot , \square & \oslash* — Table of the Moon-Sun distances, horizontal parallax, hourly motions, and semidiameters at conjunction (\odot), quadrature (\square), and opposition (\oslash).]

The argument (anomaly) runs down both edges of the table: degrees 0–180 in the left column descending in steps of 5, and degrees 360–180 in the right column (descending from 360 at the top to 180 at the bottom).

Column groups: **Distance from the center of the Earth** — *Ad Radium* (to the radius, parts of 100000) and *In Semidiam. Terrae* (in semidiameters of the Earth: 1st hypothesis, 2nd hypothesis); **Horizontal Parallax** ($^{\circ}$, $'$, $''$); **True hourly motion** (*Horarius mot. Verus*: $^{\circ}$, $'$, $''$); **Apparent semidiameter** (*Semidiam. apparentes*: $'$, $''$); **Apogee of the shadow** (\odot *Apo. Vmbrae* in 12ths, $'$); **Variation of the half-diameter** (*Variat. \odot Vmbrae demed.* $''$); **Axis of the Earth's shadow** (*Axis Vmbrae Terrae*: 1st hyp., 2nd hyp.).

	D	is	t.	A	d	D	D							V			
	R	is	t.	a	t.	t.	I	I					A	a			
	u	S	S	e	e				S	S	p	o.	ri				
A	m	e	e	m	m				e	e	m	V	p	.	A	A	A
n	(1	id	i	P	P	P	H	H	H	i	id	m	o.	d	xi	xi	o
m	0	.	d.	a	a	a	o	o	o	d.	.	b	V	e	s	s	m
al	0	1.	2.	r	r	r	r.	r.	r.	a	a	r.	m	m	1.	2.	al
.	0	h	h	al	al	al	m	m	m	p	p	(1	b	e	h	h	.
G	0	y	y	l.	l.	l.	ot	ot	ot	p.	p.	2	r.	d.	y	y	G
r.	0)	p.	p.	°	'	"	°	'	"	'	"	a)	'	"	p.	p.	.
0	1	1	7	6	6	4	2	8	5	2	2	2	1	3	4	4	0
	0	0	4	6	3	0	7		4		3	0	5	0	8	2	
	1	4	2	6							2			1	3		
	7	3	7	6							9			4	8		
	4	4															
	0	3															
5	1	1	7	6	6	3		1	5	3	2	2		3	4	4	0
	0	0	4	6	3	8		0	4		3	2		0	8	3	
	1	4	2	6							2				3		
	7	3	6	5							9				8		
	3	1															
	8	8															
1	1	1	7	6	6	3		1	5	4	2	2		3	4	4	1
0	0	0	4	6	3	7		2	4		3	6		0	9	4	
	1	4	2	6							2				3		
	7	2	5	5							9				8		
	1	8															
	0	7															
1	1	1	7	6	6	3		1	5	6	2	3		3	5	5	2
5	0	0	4	6	3	5		4	4		3	2		1	0	0	

	D is t. A d R a d i u A n o m a l G r.	D is t. I n S e m m (1 0 0 0 0 1 4 6 3 6 2 0 1 0 0 1 5 8 0 0 1 3 5	D is t. I n S e m m id i d. h y p. p.	P a r r r l. l. l. ° ' ".° ' ."' "a) ' "p. p.	P a r r r l. l. l. ' ".° ' ."' "a) ' "p. p.	P a r r r l. l. l. ' ".° ' ."' "a) ' "p. p.	H o o o r. r. r. m p. p. ' "a) ' "p. p.	H o o o r. r. r. m p. p. ' "a) ' "p. p.	H o o o r. r. r. m p. p. ' "a) ' "p. p.	S e m m id i d. h y p. p. ' "a) ' "p. p.	S e m m id i d. h y p. p. ' "a) ' "p. p.	A p p o. V p o. d xi s s xi o m a l G r.	V a r i a t i o n s A n o m a l G r.	A n o m a l G r.	
	1	4	2	6							2			3	
	6	2	3	1							9			8	
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5	0	0	4	6	3	6	7	4	0	3	1	3	2		
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	5	8	0	1						9			9		

	D is t. A d R a d i u A n o m al .G r.	D is t. D is t. I n S e m (1 0 0 0 0 0 1 1 2 9 5 0 1 0 0 8 8 1 6 5	D is t. I n S e m m id .1 h y p.	P a r r l. °	P a r r l. '	P a r r l. "	H o r r m ot .°	H o r r m ot '	H o r r m ot ."	i d .1 p. p.	i d .1 p. p.	S e m m V p (1 2 a)	S e m m V p (1 2 a)	A p o. V p (1 2 a)	A p o. V p (1 2 a)	V a r i a t i o n s A n o m al G	A p o. V p (1 2 a)	A p o. V p (1 2 a)	A p o. V p (1 2 a)	A p o. V p (1 2 a)
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	9	1																		
5	1	1	7	6	6	3	3	5	5	2	4	3	3	3	1					
5	0	0	3	6	2	9	6	4	5	4	9	9	4	2	4					
	1	2	7	1							3			0						
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	0	7																		
	9	2																		
6	1	1	7	6	6	2	4	5	4	2	0	4	6	5	1					
0	0	0	3	6	2	7	0	5		5		0	4	0	8					
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A n o m a l . G r.	D is t. A d R a d i u m o 0 0 0 0 0 5 7 5 0 0 4 5 9 8 0 0 3	D R a d i u m o 0 0 0 0 0 5 0 0 0 0 0 0 0 0 3 0 3	D R a d i u m o 0 0 0 0 0 5 0 0 0 0 0 0 0 0 3 0 3	D R a d i u m o 0 0 0 0 0 5 0 0 0 0 0 0 0 0 3 0 3	P P P a l	P P P a l	P P P a l	H H H o	H H H o	H H H o	i d	i d	V A r i a t i o n s . A t t r i b u t e s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s .	A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s .	A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s .	A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s .	A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s . A n o n y m o u s .				
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	0	1	4	9							3				4						
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5	0	0	3	5	1	1		4	5	6	6	4		3	5	5	0				
	0	1	3	8							3				4						
	4	3	3	2							1				1						
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8	1	1	7	6	6	3	2	0	5	4	2	0		4	1	1	3				
0	0	0	3	5	1	8	8		5	8	7			4	8	8	3				
	0	1	2	7							3				4						
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 r. 0) p. p. ° ' " .° .' ." ' " a) ' " p. p. .

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 0 0 1 6 3 4
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 0 0 0 3 5 1 0 8 6 4 8 6 6 4 0
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 1 9 9 7 6 6 4 3 5 3 2 1 4 3 2 4

	D	D	D	D	D	D	H	H	H	S	S	A	V	A	A	A
	is	is	is	is	is	is	o	o	o	e	e	o.	a	ri	ri	ri
	t.	t.	t.	t.	t.	t.	r.	r.	r.	m	m	V	p	at	at	at
	A	I	I	I	I	I	o	o	o	m	m	m	o.	A	A	A
	d	n	n	n	n	n	r.	r.	r.	m	m	V	p	at	at	at
	R	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	a	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	t.	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	d	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	i	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	u	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	a	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	m	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	e	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	e	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	m	S	S	S	S	S	m	m	m	m	m	V	p	at	at	at
	(1	id	i	P	P	P	H	H	H	i	id	m	o.	A	A	A
	0	.	d.	a	a	a	o	o	o	d.	.	b	V	e	s	s
	0	1.	2.	r	r	r	r.	r.	r.	a	a	r.	m	m	1.	2.
	0	h	h	al	al	al	m	m	m	p	p	(1	b	e	h	h
	0	y	y	l.	l.	l.	ot	ot	ot	p.	p.	2	r.	d.	y	y
	0	p.	p.	°	'	"	°	'	"	'	"	a)	'	"	p.	p.
	0	9	2	5	0	3		1	6	9	9	1	8	0		6
	0	6	7	3							3			4		
	9	2	8	3							3			4		
	2	2														
	1	9	7	6	6	2		3	5	5	3	2	4	3	2	4
	0	9	2	5	0	9		5	6	2	0	8	9	3	8	8
	5	5	6	2							3			4		
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	1	9	7	6	6	1		3	5	5	3	4	5	3	5	5
	1	9	2	5	0	5		9	7		0	4	0	6	2	1
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	1	9	7	6	6	2		4	5	1	3	5	5	4	1	5
	1	9	2	5	0			2	7	7	1	8	1	1	8	4
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	4	7														
	1	9	7	6	5	4		4	5	3	3	1	5	4	4	5

	D is t. A d R a d i u A n o m al . G r.	D is t. I n S e m (1 0 0 0)	D is t. I n S e m id .1 h y p.	P a r r l. °	P a r r l. '	P a r r l. "	H o t . °	H o t '	H o t ."	i d . p. '	i d . p. "	A p o. V m b r. (1 2 a)	A p o. V m b r. '	V a r i a t i o n s . A t t e n d e n c e s . A n o n y m o u s e s . A n o n y m o u s e s . A n o n y m o u s e s .	A n o n y m o u s e s . A n o n y m o u s e s . A n o n y m o u s e s .	A n o n y m o u s e s . A n o n y m o u s e s . A n o n y m o u s e s .
2 0 1 9	9 1 4 6	8 0 3 4	2 3 6 4	4 9	9 9		5 7	0 2	2 0	3 4	0 2	2 1	2 5	4 3	4 7	7 0
1 2 5	9 8 9 1	9 7 7 1	7 2 1 6	6 4 8 7	5 9 7	3 7 8	2 8 8	4 7 2	5 2 3	4 2 3	3 2 4	2 0 5	1 5 3	5 7 1	4 2 4	6 0
1 3 0	9 8 7	9 7 3	7 2 1	6 4 8	5 9 5	2 5	5 1	5 7 4	5 4	3 3	3 0	3 0	5 4	5 0 4	3 6 6	6 2
1 3 5	9 8 7 6	9 7 0 9	7 2 0 9	6 4 7 3	5 9 5	1 5	5 4	5 8	5 3	3 3	3 9	1 5	5 5	5 6 4	0 5	6 5
1	9	9	7	6	5	5	5	5	1	3	4	5	5	5	2	6

	D is t. A d R a d i u A n o m al .br/>G r.	D is t. I n S m (1 0 0 0)	D is t. I n S m id 1. h y p.	P a r l. °	P a r l. '	P a r l. "	H o t .°	H o t '	H o t ."	S e m d. p. '	S e m d. p. "	A p o. V m b (1 2 a)	A t p o. V m b r. '	V a r i a t i o n s p. "	A n o m al .br/>G r.
4	8	6	2	4	9		6	8	5	3	7	6	6	2	8
0	6	7	0	6						3			4		
	5	9	2	6						4			7		
	9	5													
1	9	9	7	6	5	5	5	5	2	3	5	5	1	3	7
4	8	6	1	4	8	5	8	8	3	4	4	7	6	8	0
5	6	5	9	5						3			4		
	6	5	6	9						4			7		
	8	3													
1	9	9	7	6	5	4	2	0	5	3	3	2	5	4	5
5	8	6	1	4	8	5	9		8	2	5		8	4	6
0	4	3	9	5						3			7		2
	8	1	0	3						5					
	8	3													
1	9	9	7	6	5	3	2	2	5	3	3	1	1	5	7
5	8	6	1	4	8	7	9		8	9	5	0	5	8	3
5	4	1	8	4						3				1	8
	2	4	5	9						5				6	
	0	4													
1	9	9	7	6	5	3	4	5	4	3	1		5	8	7

	D is t. A d R a d i u A n o m a l G r.	D is t. I n S e m (1 0 0 0 p.	D is t. I n S e m id 1. h y p.	P a r l. °	P a r l. '	P a r l. "	H o t .°	H o t '	H o t ."	S e m id p. '	S e m id p. "	A p o. V m b (1 2 a)	A p o. V m b r. '	V a r i a t i o n s p e c i f i c a t i o n s p e c i f i c a t i o n s	A n o m a l G r.
6 0 4	8 3 9 6 4 5	5 9 1 8	1 8 4 6	4 4 6	8	2			8	6	5 3 5	7	9	4 8 8	4
1 6 5	9 8 3 2 0 3	9 5 8 4 8 3	7 1 7 8 2	6 4 4 2	5 8	2		5	5 8	5 0	3 5 3	2 3 6	1 0 6	0 4 8 8	9 3 5 7
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1 7 5	9 8 2 6 6 0	9 5 6 9 4 0	7 1 7 3 4 9	6 4 8 3	5 8	2 2		7	5 8	5 6	3 4 3 5	2 8	2 1 4 8	1 1 4 8	5 7 7
1	9	9	7	6	5	2		8	5	5	3	3	2	1	5 7

Argument: **Apparent altitude** (*Altitud. appar.*, in degrees, left stub). Three seasonal blocks, each subdivided for the Sun (☉), an unmarked column, and the fixed stars (* *Fixae*): **Summer** (*Aestiva*), **Equinoctial** (*Aequinoctalis*), **Winter** (*Hyberna*). Entries are minutes (') and seconds (") of refraction.

A lt it .	A e s t i v a				A e q u i n o c t a l i s				H y b e r n a									
	A e s t i v a	A e s t i v a	A e s t i v a	A e s t i v a	A e q u i n o c t a l i s	A e q u i n o c t a l i s	A e q u i n o c t a l i s	A e q u i n o c t a l i s	H y b e r n a	H y b e r n a	H y b e r n a	H y b e r n a						
G r.	☉	☉	d)	* *	☉	☉	d)	* *	☉	☉	d)	* *						
	'	")'	"	'	"	'	")'	"	'	")'	"	'	"		
0	2	1	3	0	3	2	3	0	3	0	3	2	3	0	3	0	3	2
	9		0		0	7	0		1		1	8	1		2		2	9
1	2	0	2	0	2	2	2	0	2	0	2	2	2	0	2	0	2	2
	1		2		2	7	2		3		3	8	3		4		4	9
2	1	5	1	0	1	2	1	5	1	0	1	2	1	5	1	0	1	2
	5		6		6	6	6		7		7	7	7	5	8		8	9
3	1	1	1	0	1	2	1	1	1	0	1	2	1	5	1	0	1	2
	2	0	3		3	6	3	0	4		4	7	4	0	5		5	9
4	1	4	1	3	1	5	1	4	1	3	1	5	1	1	1	3	1	5
	0	7	1	2	1	7	1	6	2	1	2	8	3	6	3	0	3	8
5	9	5	1	3	1	5	1	5	1	3	1	5	1	1	1	3	1	5
		2	0	2	0	7	0	2	1	1	1	7	2	1	2	0	2	8
6	9	0	9	3	1	0	9	5	1	3	1	5	1	1	1	5	1	2
			5	0			6	0	1	0	7	1	1	1	3	1	0	
7	8	2	8	5	9	2	9	5	1	1	1	1	1	2	1	1	1	5
		9		9		3		3	0	8	0	8	0	3	1	2	1	9
8	7	5	7	2	7	4	7	5	8	1	8	4	8	4	9	3	1	9
		0		5		9		2		7		2		2		4	0	
9	6	2	6	4	7	1	7	3	7	5	7	5	7	5	8	4	9	1

A	A	A	A	A	A	A	A	A	A	A	A	A	A	H	H	H	H	
lt	e	e	e	e	e	e	e	e	e	e	e	e	e	y	y	y	y	
it	st	st	st	st	st	st	st	st	st	st	st	st	st	er	er	er	er	
.	A	A	i	v	A	A	e	e	i	A	A	H	H	e	e	e	e	
a	st	st	a	(	st	st	u	u	.	q	q	b	b	n	a	b	b	
p	i	i	(	m	i	i	n	n	(	m	i	n	n	r	r	n	n	
a	v	v	m	i	v	v	.	.	i	d	.	.	a	a	m	i	n	
r.	a	a	i	d	a	a	.	.	i	d	.	.	a	a	i	d	a	
G	⊙	⊙	d	)	*	*	⊙	⊙	d	)	*	*	⊙	⊙	d)	*	*
r.	'	")'	"	'	"	'	")'	"	'	"	'	")'	"	'	"
		3		3		3		3		8		3		3		8		4
1	5	5	6	1	7	3	6	4	7	7	7	2	7	2	8	1	8	3
0		6		5		8		4				7		2		4		9
1	5	3	5	4	6	1	6	1	6	3	6	5	6	5	7	4	8	9
1		0		8		1		6		4		8		2		4		
1	5	3	5	2	5	4	5	4	6	4	6	2	6	2	7	1	7	3
2				0		2		7				8		1		2		7
1	4	3	4	5	5	1	5	1	5	3	5	5	5	5	6	4	7	3
3		7		5		5		9		5		9		3		1		
1	4	2	4	2	4	4	4	5	5	6	5	2	5	2	6	6	6	3
4		2		6		8		1				9		1				3
1	3	4	3	5	4	1	4	2	4	3	4	5	4	5	5	3	5	5
5		4		8		9		2		6		8		0		6		9
1	3	1	3	3	3	5	3	1	4	4	4	2	4	2	5	4	5	2
6		9		2		1		4				0		0				7
1	2	5	3	7	3	2	3	3	3	3	4	0	3	5	4	3	4	5
7		3				7		8		8				2		2		5
1	2	1	2	2	2	4	2	4	2	5	3	1	3	6	3	4	4	6
8		4		0		6		2		4		5			3			
1	1	3	1	4	2	0	2	0	2	1	2	3	2	0	2	5	3	1
9		7		7						2		1			5			7
2	0	5	1	0	1	3	1	4	1	1	1	5	1	2	2	4	2	4
0		0				0		0				0		1		1		1

A	A	A	A	A	A	A	A	A	A	A	A	A	H	H	H	H
lt	e	e	e	e	e	e	e	e	e	e	e	e	y	y	y	y
it	st	st	st	st	st	st	st	st	st	st	st	st	er	er	er	er
.	A	A	i	v	A	A	e	e	i	n	e	e	y	y	r	n
a	e	e	v	a	e	e	q	q	n	.	q	q	b	b	n	a
p	st	st	a	(	st	st	u	u	.	(	u	u	e	e	a	(
p	i	i	(	m	i	i	i	i	(	m	i	i	r	r	(	m
a	v	v	m	i	v	v	n	n	m	i	n	n	n	n	m	i
r.	a	a	i	d	a	a	.	.	i	d	.	.	a	a	i	d
G	⊙	⊙	d	)	*	*	⊙	⊙	d	)	*	*	⊙	⊙	d)
r.	'	")'	"	'	"	'	")'	"	'	"	'	")'	"
2	0	2	0	3	0	5	1	2	1	1	3	1	0	1	4	2
1		4		3		2					1				9	0
2	0	6	0	1	0	3	0	3	0	4	1	2	0	5	1	0
2				4		3		4		2				0		1
2	0	0	0	0	0	2	0	1	0	2	0	4	0	3	0	5
3						5		8		4		4		0		2
2	0	0	0	0	0	0	0	0	0	0	2	0	7	0	3	0
4										4				0		8
2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	
5													0		8	
2	0	0	0	0	0	0	0	0	0	0	0	0	0	2		
6														2		

[At foot:] *De Emendatione Tychonicarum, vide dicta Lib. 1. Astronom. Reformatae Cap. 14. & 15.* — On the correction of Tycho's [refractions], see what is said in Book 1 of the *Astronomia Reformata*, Chapters 14 and 15.

Parsing notes: TAB. 40 is a very densely packed three-season × three-source refraction table; the inner column splits (⊙ / unmarked / *, each ' ') are extremely tight. Many low-altitude rows mix single- and double-digit entries in adjacent narrow columns, so alignment of the higher-altitude rows (where most cells fall to 0) is approximate. Several cells in the bottom rows (24°–26°) are blank or 0 in the original and have been transcribed as read; this block for column-alignment verification.

Table-page 48

TABULA 41 — The Moon's equal, or mean, motion, and of the node (♁)

[TABVLA 41. *Lunae Motus Aequalis, seu Medius, & Nodi ♁.*]

This opening presents the **epochs/radices** and the **expanded and collected years** for the Moon's mean motion in longitude (*Longit. ab* ☿ — longitude from Aries), its **anomaly** (*Anomalia*), and the **motion of the node** (*Nodi ♁ mot.*). Each entry is given in signs, degrees, minutes, seconds (Sig. G. ' ").

Left half — EPOCHS, OR RADICES (EPOCHAE, SEV RADICES)

Argument: years **before Christ** (*Anni ante Christum*), then **of Christ** (*Christi*), counted by Gregorian reckoning (*Stylo Gregoriano / Stylo Iuliano* — Gregorian / Julian style as noted in the stub).

Anni ante Christum	Longit. ab ☿ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi ♁ mot. Sig. G. ' "
6000	0 13 12 36	5 21 57 52	1 9 58 3
5000	1 1 21 6	11 26 58 57	4 18 6 56
4000	1 19 29 36	6 2 0 2	7 26 15 49
3000	8 7 38 6	0 7 1 6	11 4 24 42
2000	2 25 46 35	6 12 2 2	2 12 33 36
1000	9 13 55 5	0 17 3 19	5 20 42 29
900	7 21 43 56	7 5 33 25	1 6 31 22
800	5 29 32 47	1 24 3 32	8 22 20 16
700	4 7 21 38	8 12 33 39	4 8 9 9
600	2 15 10 29	3 1 3 46	11 23 58 2
500	0 22 59 20	9 19 33 53	7 9 46 56
400	11 0 48 11	4 8 4 0	2 25 35 49
300	9 8 37 2	10 26 34 7	10 11 24 42
200	7 16 25 53	5 15 4 14	5 27 13 36
100	5 24 14 44	0 3 34 21	1 13 2 29
Christi	4 2 3 35	6 22 4 24	8 28 51 22
100	2 9 52 25	1 10 34 31	4 14 40 16

Anni ante Christum	Longit. ab ☐ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi ☉ mot. Sig. G. ' "
200	0 17 41 16	7 29 4 38	0 0 29 9
300	10 25 30 7	2 17 34 45	7 16 15 2
400	9 3 18 57	9 6 4 52	3 2 6 56
500	7 11 7 48	3 24 34 59	10 17 55 49
600	5 18 56 39	10 13 5 6	6 3 44 42
700	3 26 45 30	5 1 35 12	1 19 33 35
800	2 4 34 22	11 20 5 19	9 5 22 28
900	0 12 23 13	6 8 35 24	4 21 11 0
1000	10 20 12 5	0 27 5 30	0 7 0 15
1100	8 28 0 55	7 15 35 37	7 22 49 8
1200	7 5 49 46	2 4 5 44	3 8 38 1
1300	5 13 38 37	8 22 35 50	10 24 26 55
1400	3 21 27 28	3 11 5 56	6 10 15 43
1500	2 19 16 19	9 29 36 3	1 26 4 41
1600	0 7 5 10	4 18 6 10	9 11 54 35
1600	7 25 19 20	0 7 27 9	9 11 22 50
1700	5 29 57 36	6 12 53 23	4 27 14 54
1800	3 24 35 52	0 18 19 37	0 13 6 58
1900	1 19 14 8	6 23 45 52	6 28 59 2
2000	11 27 2 59	1 12 15 58	2 14 47 55
2100	9 21 41 15	7 27 42 11	10 0 40 0
2200	7 16 19 31	2 3 8 26	6 16 32 4
2300	5 10 57 47	8 8 34 40	1 2 24 8

Parsing notes: The stub-block marked *Stylo Gregoriano / Stylo Iuliano* governs the lower set (years 1600–2300, the second 1600 onward); the upper set runs ante-Christum then Christi by hundreds. I have kept the printed second "1600" row as it appears (the table repeats 1600 to mark the Gregorian/Julian transition).

Left lower block — EXPANDED AND COLLECTED YEARS (ANNI EXPANSI, ET COLLECTI)

Anni	Longit. ab □ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi & mot. Sig. G. ' "
1	4 9 23 3	2 28 43 8	0 19 19 43
2	8 18 46 5	5 27 26 15	1 7 8 17
3	0 28 9 8	8 26 9 23	1 27 59 9
B. 4	5 20 42 45	0 7 56 23	2 17 22 59
5	10 0 5 48	3 6 39 31	3 6 41 46
6	2 9 28 50	6 5 22 39	3 26 1 29
7	6 18 51 53	9 4 5 46	4 15 21 12
B. 8	11 11 25 30	0 15 52 47	5 4 44 5
9	3 20 48 33	3 14 35 55	5 24 3 48
10	8 0 11 35	6 13 19 3	6 13 23 32
11	0 9 34 38	9 12 2 11	7 2 43 15
B. 12	5 2 8 16	0 23 49 12	7 22 6 8
13	9 11 31 18	5 22 32 20	8 11 25 50
14	1 20 54 21	6 21 15 27	9 0 45 34
15	6 0 17 23	9 19 58 35	9 20 5 17
B. 16	10 22 51 1	1 1 45 36	9 19 28 11
17	3 2 14 4	4 0 28 44	10 28 47 54
18	7 11 37 6	6 29 11 52	11 18 7 37
19	11 21 0 9	9 27 55 0	0 7 27 20
20	4 13 33 46	1 9 42 1	0 26 50 13

Right half — EXPANDED AND COLLECTED YEARS (ANNI EXPANSI, ET COLLECTI), continued

Anni (Exp.)	Longit. ab □ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi & mot. Sig. G. ' "
21	8 22 56 49	4 8 25 9	1 16 9 57
22	1 2 19 51	7 7 8 17	2 5 29 40
23	5 11 42 54	10 5 51 25	2 24 49 23
B. 24	10 4 16 31	1 17 38 24	3 14 12 16
25	2 13 39 34	4 16 21 32	4 3 32 0

Anni (Exp.)	Longit. ab □ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi & mot. Sig G. ' "
26	6 23 2 36	7 15 4 40	4 22 51 43
27	11 2 25 39	10 13 47 48	5 12 11 26
B. 28	3 24 59 17	2 5 34 47	6 1 34 17
29	8 4 22 19	4 24 17 55	6 20 54 2
30	0 13 45 22	7 23 1 3	7 10 13 45
31	4 23 8 24	10 21 44 11	7 29 33 28
B. 32	9 15 42 2	2 3 31 12	8 18 56 21
33	1 25 5 4	5 2 14 18	9 8 16 5
34	6 4 28 7	8 0 57 26	9 27 35 48
35	10 13 51 10	10 29 40 34	10 16 55 31
B. 36	3 6 24 47	1 11 27 33	11 6 18 24
37	7 15 47 50	5 10 10 41	11 25 38 7
38	11 25 10 52	8 8 53 49	0 14 57 50
39	4 4 33 55	11 7 36 57	1 4 17 33
B. 40	8 27 7 32	2 19 24 2	1 23 40 27
41	1 6 30 35	5 18 7 10	2 13 0 10
42	5 15 53 37	8 16 50 18	3 2 19 53
43	9 25 16 40	11 15 33 26	3 21 39 36
B. 44	2 17 50 18	2 27 20 25	4 11 2 29
45	6 27 13 20	5 26 3 33	5 0 22 13
46	11 6 36 23	8 24 46 41	5 19 41 56
47	3 15 59 25	11 23 29 49	6 9 1 39
B. 48	8 8 33 3	3 5 16 48	6 28 24 32
49	0 17 56 5	6 3 59 6	7 17 44 16
50	4 27 19 8	9 2 43 12	8 7 3 59
51	9 6 42 10	0 1 26 12	8 26 23 42
B. 52	1 29 15 48	3 13 13 11	9 15 46 35
53	6 8 38 51	6 11 56 19	10 5 6 18
54	10 18 1 53	9 10 39 25	10 24 26 2
55	2 27 24 56	0 9 22 35	11 13 45 45

Anni (Exp.)	Longit. ab □ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi & mot. Sig G. ' "
B. 56	7 19 58 33	3 21 9 34	0 3 9 34
57	11 29 21 36	6 19 52 42	0 22 28 21
58	4 8 44 38	9 18 35 50	1 11 48 4
59	8 18 7 41	0 17 18 58	2 1 7 47
B. 60	1 10 41 19	3 29 6 4	2 20 30 40
64	7 1 24 4	7 2 27	5 7 52 43
68	0 22 6 49	4 14 58 20	7 25 14 46
72	6 12 49 34	4 22 55 14	10 12 36 48
76	0 3 32 20	5 0 51 36	0 29 58 51
80	5 24 15 5	5 8 48 5	3 17 20 54
84	11 14 57 50	5 16 44 28	6 4 42 56
88	5 5 40 35	5 24 40 51	8 22 4 59
92	10 26 23 21	6 2 37 14	11 9 27 2
96	4 17 6 6	6 10 33 39	1 26 49 4
100	10 7 48 51	6 18 30 7	4 14 11 7
200	8 15 37 42	1 7 0 13	8 28 22 13
300	6 23 26 33	7 25 30 20	1 12 33 20
400	5 1 15 24	2 14 0 33	6 26 44 27
500	3 9 4 15	9 2 30 33	10 16 55 33
600	1 16 53 6	3 21 0 40	3 21 6 39
700	11 24 41 57	10 9 30 45	7 9 17 47
800	10 2 30 48	4 28 0 52	11 23 28 53
900	8 10 19 39	11 16 30 52	4 7 40 0
1000	6 18 8 30	6 5 1 5	8 21 51 7
2000	1 6 17 0	0 10 2 11	5 13 42 14
3000	7 24 25 30	6 15 3 16	2 5 33 20
4000	2 12 34 0	0 20 4 22	10 27 24 27
5000	9 0 42 29	6 25 5 27	7 19 15 34
6000	3 18 50 59	1 0 6 33	4 11 6 41

[Margin (between the two right blocks, vertical):] *Omnes hi sunt Bissextiles* — All of these are leap years (marking the years 64–96, multiples of 4).

Parsing notes: The right column's lower section (years 64 through 6000) lists every 4th year (all bissextile/leap years) and then round centuries/thousands. The Anomalia entry for year 64 reads "7 2 27" with a gap where a digit-group appears dropped in the original (likely "7 2 ?? 27" or a tight three-group); transcribed as printed and flagged.

Table-page 49

TABULA 41 (continued) — Months, Days, Hours, and Scruples

MONTHS OF THE COMMON YEAR (MENSES ANNI COMMVNIS)

Stub: *Menses Cōpleti* (completed months). Columns: **Long.** ☽ **ab** ♃ (the Moon's longitude from Aries: Sig. G. ' '), **Anomalia** (Sig. G. ' '), **Nodi** ☽ **Mot.** (G. ' ').

Menses (Compl.)	Long. ☽ ab ♃ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi ☽ Mot. G. ' "
Ianuar.	1 18 18 6	1 15 0 52	1 38 30
Febr.	1 27 24 6	1 20 50 2	3 7 28
Martius	3 15 52 12	3 5 59 55	4 45 57
Aprilis	4 21 10 2	4 7 47 53	6 21 16
Maius	6 9 38 8	5 22 48 45	7 59 46
Iunius	7 14 55 39	6 24 45 43	9 35 6
Iulius	9 3 23 44	8 9 46 35	11 15 35
August.	10 21 51 50	9 24 47 26	12 52 5
Septéb.	11 27 9 21	10 26 44 25	14 27 24
Octob.	1 15 37 26	0 11 45 17	16 5 54
Nouéb.	2 20 54 57	1 13 42 15	17 41 13
Decéb.	4 9 23 3	2 28 43 8	19 19 43

MONTHS OF THE BISSEXTILE (LEAP) YEAR (MENSES ANNI BISSEXTILIS)

Menses (Compl.)	Long. ☽ ab ♃ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi ☽ Mot. G. ' "
Ianuar.	1 18 18 6	1 15 0 52	1 38 30
Febr.	2 10 35 1	3 13 56 5	3 10 39
Martius	3 29 3 7	5 18 54 49	4 49 8

Menses (Compl.)	Long. ☽ ab ♀ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi ☽ Mot. G. ' "
Aprilis	5 4 20 37	4 20 51 47	6 24 26
Maius	6 22 48 43	6 5 52 39	8 6 56
Iunius	7 28 6 14	7 7 49 37	9 42 25
Iulius	9 16 34 19	8 20 50 29	11 21 25
August.	11 5 2 25	10 7 51 20	12 59 25
Sept.	0 10 19 56	11 9 48 11	14 30 35
Octob.	1 28 48 1	0 24 49 11	16 9 3
Nou.	3 4 5 32	1 26 46 9	17 44 24
Dec.	4 22 23 38	3 11 47 2	19 22 54

DAYS (DIES)

Stub: *Dies Compl.* (completed days). Columns as above.

Dies (Compl.)	Long. ☽ ab ♀ Sig. G. ' "	Anomalia Sig. G. ' "	Nodi ☽ Mot. G. ' "
1	0 13 10 35	0 13 3 54	0 3 11
2	0 26 21 10	0 26 7 48	0 6 21
3	1 9 31 45	1 9 11 42	0 9 32
4	1 22 42 20	1 22 15 36	0 12 43
5	2 5 52 55	2 5 19 30	0 15 53
6	2 19 3 20	2 18 23 24	0 19 4
7	3 2 14 5	3 1 27 18	0 22 14
8	3 15 24 40	3 14 31 12	0 25 25
9	3 28 35 15	3 27 35 5	0 28 36
10	4 11 45 50	4 10 38 59	0 31 46
11	4 24 56 25	4 23 42 53	0 34 57
12	5 8 7 0	5 6 46 47	0 38 8
13	5 21 17 35	5 19 50 41	0 41 18
14	6 4 28 10	6 2 54 35	0 44 29
15	6 17 38 45	6 15 58 29	0 47 40
16	7 0 49 20	6 29 2 23	0 50 50

Dies (Compl.)	Long. \bowtie ab Υ Sig. G. ' ''	Anomalia Sig. G. ' ''	Nodi \wp Mot. G. ' ''
17	7 13 59 55	7 12 6 17	0 54 1
18	7 27 10 30	7 25 10 11	0 57 11
19	8 10 21 5	8 8 14 5	1 0 22
20	8 23 31 40	8 21 18 0	1 3 33
21	9 6 42 15	9 4 21 53	1 6 43
22	9 19 52 50	9 17 25 47	1 9 54
23	10 3 3 25	10 0 29 41	1 13 5
24	10 16 14 0	10 13 33 35	1 16 15
25	10 29 24 36	10 26 37 28	1 19 26
26	11 12 35 11	11 9 41 22	1 22 37
27	11 25 45 46	11 22 45 16	1 25 47
28	0 8 56 21	0 5 49 10	1 28 58
29	0 22 6 56	0 18 53 4	1 32 9
30	1 5 17 31	1 1 56 58	1 35 19
31	1 18 28 6	1 15 0 52	1 38 30

HOURS AND SCRUPLES (HORAE, ET SCRVPVLA)

Stub: **Horae** (hours), then **Min.** (minutes) and **Sec.** (seconds) sub-rows giving the order of the figures. Columns: **Longit.** \bowtie **ab** Υ (Gr. ' '' / and finer orders ' '' '' for minutes, '' '' '' for seconds), **Anomalia** (same orders), **No. \wp mot.** (the node's motion). The header rows label the place-value of each block: for the *Horae* rows the figures are Gr. (degrees) ' '' ; for the *Min.* rows ' '' '' ; for the *Sec.* rows '' '' '' .

Hora e	Longi t. \bowtie			Ano Ano Ano			No. \wp No. \wp	
	ab \square (1)	Longi t. (2)	Longi t. (3)	malia (1)	malia (2)	malia (3)	mot. (1)	mot. (2)
1	0	32	56	0	32	40	0	8
2	1	5	53	1	5	20	0	16
3	1	38	49	1	37	59	0	24
4	2	11	46	2	10	39	0	32
5	2	44	42	2	43	19	0	40
6	3	17	39	3	15	58	0	48

Hore	Longi		Longi t. (3)	Ano			No. ʘ	
	t. ʘ ab □ (1)	Longi t. (2)		malia (1)	malia (2)	malia (3)	mot. (1)	mot. (2)
7	3	50	35	3	48	38	0	56
8	4	23	32	4	21	18	1	4
9	4	56	28	4	53	58	1	12
10	5	29	25	5	26	37	1	19
11	6	2	21	5	59	17	1	27
12	6	35	18	6	31	57	1	35
13	7	8	14	7	4	47	1	43
14	7	41	10	7	37	16	1	51
15	8	14	7	8	9	56	1	59
16	8	47	3	8	42	36	2	7
17	9	20	0	9	15	16	2	15
18	9	52	56	9	47	55	2	23
19	10	25	53	10	20	35	2	31
20	10	58	49	10	53	15	2	39
21	11	31	46	11	25	55	2	47
22	12	4	42	11	58	34	2	55
23	12	37	38	12	31	14	3	3
24	13	10	35	13	3	54	3	11
25	13	43	31	13	36	24	3	19
26	14	16	28	14	9	13	3	27
27	14	49	24	14	43	35	3	35
28	15	22	21	15	14	33	3	45
29	15	55	17	15	47	13	3	51
30	16	28	14	16	19	52	3	58
31	17	1	10	16	52	32	4	6
32	17	34	7	17	25	12	4	14
33	18	7	3	17	57	52	4	22
34	18	40	0	18	30	31	4	30
35	19	12	56	19	3	11	4	38

H o r a e	Longi t.) ab □	Longi t. (2)	Longi t. (3)	Ano	Ano	Ano	No. ☉	No. ☉
	(1)			malia (1)	malia (2)	malia (3)	mot. (1)	mot. (2)
36	19	45	53	19	35	51	4	46
37	20	18	49	20	8	31	4	54
38	20	51	45	20	41	10	5	2
39	21	24	42	21	13	50	5	10
40	21	57	38	21	46	30	5	18
41	22	30	35	22	19	9	5	26
42	23	3	31	22	51	49	5	34
43	23	36	28	23	24	29	5	42
44	24	9	24	23	57	9	5	50
45	24	42	21	24	29	49	5	58
46	25	15	17	25	2	28	6	6
47	25	48	14	25	35	8	6	14
48	26	21	10	26	7	48	6	22
49	26	54	7	26	40	28	6	29
50	27	27	3	27	13	7	6	37
51	27	59	59	27	45	47	6	45
52	28	32	56	28	18	17	6	53
53	29	5	52	28	51	0	7	1
54	29	38	49	29	23	46	7	9
55	30	11	45	29	56	26	7	17
56	30	44	42	30	29	6	7	25
57	31	17	38	31	1	46	7	33
58	31	50	35	31	34	25	7	41
59	32	23	31	32	7	5	7	49
60	32	56	28	32	39	45	7	57

Parsing notes: For *HORAE ET SCRVPVLA*, the heading establishes a place-value scheme — the same numeric blocks serve hours (degrees ' '), minutes of time (" "), and seconds of time (" "" ""); only one set of figures is printed and the reader shifts the place-value per the *Hora* / *Min.* / *Sec.* row labels at the head. The

Longitude block reaches $\sim 32^{\circ}56'$ over 60 hours, the Anomalia $\sim 32^{\circ}39'$, the Node $\sim 7'57''$ — all smoothly monotone, confirming the readings. The unmarked extra order-columns (3rd/4th place) in the original are folded into the labelled blocks above.

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae, Part III (continued)

TABVLA 42 — *Aequationum Lunae in Copulis, seu in ϕ , ϕ° .*
 (Table of the equations of the Moon in the conjunctions/oppositions, i.e. at ϕ and ϕ°)

(Table-page 50, top. The argument is the anomaly [anomalia], read down on the left (G. = degrees) and up on the right. Six paired equation columns follow, each giving degrees / minutes / seconds [G. / ' / "], headed by Roman numerals with the instruction Subtr. [subtract] at the head and Adde [add] at the foot. The header reads "O. Subtr." for the first block, then "I. Subtr." ... "V. Subtr."; the foot labels run "XI. Adde", "X. Adde", "IX. Adde", "VIII. Adde", "VII. Adde", "VI. Adde". These index the sign of the argument [Sig.]: subtract for signs 0–5, add for signs 6–11.)

Anom. G.	O. Subtr. G/'/"	I. Subtr. G/'/"	II. Subtr. G/'/"	III. Subtr. G/'/"	IV. Subtr. G/'/"	V. Subtr. G/'/"	Anom. Gr.
0	0 0 0	2 25 47	4 14 51	4 58 20	4 22 20	2 33 18	30
1	0 5 4	2 30 12	4 17 29	4 58 26	4 19 46	2 28 41	29
2	0 10 8	2 34 34	4 20 2	4 58 27	4 17 7	2 24 1	28
3	0 15 12	2 38 54	4 22 31	4 58 22	4 14 24	2 19 18	27
4	0 20 16	2 43 11	4 24 55	4 58 14	4 11 36	2 14 33	26
5	0 25 20	2 47 25	4 27 14	4 57 59	4 8 43	2 9 45	25
6	0 30	2 51	4 29	4 57	4 5 45	2 4 55	24

Anom. G.	O. Subtr. G'''	I. Subtr. G'''	II. Subtr. G'''	III. Subtr. G'''	IV. Subtr. G'''	V. Subtr. G'''	Anom. Gr.
	23	37	29	37			
7	0 35 26	2 55 46	4 31 39	4 57 10	4 2 42	2 0 2	23
8	0 40 28	2 59 52	4 33 44	4 56 38	3 59 35	1 55 7	22
9	0 45 29	3 3 54	4 35 44	4 56 1	3 56 23	1 50 9	21
10	0 50 30	3 7 53	4 37 39	4 55 18	3 53 6	1 45 8	20
11	0 55 30	3 11 49	4 39 30	4 54 30	3 49 45	1 40 5	19
12	1 0 28	3 15 42	4 41 17	4 53 36	3 46 20	1 35 1	18
13	1 5 25	3 19 31	4 42 59	4 52 37	3 42 50	1 29 55	17
14	1 10 21	3 23 17	4 44 35	4 51 33	3 39 16	1 24 47	16
15	1 15 16	3 26 59	4 46 5	4 50 23	3 35 38	1 19 38	15
16	1 20 10	3 30 38	4 47 30	4 49 7	3 31 55	1 14 27	14
17	1 25 3	3 34 13	4 48 50	4 47 46	3 28 8	1 9 14	13
18	1 29 55	3 37 44	4 50 6	4 46 21	3 24 18	1 3 59	12
19	1 34 44	3 41 12	4 51 16	4 44 50	3 20 24	0 58 43	11
20	1 39 32	3 44 36	4 52 22	4 43 13	3 16 25	0 53 27	10
21	1 44 18	3 47 56	4 53 21	4 41 31	3 12 22	0 48 10	9
22	1 49 3	3 51	4 54	4 39	3 8 15	0 42	8

	O.	I.	II.	III.	IV.	V.	
Anom.	Subtr.	Subtr.	Subtr.	Subtr.	Subtr.	Subtr.	Anom.
G.	G'''''	G'''''	G'''''	G'''''	G'''''	G'''''	Gr.
		12	16	43		52	
23	1 53 47	3 54 24	4 55 5	4 37 51	3 4 5	0 37 33	7
24	1 58 29	3 57 32	4 55 49	4 35 54	2 59 52	0 32 13	6
25	2 3 8	4 0 16	4 56 28	4 33 51	2 55 35	0 26 52	5
26	2 7 44	4 3 35	4 57 1	4 31 42	2 51 14	0 21 30	4
27	2 12 18	4 6 30	4 57 29	4 29 29	2 46 49	0 16 8	3
28	2 16 50	4 9 21	4 57 51	4 27 11	2 42 21	0 10 46	2
29	2 21 20	4 12 8	4 58 8	4 24 48	2 37 51	0 5 23	1
30	2 25 47	4 14 51	4 58 20	4 22 20	2 33 18	0 0 0	0
	XI.	X.	IX.	VIII.	VII.	VI.	
	Adde	Adde	Adde	Adde	Adde	Adde	

Parsing notes: argument runs 0–30 down the left (Anom. G.) and 30–0 up the right (Anom. Gr.). Each block heading carries the sign index and the instruction (Subtract at top for signs 0–5; Add at bottom for signs 6–11). A handful of seconds digits in the lower rows are tight in the gutter-side columns; the readings given are my best resolution.

TAB. 43 — *Aequatio Nodi, & Latitudo Maxima Lunae.* (Equation of the node, and the maximum latitude of the Moon)

(Table-page 50, bottom. Display instruction at the head: SVBTRAHE [Subtract]; at the foot: ADDE [Add]. Left and right edge stubs read "Distantia vera ☉ a ☽" (the true distance of the Sun from the node ☽). Argument is degrees (Gr.) 0–30. Three sign-blocks across, each with paired columns "Æquat. ☽" (equation of the node,

G''') and "Lat. Max." (maximum latitude, *G'''*). The block headers read "Sign. 0 vel 6", "Sign. 1 vel 7", "Sign. 2 vel 8"; the foot headers read "Sign. 11 vel 5", "Sign. 10 vel 4", "Sign. 9 vel 3".)

Gr.	Sig.0	Sig.0	Sig.1	Sig.1	Sig.2	Sig.2	Gr.
	vel 6	vel 6	vel 7	vel 7	vel 8	vel 8	
	—	—	—	—	—	—	
	Æquat	Lat.M	Æquat	Lat.M	Æquat	Lat.M	
	.8	ax.	.8	ax.	.8	ax.	
	<i>G'''</i>	<i>G'''</i>	<i>G'''</i>	<i>G'''</i>	<i>G'''</i>	<i>G'''</i>	
0	0 0 0	4 58 30	1 33 28	5 3 22	1 30 32	5 12 51	30
1	0 3 50	4 58 30	1 35 12	5 3 40	1 28 34	5 13 8	29
2	0 7 39	4 58 31	1 36 47	5 3 58	1 26 30	5 13 24	28
3	0 11 27	4 58 33	1 38 12	5 4 16	1 24 21	5 13 40	27
4	0 15 14	4 58 36	1 39 31	5 4 34	1 22 6	5 13 56	26
5	0 19 0	4 58 39	1 40 42	5 4 53	1 19 45	5 14 11	25
6	0 22 46	4 58 43	1 41 46	5 5 12	1 17 18	5 14 26	24
7	0 26 29	4 58 47	1 42 44	5 5 31	1 14 46	5 14 40	23
8	0 30 9	4 58 52	1 43 35	5 5 50	1 12 9	5 14 54	22
9	0 33 47	4 58 58	1 44 28	5 6 10	1 9 27	5 15 7	21
10	0 37 23	4 59 6	1 45 9	5 6 41	1 6 41	5 15 20	20
11	0 40 56	4 59 13	1 45 35	5 6 49	1 3 51	5 15 32	19
12	0 44 16	4 59 21	1 45 50	5 7 9	1 0 51	5 15 44	18

Gr.	Sig.0	Sig.0	Sig.1	Sig.1	Sig.2	Sig.2	Gr.
	vel 6	vel 6	vel 7	vel 7	vel 8	vel 8	
	—	—	—	—	—	—	
	Æquat	Lat.M	Æquat	Lat.M	Æquat	Lat.M	
	.ᄆ	ax.	.ᄆ	ax.	.ᄆ	ax.	
	G'''	G'''	G'''	G'''	G'''	G'''	
13	0 47 52	4 59 30	1 45 56	5 7 30	0 57 50	5 15 55	17
14	0 51 14	4 59 39	1 45 59	5 7 49	0 54 47	5 16 6	16
15	0 54 33	4 59 49	1 46 0	5 8 9	0 51 42	5 16 16	15
16	0 57 47	4 59 59	1 45 53	5 8 29	0 48 32	5 16 25	14
17	1 0 56	5 0 11	1 45 36	5 8 49	0 45 18	5 16 34	13
18	1 4 0	5 0 22	1 45 13	5 9 8	0 42 0	5 16 42	12
19	1 6 59	5 0 34	1 44 41	5 9 28	0 38 40	5 16 50	11
20	1 9 53	5 0 47	1 44 0	5 9 47	0 35 18	5 16 57	10
21	1 12 42	5 1 0	1 43 10	5 10 7	0 31 53	5 17 3	9
22	1 15 25	5 1 14	1 42 14	5 10 45	0 28 26	5 17 9	8
23	1 18 2	5 1 29	1 41 10	5 10 45	0 24 57	5 17 14	7
24	1 20 33	5 1 44	1 39 59	5 11 4	0 21 26	5 17 18	6
25	1 22 38	5 1 59	1 38 42	5 11 23	0 17 54	5 17 22	5
26	1 25 16	5 2 15	1 37 18	5 11 41	0 14 21	5 17 25	4
27	1 27 28	5 2 31	1 35 46	5 11 59	0 10 46	5 17 27	3

	Sig.0 vel 6 —	Sig.0 vel 6 —	Sig.1 vel 7 —	Sig.1 vel 7 —	Sig.2 vel 8 —	Sig.2 vel 8 —	
	Æquat .⊗ G'/'	Lat.M ax. G'/'	Æquat .⊗ G'/'	Lat.M ax. G'/'	Æquat .⊗ G'/'	Lat.M ax. G'/'	Gr.
28	1 29 34	5 2 48	1 34 8	5 12 15	0 7 11	5 17 29	2
29	1 31 34	5 3 5	1 32 23	5 12 34	0 3 36	5 17 30	1
30	1 33 28	5 3 22	1 30 32	5 12 51	0 0 0	5 17 30	0
	Sign.1 1 vel 5		Sign.1 0 vel 4		Sign.9 vel 3		

Parsing notes: head instruction SVBTRAHE, foot instruction ADDE. Top sign-block headers (Sign. 0/6, 1/7, 2/8) pair with foot headers (Sign. 11/5, 10/4, 9/3). Argument 0–30 down (left stub) and 30–0 up (right stub). Some seconds in the middle sign-block were tight; readings are best resolution.

TABVLA 44 — *LATITVDINIS LVNAE*. (Of the latitude of the Moon)

(Table-page 51. A two-panel page; the table is split into an upper and a lower half, each covering all 12 signs of the argument across paired column-groups, with "Signa Argumenti" running headers top and bottom of each panel, and "Arg. Latit." stubs at left and right (Gr. 0–30 down, 30–0 up). The sub-header reads "Latitudinis Maxima Termini" (limits of the maximum latitude). Each column-group is a value of the maximum-latitude limit; the group headers carry "G. 4 58", "5 0", "5 5", "5 10", "5 15", "5 18" — i.e. the maximum-latitude argument expressed in G'. The panel headers index which signs are northern (Bor. = boreal/north) or austral (Austr. = southern).)

TABVLA 44 — upper panel

Top header: "Signa Argumenti. — O. Latit. Bor. ... VI. Latit. Austr." Bottom header: "Signa Argum. — XI. Latit. Austr. ... V. Latit. Bor."

Arg.La t. Gr.	4°58' G//''	5°0' G//''	5°5' G//''	5°10' G//''	5°15' G//''	5°18' G//''	Arg.La t.
0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	30
1	0 5 13	0 5 14	0 5 19	0 5 24	0 5 29	0 5 33	29
2	0 10 25	0 10 27	0 10 38	0 10 48	0 10 59	0 11 15	28
3	0 15 36	0 15 41	0 15 57	0 16 12	0 16 28	0 16 35	27
4	0 20 47	0 20 54	0 21 16	0 21 36	0 21 57	0 22 6	26
5	0 25 58	0 26 7	0 26 33	0 26 59	0 27 25	0 27 37	25
6	0 31 9	0 31 19	0 31 50	0 32 22	0 32 53	0 33 8	24
7	0 36 19	0 36 31	0 37 8	0 37 44	0 38 21	0 38 55	23
8	0 41 29	0 41 42	0 42 24	0 43 6	0 43 48	0 44 7	22
9	0 46 38	0 46 52	0 47 39	0 48 26	0 49 13	0 49 35	21
10	0 51 46	0 52 2	0 52 54	0 53 46	0 54 38	0 55 3	20
11	0 56 53	0 57 10	0 58 7	0 59 4	1 0 1	1 0 29	19
12	1 1 59	1 2 18	1 3 20	1 4 22	1 5 24	1 5 54	18
13	1 7 4	1 7 24	1 8 31	1 9 38	1 10 45	1 11 19	17
14	1 12 8	1 12 29	1 13 41	1 14 53	1 16 5	1 16 42	16
15	1 17 10	1 17 33	1 18 50	1 20 7	1 21 24	1 22 3	15
16	1 22 11	1 22 36	1 23 58	1 25 21	1 26 43	1 27 24	14
17	1 27 10	1 27 37	1 29 4	1 30 32	1 32 0	1 32 42	13

Arg.La t. Gr.	4°58' G//''	5°0' G//''	5°5' G//''	5°10' G//''	5°15' G//''	5°18' G//''	Arg.La t.
18	1 32 8	1 32 36	1 34 8	1 35 41	1 37 13	1 37 59	12
19	1 37 4	1 37 34	1 39 11	1 40 48	1 42 26	1 43 14	11
20	1 41 58	1 42 30	1 44 12	1 45 54	1 47 36	1 48 27	10
21	1 46 51	1 47 23	1 49 10	1 50 57	1 52 44	1 53 38	9
22	1 51 41	1 52 16	1 54 8	1 56 0	1 57 51	1 58 47	8
23	1 56 30	1 57 6	1 59 3	2 0 59	2 2 56	2 3 54	7
24	2 1 17	2 1 54	2 3 56	2 5 57	2 7 59	2 8 59	6
25	2 6 1	2 6 39	2 8 45	2 10 51	2 12 58	2 14 1	5
26	2 10 43	2 11 22	2 13 33	2 15 45	2 17 56	2 19 1	4
27	2 15 23	2 16 4	2 18 20	2 20 35	2 22 51	2 23 58	3
28	2 20 0	2 20 42	2 23 2	2 25 23	2 27 44	2 28 53	2
29	2 24 34	2 25 18	2 27 43	2 30 8	2 32 33	2 33 45	1
30	2 29 6	2 29 52	2 32 22	2 34 51	2 37 20	2 38 34	0
	XI. Latit. Austr.				V. Latit. Bor.		

TABVLA 44 — lower panel

Top header: "Signa Argum. — I. Latitudo Bor. ... VII. Latit. Austr." Bottom header: "Signa Argum. — X. Latit. Austr. ... IV. Latit. Bor."

Arg.La t. Gr.	4°58' G//''	5°0' G//''	5°5' G//''	5°10' G//''	5°15' G//''	5°18' G//''	Arg.La t.
0	2 29 6	2 29 52	2 32 22	2 34 51	2 37 20	2 38 34	30
1	2 33 36	2 34 23	2 36 57	2 39 31	2 42 5	2 43 21	29
2	2 38 3	2 38 50	2 41 19	2 44 7	2 46 46	2 48 5	28
3	2 42 26	2 43 15	2 45 58	2 48 41	2 51 24	2 52 44	27
4	2 46 46	2 47 37	2 50 25	2 53 12	2 56 0	2 57 21	26
5	2 51 4	2 51 56	2 54 47	2 57 39	3 0 30	3 1 55	25
6	2 55 19	2 56 12	2 59 8	3 2 4	3 4 59	3 6 26	24
7	2 59 30	3 0 24	3 3 24	3 6 24	3 9 24	3 10 53	23
8	3 3 38	3 4 33	3 7 37	3 10 41	3 13 45	3 15 17	22
9	3 7 43	3 8 39	3 11 47	3 14 56	3 18 4	3 19 38	21
10	3 11 44	3 12 42	3 15 54	3 19 7	3 22 20	3 23 55	20
11	3 15 42	3 16 41	3 19 57	3 23 13	3 26 29	3 28 8	19
12	3 19 36	3 20 36	3 23 56	3 27 16	3 30 36	3 32 17	18
13	3 23 26	3 24 28	3 27 52	3 31 16	3 34 40	3 36 22	17
14	3 27 13	3 28 16	3 31 44	3 35 12	3 38 40	3 40 23	16
15	3 30 56	3 32 1	3 35 33	3 39 5	3 42 34	3 44 20	15
16	3 34	3 35	3 39	3 42	3 46	3 48	14

Arg.La t. Gr.	4°58' G//''	5°0' G//''	5°5' G//''	5°10' G//''	5°15' G//''	5°18' G//''	Arg.La t.
	35	40	16	51	27	13	
17	3 38 10	3 39 17	3 42 56	3 46 35	3 50 14	3 52 2	13
18	3 41 42	3 42 49	3 46 32	3 50 14	3 53 56	3 55 47	12
19	3 45 7	3 46 18	3 50 4	3 53 50	3 57 36	3 59 25	11
20	3 48 30	3 49 43	3 53 33	3 57 22	4 1 12	4 2 1	10
21	3 51 52	3 53 2	3 56 55	4 0 47	4 4 40	4 6 36	9
22	3 55 9	3 56 18	4 0 14	4 4 10	4 8 6	4 10 6	8
23	3 58 19	3 59 29	4 3 28	4 7 27	4 11 26	4 13 28	7
24	4 1 23	4 2 36	4 6 38	4 10 40	4 14 42	4 16 45	6
25	4 4 24	4 5 39	4 9 44	4 13 50	4 17 56	4 19 56	5
26	4 7 21	4 8 37	4 12 45	4 16 53	4 21 1	4 23 4	4
27	4 10 15	4 11 30	4 15 41	4 19 52	4 24 3	4 26 9	3
28	4 13 5	4 14 19	4 18 33	4 22 47	4 27 1	4 29 10	2
29	4 15 49	4 17 3	4 21 19	4 25 36	4 29 52	4 32 8	1
30	4 18 26	4 19 43	4 24 3	4 28 22	4 32 42	4 34 51	0
	X. Latit. Austr.				IV. Latit. Bor.		

Parsing notes (TAB. 44): six maximum-latitude argument columns (4°58' through 5°18'), each in G'''. Argument runs 0–30 down (left stub) and 30–0 up (right stub). The sign-block north/south labels are panel headers, not column heads. Several seconds digits in the densest inner columns were tight; readings are best resolution. This table continues onto the next page as TAB. 44 *Residuum*.

TABVLA 44 — *Residuum*. (continuation)

(Table-page 52, top. Same structure: "Signa Argum." headers, "Arg. Latit." stubs (Gr. 0–30 down, 30–0 up), "Latitudinis Maximae Termini" sub-header, and the six maximum-latitude argument column-groups headed "G. 5 58", "5 0", "5 5", "5 10", "5 15", "5 18". Top header: "II. Latitudo Bor. ... VIII. Latit. Austr." Bottom header: "IX. Latit. Austr. ... III. Latit. Bor.")

Arg.La t. G.	5°58' G'''	5°0' G'''	5°5' G'''	5°10' G'''	5°15' G'''	5°18' G'''	Arg.La t. G.
0	4 18 26	4 19 43	4 24 3	4 28 22	4 32 42	4 34 51	30
1	4 20 59	4 22 18	4 26 40	4 31 3	4 35 25	4 37 34	29
2	4 23 28	4 24 49	4 29 14	4 33 38	4 38 3	4 40 13	28
3	4 25 53	4 27 14	4 31 41	4 36 8	4 40 35	4 42 48	27
4	4 28 13	4 29 34	4 34 3	4 38 33	4 43 3	4 45 17	26
5	4 30 28	4 31 49	4 36 20	4 40 52	4 45 24	4 47 40	25
6	4 32 38	4 34 0	4 38 34	4 43 8	4 47 42	4 49 58	24
7	4 34 43	4 36 6	4 40 42	4 45 18	4 49 54	4 52 11	23
8	4 36 43	4 38 8	4 42 44	4 47 22	4 52 0	4 54 19	22
9	4 38 38	4 40 2	4 44 42	4 49 22	4 54 2	4 56 21	21
10	4 40	4 41	4 46	4 51	4 55	4 58	20

Arg.La t. G.	5°58' G//''	5°0' G//''	5°5' G//''	5°10' G//''	5°15' G//''	5°18' G//''	Arg.La t. G.
	27	52	33	15	57	18	
11	4 42 11	4 43 37	4 48 20	4 53 4	4 57 47	5 0 9	19
12	4 43 50	4 45 17	4 50 2	4 54 47	4 59 32	5 1 55	18
13	4 45 23	4 46 52	4 51 39	4 56 25	5 1 11	5 3 35	17
14	4 46 52	4 48 21	4 53 10	4 57 59	5 2 47	5 5 10	16
15	4 48 15	4 49 45	4 54 35	4 59 24	5 4 14	5 6 41	15
16	4 49 35	4 51 4	4 55 55	5 0 46	5 5 37	5 8 2	14
17	4 50 49	4 52 18	4 57 10	5 2 1	5 6 54	5 9 20	13
18	4 51 58	4 53 25	4 58 18	5 3 12	5 8 6	5 10 32	12
19	4 53 3	4 54 29	4 59 23	5 4 18	5 9 12	5 11 38	11
20	4 53 57	4 55 26	5 0 21	5 5 17	5 10 12	5 12 39	10
21	4 54 49	4 56 18	5 1 14	5 6 10	5 11 6	5 14 34	9
22	4 55 36	4 57 4	5 2 1	5 6 58	5 11 55	5 14 24	8
23	4 56 17	4 57 45	5 2 42	5 7 40	5 12 37	5 15 8	7
24	4 56 52	4 58 21	5 3 20	5 8 18	5 13 17	5 15 45	6
25	4 57 22	4 58 51	5 3 50	5 8 48	5 13 48	5 16 17	5
26	4 57 46	4 59 16	5 4 15	5 9 14	5 14 13	5 16 42	4

Arg.La t. G.	5°58' G/'"	5°0' G/'"	5°5' G/'"	5°10' G/'"	5°15' G/'"	5°18' G/'"	Arg.La t. G.
27	4 58 5	4 59 35	5 4 34	5 9 34	5 14 33	5 17 2	3
28	4 58 18	4 59 49	5 4 49	5 9 49	5 14 49	5 17 18	2
29	4 58 26	4 59 57	5 4 57	5 9 57	5 14 57	5 17 25	1
30	4 58 30	5 0 0	5 5 0	5 10 0	5 15 0	5 17 30	0
	IX. Latit. Austr.				III. Latit. Bor.		

Parsing notes (TAB. 44 Residuum): the first column-group header reads "G. 5 58" — note the leading degree-figure "5" where the prior page's parallel column read "4 58"; transcribed as printed (this is the maximum-latitude argument and the inconsistency is flagged below). Argument runs 0–30 down and 30–0 up. Values approach the maximum-latitude limit (□ 5°17'30") at argument 30. Some seconds in the inner columns were tight; best resolution given.

TAB. 45 — *Reductio loci veri ad Eclipticam.* (Reduction of the true place to the ecliptic)

(Table-page 52, lower-left. Stubs "Argum." (Gr. 0–30 down, 30–0 up). Three sign-blocks headed "Sig. 0 / 6", "1 / 7", "2 / 8" with the instruction Subtrahe [subtract] across the top; foot instruction Adde [add] with foot headers "11 / 5", "10 / 4", "9 / 3". Each block is a paired '/' column. Left-edge vertical note: "0 Latit. Bor. Descend. / 6 Latit. Austr. Ascend." — "for sign 0, north latitude descending; for sign 6, south latitude ascending.")

Argum. G.	Sig.0/6 '/'	Sig.1/7 '/'	Sig.2/8 '/'	Argum. G.
0	0 0	6 6	6 5	30
1	0 15	6 12	5 54	29
2	0 30	6 18	5 48	28
3	0 45	6 24	5 39	27
4	0 59	6 29	5 30	26

Argum. G.	Sig.0/6 '/'	Sig.1/7 '/'	Sig.2/8 '/'	Argum. G.
5	1 13	6 35	5 21	25
6	1 27	6 40	5 12	24
7	1 42	6 44	5 1	23
8	1 56	6 47	4 51	22
9	2 10	6 51	4 40	21
10	2 24	6 54	4 29	20
11	2 38	6 56	4 18	19
12	2 52	6 57	4 7	18
13	3 6	6 58	3 55	17
14	3 19	6 59	3 42	16
15	3 32	7 0	3 31	15
16	3 43	6 59	3 18	14
17	3 56	6 58	3 5	13
18	4 8	6 57	2 53	12
19	4 19	6 56	2 38	11
20	4 30	6 54	2 23	10
21	4 41	6 51	2 9	9
22	4 52	6 47	1 55	8
23	5 2	6 44	1 41	7
24	5 12	6 40	1 26	6
25	5 22	6 35	1 12	5
26	5 31	6 28	0 58	4
27	5 40	6 23	0 45	3
28	5 49	6 17	0 30	2
29	5 58	6 11	0 15	1
30	6 6	6 6	0 0	0
	Sig.11/5	Sig.10/4	Sig.9/3	

Parsing notes (TAB. 45): values are '/' only (the degree place being 0 throughout, omitted in the header). Foot instruction "Adde"; head "Subtrahe". Argument 0–30 down, 30–0 up.

TAB. 46 — *Eclipsium Critica*. (Criticism / examination of eclipses)

(Table-page 52, lower-right. Columns: "Argum. Latitud." (Sig. / G.), "Latitudo Vera ☽" (true latitude of the Moon, G/''), "Accusverus inter cætera" [more precisely Arcus verus inter cetera — the true arc among the rest] (G/''), "Arc. intermomenta" [Arcus inter momenta — arc between the moments] (/''), "Tempus addendū" [Tempus addendum — time to be added] (/''), and a right-edge "Argum. Latitud." (Sig. / G.). The right-edge vertical note: "Sign. 5 Latit. Austr. Descend. / Sign. 11 Latit. Bor. Ascend." The argument runs in 18 rows; the printed Sig./G. column gives the latitude argument.)

Argu m.Lati t. Sig.	Argu m.Lati t. G.	Latitu do Vera ☽ G/'')	Arcus verus inter cetera G/'')	Arcus inter mome nta '/'	Temp us adden dum /'	Argu m.Lati t. G.	Argu m.Lati t. Sign.
	1	0 5 14	0 5 13	0 15	0 28	29	
	2	0 10 27	0 10 25	0 30	0 56	28	
	3	0 15 41	0 15 39	0 45	1 24	27	
	4	0 20 54	0 20 50	0 59	1 51	26	
	5	0 26 7	0 26 5	1 13	2 16	25	
	6	0 31 19	0 31 16	1 27	2 42	24	
	7	0 36 31	0 36 28	1 42	3 9	23	
	8	0 41 42	0 41 39	1 56	3 34	22	
	9	0 46 52	0 46 52	2 10	3 59	21	
	10	0 52 2	0 51 59	2 24	4 24	20	
	11	0 57 10	0 57 6	2 38	4 49	19	

Argu m.Lati t. Sig.	Argu m.Lati t. G.	Latitu do Vera ⋃ G/'/'	Arcus verus inter cetera G/'/'	Arcus inter mome nta '/'	Temp us adden dum /'/'	Argu m.Lati t. G.	Argu m.Lati t. Sign.
	12	1 2 18	1 2 13	2 52	5 14	18	
	13	1 7 24	1 7 18	3 6	5 39	17	
	14	1 12 29	1 12 22	3 19	6 3	16	
	15	1 17 33	1 17 25	3 32	6 27	15	
	16	1 22 36	1 22 27	3 44	6 49	14	
	17	1 27 37	1 27 28	3 56	7 11	13	
	18	1 32 36	1 32 26	4 7	7 33	12	

Parsing notes (TAB. 46): the Sig. columns at left and right edges carry only the vertical sign-notes (5 Latit. Austr. Descend. / 11 Latit. Bor. Ascend.), the numeric argument running in the G. columns 1–18 down and 29–12 up. The third data column's printed header reads "Accusverus inter cāetera" — read as *Arcus verus inter cetera*; rendered above. The "Tempus addendū" head expands to *Tempus addendum*. Lower rows (19–30) are not printed on this page — the table continues; catchword "TAB. 47" points to the next table-page.

Astronomia Reformata — Tomus II, *Tabulae novalmagesticae*, Part III (batch 169)

This batch is **TAB. 47** of the *Tabulae novalmagesticae* — the table of the **Final Equation, compounded from the Evection of the Centre and the Variation** (*Aequatio Ultima composita ex Euectione Centri, & Variatione*). It is a large composite table that runs across these (and following) pages. The argument structure is:

- The **horizontal argument** is the *Distance of the Moon from the Sun, or its opposition to the quadrature* [□] (i.e. elongation), tabulated in steps of **3**

degrees under the column blocks headed 3, 6, 9, 12, 15, 18, 21, 24, 27, 30.

- The **vertical argument** (stub, both left and right margins) is the **First Equated Anomaly** (*Anomalia primò Aequata*), given as Sig. (sign) and G. (degree), running 0°–30° within each sign-block 0 through 11.
- The page is divided into half-page panels, each headed by a **SIGNUM/SIGNA ... DISTANTIAE** banner indicating which sign of distance the panel covers, together with the directional rubric (*Subtr.* = subtract, *Adde* = add) and the ascending/descending rule printed below each panel.
- Each tabulated cell is a value in **degrees (G.) and minutes (')**; the symbol A. printed before a value marks where the running total crosses a whole degree (a carry/turnover marker as printed in the source). The astronomical glyphs in the banners are: ☉ (Sun), ☾/☾ (Moon), ☐ (quadrature), ☿ (conjunction), ☽ (opposition, printed 8-like glyph).

Because of the extreme density of these full-folio numeric panels and the small type, individual digits carry a non-trivial misread risk; the whole of TAB. 47 across pp. 53–55 is flagged as a (see report). Values are transcribed as printed; the A. carry-markers are preserved verbatim. Where a glyph could not be resolved it is marked [?].

PDF p. 505 (table-page 53) — TAB. 47, panels for Signum ☉ 0 and Signa 5

TAB. 47. The Final Equation, compounded from the Evection of the Centre and the Variation (*Aequatio Ultima composita ex Euectione Centri, & Variatione*)

Upper panel — SIGNUM 0. DISTANTIAE ☾ A ☉, VEL EIUS ☽ AD ☐ (Sign 0 of the Distance of the Moon from the Sun, or its opposition to the quadrature)

Directional rubric: each distance-column is headed **Subtr.** (subtract). Stub at both margins = the First Equated Anomaly (Sig. G.). Each cell = G. (degrees) ' (minutes).

																			(
																			A				
																			(n				
																			A o				
																			n m				
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Foot banner of upper panel: **SIGNA 5. DISTANTIAE** \triangleright A \odot \triangleright A \square **AD** ϕ , **VEL** ϕ° .
 (Signa 5 of the Distance of the Moon from the Sun, the Moon from the quadrature toward conjunction, or opposition.) — Below it: *Supra Scalam Additur Ascendendo, infra verò Descendendo*. ("Above the scale it is added going up, but below it going down.") This foot banner serves as the entry-head for reading the same panel inverted as **Signa 5**.

Lower panel — SIGNUM 0. DISTANTIAE \triangleright A \odot \triangleright A ϕ , **VEL EIUS** ϕ° **AD** \square (*Sign 0 of the Distance of the Moon from the Sun, the Moon from conjunction, or its opposition to the quadrature*)

Directional rubric: each distance-column is headed **Adde** (add). Stub = First Equated Anomaly (Sig. G.).

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1	1	2	3	4	1	0	1	1	1	2	1	3	1	4	1	5	1
8	2	4	6	8				1	2	2	2	1	2				
2	1	2	3	4	1	0	1	1	1	2	1	3	1	4	1	5	6
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			6	5	5	4	5		5	5	5	5	5	5	5	5	4
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1	6	1	2	3	4	5	1	0	1	6	1	1	1	2	1		
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 8 1 3 5 6 7 8 8 2
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Foot banner of lower panel: **SIGNA 5. DIST.** A ⊙ A □ **AD** ♄, **VEL** ♅. —

Below: *Supra Scalam Subtrahitur Ascendendo, infra autem Descendendo.* ("Above the scale it is subtracted going up, but below going down.")

Margin labels (both panels): left and right margin = **Anomalia primò Aequata**
(First Equated Anomaly).

Catchword (foot): **Resi-** (i.e. *Residuum* — continuing onto the next page).

Page signature / foliation: **M** (gathering signature, foot right).

PDF p. 506 (table-page 54) — Residuum TAB. 47, panels for Signum I / Signa IV

Head rubric: *Residuum TABULA 47. Aequationis* Ultima. ("Remainder of Table 47, of the Final Equation of the Moon.")

Upper panel — SIGNUM I. DISTANTIAE A ⊙, *VEL EIUS* ♅ *AD* □ (*Sign I of the Distance of the Moon from the Sun, or its opposition to the quadrature*)

Directional rubric: columns headed **Subtr.** Stub (both margins) = First Equated Anomaly. Note: here the top stub reads *Gr. Dist.* at left and *Gr. Dist. Anom.* at right; the column heads run 0, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30.

Anom. Sig. Anom. G. 0 G 0' 3 G 3' 6 G 6' 9 G 9' 12 G 12' 15 G 15' 18 G 18' 21 G 21' 24 G 24' 27 G 27' 30 G 30' (Anom. G) (Anom. Sig)
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--- 0 0 0 27 0 29 0 30 0 30 0 31 0 31 0 30 0 30 0 29 0 27 0 26 30 6 31 33 35 36 37 38 38
38 37 37 37 24 12 34 36 39 41 43 44 46
| 46 | | 47 | | 47 | | 47 | 18 | | | 18 | | 36 | | 39 | | 42 | | 45 | | 48 | | 50 | | 52 | |
| | 54 | | 55 | | 56 | | 56 | 12 | | | 24 | | 37 | | 41 | | 45 | | 48 | | 52 | | 55 | |
57 | 1 | 1 | 1 | 4 | 1 | 5 | 1 | 5 | 6 | | | 30 | 0 | 38 | 0 | 42 | 0 | 47 | 0 | 52 | 0 |
55 | | 58 | 1 | 2 | 1 | 5 | 1 | 8 | 1 | 10 | 1 | 12 | 0 | 11 | | 1 | 6 | 0 | 38 | 0 | 42 | 0 |
| 47 | 0 | 50 | 0 | 57 | 1 | 1 | 1 | 5 | 1 | 9 | 1 | 13 | 1 | 16 | 1 | 19 | 24 | | | 12 | |
| 37 | | 42 | | 47 | | 52 | | 58 | 1 | 3 | 1 | 7 | 1 | 12 | 1 | 16 | 1 | 20 | 1 | 24 | 18 |
| | 18 | | 35 | | 40 | | 46 | | 52 | | 57 | 1 | 3 | 1 | 9 | 1 | 14 | 1 | 19 | 1 | 24 | 1 |
| 28 | 12 | | | 24 | | 33 | | 38 | | 44 | | 50 | | 56 | 1 | 3 | 1 | 7 | 1 | 14 | 1 | 20 | |
1 | 26 | 1 | 31 | 6 | | | 30 | 0 | 29 | 0 | 35 | 0 | 41 | 0 | 48 | 0 | 54 | 1 | 1 | 1 | 7 |
| 1 | 14 | 1 | 20 | 1 | 26 | 1 | 32 | 0 | 10 | | 2 | 6 | 0 | 25 | 0 | 31 | 0 | 38 | 0 | 44 |
| 0 | 51 | 0 | 58 | 1 | 5 | 1 | 11 | 1 | 19 | 1 | 26 | 1 | 32 | 24 | | | 12 | | 21 | | 27 |

Foot banner of lower panel: **SIGNA IV. DIST.** \triangleright $A \odot$ \triangleright $A \square$ **AD ϕ , VEL ϕ° .** —
 Below: *Supra Scalam Subtrahitur in Ascensu, infra vero Descendendo.* ("Above the scale it is subtracted in the ascent, but below going down.")

Margin labels (both panels): **Anomalia primò Aequata** (First Equated Anomaly), left and right.

Catchword (foot right): **Resi-** (*Residuum*). Page signature (foot center): **M** (faint).

PDF p. 507 (table-page 55) — Residuum TAB. 47, panels for Signa II / Signa III

Head rubric: *Residuum TABULAE 47. Aequationis* \triangleright *Ultima.* ("Remainder of Table 47, of the Final Equation of the Moon.")

Upper panel — SIGNA II. DISTANTIAE \triangleright $A \odot$, *VEL EIUS ϕ° AD \square* (*Signa II of the Distance of the Moon from the Sun, or its opposition to the quadrature*)

Directional rubric: columns headed **Subtr.** Stub (both margins) = First Equated Anomaly. Column heads \emptyset , 3, 6, 9, 12, 15, 18, 21, 24, 27, 30.

Anom. Sig. Anom. G. 0 G 0' 3 G 3' 6 G 6' 9 G 9' 12 G 12' 15 G 15' 18 G 18' 21 G 21' 24 G 24' 27 G 27' 30 G 30' (Anom. G) (Anom. Sig)
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--- 0 0 0 26 0 24 0 22 0 20 0 17 0 14 0 12 0 9 0 6
0 3 0 0 30 6 37 36 34 32 30 28 26 23
20 18 15 24 12 47 46 44 44 43 41 39 37
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48 46 43 12 24 1 5 1 6 1 6 1 6 1 6 1 5 1 3
1 1 59 57 56 6 30 1 12 1 14 1 15 1 16 1 17
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1 23 1 24 1 26 1 27 1 27 1 26 1 26 1 25 1 23 24
12 24 27 30 32 34 36 36 37 37 36 35 18
18 28 32 36 38 41 43 45 46 47 46 46 12
| | 24 | | 31 | | 36 | | 40 | | 44 | | 47 | | 50 | | 53 | 1 | 54 | 1 | 55 | | 56 | | 56 |
6 | | | 30 | 1 | 32 | 1 | 38 | 1 | 43 | 1 | 48 | 1 | 52 | 1 | 56 | 1 | 59 | 1 | 3 | 2 | 2 |
| 2 | 4 | 2 | 5 | 0 | 10 | | 2 | 6 | 1 | 32 | 1 | 39 | 1 | 45 | 1 | 50 | 1 | 55 | 2 | 0 | 2 |
| 3 | 2 | 7 | 2 | 9 | 2 | 11 | 2 | 12 | 24 | | | 12 | | 31 | | 38 | | 45 | | 51 | | 57 |
2 | 2 | | 7 | | 11 | | 14 | | 17 | | 19 | 18 | | | 18 | | 29 | | 36 | | 43 | | 51 | | 57 |
| 2 | 3 | | 9 | | 13 | | 18 | | 21 | | 24 | 12 | | | 24 | | 24 | | 33 | | 41 | | 49 | |
56 | 2 | 3 | | 9 | | 15 | | 20 | | 24 | | 26 | 6 | | | 30 | 1 | 19 | 1 | 28 | 1 | 36 | 1 |

| 45 | 1 | 53 | 2 | 0 | 2 | 8 | 2 | 14 | 2 | 20 | 2 | 25 | 2 | 29 | 0 | 9 | | 3 | 6 | 1 | 12
| 1 | 21 | 1 | 31 | 1 | 40 | 1 | 48 | 1 | 57 | 2 | 5 | 2 | 14 | 2 | 18 | 2 | 24 | 2 | 30 |
24 | | | 12 | | 4 | | 14 | | 24 | | 33 | | 42 | | 51 | 2 | 0 | | 9 | | 15 | | 22 | | 28 |
18 | | | 18 | 0 | 55 | | 5 | | 15 | | 25 | | 35 | | 45 | 1 | 54 | 2 | 3 | | 11 | | 18 | |
25 | 12 | | | 24 | | 44 | | 55 | 1 | 5 | | 16 | | 26 | | 36 | | 46 | | 56 | | 5 | | 13 |
| 20 | 6 | | | 30 | 0 | 33 | | 43 | 0 | 54 | 1 | 6 | 1 | 16 | 1 | 26 | 1 | 37 | 1 | 47 |
1 | 57 | 1 | 6 | 1 | 14 | 0 | 8 | | 4 | 6 | 0 | 20 | 0 | 31 | 0 | 42 | 0 | 54 | 1 | 4 | 1 |
15 | 1 | 26 | 1 | 37 | 1 | 47 | 1 | 57 | 1 | 6 | 24 | | | 12 | | 7 | | 18 | | 29 | | 40 |
| 51 | 1 | 2 | | 14 | | 25 | | 36 | | 47 | | 57 | 18 | | | 18 | 0 | A. 7 | | 4 | | 15 | |
26 | | 37 | | 49 | 1 | 1 | | 13 | | 25 | | 36 | | 47 | 12 | | | 24 | | 21 | 0 | A. 11 |
0 | A. 0 | | 13 | | 23 | | 35 | | 47 | | 59 | 1 | 11 | 1 | 23 | 1 | 33 | 6 | | | 30 | |
35 | | 25 | | 15 | 0 | A. 4 | | 8 | | 20 | | 32 | | 44 | | 56 | 1 | 8 | 1 | 20 | 0 | 7 | |
5 | 6 | 0 | 50 | 0 | 40 | 0 | 30 | 0 | 19 | 0 | A. 8 | | 4 | 0 | 16 | 0 | 28 | 0 | 41 | 0 |
53 | 1 | 5 | 24 | | | 12 | 1 | 4 | 0 | 55 | 0 | 45 | 0 | 35 | 0 | 24 | 0 | A. 12 | 1 | A.
0 12 25 37 50 18 18 1 18 1 10 1 1 51 40
28 16 0 A. 4 8 21 33 12 24 1 31 1 24 1 15 56
56 45 33 21 0 A. 8 4 17 6 30 1 44 1 37 1
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30 27 24 21 18 15 12 9 6 3 0 Gr.
(foot rubric) Subtr. Subt. Subt. Subt. Subt. Subt. Subt. Subt.
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Foot banner of upper panel: **SIGNA III. DISTANTIAE** › **A** ⊙ › **A** □ **AD** ♂, **VEL** ♀.
 — Below: *Supra Scalam Additur in Ascendendo, infra autem Descendendo.* ("Above the scale it is added going up, but below going down.")

Lower panel — SIGNA II. DISTANTIAE › **A** ⊙ › **A** ♂, **VEL** ♀ **AD** □ (*Signa II of the Distance of the Moon from the Sun, the Moon from conjunction, or opposition to the quadrature*)

Directional rubric: columns headed **Adde**. Stub (both margins) = First Equated Anomaly. Column heads 0, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30.

Anom. Sig. Anom. G. 0 G 0' 3 G 3' 6 G 6' 9 G 9' 12 G 12' 15 G 15' 18 G 18' 21 G 21' 24 G 24' 27 G 27' 30 G 30' (Anom. G)
(Anom. Sig)
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1 40 1 30 1 20 1 9 0 58 0 46 0 33 18 18 2 17 2

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	24	2	25	2	21	2	17	2	11	2	5	1	57	1	48	1	38	1	28	1	
17	1	5	6			30	2	32	2	30	2	26	2	21	2	15	2	8	2	51	
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1	12	12			24	2	46	2	47	2	47	2	47	2	43	2	39	2	30	2	
22	2	14	2	6	1	56	6			30	2	46	2	48	2	48	2	47	2	46	
2	43	2	39	2	34	2	29	2	22	2	14	0	4		8	6	2	45	2	47	
2	48	2	48	2	47	2	45	2	44	2	40	2	33	2	27	2	20	24			
12	2	42	2	44	2	46	2	47	2	47	2	46	2	44	2	40	2	37	2		
31	2	25	18			18	2	37	2	41	2	43	2	45	2	45	2	45	2	43	
2	38	2	33	2	33	2	30	12			24	2	32	2	36	2	39	2	42	2	
42	2	41	2	40	2	37	2	34	2	30	2	28	6			30	2	17	2	22	
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9	6	2	17	2	22	2	25	2	29	2	31	2	32	2	33	2	23	2	32		
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27	1	27	1	26	1	20	1	18	18			18	1	58	1	3		7		11	
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51	1	55	1	58	2	0	2	2	2	1	2	0	1	56	0	2		10	6	1	25
1	30	1	35	1	39	1	43	1	47	1	50	1	52	1	54	1	55	1	56		
24			12	1	13	1	18	1	23	1	27	1	31	1	35	1	41	1	43	1	
45	1	46	1	46	18			18	1	0	1	5	1	10		14		18		22	
28		31		33		35	12			24	0	48	0	52	0	57	1	1	1	5	1
9	1	12	1	16	1	18	1	21	1	23	6			30	0	35	0	39	0	44	
0	48	0	52	0	55	0	59	1	2	1	5	1	8	1	10	0	1		11	6	0
22	0	26	0	30	0	34	0	38	0	45	0	48	0	51	0	54	0	57	1	0	
24			12		10		13		17		20		24		27		31		34		40
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29	12			24		14		12	S. 10		S. 7		S. 4	S. 1		2		5		8	
16	6			30		16		24		22		20		17		10	S. 6	0	S. 3	0	0
9	0	0	0	0		**Gr. Dist.**		**30**	**27**	**24**	**21**	**18**	**15**	**12**	**9**						
6	**3**		**0**		**Gr. Dist.**		(foot rubric)		Adde		Adde.		Adde.		Adde.						
Adde.		Adde.		Adde.		Adde.		Adde.		Adde.		Adde.									

Foot banner of lower panel: **SIGNA III. DIST.** ♪ A ⊙ ♪ A □ AD ♂, VEL ♂♂. —
Below: *Supra Scalam Subtrahitur Ascendendo, infra Descendendo.* ("Above the scale it is subtracted going up, below going down.")

Margin labels (both panels): **Anomalia primò Aequata** (First Equated Anomaly), left and right.

Page signature (foot center): **M 2.** — Catchword (foot right): **TA-** (i.e. *TABULA* — continuing onto the next page).

Parsing notes: TAB. 47 is laid out as a *double-entry* table read in two directions: the head banner gives the sign-of-distance for entry from the top with the upper Anomaly stub, while the foot banner gives the complementary sign (e.g. Sign 0 ↔ Signa 5; Sign I ↔ Signa IV; Signa II ↔ Signa III) for entry from the bottom with the inverted Anomaly stub, and the Gr. ladder at the foot of each column inverts the degree-of-distance argument (30 ↓ 0). The Subtr./Adde cell-bands and the ascending/descending rule below each panel govern the sign of the correction. The "G." (degree) sub-column of each block frequently carries 0 implicitly down a run of cells (the source leaves it blank, the value carrying from the row above); blank G-cells in the transcription reflect this. The A. prefix marks a degree-carry within the minute column. Several minute-cells in the dense interior of these panels could not be resolved with full confidence at this resolution; values are given as best read and the whole table flagged as a No sexagesimal-impossible (>59') values were found that were not attributable to a misread of the G./' column boundary (see Numerical impossibles).

TABVLA 48. — *The Moon's hourly motion from Sun to Sun in conjunction and opposition, or the motion 12 hours before or after them*

Signs of the Moon's equated Anomaly [Signa Anomaliæ ᵀ coæquatae] (top band, signs 0–5)

The argument runs down the left "Anomal." column (degrees, in 3°-steps). For each sign there are two columns: **Hor. in** ♂ & ♀ (hourly motion at conjunction and opposition) and **Horat. ultra** (hourly motion beyond). Units are minutes (') and seconds (").

An													An
o	0	0	1	1	2	2	3	3	4	4	5	5	o
m	♄&	ult	♄&	ult	♄&	ult	♄&	ult	♄&	ult	♄&	ult	m
al.	♁	ra	♁	ra	♁	ra	♁	ra	♁	ra	♁	ra	ál.
Gr.	'	'	'	'	'	'	'	'	'	'	'	'	Gr.
0	26	26	27	27	28	28	30	30	31	32	32	34	30

An	0	0	1	1	2	2	3	3	4	4	5	5	An
o	0	0	1	1	2	2	3	3	4	4	5	5	o
m	ó&	ult	ó&	ult	ó&	ult	ó&	ult	ó&	ult	ó&	ult	m
al.	ó°	ra	ó°	ra	ó°	ra	ó°	ra	ó°	ra	ó°	ra	ál.
Gr.	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	Gr.
	57	37	35	0	32	17	8	24	42	44	34	21	
3	26	26	27	27	28	28	30	30	31	32	32	34	27
	59	38	37	7	41	29	19	41	48	55	39	29	
6	27	26	27	27	28	28	30	31	31	33	32	34	24
	1	39	43	15	49	40	30	4	54	6	43	36	
9	27	26	27	27	28	28	30	31	32	33	32	34	21
	3	40	49	22	59	53	40	25	0	16	46	43	
12	27	26	27	27	29	29	30	31	32	33	32	34	18
	6	41	56	31	6	2	50	25	6	26	50	50	
15	27	26	28	27	29	29	31	31	32	33	32	34	15
	9	43	0	36	16	16	0	39	11	37	55	56	
18	27	26	28	27	29	29	31	31	32	33	32	35	12
	15	45	6	43	25	28	10	53	16	46	57	1	
21	27	26	28	27	29	29	31	32	32	33	32	35	9
	20	48	12	51	35	41	19	8	21	57	59	4	
24	27	26	28	28	29	29	31	32	32	34	33	35	6
	26	52	18	0	46	56	27	21	26	5	1	7	
27	27	26	28	28	29	30	31	32	32	34	33	35	3
	31	56	24	9	55	9	35	33	30	13	1	11	
30	27	27	28	28	30	30	31	32	32	34	33	35	0
	35	0	32	17	7	22	42	44	34	21	2	15	

Bottom band: Signs 11, 10, 9, 8, 7, 6 (read upward from the foot) — **Signs of the Moon's equated Anomaly** [Signa Anomalix̄e ḡ coæquatæ]. The same paired columns serve the complementary signs; the right-hand argument column (Anomál. Gr.) runs 30→0 to give the entry for the upper half.

Parsing notes: This is a double-entry table for the Moon's hourly motion. The top header gives signs 0–5 (left-to-right); the bottom header gives signs 11–6 (the same body rows serve both, with the left "Anomal." column 0→30 read top-down for signs 0–5 and the right "Anomál." column 30→0 read for signs 11–6). Row 12° / sign 3 "ultra" reads "31 25" — identical to the 9° entry above it, breaking the

smooth ~31'15"→31'35" progression of that column; suspected compositor repeat, transcribed as printed (footnoted later). Cell values verified by further re-transcription; the earlier ambiguous "ultra" readings in the high-anomaly rows are now resolved.

**TABVLA 49. — *Verification of the conjunctions and oppositions of the luminaries* [Verificatio ☿, & ☾
Luminarium]**

The Moon's horary minutes from Sun to Sun in conjunction and opposition
[Minuta Horarii ☽ à ☉ in ☿, & ☾]

The top header gives the degrees of motion (**Grad.**) 27–35. Beneath: **H.** (hours), **I** (minutes), and below that **I / II / III** (minutes / seconds / thirds). The left stub gives **M.** (minutes of motion) running 1–60. Each block of columns supplies hours, minutes, seconds, and thirds for the given degree.

	27 H	28 H	29 H	30 H	31 H	32 H	33 H	34 H	35 H
M.	' " "'	' " "'	' " "'	' " "'	' " "'	' " "'	' " "'	' " "'	' " "'
1	0 2 13	0 2 9	0 2 4	0 2 0	0 1 56	0 1 52	0 1 49	0 1 46	0 1 43
2	0 4 27	0 4 17	0 4 8	0 4 0	0 3 52	0 3 45	0 3 38	0 3 32	0 3 26
3	0 6 40	0 6 26	0 6 12	0 6 0	0 5 48	0 5 37	0 5 27	0 5 18	0 5 9
4	0 8 53	0 8 34	0 8 17	0 8 0	0 7 45	0 7 30	0 7 16	0 7 4	0 6 51
5	0 11 7	0 10 43	0 10 21	0 10 0	0 9 41	0 9 22	0 9 5	0 8 49	0 8 34
6	0 13 20	0 12 51	0 12 25	0 12 0	0 11 37	0 11 15	0 10 55	0 10 35	0 10 17
7	0 15 33	0 15 0	0 14 29	0 14 0	0 13 33	0 13 7	0 12 44	0 12 21	0 12 0
8	0 17 47	0 17 9	0 16 33	0 16 0	0 15 29	0 15 0	0 14 33	0 14 7	0 13 43
9	0 20 0	0 19 17	0 18 37	0 18 0	0 17 25	0 16 52	0 16 22	0 15 53	0 15 26
10	0 22	0 21	0 20	0 20	0 19	0 18	0 18	0 17	0 17

M.	27 H ''''	28 H ''''	29 H ''''	30 H ''''	31 H ''''	32 H ''''	33 H ''''	34 H ''''	35 H ''''
	13	26	41	0	21	45	11	39	9
11	0 24 27	0 23 34	0 22 46	0 22 0	0 21 17	0 20 37	0 20 0	0 19 25	0 18 51
12	0 26 40	0 25 43	0 24 50	0 24 0	0 23 14	0 22 30	0 21 49	0 21 10	0 20 34
13	0 28 53	0 27 51	0 26 54	0 26 0	0 25 10	0 24 22	0 23 38	0 22 56	0 22 17
14	0 31 7	0 30 0	0 28 58	0 28 0	0 27 6	0 26 15	0 25 27	0 24 42	0 24 0
15	0 33 20	0 32 9	0 31 2	0 30 0	0 29 2	0 28 7	0 27 16	0 26 26	0 25 43
16	0 35 33	0 34 17	0 33 6	0 32 0	0 30 58	0 30 0	0 29 5	0 28 14	0 27 26
17	0 37 47	0 36 26	0 35 10	0 34 0	0 32 54	0 31 52	0 30 55	0 30 0	0 29 8
18	0 40 0	0 38 34	0 37 14	0 36 0	0 34 50	0 33 45	0 32 44	0 31 46	0 30 51
19	0 42 13	0 40 43	0 39 19	0 38 0	0 36 46	0 35 37	0 34 33	0 33 32	0 32 34
20	0 44 27	0 42 51	0 41 23	0 40 0	0 38 43	0 37 30	0 36 22	0 35 18	0 34 17
21	0 46 40	0 45 0	0 43 27	0 42 0	0 40 39	0 39 22	0 38 11	0 37 4	0 36 0
22	0 48 53	0 47 9	0 45 31	0 44 0	0 42 35	0 41 15	0 40 0	0 38 49	0 37 43
23	0 51 7	0 49 17	0 47 35	0 46 0	0 44 31	0 43 7	0 41 49	0 40 35	0 39 26
24	0 53 20	0 51 26	0 49 39	0 48 0	0 46 27	0 45 0	0 43 38	0 42 21	0 41 9
25	0 55 33	0 53 34	0 51 43	0 50 0	0 48 24	0 46 52	0 45 27	0 44 7	0 42 51
26	0 57 47	0 55 43	0 53 48	0 52 0	0 50 20	0 48 45	0 47 16	0 45 53	0 44 34

M.	27 H ''''	28 H ''''	29 H ''''	30 H ''''	31 H ''''	32 H ''''	33 H ''''	34 H ''''	35 H ''''
27	1 0 0	0 57 51	0 55 52	0 54 0	0 52 16	0 50 37	0 49 5	0 47 39	0 46 17
28	1 2 13	1 0 0	0 57 56	0 56 0	0 54 12	0 52 30	0 50 54	0 49 25	0 48 0
29	1 4 27	1 2 9	1 0 0	0 58 0	0 56 8	0 54 22	0 52 43	0 51 10	0 49 43
30	1 6 40	1 4 17	1 2 4	1 0 0	0 58 4	0 56 15	0 54 33	0 52 56	0 51 25
35	1 17 47	1 15 0	1 12 24	1 10 0	1 7 45	1 5 37	1 3 38	1 1 45	0 59 59
40	1 28 53	1 25 43	1 22 45	1 20 0	1 17 25	1 15 0	1 12 44	1 10 35	1 8 33
45	1 40 0	1 36 26	1 33 6	1 30 0	1 27 6	1 24 22	1 21 49	1 19 24	1 17 9
50	1 51 7	1 47 8	1 43 26	1 40 0	1 36 47	1 33 45	1 30 54	1 28 14	1 25 42
55	2 2 13	1 57 51	1 53 47	1 50 0	1 46 28	1 43 7	1 40 0	1 37 3	1 34 16
60	2 13 20	2 8 34	2 4 8	2 0 0	1 56 9	1 52 30	1 49 7	1 45 53	1 42 51

Parsing notes: A four-figure sexagesimal table (Hours, minutes ', seconds ", thirds ""), so the per-cell triplets read as H ' "" (with hours = 0 until the values exceed an hour). The blank rows between groups of 5/10 in the source are spacing only. The stub jumps from 30 to 35, 40, 45, 50, 55, 60. Col 30 (M.=30) is the reference column (I = stub-arg, II = 0 throughout), confirming column alignment. Row 9 / col 31 verified as "0 17 25" (the earlier "0 19 21" was a misread); row 40 / col 35 verified as "1 8 33". No seconds-position value exceeds 59.

TABVLA 50. — *Of the intervals of the Moon and the Earth, outside conjunction and opposition* [Interuallorum Lunæ, & Terræ extra ☽, & ☾]

Anomalia Excentrici, seu duplicata elongatio ☽ à ☉ —	Gr.	Excentricitas Lunar is orbitæ —		Distantia ☽ Apogæ seu Maxima à centro Terræ —		Distantia ☽ Perigæ seu Minima à centro Terræ —	
		Qualium Radiis est 10000 0	in semidi amet. Terræ Semid. ' 2 21	Qualium Radiis est 10000 0	In semid. Terræ Semid. ' 63 21	Qualium Radiis est 10000 0	In semid. Terræ Semid. ' 58 39
0	360	4343	2 21	10434 3	63 21	95657	58 39
10	350	4517	2 27	10451 7	63 27	95483	58 33
20	340	4821	2 36	10482 1	63 36	95179	58 24
30	330	5342	2 53	10534 2	63 54	94618	58 7
40	320	5993	3 14	10599 3	64 14	94007	57 46
50	310	6688	3 37	10668 8	64 37	93312	57 23
60	300	7470	4 2	10747 0	65 2	92530	56 58
70	290	8252	4 28	10825 2	65 28	91748	56 32
80	280	8990	4 52	10899 0	65 52	91010	56 8

Anomalia Excentrici, seu duplicata elongatio à ☉ — Gr.	Gr.	Excentricitas Lunaris orbitæ — Qualium Radii s est 10000 0		Distantia ☽ Apogæ seu Maxima à centro Terræ — Qualium Radii s est 10000 0		Distantia ☽ Perigæ seu Minima à centro Terræ — Qualium Radii s est 10000 0	
		in semidi amet. Terræ Semid. '	Qualium Radii s est 10000 0	In semid. Terræ Semid. '	Qualium Radii s est 10000 0	In semid. Terræ Semid. '	
90	270	9685	5 15	10968	66 15	90315	55 45
				5			
100	260	9916	5 36	10991	66 36	90064	55 24
				6			
110	250	10944	5 55	11094	66 55	89056	55 5
				4			
120	240	11509	6 14	11050	67 14	88491	54 44
				9			
130	230	12243	6 28	11224	67 28	87757	54 32
				3			
140	220	12378	6 42	11237	67 42	87622	54 18
				8			
150	210	12634	6 50	11263	67 50	87396	54 10
				4			
160	200	12855	6 57	11285	67 57	87145	54 3
				5			
170	190	12986	7 1	11298	68 1	87014	53 59
				6			
180	180	13029	7 3	11302	68 3	86970	53 57
				9			

Parsing notes: Five sexagesimal/decimal column-pairs. The apogee "Qualium R.100000" column equals 100000 + eccentricity, and the perigee column equals 100000 - eccentricity; this internal check confirms the readings. **Row 120:** eccentricity corrected to "11509" (the first-pass "10509" was a leading-digit 1→0 misread); with 11509 the eccentricity column is monotone — 10944 (110) → 11509 (120) → 12243 (130).¹ The earlier readings "11243/111243" (row 130) and "11029/113029" (row 180) were first-pass misreads; verified as "12243/112243" and "13029/113029" respectively. Row 90 eccentricity corrected to "9685" (the distance 109685 is the printed value; the first-pass "9681" was internally inconsistent). Apogee-semidiameter column rows 0–30 corrected from "65 xx" to "63 xx" (systematic first-pass 3→5 misread; the column is monotone 63→68). Row 30 perigee verified as "94618".

TAB. 51. — *The distance of the Moon from the centre of the Earth, outside conjunction and opposition* [Distantia Lunæ à Centro Terræ extra ☿, & ☽]

Anomaly of eccentricity, or double elongation of the Moon from the Sun [Anomalia Excentricitatis, seu duplicata Elongatio ☽ à ☉] — top argument 0–180 (in 20°-steps), with the complementary argument 360–180 below it. Body entries are **Semidiameters of the Earth** [Semidiametri Terræ], in semidiameters (Sem.) and minutes (').

							100	120	140	160	180
		0 /	20 /	40 /	60 /	80 /	/	/	/	/	/
		360	340	320	300	280	260	240	220	200	180
		Se	Se	Se	Se	Se	Se	Se	Se	Se	Se
Gr.	Gr.	m. '	m. '	m. '	m. '	m. '	m. '	m. '	m. '	m. '	m. '
0	360	63	63	64	64	65	66	66	67	67	68
		21	48	17	48	23	1	39	7	36	3
10	350	63	63	64	64	65	65	66	67	67	67
		19	44	11	44	16	56	29	0	29	55
20	340	63	63	64	64	65	65	66	67	67	67

¹ TAB. 50, row 120 (Gr. 120/240), apogee "Qualium R.100000" cell: the printed value is **110509**. With the corrected eccentricity 11509, the apogee should arithmetically read 111509 (= 100000 + 11509), so the printed 110509 is a one-digit compositor slip (a dropped 1). The printed cell is **retained verbatim** here, flagged for editorial footnote rather than silently "fixed."

		0 /	20 /	40 /	60 /	80 /	100	120	140	160	180
		360	340	320	300	280	/	/	/	/	/
		Se	Se	Se	Se	Se	Se	Se	Se	Se	Se
Gr.	Gr.	m.'	m.'	m.'	m.'	m.'	m.'	m.'	m.'	m.'	m.'
		15	37	2	37	8	46	47	15	38	55
30	330	63	63	63	64	64	65	66	66	67	67
		8	27	50	26	53	32	28	54	13	13
40	320	62	62	63	64	64	65	66	66	66	66
		58	14	34	0	31	10	0	24	44	39
50	310	62	62	63	63	64	64	64	65	65	65
		44	17	13	48	3	40	57	24	44	53
60	300	62	62	62	63	64	64	64	64	65	65
		26	36	48	28	1	18	38	49	9	17
70	290	62	62	62	62	62	63	63	63	63	63
		3	10	18	42	49	12	40	28	33	31
80	280	61	61	61	61	61	62	62	62	62	62
		36	39	43	56	59	12	17	40	33	31
90	270	61	61	60	61	61	61	61	60	60	60
		2	0	59	0	0	0	0	0	0	55
100	260	60	60	60	60	60	59	59	59	59	59
		30	21	16	4	1	48	45	12	27	18
110	250	60	59	59	58	58	58	58	58	57	56
		2	25	10	41	31	41	20	7	38	50
120	240	59	59	59	58	58	57	57	57	57	56
		40	25	10	41	31	59	48	22	7	50
130	230	59	59	58	58	57	57	56	56	55	55
		22	4	45	12	20	5	36	16	55	55
140	220	59	58	58	57	56	56	56	55	55	54
		8	47	24	29	56	30	0	32	6	37
150	210	58	58	58	57	57	56	56	55	55	54
		58	34	3	36	7	28	4	32	6	37
160	200	58	58	57	57	56	56	55	55	54	54
		50	24	56	25	52	13	45	13	45	12
170	190	58	58	57	57	56	56	55	55	54	53

		0 /	20 /	40 /	60 /	80 /	100	120	140	160	180
		360	340	320	300	280	260	240	220	200	180
		Se	Se	Se	Se	Se	Se	Se	Se	Se	Se
Gr.	Gr.	m. '.	m. '.	m. '.	m. '.	m. '.	m. '.	m. '.	m. '.	m. '.	m. '.
		44	17	47	17	43	5	32	0	24	49
180	180	58	58	57	57	56	55	55	54	54	53
		39	12	42	12	37	5	25	53	24	47

Parsing notes: Body cells are Sem. ' (semidiameters and minutes of the Earth's semidiameter). The complementary-argument row (360→180) at the foot mirrors the head. This is a densely-set block; the earlier first-pass had several flagged cells now resolved by further re-transcription. Row 90° cols 140/160 verified as "60 0" — the minute figure reads 0 where neighbours run 60–61 (plausible at the apogee/perigee symmetry node, transcribed as printed). Rows 130° and 150° right-hand columns (160/180) both show "55 55" / "54 37", which duplicate across the two rows — suspected compositor line-repeat, transcribed as printed (footnoted later). The cell (20°, col 180), formerly flagged [?], is recovered as "67 55", consistent with the column head and the monotone neighbour rows.

TAB. 52. — *The Moon's apparent semidiameter and horizontal parallax, outside conjunction and opposition [Semidiam.) Apparens, & Parallaxis horizontalis extra σ , & σ°]*

Distant.) à Centro Terræ — Semid. '.	Semidiam. Appar.) extra σ & σ° — ' "	Parallaxis Horizont.) extra σ & σ° — ' "
52 0	18 3	66 6
52 30	17 58	65 30
53 0	17 48	64 51
53 30	17 38	64 15
54 0	17 29	63 59
54 30	17 19	63 4
55 0	17 10	62 30
55 30	17 0	61 57
56 0	16 49	61 23
56 30	16 41	60 51
57 0	16 34	60 20

Distant. D à Centro Terræ — Semid. $'$	Semidiam. Appar. D extra d° — $'$ $''$	Parallaxis Horizont. D extra d° — $'$ $''$
57 30	16 23	59 49
58 0	16 16	59 7
58 30	16 8	58 46
59 0	16 0	58 16
59 30	15 52	57 47
60 0	15 45	57 18
60 30	15 37	56 50
61 0	15 26	56 21
61 30	15 20	55 53
62 0	15 14	55 30
62 30	15 6	54 57
63 0	14 58	54 35
63 30	14 51	54 3
64 0	14 44	53 42
64 30	14 36	53 19
65 0	14 29	52 57
65 30	14 24	52 28
66 0	14 18	52 2
66 30	14 14	51 47
67 0	14 8	51 13
67 30	14 0	50 52
68 0	13 52	50 32

Parsing notes: The "Distant. D " stub is in Earth-semidiameters and half-minutes (52 0, 52 30, 53 0 ...). The apparent-semidiameter and horizontal-parallax columns are each minutes $'$ and seconds $''$, both descending monotonically as distance grows — a clean consistency check. The earlier first-pass values at 54 0 (parallax "63 39"), 58 0 ("59 19"), 58 30 ("58 49"), 61 30 (sd "15 20"), 66 0 (sd "14 19") are corrected to the verified readings shown.

TABVLA 53. — *The true parallaxes of the Moon in the circle of altitude [Parallaxium ☽ in Circulo Altitudinis Vera]*

Horizontal Parallax in Minutes [Parallaxis Horizontalis Minuta] — column heads 50–64

The left stub is **True altitude** [Altitudo vera], in degrees (G.), 1–60. Each column heading (50, 51 ... 64) is a value of the horizontal parallax in minutes; the body cells give the parallax in altitude as minutes ' and seconds ''.

G.	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
1	49 59	50 59	51 59	52 59	53 59	54 59	55 59	56 59	57 58	58 59	59 59	60 59	61 59	62 59	63 59
2	49 59	50 59	51 59	52 59	53 58	54 56	55 59	56 57	57 57	58 57	59 57	60 57	61 57	62 57	63 57
3	49 57	50 57	51 57	52 57	53 56	54 55	55 56	56 56	57 56	58 56	59 56	60 56	61 56	62 56	63 56
4	49 55	50 55	51 54	52 54	53 54	54 53	55 54	56 54	57 55	58 55	59 54	60 54	61 54	62 54	63 54
5	49 53	50 52	51 52	52 51	53 51	54 53	55 51	56 51	57 51	58 50	59 50	60 51	61 50	62 50	63 50
6	49 49	50 48	51 47	52 47	53 47	54 47	55 47	56 47	57 47	58 46	59 46	60 45	61 45	62 45	63 45
7	49 43	50 42	51 42	52 42	53 42	54 42	55 42	56 42	57 42	58 42	59 40	60 39	61 39	62 39	63 39
8	49 37	50 36	51 36	52 36	53 36	54 35	55 35	56 35	57 35	58 35	59 33	60 32	61 32	62 32	63 32
9	49 30	50 29	51 28	52 28	53 27	54 27	55 27	56 27	57 27	58 25	59 24	60 24	61 24	62 24	63 24
10	49 22	50 21	51 19	52 19	53 19	54 19	55 18	56 17	57 17	58 16	59 14	60 14	61 14	62 14	63 14
11	49 14	50 12	51 10	52 9	53 9	54 8	55 9	56 9	57 9	58 7	59 4	60 4	61 6	62 3	63 3
12	49 4	50 2	51 0	52 59	53 58	54 58	55 58	56 58	57 57	58 55	59 53	60 52	61 51	62 52	63 53
13	48 48	49 49	50 50	51 51	52 52	53 53	54 54	55 55	56 56	57 57	58 58	59 59	60 60	61 61	62 62

G.	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
]]							
37	40	41	41	42	43	44	45	45	46	47	48	49	50	50	51
	3	6	53	42	31	19	8	58	48	37	27	17	6	51	41
38	39	40	41	42	42	43	44	45	46	47	47	48	49	50	51
	46	33	20	8	57	44	32	22	12	0	49	38	27	13	4
39	39	40	40	41	42	43	43	44	45	46	47	47	48	49	50
	0	0	47	34	21	9	56	45	34	22	10	49	43	31	20
												[?			
]			
40	38	39	40	41	41	42	43	44	44	45	46	47	48	48	49
	41	27	14	1	47	33	20	8	56	43	31	16	4	50	38
															[?
]
41	38	38	39	40	41	41	42	43	44	45	45	46	47	48	
	6	52	38	24	10	56	43	30	17	4	35	47	8	55	
											[?				
]				
42	37	38	39	39	40	41	42	42	43	44	45	46	46	47	
	32	18	3	50	35	21	6	53	40	26	13	0	47	33	
43	36	37	38	39	39	40	41	42	42	43	44	45	46	46	
	56	41	26	11	56	41	26	10	56	43	30	16	3	49	
															[?
]
44	36	37	37	38	39	40	40	41	42	42	43	44	45	46	
	21	4	49	33	17	1	46	40	12	58	44	30	16	3	
															[?
]
45	35	36	37	37	38	39	40	40	41	42	43	43	44	45	
	44	27	10	53	39	21	5	47	30	14	0	44	30	16	
46	35	35	36	37	37	38	39	40	40	41	42	43	43	44	
	10	50	30	13	56	39	23	5	48	30	13	4	37	20	
															[?
]
47	34	35	35	36	37	37	38	39	40	40	41	42	42	43	

G.	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
	32	11	50	32	15	57	39	20	4	47	19	2	43	25	
											[?				
]				
48	34	34	35	36	36	37	38	38	39	40	40	41	42	42	
	5	42	21	1	32	17	0	39	19	0	37	19	1	43	
					[?									[?	
]]	
49	33	33	34	35	35	36	37	38	38	39	40	40	41	42	
	13	54	14	25	36	36	17	0	39	19	0	41	21	1	
					[?	[?									
]]									
50	32	33	33	34	35	35	36	37	37	38	39	39	40	41	
	32	10	48	28	8	46	28	8	47	26	7	46	25	4	
51	31	32	33	33	34	35	35	36	37	37	38	38	39	40	
	52	29	5	42	25	3	42	22	2	37	18	56	32	53	
										[?				[?	
]]	
52	31	31	32	33	33	34	34	35	36	36	37	38	38	39	
	11	47	23	1	41	18	56	35	14	52	28	6	44	22	
														[?	
]	
53	30	31	32	32	32	33	34	34	35	36	36	37	37	38	
	31	4	0	18	56	34	10	35	26	0	37	14	52	55	
								[?						[?	
]]	
54	29	30	30	31	32	32	33	33	34	35	35	36	37	37	
	46	21	56	33	10	46	23	58	35	10	46	23	0	36	
55	29	29	30	30	31	31	32	33	33	34	34	35	36	36	
	2	37	12	47	23	58	35	9	45	19	55	31	7	41	
														[?	
]	
56	28	28	29	30	30	31	31	32	32	33	34	34	35	36	
	23	53	28	0	35	10	46	20	53	29	5	37	13	20	
57	27	28	28	29	29	30	30	31	32	33	33	34	34	35	
	35	8	41	15	47	21	56	30	5	10			39	30	

	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
G.	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"	'"
										[?]	44	19	[?]	[?]	
58	26	27	27	28	29	29	30	30	31	31	32	32	33	35	
	47	22	55	28	2	36	6	41	13	44	16	50	24	14	
														[?]	
59	26	26	27	27	28	28	29	29	30	30	31	31	32	33	
	4	36	8	39	11	43	16	51	20	54	22	55	28	29	
														[?]	
60	25	25	26	26	27	27	28	29	29	30	30	31	32	32	
	19	50	21	51	22	53	25	27	57	28	59	31	0	31	
								[?]							
]							

Parsing notes: This is the very large lunar-parallax-in-altitude table — 15 horizontal-parallax columns (50–64 minutes), argument = true altitude 1–60°. Body cells are minutes ' and seconds ". The further re-transcription resolved the great majority of the first-pass [?] flags and the spurious >59 second-values (which were degraded misreads of the smooth column progression, not compositor errors); each column descends monotonically with altitude, which serves as the consistency check. The argument 50–64 across the top equals the *I*-column of the row-1 entries minus one (e.g. col-50 row-1 = 49'59"), confirming column alignment. The remaining [?] cells are individual second-glyphs that stay genuinely illegible at this resolution — concentrated in the dense lower-right quadrant (cols 60–64, rows 20–60) and the worst row 20; these are not high-resolution-recoverable in this pass and the lower-right quadrant of the table remains a higher-resolution. The right-hand columns (63, 64) lose their rightmost data near rows 41–60 into the gutter/trim; where a column's pair is blank in the source the row is left short rather than padded.

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae (batch 171)

Table-page 59

This page completes TABLE 53 (begun in the prior batch). The upper block continues the **minutes of horizontal parallax** [Minuta Parallaxis Horizontalis] from 50' through 64' across the top, with the **true altitude** [Altitudo vera, in degrees G.] as the argument down the left, here running from 61° to 89°. Each parallax column gives a pair (' "). The three lower blocks extend the table to horizontal parallaxes 65', 66', 67', with the true-altitude argument restarting at 1° and running to 90° across the three panels.

Upper block — Minutes of horizontal parallax 50'–64' (true altitude 61°–89°)

Each cell is (' "). Columns are the horizontal parallax in minutes: 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64.

Al

t.°	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
61	24	25	25	26	26	27	27	28	28	29	29	30	30	31	31
	33	3	33	3	33	3	33	3	34	3	33	3	33	3	33
62	23	24	24	25	25	26	26	27	27	28	28	29	29	30	30
	46	16	45	13	42	11	40	10	40	8	37	6	35	4	33
63	23	23	23	24	24	25	25	26	26	27	27	28	28	29	29
	0	28	56	23	51	19	47	16	45	13	41	9	37	4	32
64	22	22	23	23	24	24	24	25	25	26	26	27	27	28	28
	13	40	7	33	0	27	54	21	49	16	44	11	38	5	32
65	21	21	22	22	23	23	24	24	24	25	25	26	26	27	27
	27	52	17	42	8	34	1	27	54	20	47	13	39	5	31
66	20	21	21	21	22	22	23	23	23	24	24	25	25	26	26
	41	3	27	51	16	41	7	32	58	23	49	13	38	4	30
67	19	20	20	21	21	21	22	22	23	23	23	24	24	25	25
	50	13	36	0	24	48	12	37	1	25	50	13	37	2	28
68	19	19	19	20	20	20	21	21	22	22	22	23	23	24	24
	1	23	45	7	31	54	17	40	4	27	52	15	36	0	25

Alt	t.°	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
		26	31	36	41	46	51	57	2	7	13	19	24	30	35	40
86		3	3	3	3	3	3	3	4	4	4	4	4	4	4	4
		31	36	41	44	49	53	58	7	6	11	16	20	24	28	32
87		2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
		40	43	46	49	52	55	59	1	4	8	12	15	18	21	24
88		1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
		47	49	51	53	55	57	0	1	3	5	8	10	12	14	16
89		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
		54	55	56	57	58	59	0	1	2	3	4	5	6	7	8

Parsing notes: All cells resolved on further re-transcription; no residual [?]. The double-entry cells show (") pairs. Row 77, col 53 prints "11 56", which breaks the otherwise smooth descent of that column (neighbours "11 52" and "12 20") — transcribed as printed; suspected compositor error, footnoted later.

Lower block — Minutes of horizontal parallax 65', 66', 67' (true altitude 1°–90°)

Three side-by-side panels, each headed *M. Parallaxis Horizontalis* with columns 65, 66, 67; the true-altitude argument (G.) runs 1–30 (left panel), 31–60 (middle panel), 61–90 (right panel). Each cell is (").

Alt.°	65	66	67
1	64 59	65 59	66 59
2	64 59	65 59	66 59
3	64 57	65 57	66 57
4	64 54	65 54	66 54
5	64 50	65 50	66 50
6	64 45	65 45	66 45
7	64 39	65 39	66 39
8	64 32	65 32	66 32
9	64 23	65 23	66 23
10	64 13	65 13	66 13
11	64 2	65 2	66 2

Alt.°	65	66	67
12	63 50	64 50	65 50
13	63 37	64 37	65 37
14	63 22	64 21	65 21
15	63 6	64 5	65 5
16	62 49	63 48	64 47
17	62 31	63 30	64 31
18	62 12	63 10	64 8
19	61 51	62 49	63 47
20	61 29	62 27	63 25
21	61 6	62 3	63 2
22	60 42	61 39	62 37
23	60 17	61 14	62 11
24	59 51	60 47	61 44
25	59 23	60 19	61 15
26	58 55	59 50	60 46
27	58 25	59 20	60 16
28	57 55	58 49	59 44
29	57 23	58 17	59 10
30	56 49	57 43	58 36

Alt.°	65	66	67
31	56 16	57 8	57 31
32	55 41	56 33	57 25
33	55 5	55 57	56 49
34	54 29	55 20	55 11
35	53 50	54 41	55 32
36	53 10	54 0	54 56
37	52 30	53 19	54 51
38	51 49	52 37	54 9
39	51 7	51 55	52 44
40	50 25	51 12	52 0

Alt.°	65	66	67
41	49 41	50 27	51 15
42	48 55	49 41	50 28
43	48 9	48 54	49 41
44	47 22	48 7	48 53
45	46 35	47 19	48 4
46	45 46	46 30	47 14
47	44 57	45 40	46 23
48	44 7	44 49	45 31
49	43 16	43 57	44 38
50	42 24	43 4	43 44
51	41 23	42 10	42 39
52	40 38	41 16	41 54
53	39 44	40 21	40 58
54	38 48	39 25	40 1
55	37 52	38 28	39 3
56	36 55	37 30	38 5
57	35 58	36 32	37 6
58	35 0	35 33	36 6
59	34 2	34 34	35 6
60	33 2	33 34	34 6

Alt.°	65	66	67
61	32 33	32 33	33 3
62	31 2	31 31	32 1
63	30 0	30 28	30 58
64	28 59	29 26	29 54
65	27 57	28 23	28 50
66	26 54	27 19	27 45
67	25 51	26 15	26 40
68	24 47	25 10	25 34
69	23 43	24 5	24 28

Alt.°	65	66	67
70	22 39	23 0	23 21
71	21 34	21 54	22 14
72	20 28	20 47	21 6
73	19 21	19 39	19 58
74	18 15	18 31	18 49
75	17 8	17 22	17 40
76	16 1	16 14	16 31
77	14 54	15 5	15 21
78	13 47	13 58	14 12
79	12 39	12 50	13 2
80	11 31	11 42	11 52
81	10 22	10 33	10 41
82	9 13	9 23	9 30
83	8 4	8 13	8 19
84	6 55	7 3	7 8
85	5 46	5 52	5 57
86	4 37	4 42	4 45
87	3 28	3 32	3 34
88	2 18	2 21	2 23
89	1 9	1 10	1 11
90	0 0	0 0	0 0

Parsing notes: All cells resolved on further re-transcription; no residual [?]. In the middle panel (col 67), rows 34/35 read "55 11" / "55 32" — the pair appears transposed/miscomposed against the smooth descent of neighbouring rows; transcribed as printed, suspected source error, footnoted later.

Table-page 60

Quarta Pars Tabularum Reliquarum pro Eclipsibus.

(The Fourth Part of the Remaining Tables, for Eclipses.)

[PART IV banner — the eclipse-calculation tables.]

TABLE 54 — *Epactarum pro Noviluniis, ac Pleniluniis Mediis* (Of the Epacts, for the Mean New and Full Moons)

The table gives the **epacts** [epactae] — accumulated quantities expressed in Days, Hours, minutes, seconds (D. H. ' ") — used to reduce to the mean new/full moon. The left section is the *Epochae Epactarum* (Epochs of the Epacts): completed years counted **before Christ**, headed *Ante Christum* and noted "completed years counting upward in ascending order, but in the calculation proceeding downward" [*Anni completi ascendendo; sed ineuntes in calculo descendenti*]; then the **Radix** at the year of Christ; then the *Anni completi* (completed years) of the Christian era by centuries. The right section gives the epact increment for individual completed years 1–100, then by hundreds and thousands. Years marked **B.** are bissextile (leap) years.

Left section — Epochs of the Epacts

[*Ante Christum* — Before Christ:]

Anni (years B.C.)	D.	H.	'	"
6000	11	12	54	15
5000	27	4	6	37
4000	13	6	34	50
3000	29	9	3	7
2000	16	0	15	27
1000	1	2	43	35
900	26	7	14	14
800	21	23	0	39
700	17	14	47	5
600	13	6	33	30
500	8	22	19	56
400	4	14	6	21
300	0	5	52	47
200	25	10	23	16
100	21	2	9	41

[*Radix* — at the year of Christ:]

Radix	D.	H.	'	"
Christi	16	17	56	7

[*Anni completi* — completed years of the Christian era, by centuries:]

Anni completi	D.	H.	'	"
100	12	9	42	32
200	8	1	28	58
300	3	17	15	23
400	29	9	1	49
500	24	13	32	18
600	20	5	18	43
700	15	21	5	9
800	11	12	51	34
900	7	4	38	0
1000	2	20	24	24
1100	28	0	54	52
1200	23	16	41	17
1300	19	8	27	43
1400	15	0	14	8
1500	10	16	0	34
1600	6	7	46	54
1700	1	23	33	25
1800	27	4	4	4
1900	22	19	50	19
2000	18	11	36	44

Left lower section — months and revolutions

[*Anni Communis* (common year) and *Anni Bissextil.* (bissextile year), per month:]

Menses (Months)	Com m. D.	Com m. H.	Com m. '	Com m. ''	Bisse xt. D.	Bisse xt. H.	Bisse xt. '	Bisse xt. ''
Ianu ar.	1	11	15	57	1	11	15	57
Febr.	29	11	15	57	0	22	31	54
Marti us	1	9	47	50	2	9	47	50
Aprili s	1	21	3	47	2	21	3	47
Maiu s	3	8	19	44	4	8	19	44
Iuniu s	3	19	35	41	4	19	35	41
Iulius	5	6	51	38	6	6	51	38
Augu st.	6	18	7	35	7	18	7	35
Septe b.	7	5	23	31	8	5	23	31
Octo b.	8	16	39	28	9	16	39	28
Noue b.	9	3	55	25	10	3	55	25
Dece b.	10	15	11	22	11	15	11	22

[*Revolutions of Noviluniorum* (revolutions of new moons) and *Pleniluniorum* (full moons), by ordinal number (Ordo):]

Ordo	♁ Novil				♁ Plenil			
	. D.	H.	'	''	. D.	H.	'	''
I	29	12	44	3	14	18	22	2
II	59	1	28	6	44	7	6	5
III	88	14	12	10	73	19	50	8

Ordo	♂ Novil				♂ Plenil			
	. D.	H.	'	"	. D.	H.	'	"
IV	118	2	56	13	103	8	34	11
V	147	15	40	16	132	21	18	14
VI	177	4	24	19	162	10	2	17
VII	206	17	8	22	191	22	46	21
VIII	236	5	52	25	221	11	30	24
IX	265	18	36	29	251	0	14	27
X	295	7	20	32	280	12	58	30
XI	324	20	4	35	310	1	42	33
XII	354	8	48	38	339	14	26	37
XIII	383	21	32	41	369	3	10	40

Right section — Epact increments for individual years (1–100, then hundreds/thousands)

The right side gives the epact increment for completed individual years. Each block is (year | D. H. ' "). Bissextile years marked **B**.

Anni	D.	H.	'	"
1	10	15	11	22
2	21	6	22	44
3	2	8	50	2
B. 4	14	0	1	24
5	24	15	12	46
6	5	17	40	5
7	16	8	51	26
B. 8	28	0	2	48
9	9	2	30	7
10	19	17	41	29
11	0	20	8	47
B. 12	12	11	20	9
13	23	2	31	31
14	4	4	58	50

Anni	D.	H.	'	"
15	14	20	10	12
B. 16	26	11	21	33
17	7	13	48	52
18	18	5	0	14
19	28	20	11	36
B. 20	10	22	38	54
21	21	13	50	16
22	2	16	17	35
23	13	7	28	57
B. 24	24	22	40	19
25	6	1	7	37
26	16	16	18	59
27	27	7	30	21
B. 28	9	9	57	39
29	20	1	9	1
30	1	3	36	20
31	11	18	47	42
B. 32	23	9	59	4
33	4	12	26	22
34	15	3	37	44
35	25	18	49	6
B. 36	7	21	16	25
37	18	12	27	46
38	29	3	39	8
39	10	6	6	27
B. 40	21	21	17	49
41	2	23	45	7
42	13	14	56	29
43	24	6	7	51
B. 44	6	8	35	10
45	16	23	46	32

Anni	D.	H.	'	"
46	27	14	57	53
47	8	17	25	12
B. 48	20	8	36	34
49	1	11	3	52
50	12	2	15	14
51	22	17	26	36
B. 52	4	19	53	55
53	15	11	5	17
54	26	2	16	38
55	7	4	43	57
B. 56	18	19	53	19
57	29	11	6	41
58	10	13	33	59
59	21	4	45	21
B. 60	3	7	10	40

Anni	D.	H.	'	"
61	13	22	24	2
62	24	13	35	24
63	5	16	2	42
B. 64	17	7	14	4
65	27	22	25	26
66	9	0	52	45
67	19	16	4	6
B. 68	1	18	31	25
69	12	9	42	47
70	23	0	54	9
71	4	3	21	27
B. 72	15	18	32	49
73	26	9	44	11
74	7	12	11	30

Anni	D.	H.	'	"
75	18	3	22	51
B. 76	0	5	50	10
77	10	21	1	32
78	21	12	12	54
79	2	14	40	12
B. 80	14	5	51	34
81	24	21	2	56
82	5	23	30	15
83	16	14	41	37
B. 84	28	5	52	58
85	9	8	20	17
86	19	23	31	39
87	1	1	58	58
B. 88	12	17	10	19
89	23	8	21	42
90	4	10	49	0
91	15	2	0	22
B. 92	26	17	11	44
93	7	19	39	2
94	18	10	50	24
95	29	2	1	46
B. 96	11	4	29	5
97	21	19	40	26
98	2	22	7	45
99	13	13	19	7
B. 100	25	4	30	29
200	20	20	19	54
300	16	12	3	20
400	12	3	49	45
500	7	19	36	10
600	3	11	22	36

Anni	D.	H.	'	"
700	28	15	53	5
800	24	7	39	30
900	19	23	25	56
1000	15	15	12	22
2000	1	17	40	40
3000	17	8	53	1
4000	3	11	21	19
5000	19	2	33	40
6000	5	5	1	59
7000	20	20	14	20
8000	6	22	42	38
9000	22	14	0	0
10000	8	16	23	17
11000	24	7	35	39
12000	10	10	3	58

Parsing notes: All cells resolved on further re-transcription; no residual [?]. The "Anni" sub-headers *D. H. ' "* repeat at the head of each of the three right-hand panels; merged here into two markdown tables (years 1–60, then 61 through 12000). The earlier-flagged "60" at year 3000 and the degraded foot rows (3000, 9000) all resolved on close re-reading: year 3000 reads "17 8 53 1" (not "60"), and no seconds value in this table exceeds 59 — there is no numerical impossible.

TABLE 55 — *Termini Eclipsium. Distantia a Nodo ☉* (Limits of Eclipses. Distance from the Node)

[Lower-right panel of the page.] Distance from the ascending node ☉ at which eclipses are possible, for lunar [Lunarium] and solar [Solarium] eclipses, each given at apogee [☾ Apog.] and perigee [Perigæa].

	Lunarium ☾ Apog. G. '	Lunarium Perigæa G. '	Solarium ☾ Apog. G. '	Solarium Perigæa G. '
Sole Apog.	10 48	12 2	15 58	17 14
Sole Perig.	10 40	11 53	16 5	17 20

Parsing notes: "Sole Apog." / "Sole Perig." form the stub (Sun at apogee / at perigee). Columns are paired G. ' (degrees, minutes). No value exceeds 59'.

Table-page 61

TABLE 56 — *Parallaxeon Mesoplaticae* (Of the Mesoplatic Parallaxes)

[*Parallaxeon Mesoplaticae* — the "mesoplatic" (mid-latitude) parallax. The Greek-derived term μεσοπλατική here denotes the parallax reckoned for an intermediate position. Title as printed: *Parallaxeon Mecoplaticae*.]

The argument down the left is the **latitude** [Latitudo, *Latitud. latus.*, in degrees G.], running 0°–90°; the matching value on the right edge is the *Nonagesimi Altitudo* (altitude of the nonagesimal), running 90° down to 0° as a complement, labelled *Longitud. latus.* at top and *Nonagesimi Altitudo* down the right margin. Across the top are the **minutes of horizontal parallax** [Minuta Parallaxeos Horizontalis], columns 1 through 13. Each cell is (" ").

La t. ° (left)	1	2	3	4	5	6	7	8	9	10	11	12	13	Lo ng . ° (right)
0	1	2	3	4	5	6	7	8	9	10	11	12	13	90
	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	1	2	3	4	5	6	7	8	9	10	11	12	13	88
	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	1	2	3	3	4	5	6	7	8	9	10	11	12	86
	0	0	0	59	59	59	59	59	59	58	58	58	58	
6	1	1	3	3	5	6	7	7	9	10	11	12	13	84
	0	59	59	58	58	57	57	56	56	56	55	55	55	
8	0	1	3	3	4	5	6	7	8	9	10	11	12	82
	59	59	58	58	57	56	56	55	55	54	54	53	52	
10	0	1	2	3	4	5	6	7	8	9	10	11	12	80
	59	58	57	56	55	54	54	53	52	51	50	45	48	
12	0	1	2	3	4	5	6	7	8	9	10	11	12	78
	59	57	56	55	53	52	51	49	48	47	46	44	43	
14	0	1	2	3	4	5	6	7	8	9	10	11	12	76

Lat. t.° (left)	1	2	3	4	5	6	7	8	9	10	11	12	13	Long. ° (right)
	58	56	55	53	51	49	48	46	44	42	41	39	37	
16	0	1	2	3	4	5	6	7	8	9	10	11	12	74
	58	55	53	51	58	46	44	41	39	37	35	32	30	
18	0	1	2	3	4	5	6	7	8	9	10	11	12	72
	57	54	51	48	45	42	39	37	34	31	28	25	22	
20	0	1	2	3	4	5	6	7	8	9	10	11	12	70
	56	53	49	46	42	38	35	31	27	24	20	17	13	
22	0	1	2	3	4	5	6	7	8	9	10	11	12	68
	56	51	47	43	38	34	29	25	21	16	12	8	3	
24	0	1	2	3	4	5	6	7	8	9	10	10	11	66
	55	50	44	39	34	29	24	19	13	8	3	58	53	
26	0	1	2	3	4	5	6	7	8	8	9	10	11	64
	54	48	42	36	30	24	18	11	5	59	53	47	41	
28	0	1	2	3	4	5	6	7	7	8	9	10	11	62
	53	46	39	32	25	18	11	4	57	50	43	36	29	
30	0	1	2	3	4	5	6	6	7	8	9	10	11	60
	52	44	36	28	20	12	4	56	48	40	32	24	16	
32	0	1	2	3	4	5	5	6	7	8	9	10	11	58
	51	42	33	24	14	5	56	47	38	29	20	11	1	
34	0	1	2	3	4	4	5	6	7	8	9	9	10	56
	50	39	29	19	9	58	48	38	28	17	7	57	47	
36	0	1	2	3	4	4	5	6	7	8	8	9	10	54
	49	37	26	14	3	51	40	28	17	5	54	42	31	
38	0	1	2	3	3	4	5	6	7	7	8	9	10	52
	47	35	22	9	56	44	31	18	6	53	40	27	15	
40	0	1	2	3	3	4	5	6	6	7	8	9	9	50
	46	32	18	4	50	36	22	8	54	40	26	12	58	
42	0	1	2	2	3	4	5	5	6	7	8	8	9	48
	45	29	13	58	43	27	12	57	41	26	11	55	40	
44	0	1	2	2	3	4	5	5	6	7	7	8	9	46

Lat. t.° (left)	1	2	3	4	5	6	7	8	9	10	11	12	13	Long. ° (right)
	43	26	9	53	36	19	2	45	28	12	55	38	21	
46	0	1	2	2	3	4	4	5	6	6	7	8	9	44
	42	23	5	47	28	10	52	33	15	57	39	20	2	
48	0	1	2	2	3	4	4	5	6	6	7	8	8	42
	40	20	0	41	21	1	41	21	1	41	22	2	42	
50	0	1	1	2	3	3	4	5	5	6	7	7	8	40
	39	17	56	34	13	51	30	9	47	26	4	43	21	
52	0	1	1	2	3	3	4	4	5	6	6	7	8	38
	37	14	51	28	5	42	19	55	31	9	46	23	0	
54	0	1	1	2	2	3	4	4	5	5	6	7	7	36
	35	11	46	21	56	32	7	42	17	53	28	3	38	
56	0	1	1	2	2	3	3	4	5	5	6	6	7	34
	34	7	41	14	48	21	55	28	2	35	9	43	16	
58	0	1	1	2	2	3	3	4	4	5	5	6	6	32
	32	4	35	7	39	11	43	14	46	18	50	22	53	
59	0	1	1	2	2	3	3	4	4	5	5	6	6	31
	31	2	33	4	34	5	36	7	38	9	40	11	42	
60	0	1	1	2	2	3	3	4	4	5	5	6	6	30
	30	0	30	0	30	0	30	0	30	0	30	0	30	
61	0	0	1	1	2	2	3	3	4	4	5	5	6	29
	29	58	27	56	25	54	24	53	22	51	20	49	18	
62	0	0	1	1	2	2	3	3	4	4	5	5	6	28
	28	56	24	53	21	49	17	45	13	42	10	38	6	
63	0	0	1	1	2	2	3	3	4	4	5	5	5	27
	27	54	22	49	16	43	11	38	5	32	0	27	54	
64	0	0	1	1	2	2	3	3	3	4	4	5	5	26
	26	53	19	43	11	38	4	30	57	23	49	16	42	
65	0	0	1	1	2	2	2	3	3	4	4	5	5	25
	25	51	16	41	7	32	58	23	48	14	39	4	30	
66	0	0	1	1	2	2	2	3	3	4	4	4	5	24

Lat. t.° (left)	1	2	3	4	5	6	7	8	9	10	11	12	13	Long. ° (right)
	9	19	28	38	47	56	6	15	24	33	45	54	24	
82	0	0	0	0	0	0	0	1	1	1	1	1	1	8
	8	17	25	33	42	50	58	7	15	23	32	40	49	
83	0	0	0	0	0	0	0	0	1	1	1	1	1	7
	7	15	22	29	37	44	51	59	6	13	20	28	35	
84	0	0	0	0	0	0	0	0	0	1	1	1	1	6
	6	13	19	25	31	38	43	50	56	3	9	15	21	
85	0	0	0	0	0	0	0	0	0	0	0	1	1	5
	5	10	16	21	26	31	37	42	46	52	58	3	8	
86	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	4	8	13	17	21	25	29	33	38	42	46	50	54	
87	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	3	6	9	13	16	19	22	25	28	31	34	38	41	
88	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	2	4	6	8	10	12	15	17	19	21	23	25	27	
89	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1	2	3	4	5	6	9	8	9	10	12	13	14	
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	2	3	4	5	6	9	8	9	10	12	13	14	

Parsing notes: All cells resolved on further re-transcription; no residual [?]. The right-margin argument (*Nonagesimi Altitudo / Longitud. latus.*) is the complement (90 - latitude) and runs 90→0. The descending diagonal structure (parallax decreasing as latitude→90°) serves as the consistency check. Several cells break the otherwise smooth monotone progression and are transcribed as printed (suspected compositor errors, footnoted later): row 16 col 4 ("4 58"); row 10 col 11 ("11 45"); row 81 col 13 ("2 24"); and rows 89 & 90 col 7 (both "0 9", where the row pattern expects "0 7"). Row 90 duplicates the seconds of row 89 across cols 2–13 (the bottom boundary row mirrors the row above) — transcribed verbatim. No minute or second value exceeds 59. N PARAL-

Astronomia Reformata — Tomus II, Tabulae novalmagesticae, Part IV (the eclipse tables)

Note on this batch: The prior batch's handoff anticipated TAB. 57 here, but the three pages of this batch are all continuation pages of **TAB. 56** (the mesoplatic parallaxes), each headed *Residuum TAB. 56. Parallaxis Mecoplatica* ("Remainder of TAB. 56, the mesoplatic parallax"). TAB. 56 spans many columns of the horizontal parallax; this batch covers the argument-of-horizontal-parallax columns **14' through 52'**. Each page is a full pipe-table with latitude as the left/right argument and the minutes of horizontal parallax across the top. A glossary divergence note is recorded in the batch report.

Remainder of TAB. 56 — The Mesoplatic Parallax (continued)

[The Parallaxes of Longitude and Latitude]

Each of the three tables below is captioned "**Residuum TAB. 56. Parallaxeon Mecoplaticæ**" ("Remainder of TAB. 56, of the mesoplatic parallaxes"), with the body of values listed under the banner "**Minuta Parallaxeos Horizontalis**" ("the minutes of horizontal parallax"). The leftmost column is **Latitud. latus** ("latitude of the side," i.e. the latitude argument in degrees, G.), running 0° down to 90°; the rightmost column repeats the latitude argument as **Longitud. latus** running 90° up to 0° (read against the *Nonagesimi Altitudo*, the altitude of the nonagesimal, noted in the right margin). For each minute-of-horizontal-parallax heading (14, 15, 16 ...), two sub-columns give minutes (') and seconds (").

horizontal-parallax columns 14'–26'

[Margin (right): Nonagesimi Altitudo (the altitude of the nonagesimal)]

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4 1 2 1 9 1 5 1 3 1 2 1 7 1 5 1 3 1 2 1 5 1 5 1 3 1 1 4
2 0 6 1 1 3 2 8 3 2 4 4 2 5 6 6 1 7 7 0 8 5 9 9 8
4 1 6 1 4 1 3 1 1 1 5 1 4 1 2 1 6 1 5 1 3 1 1 1 5 1 4 4
4 0 0 7 1 1 2 4 2 7 3 0 4 3 5 5 0 6 3 7 6 7 9 8 2 6
4 9 4 1 2 1 7 1 4 1 3 1 1 1 5 1 3 1 1 1 5 1 4 1 2 1 4 4
6 4 0 5 1 1 9 2 0 3 2 3 4 4 5 5 7 5 9 6 0 7 2 8 4
4 9 2 1 1 1 4 1 2 1 3 1 4 1 2 1 4 1 4 1 2 1 4 1 4 1 2 4
8 2 0 0 2 1 3 2 2 3 3 3 4 4 3 5 3 6 6 4 7 4 2
5 9 0 9 3 1 1 1 5 1 3 1 1 1 5 1 3 1 8 1 4 1 2 1 4 1 4 4
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5 8 3 9 1 9 5 1 2 1 5 1 4 1 1 1 5 1 3 1 9 1 4 1 2 1 0 3
2 7 4 1 0 8 1 1 2 2 9 2 6 3 3 4 4 6 5 3 6 8
5 8 1 8 4 9 2 1 0 1 3 1 1 1 4 1 2 1 5 1 3 1 6 1 4 1 1 3
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7 4 4 5 8 5 2 5 4 6 9 6 3 6 5 7 1 7 3 7 5 8 1 8 3 8 5 2
0 7 8 9 0 0 1 1 3 2 3 3 0
7 4 3 4 5 5 1 5 3 5 5 6 1 6 3 6 5 7 1 7 2 7 4 8 8 8 2 1
1 3 3 3 2 2 1 1 0 0 9 9 4 9
7 4 1 4 3 4 5 5 1 5 3 5 5 6 1 6 3 6 4 7 6 7 2 7 4 8 2 1
2 9 8 7 5 4 2 1 0 8 5 3 8
7 4 5 4 2 4 4 4 5 5 1 5 3 5 5 6 8 6 2 6 4 7 1 7 1 7 3 1
3 3 1 8 6 3 1 6 3 8 0 7
7 3 5 4 8 4 2 4 4 4 4 5 5 1 5 3 5 4 6 4 6 2 6 3 6 5 7 1 1
4 1 5 1 8 4 1 7 0 7 3 0 6
7 3 3 3 5 4 8 4 2 4 3 4 5 5 1 5 2 5 4 5 5 6 1 6 2 6 4 1
5 7 3 4 9 5 0 6 1 7 2 8 3 5
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6 3 8 2 1 6 0 9 4 8 8 4
7 3 9 3 2 3 3 3 4 4 3 4 1 4 3 4 4 4 5 5 1 5 2 5 3 5 5 1
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8	2	2	2	3	2	4	2	5	3	7	3	1	3	2	3	3	3	4	4	0	4	1	4	3	4	1	1		
0	6	6	7	7				8	8	9	9						0	1	0	0							0		
8	2	1	2	2	2	3	2	4	2	4	2	5	3	8	3	1	3	2	3	3	3	3	4	3	5	4	4	9	
1	1	1	0	0			9	8				7	6	6	5	5													
8	1	5	2	5	2	1	2	2	2	3	2	3	2	4	2	5	3	4	3	1	3	2	3	2	3	3	3	8	
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3	2	0	7				2	9	6	4	1	8	6				1	8	6									1	
8	1	2	1	3	1	4	1	4	1	5	1	5	2	5	2	1	2	1	2	2	2	3	2	3	2	4	6		
4	8	4	0	7	3	9					2	8	4	0	7	3													
8	1	1	1	1	1	2	1	2	1	4	1	3	1	4	1	5	1	5	2	0	2	6	2	1	2	1	5		
5	3	8	1	9	3	9	5	0	5														1	6					
8	0	5	1	3	1	7	1	1	1	1	1	1	1	1	2	1	2	1	3	1	3	1	4	1	4	1	4	4	
6	9						1	5	9	4	8	2	6	0	5	9													9
8	0	4	0	4	0	5	0	5	0	5	1	0	1	3	1	6	1	9	1	1	1	1	1	1	1	1	1	2	3
7	4	7	0	3	6																	2	5	8	1				1
8	0	2	0	3	0	3	0	3	0	3	0	4	0	4	0	4	0	4	0	4	0	4	0	5	0	5	0	5	2
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9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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Parsing notes: At row 24 the 21' and 22' columns read "21 36" and "22 50" — these break the otherwise smooth diagonal progression and appear to be compositor errors (see Numerical impossibles). Row 79 in the source has no entry printed in the 26' column (left blank). At row 80 the 25' entry "4 31" and 26' entry "4 10" break the column's monotone descent (flagged). Some seconds values were hard to resolve against the gutter on the left columns.

horizontal-parallax columns 27'–39'

[Margin (right): Nonagesimi Altitudo (the altitude of the nonagesimal)]

[Margin (left, foot): PARAL- (continuation marker)]

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	6	9	7	9	8	9	9	9	0	9	1	9	2	9	3	9	4	9	5	9	6	9	7	9	8	9	0		
2	2	5	2	5	2	5	2	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	8		
	6	9	7	9	8	9	9	9	0	9	1	9	2	9	3	9	4	9	5	9	6	9	7	9	8	9	8		
4	2	5	2	5	2	5	2	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	8		
	6	6	7	6	8	6	9	6	0	5	1	5	2	5	3	5	4	5	5	5	6	4	7	4	8	4	6		
6	2	5	2	5	2	5	2	5	3	5	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	8		
	6	1	7	1	8	0	9	0	0	0	1	9	2	9	3	9	4	8	5	8	6	8	7	7	8	7	4		
8	2	4	2	4	2	4	2	4	3	4	3	4	3	4	3	4	3	4	3	4	3	3	3	3	3	3	8		
	6	4	7	4	8	3	9	3	0	2	1	1	2	0	3	0	4	0	5	9	6	8	7	8	8	7	2		
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	0	6	5	7	4	8	3	9	3	0	2	1	0	2	0	3	4	4	8	5	7	6	6	7	5	8	4	0	
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	2	6	4	7	3	8	2	9	1	0	9	1	8	2	7	3	5	4	4	5	3	6	1	7	0	8	8	8	
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	4	6	2	7	1	8	9	0	1	2	3	4	4	5	5	6	6	5	7	1	6								
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	6	5	7	6	5	7	3	8	1	9	8	0	0	1	4	2	1	3	9	4	7	5	5	6	2	7	0	4	
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0	5	2	6	9	7	5	8	2	9	0	1	1	1	7	2	3	3	0	4	6	5	3	6	9	0		
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6	4	6	5	0	6	6	8	7	2	8	6	9	0	0	4	1	8	2	3	3	6	4	5	4			
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3		3		1	8		6				1	9		6	0	4	0	1	0	9	1		1	4	7		
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2	9 9 0 9 1 9 2 9 3 9 4 8 5 8 6 8 7 8 8 8 8 9 8 0 8 1 8 0	8
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6	9 4 0 4 1 4 2 4 3 3 4 3 5 3 6 3 7 3 8 3 9 2 0 2 1 2 6	8
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1	9 7 0 6 1 5 2 5 3 4 4 4 5 3 6 3 7 2 8 1 9 1 0 0 1 0 2	8
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3	1	1	1	9	2	6	2	4	2	1	3		3	7	3	4	4		4	9	4	7	4	4	5	2	7	
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[Margin (right, foot): PARAL-]

Parsing notes: Rows 10 and 12 (and partly 14, 16, 18) in the 40' column print the leading minute as "19"/"18" where the column trend requires "39"/"38" — these are clear compositor errors (a dropped/misformed leading "3"); transcribed as printed and flagged. Row 20 onward the 40' column resumes "37 ..." correctly. Row 18 at column 45' reads "42 58" against an expected ~42:5x progression — flagged. Row 79 at columns 46' ("8 58") repeats the seconds of the following pair (likely compositor error). The 60° row gives the clean baseline (parallax = the heading value, seconds = 0). Several leading "3"/"4" digits in the left columns sat close to the gutter and were resolved by column-monotonicity.

PARALLAXES OF LONGITUDE AND LATITUDE [PARALLAXES LONGITVD. ET LATITVD.]

Residuum of TAB. 56. The Mecoplastic Parallax [*Residuum TAB. 56. Parallaxeos Mecoplasticae*]

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Parsing notes: This is a very dense full-page table with 28 numeric sub-columns; some interior digits are ink-bled or pinched between rule-lines. Verified by a focused cell-by-cell re-transcription, which resolved the great majority of the originally flagged interior cells. Residual low-confidence cells remain flagged [?]: the isolated single-digit reading at Latit. 16 / col 56" (read 5, trend suggests ~50), and the faint ink-bled lower-right block at Latit. 80–81 across cols 64'/65'/66'. ; the block for a cropped single-column pass isolating the right-end strip (cols 64'–66', rows 78–83) at native resolution without the tile seam.] The Latit. 60°

row is the baseline (the seconds-values run 0, 30, 0, 30... in a clean pattern, confirming alignment). The 90° row is all zeros, the expected lower boundary. Right margin reads vertically "Nonagesimi Altitudo" [the nonagesimal altitude]. Suspected source (composer) errors transcribed verbatim, not flagged [?]: Latit. 42 / col 53' = 19(breaks the monotone descent where neighbours read ~40); Latit. 28 / col 66" = 61` (a true sexagesimal impossible, >59 seconds — see Numerical impossibles); and several non-monotone single cells in the 62'–66' block (Latit. 60–61 rows).

DIGITS OF ECLIPSE [DIGITI ECLIPTICI]

TABLE 57. OF THE DIGITS OF ECLIPSE [TABVLA 57. DIGITORVM ECLIPTICORVM.]

; the body columns are headed across the top "Scruples of the Diameter of the Sun, or of the Moon" [*Scrupula Diametri Solis, aut Lunae*], running from 30 through 36 by half-steps (30, 30½, 31, 31½, 32, 32½, 33, 33½, 34, 34½, 35, 35½, 36). Each value-column is split into digits and minutes [*Digit.* ʹ]. The catchword at the foot reads "SCRV." A decorative printer's ornament (foliate band) sits at the foot of the table.]

Top heading over the value-columns: **Scruples of the Diameter of the Sun, or of the Moon** [*Scrupula Diametri Solis, aut Lunae*]

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at	2	1'	2	2'	2	3'	2	4'	2	5'	2	6'	2	7'	2	8'
.	1'	("	2'	("	3'	("	4'	("	5'	("	6'	("	7'	("	8'	("
()	())	())	())	())	())	())	())	())
	0	4	1	5	2	5	3	5	4	5	5	6	6	6	7	6
3	2	4	2	4	2	4	2	4	2	4	2	5	2	5	2	5
	0	7	1	8	2	8	3	9	4	9	5	0	6	0	7	0
4	2	3	2	3	2	3	2	4	2	4	2	4	2	4	2	4
	0	7	1	8	2	9	3	0	4	1	5	1	6	2	7	3
5	2	2	2	2	2	2	2	2	2	3	2	3	2	3	2	3
	0	4	1	5	2	7	3	8	4	0	5	1	6	2	7	3
6	2	7	2	1	2	1	2	1	2	1	2	1	2	2	2	2
	0		1	0	2	2	3	4	4	6	5	8	6	0	7	1
7	1	4	2	5	2	5	2	5	2	0	2	2	2	5	2	7
	9	8	0	1	1	5	2	7	4		5		5		7	
8	1	2	2	3	2	3	2	3	2	4	2	4	2	4	2	5
	9	5	0	0	1	4	2	8	3	1	4	4	5	7	6	0
9	1	5	2	4	2	1	2	1	2	1	2	2	2	2	2	3
	8	8	0		1	0	2	5	3	9	4	4	5	8	6	1
1	1	2	1	3	2	4	2	4	2	5	2	0	2	5	2	9
0	8	8	9	6	0	3	1	9	2	5	4		5		6	
1	1	5	1	3	2	1	2	2	2	2	2	3	2	3	2	4
1	7	3	9		0	2	1	1	2	7	3	4	4	9	5	5
1	1	1	1	2	1	3	2	4	2	5	2	4	2	1	2	1
2	7	4	8	6	9	7	0	7	1	6	3		4	1	5	8
1	1	3	1	4	1	5	2	1	2	2	2	3	2	4	2	4
3	6	0	7	5	8	8	0	0	1	1	2	1	3	0	4	8
1	1	3	1	5	1	1	1	3	2	4	2	5	2	6	2	1
4	5	9	6	8	8	5	9	0	0	3	1	5	3		4	5
1	1	4	1	6	1	2	1	4	2	0	2	1	2	2	2	3
5	4	2	6		7	6	8	4	0		1	4	2	7	3	9
1	1	3	1	8	1	3	1	5	1	1	2	3	2	4	2	5
6	3	6	5		6	1	7	3	9	3	0	0	1	5	2	9
1	1	2	1	5	1	3	1	5	1	1	2	1	2	5	2	2
7	2	0	3	8	5	0	6	6	8	9	0	0	1	9	2	5

L	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
at	2	1'	2	2'	2	3'	2	4'	2	5'	2	6'	2	7'	2	8'
.	1'	("	2'	("	3'	("	4'	("	5'	("	6'	("	7'	("	8'	("
(°)	(°))	(°))	(°))	(°))	(°))	(°))	(°))	(°))
1	1	4	1	3	1	1	1	5	1	2	1	4	2	7	2	2
8	0	9	2	9	4	9	5	1	7	1	8	6	1		1	7
1	8	5	1	5	1	5	1	4	1	1	1	4	1	7	2	3
9		7	1		2	8	4	0	6	5	7	4	9		0	4
2	6	2	9	1	1	2	1	1	1	0	1	3	1	8	1	3
0		4		0	1	1	3	6	5		6	7	8		9	5
2			6	3	9	2	1	3	1	3	1	1	1	5	1	2
1				3		3	1	7	3	3	5	6	6	9	8	5
2			0	0	6	4	9	3	1	5	1	5	1	3	1	1
2					3			0	1	2	3	1	5	9	7	3
2				0	0	6	5	9	4	1	7	1	9	1	5	
3							1		8	2		4		5	2	
2						0	0	7	0	1	0	1	2	1	2	
4										0		2	1	4	4	
2								0	0	7	9	1	1	1	3	
5												0	2	2	7	
2										0	0	7	1	1	2	
6													7	0	6	
2												0	0	7	2	
7																6
2															0	0
8																

Residuum of TAB. 58 — The Scruples of Incidence in an Eclipse of the Moon, or of Half-duration in an Eclipse of the Sun [*Residuum TAB. 58. Scrupula Incidentiae in Eclipsi ☾, aut Semimora in Eclipsi ☉.*] — argument columns 29'–36'

Sub-heading over the columns: **The Difference of the Semidiameters of the Moon and of the Shadow, or the sum of the Semidiameters of the Moon and of the Sun** [*Differentia Semidiametrorum ☾ & Vmbrae, vel summa Semidiametrorum ☾ & ☉*]

L	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
at	2	9'	3	0'	3	1'	3	2'	3	3'	3	4'	3	5'	3	6'
.	9'	("	0'	("	1'	("	2'	("	3'	("	4'	("	5'	("	6'	("
()	())	())	())	())	())	())	())	())
0	2	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0
	9		0		1		2		3		4		5		6	
1	2	5	2	5	3	5	3	5	3	5	3	5	3	5	3	5
	8	9	9	9	0	9	1	9	2	9	3	9	4	9	5	9
2	2	5	2	5	3	5	3	5	3	5	3	5	3	5	3	5
	8	6	9	6	0	6	1	6	2	9	3	6	4	6	5	9
3	2	5	2	5	3	5	3	5	3	5	3	5	3	5	3	5
	8	1	9	1	0	1	1	1	2	1	3	2	4	2	5	3
4	2	4	2	4	3	4	3	4	3	4	3	4	3	4	3	4
	8	4	9	4	0	4	1	5	2	5	3	6	4	6	5	7
5	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
	8	4	9	5	0	5	1	6	2	7	3	8	4	8	5	9
6	2	2	2	2	3	2	3	2	3	2	3	2	3	2	3	3
	8	2	9	4	0	5	1	6	2	7	3	8	4	9	5	0
7	2	8	2	9	3	1	3	1	3	1	3	1	3	1	3	1
	8		9		0	2	1	4	2	5	3	6	4	7	5	8
8	2	5	2	5	2	5	3	5	3	5	3	3	3	4	3	6
	7	2	8	5	9	7	0	9	1	9	3		4		5	
9	2	3	2	3	2	4	3	4	3	4	3	4	3	4	3	4
	7	4	8	7	9	0	0	2	1	5	2	8	3	9	5	9
1	2	1	2	1	2	2	3	2	3	2	3	3	3	3	3	3
0	7	3	8	7	9	1	0	4	1	7	2	0	3	3	4	5
1	2	5	2	5	2	5	3	2	3	7	3	1	3	1	3	1
1	6	0	7	5	8	9	0		1		2	0	3	4	4	7
1	2	2	2	3	2	3	2	4	3	4	3	4	3	5	3	5
2	6	4	7	0	8	5	9	0	0	4	1	9	2	3	3	7
1	2	5	2	2	2	9	2	1	3	2	3	2	3	3	3	3
3	5	5	7		8		9	4	0	0	1	5	2	0	3	4
1	2	2	2	3	2	4	2	4	3	5	3	0	3	5	3	1
4	5	4	6	2	7	0	8	6	0	3	1		2		3	0
1	2	5	2	5	2	8	2	8	2	2	3	3	3	3	3	4

L	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
at	2	9'	3	0'	3	1'	3	2'	3	3'	3	4'	3	5'	3	6'
.	9'	("	0'	("	1'	("	2'	("	3'	("	4'	("	5'	("	6'	("
()	())	())	())	())	())	())	())	())
5	4	0	5	9	7		8		9	3	0	1	1	7	2	3
1	2	1	2	2	2	3	2	4	2	5	3	0	3	8	3	1
6	4	1	5	5	6	3	7	3	8	1	0		1		2	5
1	2	3	2	4	2	5	2	7	2	1	2	2	3	3	3	4
7	3	0	4	3	5	6	7		8	7	9	7	0	6	1	4
1	2	4	2	0	2	1	2	3	2	4	2	5	3	1	3	1
8	2	4	4		5	7	6	0	7	0	8	1	0		1	1
1	2	5	2	1	2	3	2	4	2	5	2	1	2	2	3	3
9	1	5	3	3	4	0	5	5	6	8	8	2	9	4	0	5
2	2	0	2	2	2	4	2	5	2	1	2	3	2	4	2	5
0	1		2	2	3	1	4	9	6	5	7	0	8	3	9	3
2	2	0	2	2	2	4	2	9	2	2	2	4	2	0	2	1
1	0		1	5	2	8	4		5	8	6	4	8		9	4
2	1	5	2	2	2	5	2	1	2	3	2	5	2	1	2	3
2	8	4	0	3	1	1	3	4	4	6	5	7	7	3	8	0
2	1	4	1	1	2	4	2	1	2	3	2	2	2	2	2	4
3	7	0	9	6	0	7	2	5	3	9	5		6	3	7	2
2	1	1	1	0	1	3	2	1	2	3	2	4	2	2	2	5
4	6	7	8		9	7	1	1	2	9	4		5	9	6	1
2	1	4	1	3	1	2	1	5	2	3	2	3	2	3	2	5
5	4	2	6	5	8	0	9	9	1	3	3		4	0	5	4
2	1	5	1	5	1	5	1	3	2	1	2	5	2	2	2	5
6	2	1	4	8	6	3	8	8	0	7	1	1	3	6	4	4
2	1	3	1	4	1	1	1	1	1	5	2	3	2	1	2	4
7	0	5	3		5	4	7	0	8	9	0	9	2	5	3	9
2	7	3	1	4	1	1	1	3	1	2	1	1	2	0	2	3
8		4	0	6	3	8	5	0	7	8	9	7	1		2	8
2	0	0	7	4	1	3	1	3	1	4	1	4	1	3	2	2
9				1	1		3	2	5	5	7	6	9	6	1	0
3			0	0	7	4	1	1	1	4	1	2	1	2	1	5
0						9	1	7	3	9	6		8	[?	9	4

L	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
at	2	9'	3	0'	3	1'	3	2'	3	3'	3	4'	3	5'	3	6'
.	9'	("	0'	("	1'	("	2'	("	3'	("	4'	("	5'	("	6'	("
(()	()	()	()	()	()	()	()
3			0	0	7	5	1	1	1	5	1	1	1	1	1	1
2						6	1	9	3	8	6	5	8	8		
3					0	0	8	4	1	3	1	1	1	3		
4									1	0	4	1	6	0		
3							0	0	8	1	1	4	1	2		
6										1	1	1	4	3		
(3									0	0	8	1	1	6		
7)												9	2			
[?																
]																
(3										0	0	8	2			
8)														6		
[?																
]																

Parsing notes: TAB. 58 and its Residuum together carry 16 argument columns (21'–36'), each split into minutes (') and seconds ("). Both half-tables are triangular: the body fills from the top and each successive column extends one or more rows further down before reaching its terminal "0 0" entry, so the lower-left cells are genuinely empty (rendered as blank cells here — NOT [?]; faint show-through digits visible in those empty cells are bleed from the page beneath and are not data). The seconds (") values stay within 0–59 throughout (no sexagesimal impossibles). Verified by further. The lower half-table's tail prints irregular row labels (... 28, 29, 30, then 32, 34, 36 by 2-steps); the final two rows have no printed stub value (cropped/illegible at the foot of the page) — provisional row identities (37)/(38) are given in parentheses and flagged [?] to preserve column alignment. One residual low-confidence seconds reading remains at Latit. 30 / col 35' (read 2, possibly 12), flagged [?].

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae

Part IV — The Eclipse Tables (continued)

TABVLA 59. The scruples of incidence and half-duration in a lunar eclipse [TABVLA 59. *Scrupula Incidentiae, & Semimora in Eclipsi Lunæ*].

The sum of the semidiameters of the Moon ☽ and of the shadow [umbra] [Summa Semidiametrorum ☽, & Vmbræ].

This is a double-entry table. The argument (stub) column at left is the *true latitude* [Latitudo Vera ☽] of the Moon, running 0–59; the left margin is further annotated, by ranges, "true latitude ☽" [Latitudo vera ☽] repeated. The body is divided into columns headed by the sum of the semidiameters in minutes — 52', 53', 54', 55', 56', 57', 58', 59', 60' — each subdivided into *I* (minutes) and *II* (seconds), giving the scruples of incidence / half-duration in minutes (*I*) and seconds (*II*). Blank body cells (where the printed source leaves a gap, the latitude exceeding the semidiameter sum) are shown empty.

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r a ☽	52'		53'		54'		55'		56'		57'		58'		59'		60'	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	6	0
	2		3		4		5		6		7		8		9		0	
1			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
			2	9	3	9	4	9	5	9	6	9	7	9	8	9	9	9
2			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
			2	8	3	8	4	8	5	7	6	7	7	7	8	7	9	8
3			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
			2	5	3	5	4	5	5	5	6	5	7	5	8	5	9	6
4			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
			2	1	3	1	4	1	5	1	6	2	7	2	8	2	9	3

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r	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	
a	2'	2'	3'	3'	4'	4'	5'	5'	6'	6'	7'	7'	8'	8'	9'	9'	0'	0'
)	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
5			5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
			2	6	3	6	4	6	5	6	6	7	7	7	8	8	9	8
6			5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
			2	0	3	0	4	0	5	0	6	1	7	1	8	3	9	2
7			5	3	5	3	5	3	5	3	5	3	5	3	5	3	5	3
			2	3	3	3	4	3	5	3	6	4	7	4	8	5	9	5
8			5	2	5	2	5	2	5	2	5	2	5	2	5	2	5	2
			2	5	3	5	4	5	5	5	6	6	7	6	8	7	9	7
9			5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			2	5	3	5	4	6	5	6	6	7	7	8	8	9	9	9
1			5	4	5	4	5	6	5	6	5	7	5	8	5	9	5	1
0			2		3		4		5		6		7		8		9	0
1			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0
1			1	2	2	3	3	4	4	4	5	5	6	6	7	7	9	
1			5	3	5	4	5	4	5	4	5	4	5	4	5	4	5	4
2			1	9	2	1	3	1	4	4	5	4	6	5	7	6	8	8
1			5	2	5	2	5	2	5	3	5	3	5	3	5	3	5	3
3			1	5	2	7	3	8	4	0	5	2	6	3	7	3	8	5
1			5	9	5	1	5	1	5	1	5	1	5	1	5	1	5	2
4			1		2	2	3	3	4	5	5	6	6	8	7	9	8	1
1			5	5	5	5	5	5	5	5	5	1	5	2	5	4	5	6
5			1	2	2	5	3	7	4	9	5		6		7		8	
1			5	3	5	3	5	3	5	4	5	4	5	4	5	4	5	5
6			1	4	2	7	3	9	4	2	5	4	6	6	7	8	7	0
1			5	1	5	1	5	2	5	2	5	2	5	3	5	3	5	3
7			1	5	2	8	3	2	4	4	5	7	6	0	7	1	7	3
1			5	5	5	5	5	2	5	5	5	9	5	8	5	1	5	1
8			0	5	1	8	3		4		5		6		7	4	7	4

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r a)	5 2' I	5 2' II	5 3' I	5 3' II	5 4' I	5 4' II	5 5' I	5 5' II	5 6' I	5 6' II	5 7' I	5 7' II	5 8' I	5 8' II	5 9' I	5 9' II	6 0' I	6 0' II
1			5	3	5	3	5	4	5	4	5	4	5	5	5	5	5	5
9			0	3	1	7	2	1	3	4	4	8	5	1	6	3	6	3
2			5	1	5	1	5	1	5	2	5	2	5	3	5	3	5	3
0			0	0	1	4	2	9	3	2	4	7	5	0	6	3	6	3
2			4	4	5	5	5	5	5	0	5	6	5	9	5	1	5	1
1			9	5	0	0	1	6	3		4		5		5	2	6	2
2			4	1	5	2	5	3	5	3	5	4	5	4	5	4	5	4
2			9	9	0	4	1	0	2	5	3	0	4	5	5	9	5	9
2			4	5	4	5	5	4	5	9	5	1	5	2	5	2	5	2
3			8	1	9	7	1		2		3	5	4	0	5	5	5	5
2			4	2	4	2	5	3	5	4	5	4	5	5	5	0	5	0
4			8	2	9	9	0	6	1	2	2	8	3	3	4		4	
2			4	5	4	5	5	7	5	1	5	2	5	2	5	3	5	3
5			7	2	8	9	0		1	4	2	0	3	7	4	2	4	2
2			4	2	4	2	4	3	5	4	5	5	5	5	5	4	5	4
6			7	0	8	8	9	6	0	4	1	1	2	8	4		4	
2			4	4	4	5	4	4	5	1	5	2	5	2	5	3	5	3
7			6	6	7	5	9		0	2	1	3	2	8	3	5	3	5
2			4	1	4	2	4	3	4	3	5	4	5	5	5	4	5	4
8			6	0	7	0	8	0	9	9	0	8	1	6	3		3	
2			4	3	4	4	4	5	4	5	5	1	5	2	5	3	5	3
9			5	3	6	4	7	5	9		0	4	1	3	2	1	2	1
3			4	5	4	6	4	1	4	2	4	3	5	4	5	5	5	5
0			4	4	6		7	8	8	9	9	9	0	8	1	8	1	8
3			4	1	4	2	4	3	4	5	4	2	5	1	5	2	5	2
1			4	3	5	6	6	9	7	1	9		0	2	1	3	1	3
3			4	3	4	4	4	5	4	1	4	2	4	3	5	4	5	4
2			3	0	4	4	5	8	7	1	8	3	9	4	0	6	0	6

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r a)	5 2' I	5 2' II	5 3' I	5 3' II	5 4' I	5 4' II	5 5' I	5 5' II	5 6' I	5 6' II	5 7' I	5 7' II	5 8' I	5 8' II	5 9' I	5 9' II	6 0' I	6 0' II
3			4	4	4	0	4	1	4	2	4	4	4	4	5	7	5	7
3			2	5	4		5	5	6	9	7	3	8	1	0		0	
3			4	1	4	1	4	3	4	4	4	1	4	1	4	2	4	2
4			1	7	3	4	4	0	5	5	7		8	4	9	6	9	6
3			4	7	4	2	4	4	4	5	4	1	4	3	4	4	4	4
5			1		2	6	3	3	4	9	6	6	7	1	8	4	8	4
3			4	1	4	3	4	5	4	1	4	2	4	4	4	0	4	0
6			0	5	1	5	2	4	4	2	5	9	6	5	8		8	
3			3	2	4	4	4	2	4	2	4	4	4	5	4	1	4	1
7			9	0	0	2	2		3	2	4	0	5	8	7	4	7	4
3			3	2	3	4	4	8	4	2	4	4	4	9	4	2	4	2
8			8	2	9	6	1		2	9	3	9	5		6	6	6	6
3			3	2	3	4	4	1	4	3	4	5	4	1	4	3	4	3
9			7	1	8	7	0	1	1	4	2	6	4	7	5	6	5	6
4			3	1	3	4	3	1	4	3	4	0	4	2	4	4	4	4
0			6	7	7	5	9	1	0	7	2		3	3	4	4	4	4
4			3	1	3	4	3	9	3	3	4	1	4	2	4	4	4	4
1			5	8	6	0	8		9	6	1		2	6	3	9	3	9
4			3	5	3	3	3	2	3	3	4	0	4	2	4	5	4	5
2			3	7	5	1	7		8	2	0		1	7	2	3	2	3
4			3	4	3	1	3	5	3	2	3	5	4	2	4	5	4	5
3			2	0	4	8	5	2	7	4	8	5	0	4	1	2	1	2
4			3	1	3	0	3	3	3	1	3	4	3	1	4	4	4	4
4			1	8	3		4	8	6	4	7	8	9	8	0	8	0	8
4			2	5	3	3	3	1	3	5	3	3	3	9	3	4	3	4
5			9	1	1	7	3	9	4	9	6	6	8		9	2	9	2
4			2	1	3	9	3	5	3	4	3	2	3	5	3	3	3	3
6			8	7	0		1	6	3	0	5	0	6	7	8	1	8	1

Parsing notes: A triangular double-entry table; the upper-left of the body is blank (latitude < semidiameter-sum region prints empty) and the lower-left columns terminate in "0 0" entries before going blank. The 52' column shows only one body value ("54 0" at lat. 0 in column-head row); from lat. 1 onward the 52' pair is blank in the printed source. Several lower cells are faint from ink wear; values flagged [?] in the report where uncertain. Catchword: "SCRV." (i.e. *Scrupula*, the continuation table).

**The remaining scruples of incidence and half-duration in a lunar eclipse
[Reliqua Scrupula Incidentiæ, & Semimora in Eclipsi Lunæ].**

**The remaining sum of the semidiameters of the Moon ☽ and of the shadow
[Reliqua Summa Semidiametrorum ☽, & Vmbræ].**

Continuation of TAB. 59. Same structure; the argument (stub) is the true latitude ☽ (0–67); columns are the semidiameter sums 61' through 68', each subdivided into *I* (minutes) and *II* (seconds).

L at . v er a ☽	6 1'	6 1'	6 2'	6 2'	6 3'	6 3'	6 4'	6 4'	6 5'	6 5'	6 6'	6 6'	6 7'	6 7'	6 8'	6 8'
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
0	6 1	0 2	6 2	0 3	6 3	0 4	6 4	0 5	6 5	0 6	6 6	0 7	6 7	0 8	6 8	0
1	6 0	5 9	6 1	5 9	6 2	5 9	6 3	5 9	6 4	5 9	6 5	5 9	6 6	5 9	6 7	5 9
2	6 0	5 8	6 1	5 8	6 2	5 8	6 3	5 8	6 4	5 8	6 5	5 8	6 6	5 8	6 7	5 8
3	6 0	5 6	6 1	5 6	6 2	5 6	6 3	5 6	6 4	5 6	6 5	5 6	6 6	5 6	6 7	5 6
4	6 0	5 3	6 1	5 3	6 2	5 3	6 3	5 3	6 4	5 3	6 5	5 3	6 6	5 3	6 7	5 3
5	6 0	4 8	6 1	4 8	6 2	4 9	6 3	4 9	6 4	5 9	6 5	4 9	6 6	4 9	6 7	4 9
6	6 0	4 2	6 1	4 2	6 2	4 3	6 3	4 3	6 4	3 3	6 5	4 3	6 6	4 3	6 7	4 3

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er	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
a	1'	1'	2'	2'	3'	3'	4'	4'	5'	5'	6'	6'	7'	7'	8'	8'
»	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
7	6	3	6	3	6	3	6	3	6	3	6	3	6	3	6	3
	0	5	1	5	2	6	3	6	4	7	5	8	6	8	7	8
8	6	2	6	2	6	2	6	2	6	3	6	3	6	3	6	3
	0	8	1	8	2	9	3	9	4	0	5	1	6	1	7	1
9	6	2	6	2	6	2	6	2	6	2	6	2	6	2	6	2
	0	0	1	0	2	1	3	1	4	2	5	3	6	4	7	4
1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1
0	0	1	1	1	2	2	3	3	4	3	5	4	6	5	7	6
1	6	1	6	6	6	2	6	2	6	3	6	4	6	5	6	6
1	0		1		2		3		4		5		6		7	
1	5	4	6	5	6	3	6	5	6	5	6	5	6	5	6	5
2	9	9	0	0	1	8	2	2	3	3	4	4	5	5	6	6
1	5	3	6	3	6	4	6	4	6	4	6	4	6	4	6	4
3	9	6	0	7	1	9	2	0	3	1	4	3	5	4	6	5
1	5	2	6	2	6	2	6	2	6	2	6	3	6	3	6	3
4	9	2	0	3	1	5	2	7	3	8	4	0	5	2	6	3
1	5	2	6	9	6	1	6	1	6	1	6	1	6	1	6	2
5	9		0		1	1	2	3	3	4	4	6	5	8	6	0
1	5	5	5	5	6	5	6	5	6	5	6	1	6	3	6	5
6	8	2	9	4	0	6	1	8	2	9	4		5		6	
1	5	3	5	3	6	4	6	4	6	4	6	4	6	4	6	5
7	8	5	9	8	0	0	1	2	2	4	3	6	4	8	6	0
1	5	1	5	2	6	2	6	2	6	2	6	3	6	3	6	3
8	8	7	9	0	0	3	1	5	2	8	3	0	4	2	5	4
1	5	5	5	1	6	5	6	7	6	1	6	1	6	1	6	1
9	7	7	9		0		1		2	0	3	1	4	5	5	8
2	5	3	5	4	5	4	6	4	6	5	6	5	6	5	6	0
0	7	7	8	1	9	5	0	8	1	1	2	4	3	7	4	
2	5	1	5	2	5	2	6	2	6	3	6	3	6	3	6	4

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	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	1'	1'	2'	2'	3'	3'	4'	4'	5'	5'	6'	6'	7'	7'	8'	8'
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
1	7	6	8	0	9	4	0	8	1	1	2	4	3	7	4	1
2	5	5	5	5	5	2	6	6	6	1	6	3	6	1	6	2
2	6	4	7	8	9		0		1	0	2	2	3	6	4	1
2	5	3	5	3	5	3	5	4	6	4	6	5	6	5	6	0
3	6	0	7	5	8	9	9	4	0	8	1	1	2	5	4	
2	5	5	5	1	5	1	5	1	6	2	6	2	6	3	6	3
4	6		7	0	8	5	9	9	0	5	1	9	2	3	3	8
2	5	3	5	4	5	5	5	5	6	1	6	6	6	1	6	1
5	5	9	6	4	7	0	8	5	0		1		2	0	3	6
2	5	1	5	1	5	2	5	2	5	3	6	4	6	4	6	5
6	5	1	6	7	7	4	8	9	9	5	0	1	1	5	2	1
2	5	4	5	4	5	5	5	2	5	8	6	1	6	1	6	2
7	4	2	5	9	6	6	8		9		0	4	1	9	2	5
2	5	1	5	1	5	2	5	3	5	4	5	4	6	5	6	5
8	4	2	5	9	6	7	7	3	8	0	9	7	0	2	1	8
2	5	4	5	1	5	5	5	3	5	1	5	1	6	2	6	3
9	3	0	4	6	5	6	7		8	2	9	8	0	5	1	0
3	5	7	5	1	5	2	5	3	5	4	5	4	5	5	6	1
0	3		4	6	5	4	6	2	7	0	8	8	9	5	1	
3	5	3	5	4	5	5	5	5	5	8	5	1	5	2	6	3
1	2	2	3	2	4	1	5	9	7		8	7	9	4	0	1
3	5	5	5	6	5	1	5	2	5	3	5	4	5	5	6	0
2	1	6	3		4	6	5	5	6	5	7	4	8	2	0	
3	5	1	5	2	5	4	5	5	5	0	5	1	5	1	5	2
3	1	8	2	9	3	0	4	0	6		7	0	8	9	9	7
3	5	3	5	5	5	2	5	1	5	2	5	3	5	4	5	1
4	0	9	1	1	3		4	3	5	4	6	4	7	4	9	8
3	4	5	5	1	5	2	5	3	5	4	5	5	5	8	5	1
5	9	8	1	1	2	3	3	5	4	6	5	7	7		8	8

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er	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
a	1'	1'	2'	2'	3'	3'	4'	4'	5'	5'	6'	6'	7'	7'	8'	8'
)	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
3	4	1	5	2	5	4	5	5	5	7	5	1	5	3	5	4
6	9	5	0	9	1	2	2	5	4		5	9	6	0	7	2
3	4	3	4	4	5	5	5	1	5	2	5	3	5	1	5	4
7	8	0	9	5	0	9	2	3	3	6	4	9	5	1	7	
3	4	4	4	5	5	1	5	3	5	4	5	5	5	1	5	2
8	7	3	8	9	0	5	1	0	2	4	3	8	5	1	6	4
3	4	5	4	1	4	2	5	4	5	0	5	1	5	2	5	4
9	6	5	8	2	9	9	0	5	2		3	5	4	8	5	3
4	4	4	4	2	4	4	4	5	5	1	5	3	5	4	5	0
0	6		7	3	8	1	9	8	1	4	2	0	3	5	5	
4	4	1	4	3	4	5	4	9	5	2	5	4	5	2	5	1
1	5	1	6	1	7	1	9		0	6	1	3	2	2	3	5
4	4	1	4	3	4	5	4	1	4	3	5	5	5	1	5	2
2	4	4	5	6	6	8	8	8	9	7	0	5	2	2	3	9
4	4	1	4	3	4	3	4	2	4	4	5	6	5	2	5	4
3	3	6	4	9	6		7	5	8	6	0		1	6	2	5
4	4	1	4	4	4	6	4	2	4	5	4	1	5	3	5	5
4	2	5	3	0	5		6	9	7	2	9	3	0	3	2	3
4	4	1	4	3	4	6	4	3	4	5	4	1	4	3	5	5
5	1	1	2	9	4		5	1	6	6	8	7	9	8	0	9
4	4	4	4	3	4	3	4	3	4	5	4	2	4	4	5	5
6	0		1	4	3		4	1	5	7	7	0	8	2	0	
4	3	5	4	2	4	5	4	2	4	5	4	2	4	4	4	9
7	8	2	0	6	1	7	3	7	4	4	6	0	7	4	9	
4	3	3	3	1	4	4	4	2	4	5	4	1	4	4	4	1
8	7	5	9	2	0	7	2	0	3	0	5	8	6	4	8	0
4	3	1	3	5	3	3	4	8	4	4	4	1	4	4	4	9
9	6	2	7	3	9	2	1		2	3	4	2	5	1	7	
5	3	4	3	2	3	1	3	5	4	2	4	4	4	3	4	0

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er	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
a	1'	1'	2'	2'	3'	3'	4'	4'	5'	5'	6'	6'	7'	7'	8'	8'
)	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
0	4	2	6	8	8	1	9	1	1	8	3		4	7	7	
5	3	5	3	5	3	4	3	2	4	9	4	4	4	2	4	5
1	3		4	6	6	4	8	8	0		1	7	3	3	4	9
5	3	1	3	1	3	9	3	5	3	4	4	2	4	8	4	4
2	1	8	3	6	5		6	8	8	4	0	7	2		3	7
5	3	1	3	1	3	7	3	5	3	3	3	2	4	0	4	3
3	0	1	2	1	4		5	3	7	9	9	1	1		2	7
5	2	2	2	2	3	2	3	2	3	1	3	0	3	4	4	2
4	8	2	8	7	2	7	4	1	6	1	8		9	7	1	0
5	2	2	2	4	3	4	3	4	3	4	3	2	3	1	4	5
5	6	3	8	7	0	3	2	4	4	8	6	9	8	6	0	9
5	2	1	2	3	2	5	3	5	3	0	3	5	3	4	3	3
6	4	1	6	7	8	3	0	9	3		4	4	6	3	8	5
5	2	4	2	2	2	5	2	6	3	1	3	1	3	1	3	3
7	1	4	4	4	6	0	9		1	2	3	6	5	3	7	5
5	1	5	2	4	2	3	2	2	2	1	3	1	3	3	3	3
8	8	8	1	9	4	8	7		9	1	1	6	5	0	5	0
5	1	3	1	3	2	6	2	4	2	1	2	3	3	4	3	4
9	5	0	9		2		4	8	7	7	9	5	1	5	3	9
6	1	0	1	3	1	1	2	1	2	0	2	3	2	4	3	0
0	1		5	7	9	3	2	6	5		7	0	9	9	2	
6	0	0	1	1	1	4	1	2	2	0	2	3	2	4	3	3
1			1	1	6	5	9	2	2		5	8	7	9	0	
6			0	0	1	1	1	5	1	0	2	1	2	2	2	5
2					1	1	5	3	9		4		6	4	7	6
6			0	0	0	0	1	1	1	0	1	4	2	4	2	3
3							1	6	6		9	0	2	8	5	5
6					0	0	0	0	1	2	1	8	1	0	2	0
4									1	2	6		9		2	

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er	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
a	1'	1'	2'	2'	3'	3'	4'	4'	5'	5'	6'	6'	7'	7'	8'	8'
)	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
6							0	0	1	2	1	0	1	4	1	5
5									1	7	6		9	9	9	9
6									0	0	1	3	1	3	1	2
6											1	1	6	2	6	2
6											0	0	1	3	1	3
7													1	2	1	7

Parsing notes: Triangular continuation; lower-left columns terminate in "0 0" then blank. Some interior digits are worn or ink-bled (notably rows 12–14 and 28–30 in the 63' and 64' columns) and are transcribed as the most probable reading; values where I am genuinely uncertain are noted in the report. Catchword "DI-" (i.e. *Distantia*, pointing to TAB. 60).

TABVLA 60. The distance of the centers of both luminaries [TABVLA 60. *Distantia Centrorum vtriusq; Luminaris*].

This is a double-entry table giving, for an argument of *Scruples* [*Scrup.*] (0–99, in the stub column) and a parallax/elongation increment heading (0', 10', 20', 30', 40', 50', 60'), the distance of the centers expressed in degrees (*G.*, i.e. *Gradus*), minutes (*I*), and seconds (*II*).

S																					
c			1	1	2	2	3	3	4	4	5	5	6	6							
r	0	0	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0	0	6	0	
u	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'
p	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I
.	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I
0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	3	0	0	4			
1	0	0	4	0	0	6	0	0	1	0	0	1	0	0	1	0	0	1			
									0			2			4			7			
2	0	0	1	0	0	2	0	0	2	0	0	2	0	0	3	0	0	3	0	0	3
			7			0			3			6			0			4			8

S																				
c			1	1	2	2	3	3	4	4	5	5	6	6						
r	0	0	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0	0	6	0
u	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0
p	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'
.	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I

4	0	1	8	0	1	1	0	1	1	0	1	2	0	1	3	0	1	3	0	1	4
					3		9		6		2		9		6						
6	0	2	3	0	2	4	0	2	5	0	2	5	0	3	8	0	3	1	0	3	2
		2		1		0		9		8		7									
8	0	4	3	0	4	4	0	4	5	0	5	6	0	5	1	0	5	3	0	5	4
		1		2		4		8		0		3									
1	0	7	3	0	7	1	0	7	3	0	7	4	0	8	1	0	8	1	0	8	3
0				7		2		6		7		2									
1	0	1	9	0	1	2	0	1	4	0	1	1	0	1	1	0	1	3	0	1	5
2	0			0	6		0	4		1		1	9		1	3		1		5	
1	0	1	4	0	1	9	0	1	2	0	1	4	0	1	1	0	1	3	0	1	5
4	3	9		4		4	9		4	9		5	0		5	1		5		2	
1	0	1	3	0	1	2	0	1	4	0	1	1	0	1	3	0	1	5	0	2	2
6	8			8	6		8	9		9	2		9	5		9	9		0	3	
1	0	2	5	0	2	1	0	2	4	0	2	8	0	2	3	0	2	0	0	2	2
8	2	1		3	6		3	2		4		4	4		5				5	7	
2	0	2	1	0	2	4	0	2	9	0	2	3	0	3	7	0	3	3	0	3	6
0	8	2		8	1		9		9	8		0			0	6		1			
2	0	3	8	0	3	3	0	3	1	0	3	4	0	3	1	0	3	4	0	3	1
2	4			4	9		5	0		5	2		6	4		6	6		7	8	
2	0	4	3	0	4	1	0	4	4	0	4	2	0	4	5	0	4	2	0	4	4
4	0	7		1	1		1	5		2	0		2	4		3	9		4		
2	0	4	4	0	4	1	0	4	5	0	4	3	0	5	9	0	5	4	0	5	2
6	7	0		8	7		8	4		9	1		0		0	6		1		4	
2	0	5	1	0	5	5	0	5	3	0	5	1	0	5	5	0	5	3	0	5	1
8	5	7		5	7		6	6		7	6		7	7		8	7		9	8	
3	1	3	2	1	4	1	1	4	5	1	5	3	1	6	1	1	7	2	1	7	4
0		7		0			3		6		9									6	
3	1	1	1	1	1	5	1	1	4	1	1	2	1	1	1	1	1	1	1	1	4
2	2	2		2	8		3	3		4	9		5	5		6			6	7	

S																					
c			1	1	2	2	3	3	4	4	5	5	6	6							
r	0	0	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0	0	6	0	
u	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	0	'	
p	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	
.	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I

3	1	2	3	1	2	1	1	2	7	1	2	5	1	2	4	1	2	3	1	2	2
4		1	1		2	9		3		3	6		4	4		5	3		6	3	
3	1	3	2	1	3	1	1	3	5	1	3	5	1	3	4	1	3	4	1	3	3
6		1	3		2	4		3		3	6		4	8		5	0		6	2	
3	1	4	4	1	4	4	1	4	3	1	4	3	1	4	2	1	4	2	1	4	1
8		1	9		2	3		3	7		4	1		5	5		6	0		7	5
4	1	5	4	1	5	4	1	5	4	1	5	3	1	5	3	1	5	3	1	5	3
0		2	9		3	6		4	2		5	9		6	7		7	4		8	2
4	2	4	2	2	5	2	2	6	2	2	7	2	2	8	2	2	9	2	2	1	2
2			3			2			2			2			2			2		0	3
4	2	1	3	2	1	3	2	1	3	2	1	3	2	2	4	2	2	4	2	2	4
4		6	1		7	3		8	5		9	8		0	1		1	4		2	7
4	2	1	2	2	3	1	2	3	2	2	3	2	2	3	3	2	3	4	2	3	4
6		9			0	7		1	2		2	8		3	4		4	0		3	6
4	2	4	2	2	4	3	2	4	4	2	4	5	2	4	1	2	4	9	2	4	1
8		2	8		3	6		4	4		5	2		7		8			9	9	
5	2	5	1	2	5	2	2	5	3	2	5	5	3	1	1	3	2	1	3	3	2
0		6	8		7	8		8	9		9	0					2			5	
5	3	1	4	3	1	5	3	1	9	3	1	2	3	1	3	3	1	5	3	1	5
2		0	1		1	5		3		4	3		5	7		6	1		8		
5	3	2	3	3	2	5	3	2	1	3	2	2	3	3	4	3	3	2	3	3	1
4		5	9		6	5		8	1		9	8		0	5		2		3	9	
5	3	4	8	3	4	2	3	4	4	3	4	6	3	4	2	3	4	4	3	4	7
6		1			2	7		3	6		5			6	6		7	6		9	
5	3	5	1	3	5	3	3	5	5	4	1	1	4	2	4	4	4	5	4	5	2
8		7	3		8	5		9	7		9			2						8	
6	4	1	5	4	1	1	4	1	4	4	1	7	4	1	3	4	2	5	4	2	2
0		3	2		5	7		6	2		8			9	2		0	8		2	4
6	4	3	4	4	3	3	4	3	0	4	3	2	4	3	5	4	3	2	4	3	5
2		1			2	2		4			5	8		6	6		8	4		9	3

S																					
c			1	1	2	2	3	3	4	4	5	5	6	6							
r	0	0	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0	0	6	0	
u	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'
p	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I
.	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I

6	4	4	5	4	5	2	4	5	5	4	5	2	4	5	5	4	5	2	4	5	5
4		8	0		0	0		1	1		3	2		4	3		6	4		7	6
6	5	7	1	5	8	4	5	1	1	5	1	5	5	1	2	5	1	5	5	1	3
6			1			4		0	7		1	1		3	5		4	9		6	3
6	5	2	4	5	2	4	5	2	1	5	3	5	5	3	3	5	3	7	5	3	4
8		6			7	0		9	6		0	3		2	0		4			5	4
7	5	4	3	5	4	1	5	4	5	5	5	2	5	5	9	5	5	4	5	5	2
0		5	2		7	1		8	0		0	9		2			3	9		5	9
7	6	5	3	6	7	1	6	8	5	6	1	4	6	1	2	6	1	5	6	1	4
2			4			6			8		0	0		2	2		4			5	8
7	6	2	1	6	2	5	6	2	3	6	3	2	6	3	9	6	3	5	6	3	4
4		6	0		7	4		9	9		1	4		3			4	5		6	0
7	6	4	1	6	4	6	6	5	5	6	5	4	6	5	3	6	5	1	6	5	7
6		7	9		9			0	4		2	2		4	0		6	8		8	
7	7	9	3	7	1	5	7	1	4	7	1	3	7	1	2	7	1	1	7	2	7
8					0	3		2	3		4	4		6	5		8	6		0	
8	7	3	2	7	3	1	7	3	6	7	3	0	7	3	5	7	4	4	7	4	4
0		1	0		3	3		5			7			8	4		0	8		2	3
8	7	5	1	7	5	7	7	5	3	7	5	5	8	1	5	8	3	5	8	5	4
2		4	2		6			8			9	9		5			2			9	
8	8	1	3	8	1	3	8	2	3	8	2	3	8	2	3	8	2	3	8	2	3
4		7	5		9	3		1	2		3	0		5	0		7	0		9	0
8	8	4	3	8	4	3	8	4	3	8	4	4	8	4	4	8	5	4	8	5	4
6		1	4		3	6		5	8		7	0		9	2		1	4		3	7
8	9	6	8	9	8	1	9	1	1	9	1	2	9	1	2	9	1	3	9	1	3
8					1	0		7		2	2		4	7		6	2		8	7	
9	9	3	1	9	3	2	9	3	2	9	3	3	9	3	4	9	4	3	9	4	5
0		1	4		3	1		5	8		7	5		9	3		1	1		3	9
9	9	5	5	9	5	4	1	1	1	1	3	2	1	5	3	1	7	4	1	9	5
2		6	4		9		0		4	0		4	0		5	0		6	0		7

S			1		1 2		2 3		3 4		4 5		5 6		6						
c	0	0	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0	0	6	0	
u	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'	'	0	'
p	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I	G	'	I
.	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I	.	I	I
9	1	2	8	1	2	2	1	2	3	1	2	4	1	3	0	1	3	1	1	3	2
4	0	3		0	5	1	0	7	4	0	9	7	0	2		0	4	4	0	6	8
9	1	4	5	1	5	1	1	5	2	1	5	4	1	5	0	1	1	1	1	3	3
6	0	9	6	0	2	1	0	4	7	0	6	3	0	9		1		6	1		3
9	1	1	1	1	1	3	1	2	3	1	2	1	1	2	3	1	2	5	1	3	1
8	1	7	9	1	9	7	1	1	6	1	4	4	1	6	3	1	8	2	1	1	2
9	1	3	1	1	3	3	1	3	5	1	3	1	1	4	3	1	4	5	1	4	1
9	1	1	2	1	3	2	1	5	2	1	8	3	1	0	3	1	2	4	1	5	5

Parsing notes: The stub steps by 1 in the top group (0–4), then by 2 thereafter (rows are grouped 4 at a time with rule-bands). The columns are grouped G./I/II per parallax-increment heading. Row "3" of the stub (between 2 and 4) is absent in the printed source — the top block prints 0, 1, 2, 4 (no row 3). Faint cells at row 46 (0' column "2 19 2" — likely a worn "2 29 2") and at the 60' column row 46 ("2 33 46" where monotone suggests "2 35 46") are transcribed as printed and flagged below. Catchword "PARAL." (i.e. *Parallaxis*) at foot, pointing to the next table.

TAB. 61. The parallaxes of the Moon in the circle of true altitude, given the distance from the center of the Earth [Parallaxes Lunae in Circulo Altitudinis Verae, sub data distantia à centro Terrae]

This is a four-panel parallax table. The argument is the apparent altitude (Alt./Gr., 0°–89°, read down the stub). The column-groups give the Moon's parallax in altitude (minutes ' and seconds ") for each value of the Moon's distance from the Earth's center, expressed in Earth-radii [Distantia ∽ à centro Terrae in semidiametris Terrae]. The two left-hand quadrants cover distances 52–61 radii for altitudes 0°–60°; the two right-hand quadrants cover the same distances for altitudes 60°–89°.

Left half — header: "Distantia 〕 à centro Terrae in semidiametris
Terrae." — Altitudes 0°–60°

Distance columns 52–61 radii. Each distance gives minutes (') and seconds (").

G	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	
r	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	0	0	1	1
.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"
0	6	6	6	5	6	3	6	3	6	2	6	1	5	1	5	1	5	1	5	2
	6		4	1	3	9	2	0	1	3	0	9	9	7	8	6	7	8	6	1
1	6	6	6	5	6	3	6	2	6	2	6	1	5	1	5	1	5	1	5	2
	6		4	1	3	9	2	9	1	2	0	9	9	7	8	6	7	8	6	1
2	6	5	6	5	6	3	6	2	6	2	6	1	5	1	5	1	5	1	5	1
	6		4	0	3	8	2	8	1	2	0	8	9	5	8	4	7	7	6	9
3	6	4	6	4	6	3	6	2	6	2	6	1	5	1	5	1	5	1	5	1
	6		4	9	3	7	2	7	1	1	0	7	9	5	8	4	7	6	6	8
4	6	1	6	4	6	3	6	2	6	1	6	1	5	1	5	1	5	1	5	1
	6		4	7	3	5	2	5	1	8	0	5	9	3	8	1	7	3	6	6
5	6	5	6	4	6	3	6	2	6	1	6	1	5	8	5	7	5	9	5	1
	5	7	4	3	3	1	2	1	1	4	0	1	9		8		7		6	3
6	6	5	6	3	6	2	6	1	6	1	6	7	5	3	5	3	5	5	5	9
	5	2	4	8	3	6	2	6	1	0	0		9		8		7		6	
7	6	4	6	3	6	2	6	1	6	4	6	1	5	5	5	5	5	5	5	3
	5	6	4	2	3	0	2	0	1		0		8	7	7	7	6	9	6	
8	6	3	6	2	6	1	6	3	6	5	5	5	5	5	5	5	5	5	5	5
	5	8	4	4	3	2	2		0	7	9	4	8	0	7	1	6	3	5	7
9	6	2	6	1	6	3	6	5	6	4	5	4	5	4	5	4	5	4	5	4
	5	9	4	5	3		1	4	0	8	9	5	8	2	7	3	6	4	5	8
1	6	1	6	5	6	5	6	4	6	3	5	3	5	3	5	3	5	3	5	3
	0	5	9	4		2	3	1	5	0	9	9	7	8	3	7	4	6	5	9
1	6	8	6	5	6	4	6	3	6	2	5	2	5	2	5	2	5	2	5	2
	1	5		3	4	2	2	1	3	0	8	9	7	8	3	7	4	6	5	9
1	6	5	6	4	6	3	6	2	6	1	5	1	5	1	5	1	5	1	5	1
	2	4	5	3	1	2	0	1	2	0	6	9	5	8	1	7	4	6	5	8
1	6	4	6	2	6	1	6	9	6	3	5	2	5	0	5	1	5	2	5	6
	3	4	1	3	8	2	7	1		0		9		8		7		6		5

G 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 6 6 6
r 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 0 0 1 1
. ' " ' " ' " ' " ' " ' " ' " ' " ' " ' "

1 6 2 6 1 6 3 6 5 5 4 5 4 5 4 5 4 5 4 5 5
4 4 6 3 4 2 0 5 9 9 8 8 7 5 6 7 5 9 4 2
1 6 1 6 5 6 4 6 3 5 3 5 3 5 3 5 3 5 3 5 3
5 4 1 2 8 1 7 0 9 9 4 8 2 7 0 6 2 5 5 4 7
1 6 5 6 4 6 3 6 2 5 1 5 1 5 1 5 1 5 2 5 2
6 3 3 2 0 1 0 0 2 9 8 8 6 7 4 6 6 5 0 4 2
1 6 3 6 2 6 1 6 4 5 1 5 5 5 0 5 0 5 4 5 7
7 3 5 2 2 1 3 0 9 7 9 7 6 5 4
1 6 1 6 3 6 5 5 4 5 4 5 4 5 3 5 4 5 4 5 4
8 3 5 2 0 4 9 6 8 2 7 2 6 9 5 3 4 9 3 9
1 6 5 6 4 6 3 5 2 5 2 5 2 5 2 5 2 5 2 5 3
9 2 4 1 3 0 4 9 7 8 2 7 1 6 1 5 4 4 9 3 2
2 6 3 6 2 6 1 5 6 5 1 5 1 5 5 5 4 5 9 5 1
0 2 1 1 1 0 3 9 8 7 5 8 5 4 3 4
2 6 8 6 5 5 5 5 4 5 4 5 4 5 4 5 4 5 5 5 5
1 2 0 8 9 1 8 4 7 0 6 0 5 0 4 4 3 0 2 5
2 6 4 6 3 5 2 5 2 5 1 5 1 5 1 5 2 5 2 5 3
2 1 4 0 3 9 7 8 1 7 8 6 8 5 8 4 3 3 8 2 3
2 6 1 6 9 5 2 5 5 5 5 5 5 5 5 5 5 5 4 5 1
3 1 9 0 9 7 8 6 5 5 4 4 3 3 9 3 2 3
2 6 5 5 4 5 3 5 3 5 2 5 2 5 3 5 3 5 4 5 5
4 0 3 9 3 8 7 7 1 6 9 5 9 4 0 3 6 2 1 1 0
2 6 2 5 1 5 9 5 6 5 3 5 4 5 6 5 1 5 1 5 2
5 0 4 9 5 8 7 6 5 4 3 2 2 5 1 7
2 5 5 5 4 5 4 5 3 5 3 5 3 5 3 5 4 5 5 5 3
6 9 5 8 7 7 1 6 8 5 6 4 8 3 9 2 6 1 0 1
2 5 2 5 1 5 1 5 1 5 8 5 8 5 1 5 1 5 2 5 3
7 9 5 8 7 7 2 6 0 5 4 3 1 2 9 1 5 0 8
2 5 5 5 4 5 4 5 4 5 3 5 4 5 4 5 5 5 5 5 1
8 8 4 7 6 6 1 5 0 4 9 3 2 2 3 1 1 0 7 0 1
2 5 2 5 1 5 1 5 9 5 9 5 1 5 1 5 2 5 3 4 4
9 8 2 7 4 6 1 5 4 3 2 2 3 1 2 0 2 9 3

G 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 6 6 6
 r 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 0 0 1 1
 . ' " ' " ' " ' " ' " ' " ' " ' " ' " ' " ' "

3 5 4 5 4 5 3 5 3 5 3 5 4 5 4 5 5 5 5 4 1
 0 7 8 6 2 5 9 4 8 3 8 2 1 1 3 0 0 0 9 3
 3 5 1 5 9 5 6 5 4 5 6 5 1 5 1 5 2 4 3 4 4
 1 7 3 6 5 4 3 2 0 1 6 0 4 9 7 8 3
 3 5 3 5 3 5 3 5 3 5 3 5 3 5 4 4 5 4 9 4 1
 2 6 8 5 4 4 2 3 0 2 3 1 7 0 4 9 4 9 8 3
 3 5 2 5 5 5 5 5 5 5 5 5 4 5 1 4 2 4 3 4 4
 3 6 4 8 3 7 2 5 1 9 1 0 1 9 2 8 4 7 0
 3 5 2 5 2 5 2 5 2 5 2 5 3 4 3 4 4 4 0 4 1
 4 5 5 4 1 3 1 2 0 1 4 0 0 9 5 8 6 8 7 0
 3 5 4 5 4 5 4 5 4 5 4 4 5 4 1 4 1 4 2 4 3
 5 4 6 3 3 2 3 1 4 0 9 9 5 9 8 2 7 5 6 7
 3 5 8 5 4 5 5 5 7 5 1 4 1 4 2 4 3 4 5 4 2
 6 4 3 2 1 0 1 9 8 8 2 7 7 6 0 6
 3 5 2 5 2 5 2 5 2 4 3 4 4 4 4 4 4 4 1 4 2
 7 3 4 2 4 1 4 0 9 9 3 8 1 7 7 6 1 6 4 5 7
 3 5 4 5 4 5 4 4 4 4 4 4 1 4 6 4 2 4 3 4 4
 8 2 2 1 3 0 4 9 9 8 8 8 7 6 1 5 8 4 9
 3 5 5 5 0 5 1 4 8 4 7 4 2 4 2 4 4 4 0 4 1
 9 1 8 1 0 9 8 7 5 6 5 5 1 5 4 1
 4 5 1 5 1 4 2 4 2 4 3 4 4 4 4 4 3 4 2 4 3
 0 1 7 0 8 9 1 8 7 7 5 6 4 5 4 5 4 2 3 0
 4 5 3 4 3 4 3 4 4 4 5 4 3 4 1 4 4 4 4 4 4
 1 0 2 9 4 8 8 7 5 6 3 6 5 3 4 3 3 3 2 9
 4 4 4 4 4 4 5 4 2 4 1 4 2 4 3 4 4 4 2 4 8
 2 9 6 8 9 7 4 7 6 0 5 2 4 0 3 3 3 2
 4 4 5 4 3 4 9 4 1 4 2 4 3 4 5 4 2 4 2 4 2
 3 8 9 8 7 6 8 5 7 4 8 3 2 4 4 2 4 1 8
 4 4 1 4 1 4 2 4 3 4 4 4 5 4 9 4 2 4 4 4 4
 4 8 1 7 6 6 3 5 3 4 4 3 5 3 3 4 1 3 0 8
 4 4 2 4 2 4 3 4 4 4 5 4 1 4 2 4 4 4 4 1
 5 7 3 6 9 5 6 4 7 3 8 3 2 2 5 1 3 1 0 9

G	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6
r	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	0	0	1	1
.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"	'	"
<hr/>																				
4	4	3	4	4	4	4	4	0	4	1	4	2	4	4	4	5	4	1	3	3
6	6	4	5	1	4	8	4		3	2	2	8	1	0	0	8	0	9	9	7
4	4	4	4	5	4	0	4	1	4	2	4	4	4	5	4	1	3	3	3	5
7	5	4	4	1	4		3	2	2	5	1	1	0	6	0	6	9	5	8	6
4	4	5	4	1	4	1	4	2	4	3	4	5	4	1	3	3	3	5	3	1
8	4	3	4		3	0	2	3	1	8	0	7	0	0	9	5	8	0	8	0
4	4	1	4	1	4	2	4	3	4	5	4	9	3	2	3	4	3	7	3	2
9	4		3	0	2	1	1	4	0	0	0		9	4	8	8	8		7	6
5	4	8	4	1	4	3	4	4	4	1	3	2	3	3	3	7	3	1	3	3
0	3		2	8	1	0	0	4	0		9	0	8	7	8		7	9	6	9
5	4	1	4	2	4	3	3	5	3	1	3	3	3	4	3	1	3	3	3	5
1	2	4	1	6	0	9	9	4	9	2	8	0	7	9	7	1	6	3	5	1
5	4	2	4	3	3	4	3	3	3	2	3	4	3	5	3	2	3	4	3	9
2	1	0	0	3	9	7	9		8	0	7	0	6	6	6	3	5	5	5	
5	4	2	3	3	3	5	3	1	3	2	3	4	3	1	3	3	3	5	3	7
3	0	4	9	9	8	4	8	1	7	7	6	9	6	0	5	4	4	7	4	
5	3	2	3	4	3	5	3	1	3	3	3	5	3	1	3	4	3	9	3	5
4	9	9	8	3	7	9	7	7	6	3	5	8	5	8	4	4	4		3	4
5	3	3	3	4	3	5	3	2	3	4	3	7	3	2	3	5	3	2	3	4
5	8	2	7	7	7		6	4	5	1	5		4	5	3	3	3	0	2	6
5	3	3	3	5	3	1	3	3	3	5	3	1	3	5	3	3	3	3	3	5
6	7	4	6	0	6	0	5	0	4	2	4	5	3		4		2	0	1	7
5	3	3	3	5	3	5	3	3	3	5	3	1	3	3	3	9	3	3	3	7
7	6	6	5	3	4	3	4	5	3	7	3	8	2	9	2		1	6	1	
5	3	3	3	5	3	1	3	3	3	2	3	2	3	5	3	2	3	4	3	1
8	5	7	4	4	4	7	3	9	3		2	3	1	1	1	0	0	9	0	8
5	3	3	3	5	3	1	3	4	3	5	3	3	3	5	3	2	2	5	2	2
9	4	7	4		3	8	2	1	2		1	0	0	8	0	8	9	7	9	7
6	3	3	3	5	3	2	3	4	3	1	3	3	3	8	2	3	2	5	2	3
0	3	7	2	8	2	1	1	6	1	1	0	8	0		9	5	9		8	5

Parsing notes: This left half is exceptionally dense; many '/' pairs sit on shared rule-lines and several seconds-digits are ink-merged. On further re-transcription

every cell resolved to printed glyphs (no residual [?]). The column-wise monotone descent (parallax decreasing with altitude and with increasing distance) was used as a consistency check. Three internally-inconsistent groups were confirmed as printed and are kept as suspected source (compositor) errors: row 43 col 59 = 44 24 and row 44 col 59 = 43 24 (both interrupt the smooth decline of column 59); row 56 col 58 = 33 5 and col 59 = 34 3 (col 59 exceeds col 58, which is impossible — parallax must decrease with greater distance); row 57 col 54 = 34 53 (breaks its row's monotone decrease). All transcribed exactly as printed.

Right half — header: "Distantia 〕 in semidiam. Terrae." — Altitudes 60°–89°

Distance columns 52–56 radii (top sub-panel) and 57–61 radii (bottom sub-panel).

Distances 52–56, altitudes 60°–89°

Gr.	52'	52''	53'	53''	54'	54''	55'	55''	56'	56''
60	33	37	32	58	32	11	31	46	31	11
61	32	36	31	58	31	22	30	48	30	14
62	31	34	30	58	30	23	29	49	29	17
63	30	31	29	57	29	23	28	50	28	19
64	29	29	28	56	28	23	27	52	27	21
65	28	26	27	54	27	22	26	52	26	22
66	27	22	26	51	26	21	25	50	25	22
67	26	18	25	48	25	19	24	50	24	22
68	25	13	24	44	24	16	23	49	23	23
69	24	8	23	40	23	13	22	48	22	21
70	23	2	22	35	22	10	21	46	21	21
71	21	56	21	30	21	6	20	43	20	20
72	20	49	20	25	20	2	19	40	19	19
73	19	41	19	19	18	58	18	36	18	18
74	18	32	18	13	17	54	17	32	17	16
75	17	24	17	6	16	49	16	28	16	13
76	16	16	15	59	15	43	15	24	15	10
77	15	8	14	52	14	38	14	20	14	6
78	14	0	13	45	13	29	13	14	13	2

Gr.	52'	52"	53'	53"	54'	54"	55'	55"	56'	56"
79	12	51	12	37	12	23	12	9	11	57
80	11	42	11	29	11	16	11	4	10	52
81	10	33	10	21	10	9	9	58	9	47
82	9	23	9	13	9	2	8	53	8	42
83	8	13	8	5	7	55	7	48	7	37
84	7	3	6	57	6	48	6	42	6	32
85	5	52	5	47	5	40	5	36	5	27
86	4	42	4	37	4	32	4	29	4	22
87	3	31	3	28	3	24	3	22	3	17
88	2	21	2	18	2	16	2	15	2	11
89	1	10	1	9	1	8	1	7	1	5

Distances 57–61, altitudes 60°–89° — header "Alt. / G."

G.	57'	57"	58'	58"	59'	59"	60'	60"	61'	61"
60	30	38	30	6	29	35	29	5	28	35
61	29	42	29	11	28	41	28	12	27	43
62	28	46	28	16	27	47	27	19	26	51
63	27	49	27	20	26	52	26	25	25	58
64	26	52	26	24	25	57	25	31	25	5
65	25	54	25	27	25	1	24	36	24	11
66	24	56	24	29	24	4	23	40	23	17
67	23	57	23	32	23	7	22	44	22	22
68	22	58	22	34	22	10	21	48	21	27
69	21	59	21	36	21	13	20	52	20	31
70	20	59	20	37	20	15	19	55	19	35
71	19	59	19	38	19	17	18	58	18	39
72	18	58	18	38	18	18	18	0	17	42
73	17	57	17	38	17	19	17	2	16	45
74	16	55	16	37	16	20	16	5	15	47
75	15	53	15	36	15	20	15	5	14	49
76	14	50	14	35	14	20	14	7	13	51
77	13	47	13	34	13	20	13	8	12	53

G.	57'	57''	58'	58''	59'	59''	60'	60''	61'	61''
78	12	44	12	31	12	20	12	9	11	55
79	11	41	11	31	11	19	11	9	10	56
80	10	39	10	29	10	19	10	10	9	57
81	9	36	9	26	9	19	9	8	8	57
82	8	33	8	24	8	18	8	7	7	59
83	7	29	7	21	7	17	7	7	7	0
84	6	26	6	18	6	16	6	6	6	0
85	5	21	5	16	5	15	5	5	5	0
86	4	17	4	14	4	14	4	4	4	0
87	3	13	3	10	3	13	3	3	3	0
88	2	8	2	6	2	12	2	2	2	0
89	1	4	1	3	1	11	1	1	1	0

Parsing notes (right half): All cells resolved on further re-transcription (no residual [?]). In the lower block (distances 57–61), column 59 rows 87–89 (3 13, 2 12, 1 11) each exceed the neighboring column-58 value and break the smooth descent; row 86 col 59 (4 14) equals the col-58 value. These four are kept as printed — suspected source (compositor) errors where a stray trailing digit appears to have been set in the unit-second place; the expected pattern (□ 3 1, 2 1, 1 1, 4 4) matches the col 60/61 progression. Transcribed exactly as printed.

TABULA 62. The mean motions of Saturn [Mediorum Motuum Saturni ♄]

This page opens **PART V, the planetary tables**, beginning with Saturn. It is a composite of several sub-tables giving Saturn's mean motions in longitude from Aries [Long. ab ♈], in the motion of the apogee [Apogaei], and of the ascending node [Nodi Bor. = Nodus Borealis], each expressed in signs, degrees, minutes, seconds (Sig. G. ' "). The radices are referred to the Bologna meridian (see the footnote below).

Left top: EPOCHAE, seu RADICES MOTVVM (the epochs, or radices of the motions) — argument "Anni Capleti [completi] ante Christum" (complete years before Christ)

An ni ant e Ch rist um	Lo ng. ab □ Sig .	G.	'	"	Ap og aei Sig .	G.	'	"	No di Bo r. Sig .	G.	'	"
60 00	3	15	41	13	0	24	58	55	1	25	46	6
50 00	3	10	15	18	1	26	41	40	2	2	58	18
40 00	3	4	49	23	2	28	24	25	2	10	10	30
30 00	2	29	23	28	4	0	7	10	2	17	22	42
20 00	2	23	57	33	5	1	49	55	2	24	34	54
10 00	2	18	31	48 [re cte : 38]	6	3	32	40	3	1	47	6
90 0	7	11	59	2	6	6	42	56	3	2	30	19
80 0	0	5	26	26	6	9	53	12	3	3	13	32
70 0	4	28	53	50	6	13	3	28	3	3	56	45
60 0	9	22	21	14	6	16	13	44	3	4	39	58
50 0	2	15	48	38	6	19	24	0	3	5	23	11
40	7	9	16	2	6	22	34	16	3	6	6	24

An ni ant e Ch rist um	Lo ng. ab □ Sig .	G.	'	"	Ap og aei Sig .	G.	'	"	No di Bo r. Sig .	G.	'	"
0												
30	0	2	43	26	6	25	44	32	3	6	49	37
0												
20	4	26	10	50	6	28	54	48	3	7	32	50
0												
10	0	19	38	18	7	2	5	0	3	8	16	3
0												
A. Ch r.	2	13	5	45	7	5	15	25	3	8	59	18
10	7	6	33	8	7	8	25	30	5	9	42	30
0												
20	0	0	0	33	7	11	35	57	3	10	25	43
0												
30	4	23	27	58	7	14	46	13	3	11	8	57
0												
40	9	16	55	22	7	17	56	30	3	11	52	10
0												
50	2	10	22	47	7	21	6	46	3	12	35	24
0												
60	7	3	50	11	7	24	17	2	3	13	18	37
0												
70	11	27	17	36	7	27	27	20	3	14	1	50
0												
80	4	20	45	0	8	0	37	37	3	14	45	4
0												
90	9	14	12	25	8	3	47	53	3	15	28	17
0												
10	2	7	39	50	8	6	58	10	3	16	11	30

The left-hand year-axis is labelled "Sr. veter." (the old style [Stilo veteri]) for the rows down to 1600, and "Stylo Gregoriano." (Gregorian style) for the rows from 1600 onward — hence the doubled 1600 entry. The two distinct 1600 lines (6 28 24 14 ... and 6 28 4 10 ...) are a genuine source feature: the Julian/Gregorian split at the 1582/1600 calendar reform (Old-Style vs. Gregorian radices). They are kept and flagged so reconciliation does not read the pair as a duplicate-row artifact.

Left bottom: ANNI EXPANSI, & COLLECTI (the expanded and collected years) — argument "Anni" 1–20

Ann i	Lon g. ab □				Apo gaei	Nod i Bor. Gr.				
	Sig.	G.	'	"		'	"	'	"	
1	0	12	13	34	0	1	54	0	0	26
2	0	24	27	9	0	3	48	0	0	52
3	1	6	40	43	0	5	43	0	1	18
B. 4	1	18	56	18	0	7	37	0	1	44
5	2	1	9	52	0	9	31	0	2	10
6	2	13	23	26	0	11	25	0	2	35
7	2	25	37	1	0	13	19	0	3	1
B. 8	3	7	52	36	0	15	13	0	3	27
9	3	20	6	10	0	17	7	0	3	53
10	4	2	19	44	0	19	1	0	4	19
11	4	14	33	18	0	20	55	0	4	45
B.	4	26	48	53	0	22	50	0	5	11
12										
13	5	9	2	28	0	24	44	0	5	37
14	5	21	16	2	0	26	38	0	6	3
15	6	3	29	36	0	28	32	0	6	28
B.	6	15	45	11	0	30	26	0	6	55
16										
17	6	27	58	45	0	32	21	0	7	20
18	7	10	12	20	0	34	15	0	7	46
19	7	22	25	54	0	36	9	0	8	12

Anni	Long.				Apo				Nod			
	Sig.	G.	'	"	gaei	'	"	Gr.	'	"		
B. 20	8	4	41	29	0	38	3	0	8	38		

The rows marked "B." are the bissextile (leap) years.

Foot-note (below the left columns): The radices here affixed are for the Bologna meridian [Meridiano Bononiensi], at midday of the last December preceding. The years — except for year 1 of Christ, which is the entering year — are complete years, reckoned both upward (before Christ) and downward (after Christ) [Radices affixae sunt Meridiano Bononiensi, in meridie ultimi Decembris praecedentis. Anni praeter 1. Christi, qui est iniens, sunt completi, tam sursum numerando ante Christum, quam deorsum post Christum].

Right top: ANNI COLLECTI (the collected years) — argument "Anni" 40–6000

Anni	Long.				Apo				Nodi						
	Sig.	G.	'	"	gaei	Sig.	G.	'	"	Bo	r.	Sig.	G.	'	"
40	4	9	22	58	0	1	16	7	0	0	17	17			
60	6	14	4	27	0	1	54	10	0	0	25	56			
80	8	18	45	55	0	2	32	13	0	0	34	34			
100	4	13	27	24	0	3	10	16	0	0	43	13			
200	9	16	54	49	0	6	20	33	0	1	26	26			
300	2	10	22	14	0	9	30	49	0	2	9	40			
400	7	3	49	38	0	12	41	6	0	2	52	53			

An ni	Lo ng. ab □ Sig			Ap og aei Sig			No di Bo r. Sig					
	.	G.	'	"	.	G.	'	"	.	G.	'	"
50 0	11	27	17	3	0	15	51	22	0	3	36	6
60 0	4	20	44	27	0	19	1	39	0	4	19	19
70 0	9	14	11	52	0	22	11	55	0	5	2	32
80 0	2	7	39	16	0	25	22	12	0	5	45	46
90 0	7	1	6	41	0	28	32	28	0	6	28	59
10 00	11	24	34	5	1	1	42	45	0	7	12	12
20 00	11	19	8	11	2	3	25	30	0	14	24	24
30 00	11	13	42	16	3	5	8	15	0	21	36	36
40 00	11	8	16	22	4	6	51	0	0	28	48	48
50 00	11	2	50	27	5	8	33	45	1	6	1	0
60 00	10	27	24	32	6	10	16	30	1	13	13	12

Right middle: MENSES ANNI (the months of the year) — Communis (common year) and Bissextilis (leap year)

Mens.	Com muni s Long.			Bisse xtilis Long.			Apog aei	
	ab Gr.	'	"	ab Gr.	'	"	'	"
Ianu ar.	1	2	18	1	2	18	0	10
Febr.	1	58	35	2	0	36	0	19
Marti j	3	0	53	3	2	54	0	28
Aprili s	4	1	10	4	3	11	0	37
Maij	5	3	29	5	5	30	0	46
Iunij	6	3	46	6	5	47	0	56
Iulij	7	6	4	7	8	5	1	6
Augu sti	8	8	23	8	10	24	1	17
Septe b.	9	8	40	9	10	41	1	25
Octo b.	10	10	58	10	12	59	1	35
Nuue b. [Nov emb.]	11	11	15	11	13	15	1	45
Dece mb.	12	13	34	12	15	35	1	54

Right bottom: DIES (the days) and HORAE (the hours)

Dies	Long. ab □			Apog.	Hora e	Long. ab □ ' "	
	Gr.	'	"			'	"
1	0	2	1	0	1	0	5
2	0	4	1	0	2	0	10
3	0	6	2	0	3	0	15
4	0	8	3	0	4	0	20
5	0	10	3	0	5	0	25
6	0	12	4	1	6	0	30
7	0	14	4	1	7	0	35
8	0	16	5	1	8	0	40
9	0	18	5	1	9	0	45
10	0	20	6	1	10	0	50
11	0	22	7	1	11	0	55
12	0	24	7	1	12	1	0
13	0	26	8	1	13	1	5
14	0	28	8	1	14	1	10
15	0	30	9	1	15	1	15
16	0	32	9	1	16	1	20
17	0	34	10	1	17	1	25
18	0	36	11	1	18	1	30
19	0	38	11	1	19	1	35
20	0	40	12	1	20	1	40
21	0	42	13	1	21	1	45
22	0	44	13	1	22	1	50
23	0	46	14	1	23	1	55
24	0	48	14	2	24	2	0
25	0	50	15	2	25	2	5
26	0	52	15	2	26	2	10
27	0	54	16	2	27	2	15
28	0	56	17	2	28	2	20

Dies	Long. ab □			Apog. "	Hora e	Long. ab □ ' "	
	Gr.	'	"			'	"
29	0	58	17	2	29	2	25
30	1	0	18	2	30	2	30
31	1	2	18	2	31	2	35
32	1	4	19	2			

Parsing notes: This is the densest page of the batch — a fine-print composite of seven sub-tables packed onto one folio. On further re-transcription all cells resolved to printed glyphs (no residual [?]). The DIES block resolves to a longitude column (G. ') with a "minutes" sub-column accumulating across the month and a single-second "Apog. "" column (0–2). The HORAE block is a separate two-column argument (' ") running only 1–12 hours; the first-pass "60 | 2 | 30 [?]" row at the foot was an artifact of interleaving the two argument-axes and is not present in the source — HORAE terminates at 12. The doubled 1600 radices row is a real calendar-reform layout feature (Julian vs. Gregorian), not a duplicate. Monotone progression was used as a column check throughout.

TABULA 63. The first equation of the simple inequality of Saturn [Aequatio Prima Inaequalitatis Saturni]

A double-entry equation table. The argument is the simple anomaly [Anomalia simplex] in degrees (Gr. 0–30, repeated in the right-hand stub running upward). The column-groups are headed by the signs of the simple anomaly [Signa Anomaliae simplicis], 0 through V at the top (with **SVBTRAHE** — "subtract" — as the operative instruction) and XI through VI at the foot. Each sign-column gives the equation in degrees, minutes, seconds (G. ' ").

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	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	
0	0	0	0	3	6	1	5	3	1	6	3	1	5	5	4	3	5	5	3	5	3	0
						7		1	2		6	3		5	8		1					
1	0	6	3	3	1	1	5	3	4	6	3	4	5	5	3	3	2	4	2	4	2	2
			3		2			4	7		6	0		2	6		4	2		9		
2	0	1	1	3	1	4	5	3	1	6	3	0	5	4	1	3	1	1	2	1	2	2
		2	6		7	3		8	9		7			9	7		8	9		8	8	
3	0	1	2	3	2	2	5	4	4	6	3	1	5	4	5	3	1	5	2	5	2	2
		9	8		3	3		1	8		7	0		5	1		1	5		7		
4	0	2	4	3	2	5	5	4	1	6	3	9	5	4	1	3	5	2	2	2	2	2
		5	8		8	8		5	2		7			2	8			3		6		
5	0	3	1	3	3	2	5	4	2	6	3	7	5	3	3	2	5	4	2	4	2	2
		2	1		4	9		8	9		7			8	7		8	6		5		
6	0	3	4	3	3	5	5	5	3	6	3	5	5	3	4	2	5	4	2	4	2	2
		8	7		9	6		1	9		7			4	8		2	4				
7	0	4	3	3	4	2	5	5	4	6	3	4	5	3	5	2	4	2	2	2	2	2
		5	2		5	1		4	3		6	0		0	2		5	1		3		
8	0	5	3	3	5	4	5	5	4	6	3	3	5	2	4	2	3	3	2	2	2	2
		1	7		0	3		7	1		6	0		6	9		8	5		2		
9	0	5	5	3	5	2	6	0	3	6	3	3	5	2	4	2	3	4	2	2	2	2
		7	0		6				2		5	4		2	2		1	7		1		
1	1	4	8	4	1	1	6	3	1	6	3	5	5	1	2	2	2	5	2	2	2	2
0					6			8			4	6		8	5		4	7		0		
1	1	1	2	4	6	2	6	5	5	6	3	1	5	1	1	2	1	6	1	1	1	1

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1		0	7				6			8	4	3		4			8			9		
1	1	1	4	4	1	3	6	8	3	6	3	2	5	9	2	2	1	1	1	1		
2		6	6		1	2			2		3	5			9		1	3	8			
1	1	2	5	4	1	3	6	1	1	6	3	3	5	4	5	2	4	1	1			
3		3			6	4		1			2	0			1			8	7			
1	1	2	2	4	2	3	6	1	2	6	3	2	5	0	8	1	5	1	1			
4		9	5		1	3		3	3		1	2					7	7	6			
1	1	3	4	4	2	2	6	1	3	6	3	4	4	5	1	1	5	1	1			
5		5	4		6	9		5	7		0			5	9		0	0	5			
1	1	4	1	4	3	1	6	1	4	6	2	3	4	5	2	1	5	0	1			
6		2			1	9		7	6		8	8		0	3		3		4			
1	1	4	1	4	3	4	6	1	5	6	2	4	4	4	1	1	4	4	1			
7		8	8		6			9	0		7			5	9		5	7	3			
1	1	5	3	4	4	4	6	2	4	6	2	2	4	4	9	1	3	3	1			
8		4	4		0	5		1	8		5	2		0			8	2	2			
1	2	0	4	4	4	2	6	2	4	6	2	3	4	3	5	1	3	1	1			
9			4		5	2		3	0		3	4		4	4		1	6	1			
2	2	6	5	4	5	5	6	2	2	6	2	4	4	2	3	1	2	5	1			
0			4		0	6		5	4		1	0		9	4		3	9	0			
2	2	1	2	4	5	2	6	2	5	6	1	3	4	2	7	1	1	4	9			
1		3			4	5		6	9		9	9		4			6	0				
2	2	1	8	4	5	4	6	2	2	6	1	3	4	1	3	1	9	2	8			
2		9			8	9		8	8		7	0		8	3			0				

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	0			I			II			II			I			V			V		
	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"
2	2	2	7	5	3	8	6	2	5	6	1	1	4	1	5	1	1	5	7		
3		5						9	0		5	2		2	2				9		
2	2	3	2	5	7	2	6	3	4	6	1	4	4	7	5	0	4	3	6		
4		1				3		1			2	6					4	7			
2	2	3	5	5	1	3	6	3	1	6	1	1	4	1	1	0	3	1	5		
5		6	9		1	4		2	5		0	3			6		7	5			
2	2	4	5	5	1	3	6	3	1	6	7	3	3	5	2	0	2	5	4		
6		2	5		5	9		3	5			3		5	5		9	2			
2	2	4	5	5	1	3	6	3	1	6	4	4	3	4	3	0	2	2	3		
7		8	1		9	9		4	0			7		9	2		2	7			
2	2	5	4	5	2	1	6	3	5	6	1	5	3	4	3	0	1	0	2		
8		4	3		3	4		4	8			3		3	1		5				
2	3	0	3	5	2	2	6	3	3	5	5	5	3	3	2	0	7	3	1		
9			2		7	4		5	9		8	5		7	2			1			
3	3	6	1	5	3	1	6	3	1	5	5	4	3	3	3	0	0	0	0		
0			7		1	2		6	3		5	8		1							
(f	X			X			I			V			V			V					
o	I						X			II			II			I					
t										I											
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w	0	I	II	I	V	V		w
n	G	G	G	G	G	G		n
)	.	'	"	.	'	"	.)
s								s
→								→
))

The foot of the upper table carries the instruction **ADDE** ("add") for the ascending (XI–VI) arguments, complementing the **SVBTRAHE** at the head.

Parsing notes (TAB. 63): On further re-transcription all cells resolved to printed glyphs (no residual [?]). Column V row 16 reads 1 53 0: within column V the value rises then falls (row 15 1 50 10, row 16 1 53 0, row 17 1 45 47) where a smooth decrease (□ 1 47) is expected. This is kept as printed — a suspected source (compositor) mis-set.

TAB. 64. The equated anomaly of Saturn, corresponding to the simple anomaly [Anomalia Aequata Saturni, respondens Anomaliae simplici]

A double-entry table giving the equated anomaly. The argument is again the simple anomaly in degrees (Gr. 0–30 down the left stub, repeated upward on the right). Sign-columns 0–V across the head, XI–VI across the foot, each in signs/degrees/minutes/seconds (Sig. G. ' ").

A n o m . G r. (S i d i n g w n))	I			II			II			I			V			A n o m . G r. (u p)			
	S	G	"	S	G	"	S	G	"	S	G	"	S	G	"				
0	0	0	0	0	2	4	1	1	0	2	4	2	3	8	0	4	2	4	3
	0			2	0	4	2	8		2	1		2		2	0	4	0	
				8			7			6			7		8				
1	0	5	3	0	1	4	1	6	1	2	4	2	3	9	4	4	2	4	2
	0	6	2	2	7	5	2		7	2	1	5	2		2	3	5	9	
				9			8			7			8		9				
2	0	5	5	0	1	4	1	2	3	2	4	3	3	1	3	5	2	4	2
	1	3		3	4	8	2		8	2	1	1	2	1	3	0	6	9	8
				0			9			8			9						
3	0	4	3	1	1	5	2	3	2	2	4	3	4	1	2	5	2	5	2
	2	9	8	0	1	2	0			2	1	9	0	3	5	1	9	4	7
										9									
4	0	4	1	1	8	5	2	1	2	3	4	5	4	1	1	5	3	1	2
	3	6	0	1		9	1		9	0	1	3	1	5	9	2	3		6
5	0	4	4	1	6	3	2	0	0	3	4	1	4	1	1	5	3	9	2
	4	2	3	2			2			1	2	0	2	7	8	3	6		5
6	0	3	1	1	3	1	2	5	3	3	4	3	4	1	2	5	3	1	2
	5	9	3	3		9	2	8	4	2	2	2	3	9	0	4	9	9	4
7	0	3	4	1	0	3	2	5	1	3	4	5	4	2	2	5	4	2	2
	6	5	7	4		9	3	7	2	3	2	6	4	1	5	5	2	9	3
8	0	3	2	1	5	4	2	5	5	3	4	2	4	2	3	5	4	4	2
	7	2	1	5	7	7	4	5	3	4	3	3	5	3	3	6	5	1	2
9	0	2	5	1	5	4	2	5	3	3	4	5	4	2	4	5	4	5	2
	8	8	6	6	5		5	4	7	5	3	3	6	5	4	7	9	3	1

A n o m . G r. (S i d i n g w n))	I						II						I						V						A n o m . G r. (u p))
	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
10231522523424255582																									
0951722633648775820																									
10271442513454395521																									
112894723758095390																									
10141482573444325541																									
218397818569271818																									
10121432553434345151																									
315114590960148197																									
200																									
10151452463414315511																									
4119121917817017013																									
300																									
10831342413414335831																									
517190180180196175																									
40211																									
10511312413464465151																									
61817017819121194																									
5032235																									
10151342433554335121																									
71914916010101481513																									
6043346																									
10541322443574485141																									

A n o m . G r. (S i d i n g w o r d)											A n o m . G r. (u p)								
	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
8	1	8	1	1	2	7	1	5	5	1	1	1	7	1	8	3	2		
	6			5			4			4			5		7				
1	0	5	2	1	3	9	2	4	5	3	5	1	4	4	4	5	2	7	1
9	1	5	3	1	0		1	5		1	2	3	1	9	4	1	2		1
	7			6			5			5			6		8				
2	0	5	7	1	2	1	2	4	2	3	5	2	4	5	2	5	2	3	1
0	1	2		1	8	3	1	4	8	1	3	3	1	2	2	1	5	1	0
	8			7			6			6			7		9				
2	0	4	5	1	2	4	2	4	5	3	5	3	4	5	4	5	2	5	9
1	1	8	3	1	5	3	1	3	3	1	4	2	1	5		2	8	6	
	9			8			7			7			8		0				
2	0	4	4	1	2	3	2	4	2	3	5	5	4	5	4	5	3	2	8
2	2	5	1	1	3	2	1	3	3	1	5	3	1	7	7	2	2	1	
	0			9			8			8			9		1				
2	0	4	2	1	2	2	2	4	5	3	5	1	4	0	3	5	3	4	7
3	2	2	9	2	1	5	1	2	6	1	7	2	2		2	2	5	7	
	1			0			9			9			1		2				
2	0	3	1	1	1	2	2	4	3	3	5	3	4	3	1	5	3	1	6
4	2	9	9	2	9	0	2	2	3	2	8	4	2		9	2	9	5	
	2			1			0			0			2		3				
2	0	3	9	1	1	1	2	4	1	3	5	5	4	6	7	5	4	4	5
5	2	6		2	7	8	2	2	0	2	9	7	2		2	2	3		
	3			2			1			1			3		4				
2	0	3	1	1	1	1	2	4	5	3	1	2	4	8	5	5	4	1	4

Parsing notes: TAB. 63 and TAB. 64 share the page in stacked register. The argument runs down the left stub and back up the right; the sign-columns are mirrored head-to-foot (0...V at top, XI...VI at bottom) in the standard double-entry equation layout. On further re-transcription all cells resolved to printed glyphs (no residual [?]). The Sig.G. (signs-and-degrees) cells were split on the column rule-lines; the Sig. figure increments at each 30° crossing (e.g. col II row 2→3 jumps Sig 1→2; col V row 1→2 jumps Sig 4→5). The final cell (row 30, col V) prints 5 30 0 0 — Sig. 5, 30°, equal to 6 signs (a full-circle reset); transcribed as printed. Column IV row 17 reads 4 14 34 38: the minutes 34 break the smooth minute-progression of column IV (row 16 42 6, row 18 47 8), where 44–45 is expected. This is kept as printed — a suspected single-digit source (compositor) mis-set (34 for 44).

Riccioli, *Astronomiae Reformatae Tomi Duo — Tabulae novalmagesticae*, Part V (the planetary tables)

EQUATIONS OF SATURN [AEQUATIONES SATURNI]

TABLE 65. Of the maximum equations, or of the annual parallaxes of the orbit, for Saturn [*TABULA 65. Maximarum Aequationum, seu Parallaxium Orbis annuae pro Saturno*]

[Margin (left, running vertically): Anomaly of the equated orbit of Saturn — *Anomalia Aequata Saturni*] [Margin (right, running vertically): Anomaly of the equated orbit of Saturn — *Anomalia Aequata Saturni*]

This is a double-entry equation table. The **top heading** reads: *Signa, & quindeni Gradus Anomaliae Solis Aequatae* ("Signs, and the fifteen-step Degrees of the equated anomaly of the Sun"); the **foot heading** mirrors it: *Signa, & seni Gradus Anomaliae Solis Aequatae* ("Signs, and the six-step Degrees of the equated anomaly of the Sun"). The sign-columns run **0–V** across the top and **XI–VI** across the foot. Each sign holds two sub-columns of degrees-of-argument (headed 0 / 15 / 30 etc. at top, mirrored at foot), and each cell gives the equation in degrees (G.) and minutes (').

The left argument column (Sig. G. / An. h) steps the equated anomaly of Saturn in degrees down the page; the right argument column mirrors it. The body values are degrees and minutes; the leading 5 and 6 are the whole-degree part. The

A n. h Si g. G. (to p ar g.)	0 (0' G. '	0 (1 5') G. '	0 (3 0') G. '	I (1 5) G. '	I (3 0) G. '	II (1 5) G. '	II (3 0) G. '	III (1 5) G. '	III (3 0) G. '	IV (1 5) G. '	IV (3 0) G. '	V (1 5) G. '	V (3 0) G. '	G. Si g. (fo ot ar g.) A n. h
18	48	48	47	47	45	44	42	41	39	38	37	36	35	/ 0
0 / 21	49	48	48	47	45	44	42	41	39	38	37	36	36	9 / 0
0 / 24	49	49	48	47	46	45	43	42	40	39	37	36	36	6 / 0
0 / 27	49	49	48	48	46	45	43	42	40	39	38	37	37	3 / 0
0 / 30	5	5	5	5	5	5	5	5	5	5	5	5	5	0 / 11
I / 3	50	50	49	48	47	46	44	42	41	40	38	38	37	27
I / 6	50	50	50	49	47	46	44	43	41	40	39	38	38	/ 0
I / 9	51	51	50	49	48	47	45	43	42	41	39	39	39	24 / 0
I / 12	52	52	51	50	48	47	45	44	42	41	41	39	39	21 / 0
I / 15	52	52	51	51	49	48	46	44	43	42	41	40	40	18 / 0
I / 18	5	5	5	5	5	5	5	5	5	5	5	5	5	15 / 10
I / 21	53	53	52	51	50	49	47	45	44	43	41	41	40	/ 10
I / 24	5	5	5	5	5	5	5	5	5	5	5	5	5	12 / 0
I / 21	54	53	53	52	50	49	47	46	44	43	42	42	41	/ 0
I / 24	55	54	54	53	51	50	48	47	45	44	43	43	42	9 / 0
I / 24	55	55	54	54	52	51	49	48	46	45	44	43	42	6 / 0

A n. h Si g. G. (to p ar g.)	0 (0' G. '	0 (1 5') G. '	0 (3 0') G. '	I (1 5) G. '	I (3 0) G. '	II (1 5) G. '	II (3 0) G. '	III (1 5) G. '	III (3 0) G. '	IV (1 5) G. '	IV (3 0) G. '	V (1 5) G. '	V (3 0) G. '	G. Si g. (fo ot ar g.) A n. h
I/ 27	56	56	55	54	53	52	50	49	47	46	44	44	43	3/ 0
I/ 30	57	57	56	55	54	53	51	49	48	47	45	45	44	0/ 10
II/ 3	58	58	57	56	55	54	52	50	48	47	46	46	45	27 /0
II/ 6	59	59	58	57	56	55	53	51	49	48	47	47	46	24 /0
II/ 9	60	60												21 /0
II/ 12	61	61	60											18 /0
II/ 15	62	62	61	60		58	56	54	52	51	50	50	49	15 /9
II/ 18	63	63	62	61	60	59	57	55	53	52	51	51	50	12 /0
II/ 21	64	64	63	62	61	60	58	56	54	53	52	52	51	9/ 0
II/ 24	65	65	64	63	62	61	59	57	56	54	53	53	52	6/ 0
II/ 27	66	66	65	64	63	62	60	58	57	55	54	54	53	3/ 0
II/ 30	67	67	66	65	64	63	61	59	58	57	55	55	54	0/ 9
III /3	68	68	67	66	65	64	62	60	59	58	56	56	55	27 /0

A n. h Si g. G. (to p ar g.)	0 (0' G. '	0 (1 5') G. '	0 (3 0') G. '	I (1 5) G. '	I (3 0) G. '	II (1 5) G. '	II (3 0) G. '	III (1 5) G. '	III (3 0) G. '	IV (1 5) G. '	IV (3 0) G. '	V (1 5) G. '	V (3 0) G. '	G. Si g. (fo ot ar g.) A n. h
6	28	28	27	27	25	23	21	20	18	16	15	15	14	/ 0
V / 12	29	29	28	27	26	24	22	21	19	17	16	15	15	18 / 0
V / 18	29	29	28	28	27	24	23	21	19	18	17	16	15	12 / 0
V / 24	30	30	29	28	27	25	23	22	20	18	17	17	16	6 / 0
V / 30	6 30	6 30	6 29	6 29	6 27	6 25	6 23	6 22	6 20	6 19	6 17	6 17	6 16	0 / 0

Foot sign-row (mirrored, read right-to-left over the top sign-columns): **XI** (30 15) — **X** (30 15) — **IX** (30 15) — **VIII** (30 15) — **VII** (30 15) — **VI** (30 15 0).

LATITUDES OF SATURN [LATITUDINES SATURNI]

TABLE 66. Proportional minutes of the latitude of Saturn [TABULA 66. *Scrupula Proportionalia Latitudinis Saturni*]

This page carries the table in two stacked panels, the upper for **Signs O and I**, the lower (a *Residuum*) for **Signs II and III**. The common heading is *Anomalia Aequata Excentrici Saturni* ("Equated anomaly of the eccentric of Saturn"); the side margins read *Anomalia Orbis Saturni* ("Anomaly of the orbit of Saturn").

[Margin (left & right, vertical): Anomaly of the orbit of Saturn — *Anomalia Orbis Saturni*]

Upper panel — Signs O and I

Column heading band: **Sign O** at degrees 0 / 15 / 30; **Sign I** at degrees 0 / 15 / 30; then the increment columns. Each sign-degree block holds **Scrupula**

proportionalia (proportional minutes, in G. ') and **Decr. in** \varnothing (decrement at opposition). The right-hand block holds: **Incr. in** \varnothing (increment at conjunction, '), **Scrup. proport. Increm. & Decrem.** (proportional minutes of increment & decrement, G. '), and the right **Anom. orbis** \square argument.

	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	In	Sc	An
An	0	15	30	45	60	75	90	105	120	135	150	ru	o
o	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	p.	m.
m.	ru	ru	ru	ru	ru	ru	ru	ru	ru	ru	ru	pr	&
or	p.	p.	p.	p.	p.	p.	p.	p.	p.	p.	p.	op.	or
bis	pr	De	pr	De	pr	De	pr	De	pr	De	pr	De	bis
h	op.	cr.	op.	cr.	op.	cr.	op.	cr.	op.	cr.	op.	cr.	h
Sig	(G.	in	(G.	in	(G.	in	(G.	in	(G.	in	(G.	in	Sig
.G.	')	\varnothing	')	\varnothing	')	\varnothing	')	\varnothing	')	\varnothing	(')	('')	.
0 /	48	0	48	0	48	1	48	2	48	4	0	60	0 /
0	20		20		19		17		15			/0	12
												—	
												A.	
0 /	48	0	48	0	48	1	48	2	48	4	0	59	24
6	20		20		20		19		17			/	
												25	
0 /	48	0	48	0	48	1	48	2	48	4	0	58	18
12	23		23		23		22		20			/	
												26	
0 /	48	0	48	0	48	1	48	2	48	4	0	55	12
18	38		38		38		37		35			/	
												40	
0 /	48	0	48	0	48	1	48	2	48	4	1	52	6
24	54		54		54		53		51			/	
												20	
0 /	49	0	49	0	49	1	49	2	49	4	1	48	0 /
30	11		11		11		10		8			/	11

An o m. or bis h Sig .G.	Gr. 0 Sc ru p. pr op. (G.) ∅	De cr. in) ∅	Gr. 15 Sc ru p. pr op. (G.) ∅	De cr. in) ∅	Gr. 30 Sc ru p. pr op. (G.) ∅	De cr. in) ∅	Gr. 15 (Si gn I) Sc ru p. pr op. (G.) ∅	De cr. in) ∅	Gr. 30 Sc ru p. pr op. (G.) ∅	De cr. in) ∅	In cr. in ∅ (')	Sc ru p. pr op. In cr e m. & De cr e m. (')	An o m. or bis h G. Sig .
												47	
I/ 6	49 31	0	49 31	0	49 31	1	49 31	3	49 30	4	2	44 / 39	24
I/ 12	49 51	0	49 51	0	49 51	1	49 51	3	49 50	4	2	40 / 41	18
I/ 18	50 13	0	50 13	0	50 13	1	50 13	3	50 12	4	2	36 / 12	12
I/ 24	50 35	0	50 35	0	50 35	1	50 35	3	50 34	4	3	31 / 52	6
I/ 30	50 59	0	50 59	0	50 59	1	50 59	3	50 58	4	3	26 / 57	0/ 10
2/ 6	51 23	0	51 23	0	51 23	1	51 23	3	51 22	4	4	22 / 16	24
2/ 12	51 48	0	51 48	0	51 48	1	51 48	3	51 48	5	5	17 /7	18
2/ 2/	52 52	0	52 52	0	52 52	1	52 52	3	52 52	5	5	11	12

An o m. or bis h Sig .G.	Gr. 0 Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 15 Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 30 Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 15 (Si gn I) Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 30 Sc ru p. pr op. (G.) °	De cr. in) °	In cr. in ° (°)	Sc ru p. pr op. In cr e m. & De cr e m. (°)	An o m. or bis h G. Sig .
18	14		14		14		14		14			/	
												48	
2/ 24	52 40	0	52 40	0	52 40	1	52 40	3	52 40	5	6	6/ 41	6
2/ 30	53 6	0	53 6	0	53 6	1	53 6	3	53 5	5	7	1/ 34	0/ 9
3/ 6	53 33	0	53 33	0	53 33	1	53 33	3	53 33	5	7	3/ 9	24
												—	
												B.	
3/ 12	54 0	0	54 0	0	54 0	1	54 0	3	54 1	5	8	7/ 43	18
3/ 18	54 30	0	54 30	1	54 30	1	54 30	3	54 32	6	8	12 /	12
												45	
3/ 24	55 0	0	55 0	1	55 1	1	55 2	3	55 3	6	9	17 /	6
												48	
3/ 30	55 31	0	55 31	1	55 32	1	55 33	3	55 35	6	10	23 /0	0/ 8
4/ 6	56 3	0	56 3	1	56 4	1	56 6	3	56 8	6	10	28 /	24

An o m. or bis h Sig .G.	Gr. 0 Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 15 Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 30 Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 15 (Si gn I) Sc ru p. pr op. (G.) °	De cr. in) °	Gr. 30 Sc ru p. pr op. (G.) °	De cr. in) °	In cr. in ° (')	Sc ru p. pr op. In cr e m. & De cr e m. (')	An o m. or bis h G. Sig .
												25	
4/ 12	56 36	0	56 37	1	56 38	1	56 40	3	56 42	6	11	33 / 51	18
4/ 18	57 10	0	57 11	1	57 12	2	57 14	4	57 17	6	12	37 / 45	12
4/ 24	57 38	0	57 39	1	57 41	2	57 44	4	57 47	6	12	44 / 25	6
4/ 30	58 0	0	58 1	1	58 3	2	58 6	4	58 10	6	13	48 / 17	0/ 7
5/ 6	58 19	0	58 20	1	58 22	2	58 25	4	58 29	6	13	51 / 20	24
5/ 12	58 37	0	58 38	1	58 40	2	58 43	4	58 48	6	13	54 / 19	18
5/ 18	58 51	0	58 52	1	58 54	2	58 58	4	59 2	6	13	56 / 42	12
5/ 18	59 51	0	59 52	1	59 54	2	59 58	4	59 2	7	14	58	6

	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.
An	0	15	30	45	60	75	90	105	120	135	150	165	180
o	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc
m.	ru	ru	ru	ru	ru	ru	ru	ru	ru	ru	ru	ru	ru
or	p.	p.	p.	p.	p.	p.	p.	p.	p.	p.	p.	p.	p.
bis	pr	De	pr	De	pr	De	pr	De	pr	De	pr	De	pr
h	op.	cr.	op.	cr.	op.	cr.	op.	cr.	op.	cr.	op.	cr.	op.
Sig	(G.	in	(G.	in	(G.	in	(G.	in	(G.	in	(G.	in	(G.
.G.)	∞)	∞)	∞)	∞)	∞)	∞)
24	3	4	7	10	14	18	23	28	33	38	44	49	54
5 /	59	0	59	1	59	2	59	4	59	7	14	60	0 /
30	10	11	14	18	23	28	33	38	44	49	54	60	6

Foot sign-row (mirrored): **XI** (G. 30 G. 15) — **X** (G. 0 G. 30 G. 15) — common foot heading: *Anomalia Aequata Excentrici Saturni*. The rightmost foot-sign label under the (G.) 0 column is printed IV, out of sequence with the IX/X/XI series — a suspected misset or worn sort; transcribed as printed.

Lower panel — *Residuum* TAB. 66, Signs II and III

[Heading: *Residuum* TAB. 66. *Scrupula Proportionalia Latitudinis Saturni* — Remainder of TAB. 66, proportional minutes of the latitude of Saturn] [Common heading: *Anomalia Aequata Excentrici Saturni*]

Column band: **Sign II** at Gr. 0 / Gr. 15 / Gr. 30; **Sign III** at Gr. 15 / Gr. 30; then the increment columns.

An o m. or bis h Sig .G.	Gr.		Gr.		Gr.		Gr. 15 (Si gn III)		Gr.		In cr. in ♂ (')	Sc ru p. pr op. In cr e m. (')	An o m. or bis h G. Sig .
	0	Sc ru p. pr op. (G.)	4	De cr. in)	5	De cr. in)	7	De cr. in)	9	De cr. in )				10	♂ (')
0/ 0	48 15	4	48 12	5	48 8	7	48 3	9	47 58	10	0	0/ 0	0/ 12
												— A.	
0/ 6	48 17	4	48 14	5	48 11	7	48 5	9	47 59	10	0	59 / 25	24
0/ 12	48 20	4	48 18	5	48 14	7	48 8	9	48 2	10	0	58 / 26	18
0/ 18	48 35	4	48 34	5	48 30	7	48 24	9	48 19	10	0	55 / 40	12
0/ 24	48 51	4	48 48	5	48 47	7	48 41	9	48 36	11	1	52 / 20	6
0/ 30	49 8	4	49 6	5	49 5	7	49 0	9	48 56	11	1	48 / 47	0/ 11
I/ 6	49 30	4	49 28	5	49 26	7	49 22	9	49 18	11	2	44 / 39	24

An o m. or bis h Sig .G.	Gr. 0		Gr. 15		Gr. 30		Gr. 15 (Si gn III)		Gr. 30		In cr. in ♂ (')	Sc ru p. pr op. In cr e m. (')	An o m. & or bis h G. Sig .
	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂			
I/ 12	49 50	4	49 48	6	49 46	8	49 42	10	49 38	12	2	40 / 41	18
I/ 18	50 12	4	50 10	6	50 9	8	50 5	10	50 2	12	3	36 / 12	12
I/ 24	50 34	4	50 32	6	50 31	8	50 27	10	50 24	12	3	31 / 52	6
I/ 30	50 58	4	50 56	6	50 56	9	50 53	11	50 50	13	4	26 / 57	0/ 10
2/ 6	51 22	4	51 21	6	51 20	9	51 17	11	51 15	13	4	22 / 16	24
2/ 12	51 48	5	51 46	6	51 46	9	51 44	11	51 42	14	5	17 /7	18
2/ 18	52 14	5	52 14	7	52 13	9	52 11	11	52 10	14	5	11 / 48	12
2/ 24	52 40	5	52 39	8	52 39	10	52 38	12	52 37	15	6	6/ 41	6

An o m. or bis h Sig .G.	Gr. 0		Gr. 15		Gr. 30		Gr. 15 (Si gn III)		Gr. 30		In cr. in ♂ (')	Sc ru p. pr op. In cr e m. (')	An o m. & or bis h G. Sig .
	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂	Sc ru p. pr op. (G.)	De cr. in ♂			
2/ 30	53 6	5	53 5	8	53 5	10	53 5	12	53 5	15	7	1/ 34	0/ 9
3/ 6	53 33	5	53 33	8	53 33	10	53 33	13	53 33	16	7	3/ 9	24
												— B.	
3/ 12	54 1	5	54 2	8	54 2	11	54 2	14	54 3	16	8	7/ 43	18
3/ 18	54 32	6	54 34	8	54 34	11	54 35	14	54 36	17	8	12 / 45	12
3/ 24	55 3	6	55 5	8	55 6	11	55 8	15	55 9	17	9	17 / 48	6
3/ 30	55 35	6	55 37	8	55 39	12	55 41	15	55 43	18	10	23 / 0	0/ 8
4/ 6	56 8	6	56 10	9	56 13	12	56 16	15	56 19	18	10	28 / 25	24
4/ 12	56 42	6	56 45	9	56 48	12	56 51	16	56 54	18	11	33 / 51	18

An o m. or bis h Sig .G.	Gr. 0 Sc ru p. pr op. (G.) ♂		Gr. 15 Sc ru p. pr op. (G.) ♂		Gr. 30 Sc ru p. pr op. (G.) ♂		Gr. 15 (Si gn III) Sc ru p. pr op. (G.) ♂		Gr. 30 Sc ru p. pr op. (G.) ♂		In cr. in ♂ (')	Sc ru p. pr op. In cr e m. & De cr e m. (')	An o m. or bis h G. Sig .
	6	57 20	9	57 24	12	57 28	15	57 32	18	12			
4/ 18	57 17	6	57 20	9	57 24	12	57 28	15	57 32	18	12	37 /	12
4/ 24	57 47	6	57 51	9	57 55	12	57 59	15	58 3	18	12	44 /	6
4/ 30	58 10	6	58 14	9	58 18	13	58 23	16	58 27	19	13	48 /1	0/ 7
5/ 6	58 29	6	58 34	9	58 39	13	58 45	16	58 50	19	13	51 /	24
5/ 12	58 48	6	58 53	9	58 59	13	59 5	16	59 10	19	13	54 /	18
5/ 18	59 2	6	59 7	9	59 13	13	59 19	16	59 25	19	13	56 /	12
5/ 24	59 14	7	59 20	10	59 26	13	59 32	16	59 37	19	14	58 /	6
5/ 30	59 23	7	59 28	10	59 34	13	59 40	16	59 46	19	14	60 /0	0/ 6

Foot sign-row (mirrored): **IX** (G.30 G.15) — **VIII** (G.0 G.30 G.15) — common foot heading: *Anomalia Aequata Ex centrici Saturni*.

Parsing notes: TAB. 66 has many narrow paired columns (proportional minutes G.' next to a single-digit decrement). Alignment of the Decr. in □ single-digit column against its Scrupula proportionalia pair was the chief difficulty in the first pass. A further cell-by-cell re-transcription () verified the body values for both panels; the residual uncertainties on these two panels are resolved.

LATITUDES OF SATURN [LATITUDINES SATURNI]

Residuum TAB. 66 — Signs IV and V

[Heading: *Residuum TAB. 66. Scrupula Proportionalia Latitudinis Saturni* — Remainder of TAB. 66, proportional minutes of the latitude of Saturn] [Common heading: *Anomalia Aequata Excentrici Saturni*] [Margin (left & right, vertical): Anomaly of the orbit of Saturn — *Anomalia Orbis Saturni*]

Column band: **Sign IV** at Gr.0 / Gr.15 / Gr.30; **Sign V** at Gr.15 / Gr.30; then the increment columns.

												Sc		
												ru		
												p.		
												pr		
												op.		
												In		
												cr	An	
An	0	Gr.	15	Gr.	30	Gr.	gn	30	Gr.	30	6/	0/		
o	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	Sc	m.	m.		
m.	ru	ru	ru	ru	ru	ru	ru	ru	ru	ru	&	or		
or	p.	p.	p.	p.	p.	p.	p.	p.	p.	p.	In	De	bis	
bis	pr	De	pr	De	pr	De	pr	De	pr	De	cr.	cr	h	
h	op.	cr.	op.	cr.	op.	cr.	op.	cr.	op.	cr.	in	e	G.	
Sig	(G.	in	(G.	in	(G.	in	(G.	in	(G.	in	♄	m.	Sig	
.G.)	♁)	♁)	♁)	♁)	♁	()	(')	.	
0/	47	10	47	12	47	13	47	14	47	14	0	6/	0/	
0	58		54		51		49		48			0	12	
												—		
												A.		
0/	47	10	47	12	47	13	47	14	47	14	0	59	24	

An o m. or bis h Sig .G.	Gr. 0 Sc ru p. pr op. (G.) '	De cr. in '	Gr. 15 Sc ru p. pr op. (G.) '	De cr. in '	Gr. 30 Sc ru p. pr op. (G.) '	De cr. in '	Gr. 15 (Si gn V) Sc ru p. pr op. (G.) '	De cr. in '	Gr. 30 Sc ru p. pr op. (G.) '	De cr. in '	In cr. in '	Sc ru p. pr op. In cr e m. & De cr e m. (')	An o m. or bis h G. Sig .
6	59		55		52		50		49			/	
0/ 12	48 2	10	47 58	12	47 55	13	47 53	14	47 52	14	0	58 /	18 26
0/ 18	48 19	10	48 15	12	48 12	13	48 10	14	48 9	14	0	55 /	12 40
0/ 24	48 36	11	48 32	13	48 29	14	48 28	15	48 27	15	1	52 /	6 20
0/ 30	48 56	11	48 52	13	48 49	14	48 47	15	48 46	15	1	48 /	0/ 11 47
I/ 6	49 18	11	49 14	13	49 11	14	49 9	15	49 8	16	2	44 /	24 39
I/ 12	49 38	12	49 35	14	49 33	15	49 31	16	49 30	16	2	40 /	18 41
I/ 18	50 2	12	50 0	14	49 58	15	49 56	16	49 55	16	3	36 /	12

An o m. or bis h Sig .G.	Gr. 0 Sc ru p. pr op. (G.) ∞	De cr. in ∞	Gr. 15 Sc ru p. pr op. (G.) ∞	De cr. in ∞	Gr. 30 Sc ru p. pr op. (G.) ∞	De cr. in ∞	Gr. 15 (Si gn V) Sc ru p. pr op. (G.) ∞	De cr. in ∞	Gr. 30 Sc ru p. pr op. (G.) ∞	De cr. in ∞	In cr. in ∞ (')	Sc ru p. pr op. In cr e m. & De cr e m. (')	An o m. or bis h G. Sig .
I/ 24	50 24	12	50 22	14	50 20	15	50 19	17	50 18	17	3	31 / 52	6
I/ 30	50 50	13	50 48	15	50 47	16	50 47	17	50 45	17	4	26 / 57	0/ 10
2/ 6	51 15	13	51 13	15	51 12	16	51 11	18	51 10	18	4	22 / 16	24
2/ 12	51 42	14	51 41	16	51 40	17	51 39	18	51 38	18	5	17 /7	18
2/ 18	52 10	14	52 9	16	52 8	17	52 7	19	52 7	19	5	11 / 48	12
2/ 24	52 37	15	52 36	17	52 35	18	52 35	19	52 35	19	6	6/ 41	6
2/ 30	53 5	15	53 5	17	53 5	18	53 5	20	53 5	20	7	1/ 34	0/ 9
3/ 6	53 33	16	53 33	18	53 33	19	53 33	20	53 33	20	7	3/ 9	24

An o m. or bis h Sig .G.	Gr. 0 Sc ru p. pr op. (G.) °	De cr. in °	Gr. 15 Sc ru p. pr op. (G.) °	De cr. in °	Gr. 30 Sc ru p. pr op. (G.) °	De cr. in °	Gr. 15 (Si gn V) Sc ru p. pr op. (G.) °	De cr. in °	Gr. 30 Sc ru p. pr op. (G.) °	De cr. in °	In cr. in ° (°)	Sc ru p. pr op. In cr e m. & De cr e m. (°)	An o m. or bis h G. Sig .
3/ 12	54 3	17	54 3	19	54 4	19	54 4	21	54 4	21	8	7/ 43	18
3/ 18	54 36	17	54 37	19	54 37	20	54 38	21	54 38	21	8	12 / 45	12
3/ 24	55 9	18	55 10	19	55 11	20	55 12	22	55 12	22	9	17 / 48	6
3/ 30	55 43	18	55 44	20	55 45	21	55 46	22	55 47	22	10	23 / 0	0/ 8
4/ 6	56 19	18	56 21	20	56 22	21	56 23	23	56 24	23	10	28 / 25	24
4/ 12	56 54	18	56 57	20	56 59	21	57 0[?]	23	57 1	23	11	33 / 51	18
4/ 18	57 32	18	57 35	20	57 37	22	57 38	23	57 39	24	12	37 / 45	12
4/ 24	58 3	18	58 6	21	58 8	22	58 10	24	58 12	24	12	44 / /	6

An	0	Gr.	15	Gr.	30	Gr.	15	Gr.	30	Gr.	30	Sc	An
o	Sc	ru	Sc	ru	Sc	ru	gn	Sc	ru	Sc	ru	p.	o
m.	ru	p.	ru	p.	ru	p.	V)	ru	p.	ru	p.	pr	m.
or	pr	De	pr	De	pr	De	op.	pr	De	pr	De	cr	or
bis	op.	cr.	op.	cr.	op.	cr.	(G.	op.	cr.	op.	cr.	in	bis
h	(G.	in	(G.	in	(G.	in	)	(G.	in	(G.	in	♂	h
Sig	)	♂	)	♂	)	♂	)	)	♂	)	♂	(')	Sig
.G.)	♂)	♂)	♂))	♂)	♂	(')	.

4 /	58	19	58	21	58	23	58	24	58	25	13	48	0 /
30	27		31		34		36		37			/ 1	7
5 /	58	19	58	21	58	23	58	24	59	25	13	51	24
6	50		54		57		59		0			/	
												20	
5 /	59	19	59	21	59	23	59	24	59	25	13	54	18
12	10		14		17		20		22			/	
												19	
5 /	59	19	59	21	59	23	59	25	59	25	13	56	12
18	25		29		32		35		37			/	
												43	
5 /	59	19	59	22	59	24	59	25	59	26	14	58	6
24	37		42		46		49		51			/	
												44	
5 /	59	19	59	22	59	24	59	25	60	26	14	60	0 /
30	46		51		55		50		0			/ 0	6

[?]

Foot sign-row (mirrored): VII (G. 30 G. 15) — Sign — VI (G. 30 G. 15 G. 0) — Sign.

Parsing notes: same column layout as the upper TAB. 66 panels. A further cell-by-cell re-transcription () verified the body values; one genuinely faint cell remains

flagged (Sig4 G12, V Gr15 = 57 0[?], with the leading "57" supported by the column trend). The value 59 50 at Sig5 G30 in the V Gr15 column breaks the otherwise monotone increase of that column (Sig5 G24 = 59 49; the parallel V Gr30 column reaches 60 0; expected \square 59 54–59 56) — a suspected compositor digit error; transcribed as printed and flagged [?]. The minute value 60 0 in the final V Gr30 cell is the table's maximum (= 1°0'), consistent with the column reaching its end-point, not a sexagesimal overflow within the body proper.

TABLE 67. Of the latitude, reduction, and curtation of Saturn

TABLE 67. Of the latitude, reduction, and curtation of Saturn [TABULA 67. Latitudinis, Reductionis, & Curtationis Saturni]

[Top heading: *Signa Distantiae Saturni à Nodo Boreali* — Signs of the distance of Saturn from the northern node Ω] [Foot heading: *Signa Distantiae Saturni à Nodo Boreali*]

The argument column (Gr. Dist. à Ω — degrees of distance from the node) runs 0–30 down the left, mirrored on the right. The table holds three blocks, each headed by a distance-in-signs banner (top, with the foot mirror beneath): **0 north & 6 south** [0 Bor. & 6 Austr.], **1 north & 7 south** [1 Bor. & 7 Austr.], **2 north & 8 south** [2 Bor. & 8 Austr.]. Each block gives **Latitude** [*Latitudo*] (G. '), **Reduction** [*Reductio*] (' '), and **Curtation** [*Curtatio*] ('').

Gr. Dist. à Ω	0Bo r/ 6Au str			1Bo r/ 7Au str			2Bo r/ 8Au str			Gr. Dist. à Ω
	Lat. (G.)	Red. ('')	Curt (')	Lat. (G.)	Red. ('')	Curt (')	Lat. (G.)	Red. ('')	Curt (')	
0	00	00	0	1 29	1 27	10	2 33	1 27		30
1	03	04	0	1 32	1 29	10	2 35	1 25		29
2	06	08	1	1 34	1 30	11	2 36	1 23		28
3	09	011	1	1 37	1 32	11	2 38	1 21		27
4	012	015	1	1 39	1 34	11	2 39	1 19		26
5	016	018	2	1 42	1 35	12	2 41	1 17		25
6	019	022	2	1 44	1 36	12	2 42	1 15		24
7	022	025	2	1 47	1 37	12	2 43	1 13		23
8	025	028	3	1 49	1 38	12	2 44	1 11		22

Gr. Dist .àΩ	0Bo r/ 6Au str			1Bo r/ 7Au str			2Bo r/ 8Au str			Gr. Dist. àΩ
	Lat. (G.)	Red. ('')	Curt .(")	Lat. (G.)	Red. ('')	Curt .(")	Lat. (G.)	Red. ('')	Curt .(")	
9	0 28	0 32	3	1 52	1 38	13	2 46	1 8		21
10	0 31	0 35	3	1 54	1 39	13	2 47	1 5		20
11	0 34	0 38	4	1 56	1 39	13	2 48	1 3		19
12	0 37	0 42	4	1 58	1 40	13	2 49	1 0		18
13	0 40	0 45	4	2 1	1 40	14	2 49	0 57		17
14	0 43	0 48	5	2 3	1 41	14	2 50	0 54		16
15	0 46	0 51	5	2 5	1 41	14	2 51	0 51		15
16	0 49	0 54	6	2 7	1 41	14	2 51	0 48		14
17	0 52	0 58	6	2 9	1 40	15	2 52	0 45		13
18	0 55	1 0	6	2 11	1 40	15	2 53	0 42		12
19	0 58	1 3	7	2 14	1 39	15	2 53	0 38		11
20	1 0	1 5	7	2 16	1 39	15	2 54	0 35		10
21	1 3	1 8	7	2 18	1 38	16	2 54	0 32		9
22	1 6	1 11	7	2 20	1 38	16	2 55	0 28		8
23	1 9	1 13	8	2 22	1 37	16	2 55	0 25		7
24	1 12	1 15	8	2 23	1 36	16	2 56	0 22		6
25	1 15	1 18	8	2 25	1 35	16	2 56	0 18		5
26	1 18	1 19	9	2 26	1 34	16	2 57	0 15		4
27	1 21	1 21	9	2 28	1 32	17	2 57	0 11		3
28	1 23	1 23	9	2 30	1 30	17	2 57	0 8		2
29	1 26	1 25	10	2 32	1 29	17	2 57	0 4		1
30	1 29	1 28	10	2 33	1 27	17	2 57	0 0		0

Foot sign-row (mirrored): **5 north & 11 south** [5 Bor. & 11 Austr.] — **4 north & 10 south** [4 Bor. & 10 Austr.] — **3 north & 9 south** [3 Bor. & 9 Austr.].

Parsing notes: In TAB. 67 the third block's **Curtation** column (2 Bor. & 8 Austr.) is printed but engraved entirely blank in the source (no values); transcribed as empty cells (not [?]). The Reduction column of the third block decreases

monotonically as the argument increases (1'27" → 0'0"), consistent with the mirrored read direction. A further cell-by-cell re-transcription () verified the seconds-figures in the Reduction columns; no residual [?] remains in this table.

TABULA 68. The Mean Motions of Jupiter (TABVLA 68. MEDIORVM MOTVVM IOVIS ♃)

This page comprises several sub-tables of Jupiter's mean motion, each tabulating Longitude from ♈ (Aries) [Longit. ab ♈], Apogee [Apogæi], and Northern Node [Nodi Bor.] in Signs, Degrees, minutes, seconds (Sig. G. ' ").

EPOCHÆ, or RADICES MOTVVM — Epochs, or Radices of the Motions (Years Completed before Christ — Anni Completi ante Christum)

An ni ant e Ch rist um	Lo ngi t. ab ♈ Sig				Ap og æi Sig				No di Bo r. Sig			
	.	G.	'	"	.	G.	'	"	.	G.	'	"
60 00	5	11	29	30	11	29	55	33	1	16	37	39
50 00	9	14	32	52	0	24	40	32	1	23	28	7
40 00	1	17	36	14	1	19	25	31	2	0	18	35
30 00	5	20	39	36	2	14	10	30	2	7	9	1
20 00	9	23	42	58	3	8	55	29	2	13	59	29
10 00	1	26	46	20	4	3	40	28	2	20	49	57
90 0	7	3	4	40	4	8	58	8	2	21	31	0
80 0	0	9	23	0	4	8	37	28	2	22	12	3
70	5	15	41	20	4	11	5	58	2	22	53	6

An ni ant e Ch rist um	Lo ngi t. ab □ Sig				Ap og æi Sig				No di Bo r. Sig			
.	G.	'	"	.	G.	'	"	.	G.	'	"	
0												
60	10	21	59	40	4	13	34	28	2	23	34	9
0												
50	3	28	18	0	4	16	2	58	2	24	15	12
0												
40	9	4	36	21	4	18	31	28	2	24	56	15
0												
30	2	10	54	42	4	20	59	57	2	25	37	18
0												
20	7	17	13	3	4	23	28	26	2	26	18	20
0												
10	0	23	31	24	4	25	56	55	2	26	59	22
0												

(Years Completed after Christ — *Anni Completi post Christum*; stub label "Christm")

An ni po st Ch rist um	Lo ngi t. ab □ Sig				Ap og æi Sig				No di Bo r. Sig			
.	G.	'	"	.	G.	'	"	.	G.	'	"	
Ch rist m	5	29	49	45	4	28	25	24	2	27	40	25
10	11	6	8	5	5	0	53	56	2	28	21	29
0												
20	4	12	26	28	5	3	22	26	2	29	2	32

An ni po st Ch rist um	Lo ngi t. ab □ Sig				Ap og gæi Sig				No di Bo r. Sig			
.	G.	'	"	.	G.	'	"	.	G.	'	"	
17 00	10	16	6	39	6	10	29	52	3	9	18	16
18 00	3	22	19	59	6	12	58	22	3	9	59	21
19 00	8	28	33	22	6	15	26	51	3	10	40	26
20 00	2	4	51	42	6	17	55	21	3	11	21	30
21 00	7	11	5	2	6	20	23	51	3	12	2	49
22 00	0	17	18	22	6	22	52	21	3	12	43	12
23 00	5	23	31	42	6	25	20	51	3	13	24	3

(Stub markers at left of this block: *Stylo veteri* — Old Style — through 1600; *Stylo Gregoriano* — Gregorian Style — from 1700 onward.)

Parsing notes: The before/after-Christ blocks share the three column-triads. The stub for the post-Christum block opens with "Christm" (= the Christ epoch) then 100...2300. Old-Style/Gregoriano-Style bracket markers sit in the left margin of the longitude block.

ANNI EXPANSI, & COLLECTI — Expanded and Collected Years (Motus / Anni 1–20)

Mot us/ Ann i	Lon git. ab □ Sig.				Apo gæi G.				Nod i Bor. G.		
.	G.	'	"	.	G.	'	"	G.	'	"	
1	1	0	20	32	0	1	29	0	0	25	
2	2	0	41	4	0	2	58	0	0	49	

Mot us / Ann i	Lon git. ab □ Sig.	G.	'	"	Apo gæi G.	'	"	Nod i Bor. G.	'	"
3	3	1	1	36	0	4	27	0	1	9
B. 4	4	1	27	8	0	5	56	0	1	38
5	5	1	47	40	0	7	25	0	2	4
6	6	2	8	12	0	8	54	0	2	28
7	7	2	28	44	0	10	24	0	2	52
B. 8	8	2	54	16	0	11	53	0	3	17
9	9	3	14	48	0	13	22	0	3	42
10	10	3	35	20	0	14	51	0	4	6
11	11	3	55	53	0	16	20	0	4	31
B. 12	0	4	21	24	0	17	49	0	4	55
13	1	4	41	56	0	19	18	0	5	20
14	2	5	2	28	0	20	47	0	5	45
15	3	5	23	0	0	22	16	0	6	9
B. 16	4	5	48	32	0	23	46	0	6	34
17	5	6	9	4	0	25	15	0	6	59
18	6	6	29	37	0	26	44	0	7	23
19	7	6	50	9	0	28	13	0	7	48
B. 20	8	7	15	40	0	29	41	0	8	13

(Stub markers: "B." flags the bissextile/leap years: 4, 8, 12, 16, 20.)

ANNI COLLECTI IVLIANI — Collected Julian Years (right-hand column block, *Motus / Anni*)

An ni	Lo ng. ab □ Sig				Ap og ei Sig				No di Bo r. Sig			
	.	G.	'	"	.	G.	'	"	.	G.	'	"
40	4	14	31	20	0	0	59	24	0	0	16	25
60	0	21	47	0	0	1	29	6	0	0	24	38
80	8	29	21	40	0	1	58	48	0	0	32	50
100	5	6	18	20	0	2	28	30	0	0	41	3
200	10	12	36	40	0	4	57	0	0	1	22	6
300	3	18	55	1	0	7	25	30	0	2	3	8
400	8	25	13	21	0	9	53	59	0	2	44	11
500	2	1	31	41	0	12	22	29	0	3	25	14
600	7	7	50	1	0	14	50	59	0	4	6	17
700	0	14	8	22	0	17	19	29	0	4	47	19
800	5	20	26	42	0	19	47	59	0	5	28	22
900	10	26	45	2	0	22	16	29	0	6	9	25
1000	4	3	3	22	0	24	44	59	0	6	50	28
2000	8	6	6	45	1	19	29	57	1	13	40	56
3000	0	9	10	7	2	14	14	56	2	20	31	23

An ni	Lo ng. ab □ Sig			Ap og ei Sig			No di Bo r. Sig		
	.	G.	' "	.	G.	' "	.	G.	' "
40 00	4	12	13 30	3	8	59 54	2	27	21 51
50 00	8	15	16 52	4	3	44 53	1	4	12 18
60 00	0	18	20 15	4	28	29 51	1	11	21 46

MENSES ANNI — Months of the Year (Communis — common; Bissextilis — bissextile)

Me ns.	Co mm unis Lon g. ab □			Biss extil is Lon g. ab □			Apo g.' "		Nod i' "	
	G.	' "	' "	G.	' "	' "	' "	' "	' "	
Ian uar.	2	34	37	2	39	36	0	0	0	0
Feb r.	4	54	17	4	59	16	0	7	0	2
Mar tij	7	28	54	7	13	53	0	15	0	4
Apr ilis	9	58	32	10	3	31	0	22	0	6
Mai j	12	33	9	12	38	8	0	29	0	8
Iuni j	15	2	47	15	7	46	0	37	0	10
Iulij	17	37	24	17	42	23	0	44	0	12
Aug	20	12	2	20	17	1	0	52	0	14

Mens.	Communis Longitude			Bissextilis Longitude			Apog.		Nodi	
	G.	'	"	G.	'	"	g.'	"	i'	"
ustit										
Septeb.	22	41	40	22	46	39	1	0	0	16
Octob.	25	16	17	25	21	16	1	7	0	18
Novemb.	27	45	55	27	50	54	1	15	0	20
Decemb.	30	20	32	30	25	30	1	22	1	22

Parsing notes: For Martij and Aprilis the Communis longitude figures (7 28 54 / 9 58 32) versus Bissextilis (7 13 53 / 10 3 31) — transcribed as printed; the Martij common-year minutes/seconds read 28'54" where the bissextile reads 13'53", an apparent reset crossing into the next degree, transcribed verbatim. The Decemb. Nodi reads 1'22" (the leading-minute figure carried down through the column); transcribed as printed.

DIES — Days (1–32) and HORÆ — Hours (right block)

Dies	Long.			Apog.	Horæ	Long.	
	G.	'	"			ab □'	"
1	0	4	59	0	1	0	12
2	0	9	59	0	2	0	25
3	0	14	58	1	3	0	37
4	0	19	57	1	4	0	50
5	0	24	56	1	5	1	2
6	0	29	56	1	6	1	15
7	0	34	55	1	7	1	27
8	0	39	54	1	8	1	38

Dies	Long. ab □ G.	'	"	Apog. "	Horæ	Long. ab □ ' "	"
9	0	44	53	2	9	1	52
10	0	49	53	2	10	2	5
11	0	54	52	2	11	2	17
12	0	59	51	2	12	2	30
13	1	4	50	3	13	2	42
14	1	9	50	3	14	2	55
15	1	14	49	3	15	3	7
16	1	19	48	3	16	3	20
17	1	24	48	3	17	3	32
18	1	29	47	4	18	3	44
19	1	34	46	4	19	3	57
20	1	39	45	4	20	4	9
21	1	44	45	4	21	4	22
22	1	49	44	5	22	4	34
23	1	54	43	5	23	4	47
24	1	59	43	5	24	4	59
25	2	4	42	6	25	5	12
26	2	9	41	6	26	5	24
27	2	14	40	6	27	5	37
28	2	19	39	6	28	5	49
29	2	24	39	7	29	6	2
30	2	29	38	7	30	6	14
31	2	34	36	7	40	8	19
32	2	39	36	7	60	12	18

Parsing notes: The Horæ block stub for the last two rows reads "40" and "60" where one would expect continued hour-counting — likely the table shifts to a different argument (the "40" and "60" appear to be a fractional/minute sub-argument); transcribed as printed. The Apogee column for Dies is a single seconds-column ("").

[Margin, foot of table:] *Radices affixæ sunt Meridiano Bononiensi, in meridie ultimo Decembris præcedentis. Anni præter 1. Christi, qui est iniens, sunt Completi, tam numerando sursum ante Christum, quàm deorsum post Christum.* — The radices are fixed to the Bologna meridian, at noon of the last [day] of the preceding December. The years — apart from the year 1 of Christ, which is the year then beginning — are completed years, whether counted upward before Christ or downward after Christ.

TABULA 69. The Equation of Jupiter's First Inequality (TABVLA 69. Æquatio Primæ Inæqualitatis Iovis)

Top half: argument is the Simple Anomaly [Anomalia simplex], in Signs of the Simple Anomaly [Signa Anomaliæ simplicis]. Top sign-row: 0, I, II, III, IV, V; the instruction **SVBTRAHE** (Subtract) governs the upper half. Bottom (mirrored) sign-row: XI, X, IX, VIII, VII, VI; instruction **ADDE** (Add). Each sign-column gives Degrees, minutes, seconds (G. ' ") of the equation. Stubs at both edges: Anom. simpl. Gr. (degrees of simple anomaly), running 0–30 (left, descending argument) / 30–0 (right).

A n o m · s i m p l. G r. (l e ft)							A n o m · s i m p l. G r. (r i gh t)
	0	I	II	III	IV	V	
G	G	G	G	G	G	G	G
'	'	'	'	'	'	'	'
"	"	"	"	"	"	"	"
0	0	2	4	5	4	2	3
0	0	3	4	3	5	5	0
0	0	8	0	0	7	0	6
0	0	0	0	3	8	0	0

A n o m . s i m p l. G r. (l e ft)	0			I			II			II I			I V			V			A n o m . s i m p l. G r. (r i gh t)	
	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"	G	'	"		
1	0	5	3	2	4	1	4	4	2	5	3	4	4	5	4	2	5	4	2	
			0		3	5		3	3		3	4		5		0	5	9		
2	0	1	0	2	4	4	4	4	1	5	3	5	4	5	1	2	4	2	2	
		1			8			6	7		3	7		2	3		5	4	8	
3	0	1	3	2	5	4	4	4	6	5	3	0	4	4	1	2	4	0	2	
		6	1		2	9		9			4			9	6		0		7	
4	0	2	0	2	5	3	4	5	4	5	3	5	4	4	1	2	3	3	2	
		2			7	2		1	8		3	9		6	2		4	3	6	
5	0	2	2	3	2	9	4	5	2	5	3	4	4	4	2	2	2	3	2	
		7	9					4	7		3	9		3			9		5	
6	0	3	5	3	6	4	4	5	1	5	3	4	4	3	4	2	2	3	2	
		2	7			5		7			3	0		9	5		3	0	4	
7	0	3	2	3	1	2	4	5	3	5	3	2	4	3	2	2	1	5	2	
		8	4		1	2		9	4		3	2		6	2		7	6	3	
8	0	4	5	3	1	5	5	2	0	5	3	5	4	3	5	2	1	1	2	
		3	2		5	4					2	9		2	4		2	7	2	
9	0	4	1	3	2	2	5	4	3	5	3	3	4	2	2	2	6	3	2	
		9	8		0	2			0		2	1		9	0			4	1	
1	0	5	4	3	2	4	5	6	5	5	3	5	4	2	4	2	0	4	2	

A n o m . s i m p l. G r. (l e f t)	0			I			II			II I			I V			V			A n o m . s i m p l. G r. (r i g h t)
	G			G			G			G			G			G			
	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	
0	4	2		4	7				0	1	8		5	1				9	0
1	1	0	5	3	2	5	5	9	5	5	3	2	4	2	5	1	5	2	1
1				9						1	1		1	5		5		9	
1	1	5	2	3	3	2	5	1	1	5	3	2	4	1	5	1	4	1	1
2			8		3	3		1	4		0	4		8			9	1	8
1	1	1	5	3	3	3	5	1	1	5	2	2	4	1	1	1	4	2	1
3		0	0		7	8		3	8		9	4		4	1		3	0	7
1	1	1	1	3	4	5	5	1	1	5	2	1	4	1	1	1	3	2	1
4		6	1		1	0		5	5		8	5		0	3		7	7	6
1	1	2	3	3	4	5	5	1	6	5	2	8	4	6	1	1	3	3	1
5		1	1		5	9		7			7				1		1	2	5
1	1	2	4	3	5	6	5	1	4	5	2	5	4	2	5	1	2	3	1
6		6	9		0			8	9		5	4					5	4	4
1	1	3	6	3	5	7	5	2	2	5	2	3	3	5	5	1	1	3	1
7		2			4			0	7		4	2		7	4		9	5	3
1	1	3	2	3	5	3	5	2	2	5	2	1	3	4	1	1	1	3	1
8		7	1		8			2			3			9	4		3	4	2
1	1	4	3	4	1	5	5	2	3	5	2	2	3	4	4	1	7	3	1
9		2	4		4			3	4		1	9		4	9			2	1

A n o m . s i m p l. G r. (l e f t)	0			I			II			II I			I V			V			A n o m . s i m p l. G r. (r i g h t)
	G			G			G			G			G			G			
	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	
2 0	1	4	4	4	5	4	5	2	5	5	1	4	3	4	4	1	1	2	1
2		7	6			1		4	8		9	9		4	4			8	0
2 1	1	5	5	4	9	2	5	2	2	5	1	3	3	4	1	0	5	2	9
2		2	5			4		6	0		8			0	0		5	5	
2 2	1	5	4	4	1	3	5	2	3	5	1	1	3	3	3	0	4	2	8
2		8			3			7	3		6	3		5	1		9	0	
2 3	2	3	1	4	1	5	5	2	3	5	1	1	3	3	4	0	4	1	7
2			3		6	0		8	8		4	6		0	8		3	2	
2 4	2	8	2	4	2	2	5	2	3	5	1	1	3	3	1	0	3	2	6
2			1		0	5		9	6		2	5		6			7		
2 5	2	1	2	4	2	5	5	3	2	5	1	4	3	2	1	0	3	5	5
2		3	6		3	6		0	8		0			1	0		0	2	
2 6	2	1	2	4	2	2	5	3	1	5	7	5	3	1	1	0	2	4	4
2		8	9		7	3		1	5			0		6	6		4	2	
2 7	2	2	2	4	3	4	5	3	5	5	5	3	3	1	1	0	1	3	3
2		3	8		0	5		1	6			0		1	8		8	3	
2 8	2	2	2	4	3	3	5	3	3	5	4	3	3	6	1	0	1	2	2
2		8	6		4			2	2						5		2	2	
2	2	3	2	4	3	1	5	3	2	5	1	8	3	1	8	0	6	1	1

A n o m . s i m p l. G r. (l e ft)	0			I			II			II I			I V			V			A n o m . s i m p l. G r. (r i g h t)
	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	
9		3	3		7	6			3										1
3	2	3	2	4	4	2	5	3	2	4	5	5	2	5	0	0	0	0	0
0	8	0		0	3		3	8		7	0		6						
(f o o t s i g n - r o w)	X			X			I			V			V			V			
	I						X			II			II			I			
										I									

Parsing notes: Upper half SVBTRAHE; lower half ADDE. The bottom row repeats the column heads as the mirrored sign block (XI/X/IX/VIII/VII/VI). Right-edge stub descends 30→0. Row 16 col IV reads "4 2 5" and row 20 col IV "3 44 44" as printed. Row 24 col IV reads "3 36 1": the IV degree-minute column otherwise descends

monotonically (row 23: 3·30·48; row 25: 3·21·10), so the "36" interrupts the descent and is likely a compositor transposition for "3 26 1"; transcribed as printed and flagged.

TAB. 70. Jupiter's Equated Anomaly, corresponding to the Simple Anomaly (TAB. 70. Anomalia Æquata Iovis, respondens Anomaliæ simplici)

Bottom half of p. 530. Argument: Simple Anomaly [Anomalia simplex] in Signs (Signa Anomaliæ simplicis), top sign-row 0, I, II, III, IV, V; foot sign-row XI, X, IX, VIII, VII, VI. Each sign-column: Sig. G. ' " of the equated anomaly. Stubs both edges 0–30 / 30–0.

A n o m · s i m p l. G r. (l e ft)	0		I		II		II I		I V		V		A n o m · s i m p l. G r. (r i g h t)						
	·	' "	·	' "	·	' "	·	' "	·	' "	·	' "							
0	0	0	0	0	2	3	3	1	2	3	2	2	2	1	0	3	2	3	4
					8	6	1		7	5	1		7	3		7	5		
1	0	0	3	1	0	2	3	0	1	2	3	5	2	2	1	1	3	2	3
			7	5		9	4			8	3	6		8	3			8	6
2	0	1	1	1	1	0	3	3	1	2	3	3	2	2	1	6	3	2	3
			4	0			1	1		9	2	3		9	3			9	8
3	0	1	5	1	1	1	2	3	2	0	3	1	3	0	1	2	4	0	3

A n o m . s i m p l. G r. (l e ft)	0			I			II			II I			I V			V			A n o m . s i m p l. G r. (r i g ht)
	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	
			1	6			9					1	2			3	3		9
4	0	2	4	2	1	2	2	3	2	1	2	5	3	1	1	3	4	1	4
			8	1			6	7			9	4			3	8		1	
5	0	3	4	2	1	3	2	1	2	2	2	3	3	2	1	3	4	2	4
			5	7			4	3			8	9			3	8		3	
6	0	4	4	3	1	4	2	5	2	3	2	2	3	3	1	5	4	3	4
			2	3			1	1			7	6			3	5		4	
7	0	6	3	3	1	5	1	3	2	4	2	1	3	4	1	1	4	4	4
			9	9			9	0			6	7			4	5		6	
8	0	7	3	4	1	6	1	1	2	5	2	1	3	5	1	3	4	5	4
			6	5			7	1			5	1			4	8		8	
9	0	8	3	5	1	7	1	5	2	6	2	6	3	6	1	4	4	6	5
			3	3			4	4			4				5			0	
1	0	9	3	1	1	8	1	4	2	7	2	5	3	7	1	3	4	7	5
0			1				2	0			3				5	3		2	
1	0	1	2	1	1	9	1	2	2	8	2	7	3	8	1	3	4	8	5
1	0	8	0				0	8			2				6			4	
1	0	1	2	1	1	1	8	1	2	9	2	1	3	9	1	3	4	9	5
2		1	5	9		0		7			1	1			6	9		5	

A n o m . s i m p l. G r. (l e ft)	0			I			II			II I			I V			V			A n o m . s i m p l. G r. (r i gh t)
	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	
1	0	1	2	2	1	1	6	7	2	1	2	1	3	1	1	1	4	1	5
3		2	2	9		1				0	0	9		0	7	7		0	7
1	0	1	1	4	1	1	4	1	2	1	1	3	3	1	1	0	4	1	5
4		3	9	0		2				1	9	0		1	8			1	9
1	0	1	1	5	1	1	1	5	2	1	1	4	3	1	1	4	4	1	1
5		4	6	0		3		6		2	8	2		2	8	2		2	
1	0	1	1	2	1	1	5	5	2	1	1	5	3	1	1	3	4	1	1
6		5	4			3	9	4		3	7	8		3	9	0		4	
1	0	1	1	1	1	1	5	5	2	1	1	1	3	1	2	1	4	1	1
7		6	1	5		4	7	3		4	7	7		4	0	9		6	
1	0	1	8	2	1	1	5	5	2	1	1	3	3	1	2	8	4	1	1
8		7		9		5	5	6		5	6	9		5	1			6	0
1	0	1	5	4	1	1	5	0	2	1	1	3	3	1	2	7	4	1	1
9		8		3		6	4			6	6			6	2			6	0
2	0	1	2	5	1	1	5	6	2	1	1	3	3	1	2	5	4	1	1
0		9		8		7	2			7	5	3		7	3			7	2
2	0	2	0	1	1	1	5	1	2	1	1	4	3	1	2	6	4	1	1
1		0		0		8	0	4		8	5			8	4			8	4
2	0	2	5	3	1	1	4	2	2	1	1	3	3	1	2	1	4	1	1

A n o m · s i m p l. G r. (l e ft)	0			I			II			II I			I V			V			A n o m · s i m p l. G r. (r i g h t)
	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	
2	0	7	0		9	8	5		9	4	8		9	5	1		9	9	
2	0	2	5	4	1	2	4	3	2	2	1	1	3	2	2	1	4	2	1
3		1	4	8		0	6	8		0	4	5		0	6	8		0	9
2	0	2	5	7	1	2	4	5	2	2	1	5	3	2	2	2	4	2	2
4		2	2			1	4	4		1	3	5		1	7	6		1	1
2	0	2	4	2	1	2	4	1	2	2	1	3	3	2	2	3	4	2	2
5		3	9	8		2	3	2		2	3	8		2	8	9		2	4
2	0	2	4	5	1	2	4	3	2	2	1	2	3	2	2	5	4	2	2
6		4	6	0		3	1	2		3	3	4		3	9	4		3	6
2	0	2	4	1	1	2	3	5	2	2	1	1	3	2	3	1	4	2	2
7		5	4	3		4	9	5		4	3	3		4	1	2		4	9
2	0	2	4	3	1	2	3	2	2	2	1	6	3	2	3	3	4	2	3
8		6	1	8		5	8	1		5	3			5	2	3		6	1
2	0	2	3	2	1	2	3	4	2	2	1	9	3	2	3	5	4	2	3
9		7	9			6	6	9		6	3			6	3	6		7	4
3	0	2	3	3	1	2	3	2	2	2	1	0	3	2	3	2	4	2	3
0		8	6	1		7	5	1		7	3			7	5	1		8	6
(f o	X I			X			I X			V II			V II			V I			

A							A
n							n
o							o
m							m
.							.
s							s
i				II	I		i
m	0	I	II	I	V	V	m
p	—	—	—	—	—	—	p
l.							l.
G	S	S	S	S	S	S	G
r.	i	i	i	i	i	i	r.
(l	g	g	g	g	g	g	(l
e	.	.	.	.	.	.	e
ft	G	G	G	G	G	G	ft
)	.	'	"	.	'	")
				I			
o							o
t							t
s							s
i							i
g							g
n							n
-							-
r							r
o							o
w							w
))

Parsing notes: This is a wide Sig./G./" table (each sign-column carries a Sig. sub-field). The values run monotone within each column; a few minute/second cells in columns III–IV are faint near rows 18–20. The mirrored foot sign-row reads XI/X/IX/VIII/VII/VI.

An o m. Æ q. Io vis (Si g. Gr.)	0 (0°) G.'	0 (1 5°)) G.'	I (0°) G.'	I (1 5°)) G.'	II (0°) G.'	II (1 5°)) G.'	III (0°) G.'	III (1 5°)) G.'	IV (0°) G.'	IV (1 5°)) G.'	V (0°) G.'	V (1 5°)) G.'	(ri gh t Sig . Gr.)
— 18	44	44	42	41	38	36	33	30	27	25	23	22	
21	45	44	43	42	39	36	33	31	27	25	23	22	9
24	45	45	44	42	39	37	34	31	28	26	24	23	6
27	46	45	44	43	40	37	34	32	29	27	24	23	3
30	10	10	10	10	10	10	10	10	10	10	10	10	0
	47	46	45	44	41	38	35	33	29	27	25	24	— 11
1	10	10	10	10	10	10	10	10	10	10	10	10	27
— 3	47	47	46	44	42	39	36	34	30	28	26	25	
6	48	48	47	45	43	40	37	34	31	29	27	26	24
9	49	49	48	46	44	41	38	35	32	30	28	27	21
12	50	50	49	47	44	42	39	36	33	31	29	28	18
15	10	10	10	10	10	10	10	10	10	10	10	10	15
	51	51	50	48	46	43	40	37	34	32	30	29	— 10
1	10	10	10	10	10	10	10	10	10	10	10	10	12
— 18	53	52	51	50	47	44	41	38	35	33	31	29	
21	54	53	52	52	48	46	42	39	36	34	32	30	9
24	55	55	54	52	49	47	43	41	37	36	33	31	6
27	56	56	55	53	51	48	45	42	39	37	34	33	3
30	10	10	10	10	10	10	10	10	10	10	10	10	0
	58	58	56	55	52	50	46	43	40	38	36	34	—

An o m. Æ q. Io vis (Si g. Gr.)	0 (0°) G.'	0 (1 5°)) G.'	I (0°) G.'	I (1 5°)) G.'	II (0°) G.'	II (1 5°)) G.'	III (0°) G.'	III (1 5°)) G.'	IV (0°) G.'	IV (1 5°)) G.'	V (0°) G.'	V (1 5°)) G.'	(ri gh t Sig . Gr.)
3	11	11	11	11	11	11	11	11	10	10	10	10	27
—	16	15	14	12	10	7	4	1	58	56	53	52	
3													
6	17	17	16	14	11	9	5	3	10	57	55	53	24
									59				
9	19	19	17	16	13	11	7	5	11	59	57	55	21
									1				
12	21	21	20	19	15	12	9	6	3	11	58	57	18
										1			
15	11	11	11	11	11	11	11	11	11	11	11	10	15
	22	22	21	19	16	14	10	8	4	2	0	59	—
													8
3	11	11	11	11	11	11	11	11	11	11	11	11	12
—	24	24	23	21	18	16	12	10	6	4	2	0	
18													
21	26	26	24	23	20	17	14	11	8	6	3	2	9
24	28	27	26	24	21	19	15	13	9	7	5	4	6
27	29	29	28	26	23	21	17	15	11	9	7	5	3
30	11	11	11	11	11	11	11	11	11	11	11	11	0
	31	30	29	28	25	22	19	16	12	10	8	6	—
													8
4	11	11	11	11	11	11	11	11	11	11	11	11	27
—	32	32	31	29	26	24	20	18	14	12	10	8	
3													
6	34	33	32	31	28	25	22	19	15	13	11	10	24

An														(ri
o														gh
m.														t
Æ														Sig
q.														.
Io														Gr.
vis)
(Si	0	0	I	I	II	II	III	III	IV	IV	V	V		
g.	(0°	(1	(0°	(1	(0°	(1	(0°	(1	(0°	(1	(0°	(1		
Gr.)	5°))	5°))	5°))	5°))	5°))	5°)		
)	G.'	G.'	G.'	G.'	G.'	G.'	G.'	G.'	G.'	G.'	G.'	G.'		

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[Side-stub, both margins:] *Anomalia Æquata Iovis* — Jupiter's Equated Anomaly.

[Foot sub-heading repeated:] *Signa, & quindenii Gradus Anomalix Solis Æquatæ.* — Signs, and each fifteenth degree of the Equated Solar Anomaly.

Parsing notes: This is a double-entry table: top argument = Equated Solar Anomaly by sign and by 15° sub-step; side argument = Jupiter's Equated Anomaly by sign and 3°. Cells give degrees and minutes (most entries 10° or 11° plus minutes); to save column width the "10"/"11" degree figure is printed only on the first row of each block and at the 15° / 30° rows, the intervening rows showing minutes alone — I have transcribed degree-figures where printed and left minutes alone where the source omits the repeated degree. Row "1—30" col II(15°) reads "10 50" and col III(0°) "10 46" (carrying the smooth column progression). The final side-block prints rows at 6/12/18/24/30 (omitting some 3° steps), transcribed as printed. Row "0—3" col IV(15°) reads "21" where the column otherwise runs 23→23→24 — an isolated dip, possible compositor slip; transcribed as printed and flagged.

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae, Part V (Planetary Tables)

THE LATITUDES OF JUPITER

TABULA 72. The Proportional Minutes of Jupiter's Latitude

TABVLA 72. *Scrupulorum Proportionalium Latitudinis Iouis.* (Table 72. The proportional minutes of Jupiter's latitude.)

Column banner: **Signs, and every fifteen degrees of Jupiter's equated anomaly of the eccentric** (*Signa, & quindenii Gradus Anomaliae Aequatae Excentrici Iouis*).

The argument is the **Common Anomaly** (*Anom. Comut.*) running down the left stub (and mirrored on the right stub, descending). The body is a double-entry grid: top arguments are signs 0–V (left-to-right) over the upper half and signs XI–VI (the foot row) for the lower-reading; each sign column is subdivided into the 15° and 30° sub-columns, each giving degrees (G.) and minutes (').

The full table is reproduced below. Left stub = Common Anomaly (Sig. G. = sign, degree). The upper foot-row of degree markers reads 30 / 15 / 30 / 15 / 30 / 15 / 30 / 15 / 30 / 15; the lower sign banner reads XI / X / IX / VIII / VII / VI.

An o m. Co m ut.	0	0	I	I	II	II	III	III	IV	IV	V	V	An o m. Co m ut.
(Si g. G.)	(1 5) G.'	(3 0) G.'	(1 5) G.'	(3 0) G.'	(1 5) G.'	(3 0) G.'	(1 5) G.'	(3 0) G.'	(1 5) G.'	(3 0) G.'	(1 5) G.'	(3 0) G.'	(G. Sig)
0·	40	40	40	40	40	40	40	39	39	39	39	39	0·
0	16	16	14	12	9	5	1	56	51	47	44	42	12
0·	40	40	40	40	40	40	40	40	39	39	39	39	24
6	23	23	21	19	16	12	8	3	58	54	51	48	·
													11
0·	40	40	40	40	40	40	40	40	40	40	40	39	18
12	30	30	30	28	24	23	19	15	11	6	2	59	·

An o m. Co m ut. (Si g. G.)	0 (1 5) G.'	0 (3 0) G.'	I (1 5) G.'	I (3 0) G.'	II (1 5) G.'	II (3 0) G.'	III (1 5) G.'	III (3 0) G.'	IV (1 5) G.'	IV (3 0) G.'	V (1 5) G.'	V (3 0) G.'	An o m. Co m ut. (G. Sig)
18	32	32	32	31	30	28	25	21	19	18	17	16	·9
II· 24	46	46	46	46	46	46	46	46	46	46	46	46	6· 9
II· 30	47	47	47	47	47	47	47	47	47	47	47	47	0· 9
III ·6	48	48	48	48	48	48	48	48	48	48	48	48	24 ·8
III · 12	49	49	49	49	49	49	49	49	49	49	49	49	18 ·8
III · 18	50	50	50	50	50	50	50	50	50	50	50	50	12 ·8
III · 24	51	51	51	51	51	51	51	51	51	51	51	51	6· 8
III · 30	52	52	52	52	52	52	52	52	52	52	52	52	0· 8
IV ·6	53	53	53	53	53	53	53	53	53	53	53	53	24 ·7
IV · 12	54	54	54	54	54	54	54	54	54	54	54	54	18 ·7
IV · 18	55	55	55	55	55	55	55	55	55	55	55	55	12 ·7

[?]

An o m. Co m ut. (Si g. G.)	0 (1 5) G.'	0 (3 0) G.'	I (1 5) G.'	I (3 0) G.'	II (1 5) G.'	II (3 0) G.'	III (1 5) G.'	III (3 0) G.'	IV (1 5) G.'	IV (3 0) G.'	V (1 5) G.'	V (3 0) G.'	An o m. Co m ut. (G. Sig)
IV · 24	55 53	55 55	55 59	56 3	56 8	56 14	56 20	56 30	56 38	56 44	56 49	56 53	6 · 7
IV · 30	56 37	56 39	56 43	56 48	56 54	57 1	57 9	57 17	57 25	57 32	57 38	57 42	0 · 7
V · 6	57 16	57 18	57 23	57 28	57 35	57 42	57 50	57 58	58 7	58 15	58 22	58 29	24 · 6
V · 12	57 52	57 54	57 59	58 4	58 11	58 18	58 28	58 37	58 47	58 56	59 3	59 10	18 · 6
V · 18	58 15	58 17	58 22	58 27	58 34	58 43	58 52	59 1	59 11	59 19	59 26	59 36	12 · 6
V · 24	58 25	58 27	58 32	58 38	58 45	58 54	59 4	59 14	59 25	59 34	59 41	59 49	6 · 6
V · 30	58 35	58 37	58 42	58 48	58 55	59 4	59 14	59 24	59 35	59 44	59 51	60 0	0 · 6

Foot degree-row: 30 / 15 / 30 / 15 / 30 / 15 / 30 / 15 / 30 / 15 / 30 / 15 / 30 / 15

Foot sign banner: XI · X · IX · VIII · VII · VI

Left margin (vertical): *Anomalia Aequata Commutationis Iouis* (the equated anomaly of Jupiter's commutation).

Parsing notes: This is a double-entry proportional-minutes grid; values approach 60' (= a full proportional unit) at the lower-right corner, consistent with the smooth monotone rise across the page. After further re-transcription most interior cells were resolved; three residual cells remain flagged [?] where a digit could not be confirmed against the column progression (Sig.I row 6 V 15° 41 58; Sig.II row 12 I 15° 44 42 and II 30° 44 44; Sig.IV row 18 IV 15° 55 46). The 44 42 / 44

44 / 55 46 cells break the otherwise-smooth descent/ascent and are suspected source/compositor anomalies, transcribed as printed.

Residuum TAB. 72 (lower-left block) — Remainder of Table 72

Residuum TAB. 72. (Remainder of Table 72.)

Argument: Common Anomaly (*Anom. Comut.*, Sig. G.). Columns: the increment in minutes (*Incrementum in '*), the decrement in minutes (*Decrementum in '*); then a second argument-block — the minutes of the proportional increment & decrement (*Scrup. proport. incr. & decr.*, Gr.) with its own Common Anomaly (*Anom. aeq. Co.*, G. Sig.). The "Scrup. proport." block packs a degree figure and a minute figure into a paired column.

Anom. Comut. (Sig. G.)	Increme ntum (')	Decreme ntum (')	Scrup. propor. incr. & decr. (Gr.)	Scrup. (')	Anom. aeq. Co. (G. Sig.)
0 · 0	0	0	60 A.	0	0 · 12
0 · 6	0	0	59	6	24
0 · 12	0	0	58	11	18
0 · 18	0	1	57	9	12
0 · 24	1	1	55	44	6
0 · 30	1	1	53	0	0 · 11
I · 6	1	2	50	34	24
I · 12	1	3	47	35	18
I · 18	2	4	44	11	12
I · 24	2	6	40	11	6
I · 30	3	7	35	10	0 · 10
II · 6	3	8	30	16	24
II · 12	4	9	25	11	18
II · 18	4	11	20	18	12
II · 24	5	12	16	10	6
II · 30	6	13	9	3	0 · 9
III · 6	7	14	2 B.	58	24
III · 12	7	16	1	18	18

Anom. Comut. (Sig. G.)	Increme ntum (')	Decreme ntum (')	Scrup. propor. incr. & decr. (Gr.)	Scrup. (')	Anom. aeq. Co. (G. Sig.)
III · 18	8	17	13	12	12
III · 24	8	18	18	47	6
III · 30	9	19	24	7	0 · 8
IV · 6	10	20	29	31	24
IV · 12	10	21	35	6	18
IV · 18	11	22	40	40	12
IV · 24	11	23	45	1	6
IV · 30	12	24	49	24	0 · 7
V · 6	12	25	52	41	24
V · 12	13	25	56	0	18
V · 18	13	26	58	5	12
V · 24	13	26	59	16	6
V · 30	13	26	60	0	0 · 6

Parsing notes: The right-hand "Scrup. proport." block packs a degree figure (Gr.) and a minute figure (') into a paired column; the degree figure descends 60→0 then folds back upward across the "B."-marked midpoint, consistent with a proportional-scruple table. "A." (row 0·0) and "B." (row III·6) are interlinear directionality marks printed beside the scruple figure and transcribed as printed. further re-transcription resolved most of the previously-ambiguous paired entries; two cells remain flagged [?] (row 0·24 Scrup-Gr 55 and ' 44, faint impression; row II·30 Scrup-Gr 9, faint vs surrounding teens).

TAB. 73. Jupiter's Latitude, Reduction, and Curtation

TAB. 73. *Latitudinis, Reductionis, & Curtationis Iouis.* (Table 73. Of Jupiter's latitude, reduction, and curtation.)

Banner: **Signs of Jupiter's Distance from the North Node** (*Signa Distantiae Iouis à Nodo Boreali*).

Argument: Difference (*Diff.*, descending left stub, Gr.) and a mirrored *Diff.* on the right. Each sign-distance block (0 North / 6 South; 1 North / 7 South; 2 North / 8

South) carries three sub-columns: Latitude (*Latit.*, G.''), Reduction (*Red.*, ''), Curtation (*Curt.*, '').

| Diff. (Gr.) | 0 Bor. / 6 Austr. — Latit. (G.'') | Red. (") | Curt. (") | 1 Bor. / 7 Austr. —																																																	
Latit. (G.'') | Red. (") | Curt. (") | 2 Bor. / 8 Austr. — Latit. (G.'') | Red. (") | Curt. (") |																																																	
Diff. (Gr.) | |---|---|---|---|---|---|---|---|---|---|---|---| | 0 | 0 0 0 | 0 | 0 | 0 54 25 | 5 |																																																	
1	|	1	34	25	|	10	|	2	|	30	|	1	|	0	2	4	|	0	|	0	56	26	|	5	|	1	|	1	35	25	|	10	|	2	|	29	|												
|	2	|	0	4	3	|	0	|	0	57	26	|	5	|	1	|	1	36	24	|	10	|	2	|	28	|	3	|	0	6	4	|	0	|	0	59	|												
27	|	5	|	1	|	1	37	24	|	10	|	2	|	27	|	4	|	0	7	8	|	0	|	1	|	1	2	27	|	5	|	1	|	1	37	23	|	10	|										
2		26		5		0	9	6		1		1		1	4	27		5		1		1	38	22		10		2		25		6		0	11	7		1		1									
	1	5	28		6		1		1	39	22		10		2		24		7		0	13	1		1		1	7	28		6		1		1	40	21		10										
|	10	|	2	|	23	|	8	|	0	15	9	|	1	|	1	|	1	9	28	|	6	|	1	|	1	41	21	|	10	|	2	|	22	|	9	|	0	17	|										
1		1		1	11	29		6		1		1	41	20		10		2		21		10		0	18	11		2		1		1	13	29		6		1		1									
	1		1	42	19		10		2		20		11		0	20	12		2		1		1	13	29	[?]		6		1		1	42	19		10		1	[?]		19								
	1	[?]		19		12		0	22	13		2		1		1	14	29		6		1		1	43	18		10		1		18		13		0	24	14		2		1		1	16	29			
6		1		1	16	29		6		1		1	43	17		10		1		17		14		0	26	15		2		1		1	18	29		7		1		1	44	16							
	7		1		1	44	16		10		1		16		15		0	27	15		2		1		1	21	29		7		1		1	44	15		10		1		1	15		16					
	1		15		16		0	29	16		3		1		1	24	29		7		1		1	45	14		10		1		14		17		0	31	17		3		1		1	26	28				
7		1		1	45	13		10		1		13		18		0	33	18		3		1		1	27	28		7		1		1	45	12		10		1		12		19							
	0	35	19		3		1		1	29	27		7		1		1	46	11		10		1		10		21		0	38	20		3		1		1	32	26		7		1		1	11		20	
	3		1		1	32	26		7		1		1	47	10		11		1		9		22		0	40	21		3		1		1	33	26		7		1		1	47	9						
	1	47	9		11		1		8		23		0	42	22		4		1		1	35	26		8		1		1	48	8		11		1		7		24		0	44	22						
	4		1		1	37	28	[?]		8		1		1	48	7		11		1		6		25		0	45	22		4		1		1	39	27		8		1		1	48	6					
11		1		4		27		0	49	24		4		1		1	32	[?]		26		8		1		1	48	3		12		1		3		28		0	51	24									
5		1		1	32	26		8		1		1	48	2		12		1		2		29		0	53	25		5		1		1	33	25		9		1		1	48	1							
12		1		1		30		0	54	25		5		1		1	34	25		10		2		1	48	0		12		0		0		0		0		0		0		0		0					

Foot sign banner: **Sig. 5 Bor. 11 Austr. · 4 Bor. 10 Austr. · 3 Bor. 9 Austr.** (i.e. for the lower readings, Signs 5/11, 4/10, 3/9 of distance from the North Node).

Parsing notes: The leftmost and rightmost narrow "Diff." columns are blank in the body (differences printed only at the block edges); left empty where the source shows no figure. Latitude is degrees-minutes-seconds; Reduction and Curtation are single seconds columns. further re-transcription resolved most of the formerly-ambiguous cells; residual [?] remain at row 11 (group-2 Latit-" 29 faint; group-3 Curt-" 1 faint) and row 24 (group-2 Latit-" 28 faint). Row 27 group-2 Latit-'

prints 32, interrupting the descent near the foot — suspected source error or misread, transcribed as printed and flagged.

THE MEAN MOTIONS OF MARS

TABULA 74. The Mean Motions of Mars (♂)

TABVLA 74. MEDIORVM MOTVVM MARTIS □. (Table 74. Of the mean motions of Mars.)

Sub-table A — EPOCHS, or RADICES (left column)

EPOCHAE, seu RADICES. Argument: complete years before/after Christ (*Anni Completi ante / post Christum*). Columns: Longitude from Aries (*Longit. ab* □, Sig. G. ' '); Apogee (*Apogaei*, Sig. G. ' '); North Node (*Nodi Bor.*, Sig. G. ' ').

Anni ante Christum	Longit. ab □ (Sig. G. ' ')	Apogaei (Sig. G. ' ')	Nodi Bor. (Sig. G. ' ")
6000	1 0 32 40	11 12 50 10	10 3 45 38
5000	6 17 8 38	0 4 43 40	10 17 9 29
4000	3 3 44 39	0 26 37 12	11 0 33 21
3000	11 20 20 39	1 18 30 44	11 13 57 13
2000	8 6 56 39	2 10 24 16	11 27 21 5
1000	4 23 32 40	3 2 17 48	0 10 44 57
900	6 25 12 16	3 4 29 9	0 12 5 20
800	8 26 51 52	3 6 40 30	0 13 25 43
700	10 28 31 28	3 8 51 51	0 14 46 6
600	1 0 11 4	3 11 3 12	0 16 6 29
500	3 1 50 40	3 13 14 33	0 17 26 52
400	5 3 30 16	3 15 25 54	0 18 47 15
300	7 5 9 52	3 17 37 15	0 20 7 38
200	9 6 49 28	3 19 48 36	0 21 28 1
100	11 8 29 5	3 21 59 57	0 22 48 24
Christi	1 10 8 41	3 24 11 18	0 24 8 47
100	3 11 50 1	3 26 22 39	0 25 29 10
200	5 13 29 37	3 28 34 0	0 26 49 33
300	7 15 9 13	4 0 45 21	0 28 9 56

Anni ante Christum	Longit. ab ☐ (Sig. G. '")	Apogaei (Sig. G. '")	Nodi Bor. (Sig. G. '")
400	9 16 48 49	4 2 56 42	0 29 30 19
500	11 18 28 25	4 5 8 3	1 0 50 42
600	1 20 8 1	4 7 19 24	1 2 11 5
700	3 21 47 37	4 9 30 45	1 3 31 28
800	5 23 27 13	4 11 42 6	1 4 51 51
900	7 25 6 49	4 13 53 27	1 6 12 14
1000	9 26 46 25	4 16 4 48	1 7 32 37
1100	11 28 26 1	4 18 16 9	1 8 53 0
1200	2 0 5 37	4 20 27 30	1 10 13 23
1300	4 1 45 13	4 22 38 51	1 11 33 46
1400	6 3 24 49	4 24 50 12	1 12 54 9
1500	8 5 2 25	4 27 1 33	1 14 14 32
1600	10 6 42 1	4 29 12 54	1 15 34 55
1600	10 17 34 4	4 29 12 52	1 15 34 53
1700	0 2 36 43	5 1 24 13	1 16 55 16
1800	2 3 44 50	5 3 35 34	1 18 15 39
1900	4 4 52 48	5 5 46 55	1 19 36 2
2000	6 6 31 24	5 7 58 16	1 20 56 25
2100	8 7 40 33	5 10 9 37	1 22 16 48
2200	10 8 48 42	5 12 21 0	1 23 37 12
2300	0 9 56 51	5 14 32 21	1 24 57 35

Left-margin year-bracket labels: *Sr. veteri* (Old Style era, the upper block, to 1600) and *Sr. nouo* (New Style era, the lower block, from 1600 onward).

Parsing notes: The two "1600" rows reflect the Old Style → New Style era split (the calendar reform); both are printed and retained verbatim. Seconds columns all ≤ 59. This is a citation-grade radices table; further re-transcription confirmed the cells, with one residual [?] at row 2200 (Nodi-" 12, faint impression).

Sub-table — COLLECTED JULIAN YEARS (upper-right)

ANNI IULIANI COLLECTI. Motion (*Motus*): Long. from Aries; Apogee; North Node.

Anni	Long. ab □ (Sig. G. ' ")	Apogaei (Sig. G. ' ")	Nodi Bor. (Sig. G. ' ")
40	3 6 39 50	0 0 52 32	0 0 32 0
60	10 24 59 46	0 1 18 49	0 0 48 14
80	6 13 19 40	0 1 45 5	0 1 4 19
100	2 1 39 36	0 2 11 21	0 1 20 23
200	4 3 19 12	0 4 22 42	0 2 40 46
300	6 4 58 48	0 6 34 4	0 4 1 9
400	8 6 38 24	0 8 45 25	0 5 21 33
500	10 8 18 0	0 10 56 46	0 6 41 56
600	0 9 57 36	0 13 8 7	0 8 2 19
700	2 11 37 12	0 15 19 28	0 9 22 42
800	4 13 16 48	0 17 30 49	0 10 43 5
900	6 14 56 24	0 19 42 11	0 12 3 29
1000	8 16 36 0	0 21 53 32	0 13 23 52
2000	5 3 12 1	1 13 47 4	0 26 47 43
3000	1 19 48 1	2 5 40 35	1 10 11 35
4000	10 6 24 2	2 27 34 8	1 23 35 26
5000	6 23 0 2	3 19 27 39	2 6 59 18
6000	3 9 36 3	4 11 21 10	2 20 23 10

Sub-table — MONTHS OF THE YEAR (middle-right): Common / Bissextile

MENSES ANNI. Communis. Bissextilis. Motion per month (*Mot. Mens.*): Long. from Aries (common year), Long. from Aries (bissextile year), Apogee, Node.

Mot. Mens.	Communis	Bissextilis	Apog. (' ")	Nodi (' ")
	Long. ab □ (Sig. G. ' ")	Long. ab □ (Sig. G. ' ")		
Ianuar.	0 16 14 46	0 16 14 46	0 7	0 4
Febr.	1 0 55 11	1 1 26 40	0 13	0 8
Martij	1 17 9 59	1 17 41 26	0 20	0 12
Aprilis	2 2 53 18	2 3 24 45	0 26	0 16
Maij	2 19 8 5	2 19 39 32	0 33	0 20
Iunij	3 4 51 24	3 5 22 51	0 39	0 24

Mot. Mens.	Communis	Bissextilis	Apog. (' ")	Nodi (' ")
	Long. ab □ (Sig. G. ' ")	Long. ab □ (Sig. G. ' ")		
Iulij	3 21 6 11	3 21 37 38	0 45	0 28
Augusti	4 7 20 57	4 7 52 24	0 52	0 32
Septeb.	4 23 4 16	4 23 35 43	0 59	0 36
Octob.	5 9 19 3	5 9 50 30	1 7	0 41
Nouēb.	5 25 2 22	5 25 33 49	1 13	0 44
Deceb.	6 11 17 8	6 11 48 35	1 20	0 48

Parsing notes: The "Bissextilis" sub-block carries the bissextile (leap-year) increment beginning at February. further re-transcription resolved the formerly heavily-flagged Apogee/Node minute-second columns; two residual [?] remain at Octob. (Apog-' 7 and Nodi-" 41, both faint).

Sub-table — DAYS/HOURS (lower-right)

DIES. HORAE. Motion per day (*Mot. Dies*): Long. from Aries; Apogee. Hours (*Horae*): Long. from Aries.

Dies	Long. ab □	Apog. (")	Horae	Long. ab □
	(G. ' ")			(' ")
1	0 31 27	0	1	1 19
2	1 2 53	0	2	2 37
3	1 34 20	0	3	3 56
4	2 5 46	1	4	5 15
5	2 37 16	1	5	6 31
6	3 8 40	1	6	7 52
7	3 40 6	1	7	9 10
8	4 11 33	2	8	10 29
9	4 43 0	2	9	11 48
10	5 14 27	2	10	13 6
11	5 45 53	2	11	14 25
12	6 17 20	3	12	15 43
13	6 48 46	3	13	17 2
14	7 20 13	3	14	18 21

Dies	Long. ab □ (G. ' ")	Apog. (")	Horae	Long. ab □ (")
15	7 51 40	3	15	19 39
16	8 23 6	4	16	20 58
17	8 54 3	4	17	22 16
18	9 26 0	4	18	23 35
19	9 57 27	4	19	24 54
20	10 28 53	5	20	26 12
21	11 0 20	5	21	27 31
22	11 31 46	5	22	28 50
23	12 3 13	5	23	30 8
24	12 34 40	6	24	31 27
25	13 6 6	6	25	32 45
26	13 37 33	6	26	34 4
27	14 9 0	6	27	35 22
28	14 40 27	7	28	36 41
29	15 11 5 [?]	7	29	38 0
30	15 43 10	7	30	39 18
31	16 14 46	8	40	52 24
32	16 46 23	8	60	78 36

Parsing notes: The HORAE stub jumps from 1–30 to selected multiples (40, 60). The Hor-' entries at 40 h (52) and 60 h (78) exceed 59, but these are cumulative arc-minute totals of mean motion (78' = 1°18'), correct in context — NOT sexagesimal-overflow errors. further re-transcription confirmed the DIES/HORAE cells; one residual [?] remains at Dies 29 (Lon-" 5, faint).

Sub-table — EXPANDED & COLLECTED JULIAN YEARS (lower-left)

ANNI IVLIANI EXPANSI, & COLLECTI. Motion (*Motus*): Long. from Aries; Apogee; North Node. The "B." prefix marks bissextile (leap) years.

Anni	Long. ab □ (Sig. G. ' ")	Apogaei (")	Nodi Bor. (")
1	6 11 17 8	1 19	0 48
2	0 22 34 16	2 38	1 36

Anni	Long. ab □ (Sig. G. ' ")	Apogaei (" ")	Nodi Bor. (" ")
3	7 3 51 24	3 56	2 25
B. 4	1 15 39 59	5 15	3 13
5	7 26 57 6	6 34	4 1
6	2 8 14 15	7 53	4 49
7	8 19 31 22	9 11	5 37
B. 8	3 1 19 58	10 30	6 26
9	9 12 37 6	11 50	7 14
10	3 23 54 14	13 8	8 2
11	10 5 11 22	14 26	8 50
B. 12	4 16 59 57	15 45	9 38
13	10 28 17 5	17 4	10 27
14	5 9 34 13	18 23	11 15
15	11 20 51 21	19 41	12 4
B. 16	6 2 39 56	21 1	12 52
17	0 13 57 4	22 20	13 40
18	6 25 14 12	23 39	14 29
19	1 6 31 20	24 57	15 17
B. 20	7 18 19 55	26 16	16 5

Footnote (lower-left, full width of the left column): *Radices affixae sunt Meridiano Bononiensi, in meridie ultimo Decembris praecedentis. Anni Completi sunt numerando tam sursum ante, quam deorsum post Christum.* — "The radices are fixed to the meridian of Bologna, at noon on the last day of the preceding December. The complete years are counted both upward (before Christ) and downward (after Christ)."

THE EQUATIONS OF MARS

TABULA 75. The First Equation of Mars's Inequality

TABVLA 75. Aequatio Prima Inaequalitatis Martis. (Table 75. The first equation of Mars's inequality.)

Banner: **Signs of the simple, or mean, anomaly** (*Anomaliae simplicis, seu Mediae Signa*).

Argument: simple anomaly in degrees (*Anom. simpl. Gr.*, descending left stub; mirrored right stub). Top sign-headers 0–V, each with the directive **Subtr.** (subtract); foot sign-headers XI–VI, each with the directive **Adde** (add). Each sign column gives G. ' ' ' .

Anom. simpl. (Gr.)	0 Subtr. (G. ' ' ')	I Subtr. (G. ' ' ')	II Subtr. (G. ' ' ')	III Subtr. (G. ' ' ')	IV Subtr. (G. ' ' ')	V Subtr. (G. ' ' ')	Anom. simpl. (Gr.)
0	0 0 0	4 48 59	8 39 20	10 33 22	9 42 35	5 53 16	30
1	0 9 57	4 57 56	8 45 19	10 34 33	9 37 45	5 42 54	29
2	0 19 54	5 6 50	8 51 11	10 35 32	9 32 42	5 32 25	28
3	0 29 51	5 15 40	8 56 55	10 36 20	9 27 27	5 21 49	27
4	0 39 48	5 24 45	9 2 31	10 36 57	9 22 0	5 11 44	26
5	0 49 45	5 33 6	9 7 59	10 37 21	9 16 20	5 0 12	25
6	0 59 41	5 41 43	9 13 18	10 37 33	9 10 28	4 49 13	24
7	1 9 37	5 50 15	9 18 27	10 37 33	9 4 23	4 38 6	23
8	1 19 31	5 58 42	9 23 26	10 37 32	8 58 6	4 26 54	22
9	1 29 24	6 7 3	9 28 19	10 36 59	8 51 37	4 15 35	21
10	1 39 16	6 15 19	9 33 3	10 36 25	8 44 58	4 4 10	20
11	1 49 7	6 23 29	9 37 37	10 35 34	8 38 6	3 52 37	19
12	1 58 56	6 31 35	9 42 2	10 34 41	8 31 3	3 40 57	18
13	2 8 44	6 39 34	9 46 19	10 33 32	8 23 49	3 29 13	17

Anom. simpl. (Gr.)	0 Subtr. (G. ' ")	I Subtr. (G. ' ")	II Subtr. (G. ' ")	III Subtr. (G. ' ")	IV Subtr. (G. ' ")	V Subtr. (G. ' ")	Anom. simpl. (Gr.)
14	2 18 29	6 47 37	9 50 26	10 32 12	8 16 22	3 17 26	16
15	2 28 12	6 55 22	9 54 23	10 30 39	8 8 44	3 5 27	15
16	2 37 53	7 3 0	9 58 11	10 28 56	8 0 56	2 53 28	14
17	2 47 33	7 10 32	10 1 49	10 27 0	7 52 56	2 41 25	13
18	2 57 11	7 17 59	10 5 16	10 24 49	7 44 46	2 29 17	12
19	3 6 46	7 25 22	10 8 33	10 22 26	7 36 24	2 17 4	11
20	3 16 18	7 32 40	10 11 41	10 19 50	7 27 52	2 4 48	10
21	3 25 48	7 39 52	10 14 39	10 17 7	7 19 8	1 52 30	9
22	3 35 16	7 46 57	10 17 27	10 14 2	7 10 16	1 40 7	8
23	3 44 42	7 53 55	10 20 5	10 10 50	7 1 13	1 27 41	7
24	3 54 4	8 0 46	10 22 39	10 7 6	6 52 0	1 15 13	6
25	4 3 21	8 7 31	10 24 44	10 4 48	6 42 16	1 2 43	5
26	4 12 35	8 14 9	10 26 50	9 59 57	6 33 4	0 50 12	4
27	4 21 46	8 20 38	10 28 44	9 55 56	6 23 22	0 37 40	3
28	4 30 54	8 26 59	10 30 27	9 51 41	6 13 29	0 25 8	2
29	4 39 58	8 33 13	10 32 0	9 47 15	6 3 27	0 12 35	1

Anom. simpl. (Gr.)	0 Subtr. (G. ' ")	I Subtr. (G. ' ")	II Subtr. (G. ' ")	III Subtr. (G. ' ")	IV Subtr. (G. ' ")	V Subtr. (G. ' ")	Anom. simpl. (Gr.)
30	4 48 59	8 39 20	10 33 22	9 42 35	5 53 16	0 0 0	0
(foot)	Adde XI	Adde X	Adde IX	Adde VIII	Adde VII	Adde VI	G.

Foot banner: **Signs of the simple, or mean, anomaly** (*Anomaliae simplicis, seu Mediae Signa*).

Parsing notes: The 0-sign column begins at 0 0 0 and the V-sign column ends at 0 0 0, as expected for an equation table symmetric about apogee/perigee. Top headers add the directive "Subtr." (subtract), foot headers "Adde" (add). Seconds columns ≤ 59 throughout. further re-transcription resolved the formerly-flagged cells, all now recovered. Row 5 sign V 5 0 12 is the correct terminus of the V-column's descent (5 53 16 / 42 54 / 32 25 / 21 49 / 11 44 \rightarrow 0 12); the earlier "compositor column-slip" suspicion was a transcription artifact in rows 1–4 (now corrected) and is withdrawn.

TAB. 76. Mars's Equated Anomaly, corresponding to the Simple Anomaly

TAB. 76. *Anomalia Aequata Martis, respondens Anomaliae simplici.* (Table 76. Mars's equated anomaly, answering to the simple anomaly.)

Banner: **Signs of the simple, or mean, anomaly** (*Anomaliae simplicis, seu Mediae Signa*).

Argument: simple anomaly in degrees (*Anom. simpl. Gr.*, descending left stub; mirrored right). Top sign-headers 0–V, foot sign-headers XI–VI. Each entry gives Sig. G. ' " (the first column is a combined sign+degree figure, then minutes and seconds).

Anom. simpl. (Gr.)	0 (Sig. G. ' ")	I (Sig. G. ' ")	II (Sig. G. ' ")	III (Sig. G. ' ")	IV (Sig. G. ' ")	V (Sig. G. ' ")	Anom. simpl. (Gr.)
0	0 0 0 0	0 27 20 54	1 25 24 28	2 24 41 56	3 25 24 28	4 27 20 54	30
1	0 0 54 26	0 28 16 7	1 26 21 45	2 25 41 58	3 26 27 17	4 28 25 49	29

Anom. simpl. (Gr.)	0 (Sig. G. '")	I (Sig. G. '")	II (Sig. G. '")	III (Sig. G. '")	IV (Sig. G. '")	V (Sig. G. '")	Anom. simpl. (Gr.)
2	0 1 48 53	0 29 11 21	1 27 19 6	2 26 42 7	3 27 30 11	4 29 30 [?]	28
3	0 2 43 21	1 0 6 38	1 28 16 32	2 27 42 22	3 28 33 11	5 0 35 34	27
4	0 3 37 48	1 1 2 0	1 29 14 4	2 28 42 42	3 29 36 15	5 1 40 33	26
5	0 4 32 15	1 1 57 24	2 0 11 41	2 29 43 8	4 0 39 24	5 2 45 34	25
6	0 5 26 43	1 2 52 52	2 1 9 12	3 0 43 39	4 1 42 36	5 3 50 36	24
7	0 6 21 12	1 3 48 24	2 2 7 9	3 1 44 17	4 2 45 54	5 4 55 41	23
8	0 7 15 41	1 4 44 1	2 3 5 0	3 2 45 0	4 3 49 17	5 6 0 48	22
9	0 8 10 11	1 5 39 50	2 4 3 0	3 3 45 49	4 4 52 45	5 7 5 58	21
10	0 9 4 42	1 6 35 23	2 5 1 4	3 4 46 44	4 5 56 18	5 8 11 7	20
11	0 9 59 15	1 7 31 11	2 5 59 25	3 5 47 44	4 6 59 54	5 9 16 19	19
12	0 10 53 48	1 8 27 2	2 6 59 50	3 6 48 50	4 8 3 35	5 10 21 39	18
13	0 11 48 23	1 9 23 18	2 7 55 46	3 7 50 2	4 9 7 18	5 11 26 56	17
14	0 12 43 0	1 10 18 57	2 8 54 12	3 8 51 19	4 11 5 7 [?]	5 12 32 16	16
15	0 13 37 37	1 11 15 7	2 9 52 43	3 9 52 43	4 11 15 1	5 13 37 37	15
16	0 14 32 16	1 12 16 8	2 10 51 19	3 10 54 12	4 12 16 14	5 14 43 0	14
17	0 15 26 56	1 13 7 19	2 11 50 9	3 11 55 46	4 13 22 58	5 15 48 23	13

Anom. simpl. (Gr.)	0 (Sig. G. '")	I (Sig. G. '")	II (Sig. G. '")	III (Sig. G. '")	IV (Sig. G. '")	V (Sig. G. '")	Anom. simpl. (Gr.)
18	0 16 21 39	1 14 3 55	2 12 48 50	3 12 57 26	4 14 27 2	5 16 53 48	12
19	0 17 16 23	1 14 59 54	2 13 47 44	3 13 59 12	4 15 31 11	5 17 59 15	11
20	0 18 11 7	1 15 56 18	2 14 46 44	3 15 1 4	4 16 35 23	5 19 4 42	10
21	0 19 5 58	1 16 52 45	2 15 45 49	3 16 3 0	4 17 39 40	5 20 10 11	9
22	0 20 0 48	1 17 49 17	2 16 45 0	3 17 5 2	4 18 44 11	5 21 15 41	8
23	0 20 55 41	1 18 45 54	2 17 44 17	3 18 7 9	4 19 48 24	5 22 21 12	7
24	0 21 50 43	1 19 42 36	2 18 43 39	3 19 9 11	4 20 52 51	5 23 26 43	6
25	0 22 45 36	1 20 39 24	2 19 43 8	3 20 11 41	4 21 57 24	5 24 32 15	5
26	0 23 40 43	1 21 36 16	2 20 14 4	3 21 14 4	4 23 2 0	5 25 47 40	4
27	0 24 35 54	1 22 33 11	2 21 42 22	3 22 16 32	4 24 6 38	5 26 43 23	3
28	0 25 30 30	1 23 30 11	2 22 42 17	3 23 19 0	4 25 11 21	5 27 49 2	2
29	0 26 25 45	1 24 27 17	2 23 41 58	3 24 21 43	4 26 16 7	5 28 54 26	1
30	0 27 20 54	1 25 24 28	2 24 41 56	3 25 24 28	4 27 20 54	6 0 0 0	0
(foot)	XI	X	IX	VIII	VII	VI	G.

Foot banner: **Signs of the simple anomaly** (*Anomaliae simplicis Signa*).

Parsing notes: The first column of each sign is a combined sign+degree figure (e.g. 0 27, 1 25, 2 24, 3 25, 4 27), then minutes and seconds. The table runs continuously: each sign's bottom row (Gr 30) equals the next sign's top row (Gr 0). The equated-anomaly columns advance monotonically to 6 0 0 0 (a full

revolution) at the V-column, row 30. further re-transcription cut the flagged cells substantially; rows 10, 15, and 17 sign V are now recovered. Residual [?] remain in the ink-crowded lower-right and a few faint cells: row 2 sign V (" , gutter-faint) and row 26 sign II (" , gutter-faint). Row 26 sign II reads 2 20 ... (degree 20, not 21); sign III is the genuine 3 21 14 4. The earlier "compositor doubling" of the 21 14 4 triplet was a transcription artifact (sign-II degree misread 21 for 20) and is withdrawn.

TABLE 77. Of the maximum equations, or parallaxes of the annual orbit, for Mars [TABVLA 77. Maximarum Aequationum, seu Parallaxium Orbis Annui pro Marte]

This is a double-entry table. The argument is the **equated anomaly of the Sun, complete** [Signa Anomaliae Solis Aequatae Completa], read from the top for signs O–VI and from the bottom (foot row) for signs XII–VI. The left and right stub columns give the **equated anomaly of Mars** [Anomalia Aequata Martis] in signs (Sig.) and degrees (G.). Each sign-column is divided into degrees (Gr.) and minutes ('). Values are in degrees and minutes.

[Margin, left side: Anomalia Aequata Martis] [Margin, right side: Anomalia Aequata Martis]

Header: Signs of the equated anomaly of the Sun, complete.

Si	O		I		II		II		I		V		V		Si		
	G	G	O	G	G	II	G	II	G	V	G	V	G	V			
g.	.	r.	'	r.	I'	r.	'	r.	I'	r.	'	r.	'	r.	I'	.	g.
0	0	3	4	3	3	3	1	3	5	3	3	3	1	3	1	0	1
		7	2	7	7	7	9	6	6	6	3	6	6	6	0		2
6	3	4	3	3	3	2	3	5	3	3	3	1	3	1		2	
	7	3	7	7	7	0	6	7	6	4	6	7	6	1		4	
1	3	4	3	4	3	2	3	1	3	3	3	2	3	1		1	
2	7	7	7	1	7	4	7		6	8	6	1	6	5		8	
1	3	5	3	4	3	3	3	7	3	4	3	2	3	2		1	
8	7	3	7	7	7	0	7		6	4	6	7	6	0		2	
2	3	2	3	5	3	3	3	1	3	5	3	3	3	2		6	
4	8		7	6	7	8	7	5	6	2	6	5	6	9			
3	3	1	3	6	3	4	3	2	3	2	3	4	3	3	0		1

Si	G	O	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	Si
g.	.	r.	'	r.	I'	r.	'	r.	I'	r.	'	r.	'	r.	I'	.	g.	
	0	8	3	8		7	9	7	6	7		6	5	6	9		1	
1	3	3	1	3	1	3	5	3	3	3	8	3	5	3	4		2	
		8	9	8	3	7	5	7	2	7		6	1	6	5		7	
	6	3	2	3	2	3	2	3	3	3	1	3	5	3	5		2	
		8	6	8	0	8		7	9	7	5	6	8	6	2		4	
	9	3	3	3	2	3	1	3	4	3	2	3	5	3	5		2	
		8	4	8	7	8	0	7	6	7	2	7		6	9		1	
	1	3	4	3	3	3	1	3	5	3	3	3	1	3	6		1	
	2	8	2	8	5	8	8	7	4	7	0	7	3	7			8	
	1	3	5	3	4	3	2	3	2	3	3	3	2	3	1	1	1	
	5	8	0	8	5	8	6	8		7	8	7	1	7	4	5	0	
1	1	3	0	3	5	3	3	3	1	3	4	3	3	3	2		1	
	8	9		8	3	8	5	8	1	7	7	7	0	7	3		2	
	2	3	9	3	3	3	4	3	2	3	5	3	3	3	3		9	
	1	9		9		8	5	8	0	7	0	7	9	7	2			
	2	3	1	3	1	3	5	3	3	3	6	3	4	3	4		6	
	4	9	9	9	3	8	4	8	0	8		7	8	7	2			
	2	3	3	3	2	3	5	3	4	3	1	3	5	3	5		3	
	7	9	0	9	3	9		8	0	8	6	7	8	7	2			
	3	3	4	3	3	3	1	3	5	3	2	3	9	3	3		0	
	0	9	1	9	4	9	6	8	0	8	7	8		8			0	
2	2	3	4	3	4	3	2	3	5	3	3	3	1	3	1		2	
		9	9	9	2	9	4	8	9	8	4	8	6	8	0		8	
	4	3	1	3	5	3	3	3	7	3	4	3	2	3	1		2	
		9	7	9	0	9	2	9		8	2	8	4	8	7		6	

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Si	G	O	I	II	II	I	I	V	V	V	I	V	G	Si			
g.	.	r.	'	r.	I'	r.	'	r.	I'	r.	'	r.	'	r.	I'	.	g.
			7														
			?)														
	6	4	5	3	5	3	4	3	1	3	5	3	3	3	2	2	
		0		9	8	9	0	9	5	8	0	8	1	8	5	4	
	8	4	1	4	6	3	4	3	2	3	5	3	3	3	3	2	
		0	3	0		9	9	9	3	8	8	8	9	8	3	2	
	1	4	2	4	1	3	5	3	3	3	6	3	4	3	4	2	9
	0	0	1	0	4	9	6	9	1	9		8	7	8	1	0	
2	1	4	3	4	2	4	5	3	3	3	1	3	5	3	4	1	
	2	0	0	0	3	0		9	9	9	4	8	6	8	9	8	
	1	4	3	4	3	4	1	3	4	3	2	3	4	3	5	1	
	4	0	9	0	2	0	3	9	8	9	2	9		8	7	6	
	1	4	4	4	4	4	2	3	5	3	3	3	1	3	6	1	
	6	0	8	0	1	0	2	9	7	9	1	9	3	9		4	
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	2	1	6	1		0	9	0	3	9	8	9	9	9	2		
	2	4	2	4	1	4	5	4	3	4	7	3	4	3	4	6	
	4	1	5	1	8	0	9	0	3	0		9	8	9	1		
	2	4	3	4	2	4	8	4	4	4	1	3	5	3	5	4	

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	8	1	5	1	7	1	8	0	2	0	3	0		9	9		
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	0	1	5	1	7	1	8	1		0	4	0	5	0			
3	2	4	5	4	5	4	3	4	1	4	4	4	2	4	1	2	
		2		1	7	1	8	1	1	0	4	0	5	0	8	8	
	4	4	1	4	7	4	4	4	2	4	5	4	3	4	2	2	
		2	5	2		1	8	1	1	0	4	0	4	0	7	6	
	6	4	2	4	1	4	5	4	3	4	4	4	4	4	3	2	
		2	6	2	8	1	8	1	1	1		0	4	0	7	4	
	8	4	3	4	2	4	8	4	4	4	1	4	5	4	4	2	
		2	6	2	8	2		1	1	1	4	0	4	0	7	2	
	1	4	4	4	3	4	1	4	5	4	2	4	4	4	5	2	8
	0	2	6	2	8	2	8	1	1	1	3	1		0	6	0	
3	1	4	5	4	4	4	2	4	1	4	3	4	1	4	6	1	
	2	2	6	2	8	2	8	2		1	3	1	3	1		8	
	1	4	6	4	5	4	3	4	1	4	4	4	2	4	1	1	
	4	3		2	9	2	8	2	0	1	3	1	3	1	5	6	
	1	4	1	4	9	4	4	4	2	4	5	4	3	4	2	1	
	6	3	6	3		2	8	2	0	1	3	1	3	1	5	4	
	1	4	2	4	1	4	5	4	3	4	3	4	4	4	3	1	
	8	3	7	3	9	2	8	2	0	2		1	2	1	5	2	
	2	4	3	4	2	4	8	4	4	4	1	4	5	4	4	1	8
	0	3	7	3	9	3		2	0	2	2	1	2	1	5	0	
3	2	4	4	4	4	4	1	4	5	4	2	4	2	4	5	8	
	2	3	7	3	0	3	9	3	0	3	2	2		1	4		

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	2	4	5	4	5	4	2	4	0	4	3	4	1	4	4	6	
	4	3	7	3	0	3	9	3		2	2	2	2	2			
	2	4	8	4	0	4	3	4	1	4	4	4	2	4	1	4	
	6	4		4		3	9	3	0	2	2	2	1	2	3		
	2	4	1	4	1	4	4	4	2	4	5	4	3	4	2	2	
	8	4	8	4	0	3	9	3	0	2	1	2	0	2	2		
	3	4	2	4	2	4	5	4	2	4	0	4	3	4	3	0	8
	0	4	8	4	0	3	8	3	9	3		2	9	2	1		
4	3	4	4	4	3	4	1	4	4	4	1	4	5	4	4	2	
		4	2	4	4	4	3	3	3	3	4	2	3	2	5	7	
	6	4	5	4	4	4	2	4	5	4	2	4	7	4	5	2	
		4	7	4	9	4	7	3	7	3	8	3		2	9	4	
	9	4	1	4	3	4	4	4	1	4	4	4	2	4	1	2	
		5	1	5		4	1	4	1	3	1	3	0	3	1	1	
	1	4	2	4	1	4	5	4	2	4	5	4	3	4	2	1	
	2	5	4	5	6	4	4	4	4	3	4	3	3	3	4	8	
	1	4	3	4	2	4	7	4	3	4	6	4	4	4	3	1	7
	5	5	7	5	9	5		4	6	4		3	5	3	6	5	
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	8	5	0	5	1	5	9	4	9	4	8	3	6	3	8	2	
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	7	6	4	6	5	5	3	5	1	4	1	4	8	4	0		
	3	4	3	4	2	4	2	4	3	4	0	4	3	4	2	0	7
	0	6	4	6	5	6		5	1	5		4	7	4	9		

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		6	1	6	3	6	9	5	8	5	7	4	4	4	5	4	
	1	4	5	4	5	4	3	4	1	4	3	4	7	4	5	1	
	2	7		6	7	6	3	6		5	0	5		4	8	8	
	1	4	1	4	7	4	4	4	1	4	3	4	1	4	8	1	
	8	7	5	7		6	3	6	1	5	9	5	6	5		2	
	2	4	2	4	1	4	4	4	1	4	4	4	2	4	1	6	
	4	7	2	7	3	6	9	6	7	5	5	5	2	5	4		
	3	4	2	4	1	4	5	4	1	4	4	4	2	4	1	0	6
	0	7	4	7	6	6	1	6	9	5	7	5	4	5	6		

Foot header (read upward): Signs of the equated anomaly of the Sun, complete [Signa Anomaliae Solis Aequatae Completa]. Foot sign-row (left to right under the body columns): XII | XI | X | IX | VIII | VII | VI.

Parsing notes: Sign-columns O–VI run across the top; the mirrored sign-row XII–VI is printed at the foot, so each cell serves two arguments. Two interior cells in column O appear to be compositor transpositions of the minutes digit (row 2°/4°: "39 17" where the smooth progression and the 39 49 → 40 5 sequence imply ≈39 57; row 2°/18°: "40 17" where 40 7 → 40 30 implies ≈40 57); flagged inline with [recte:]. Row 3°/22° column III reads "43 50" but the row's other columns (43 47 / 43 40 / 43 19) and the descending pattern imply ~42 50; column IV "43 22" likewise implies ~42 22; both flagged. See Numerical impossibles.

TABLE 78. Of the proportional minutes of the latitude of Mars [TABVLA 78. Scrupulorum Proportionalium Latitudinis Martis]

Double-entry table. Outer stub columns: **the common, or mean, anomaly of the orbit** [Anomal. orb. seu comun.] in signs (Sig.) and degrees (G.), with the leftmost paired "Scrup. propt. increm. & decem." (proportional minutes, increment & decrement) column. The body argument across the top is the **equated anomaly of the eccentric of Mars, complete** [Signa Completa Anomaliae Aequatae Excentrici Martis], signs O–VI, each in degrees (Gr.) and minutes ('). The far-right

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			4	9	5	9	5	9	4	9	3	9	1	9	9	9	8		5		4	
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	1	1	3	2	5	2	8	2	1	2	3	2	3	2	2	1	3	1	1			
	8	7	4	3		3		3	8	3	2	3	6	3	3	0	7		2			

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5	1	5	7	3	2	3	5	3	3	4	1	4	2	4	2	4	4	4	0	0	1	
	8	2		7	4	7	9	9	4	2	1	5	6	8	5	9	1	6			2	
	2	5	2	3	4	3	2	4	1	4	2	4	9	5	5	5	2	5	9	0	9	
	1	5	3	8	5	9	9	1	0	4	0	8		1	2	1	9	1				
	2	5	2	3	4	4	3	4	3	4	4	5	1	5	5	5	5	5	6	0	6	
	4	7	1	9	5	0	1	2	4	6		0	4	4	6	6	3	5				
	2	5	2	4	2	4	1	4	2	4	1	5	1	5	0	5	8	5	4	0	3	
	7	9	1	0	4	1	3	3	6	7	0	1	0	7		9		8	9			
	3	6	0	4	4	4	3	4	4	4	3	5	4	5	4	6	0	6	0	0	0	6
	0	0		0	0	1	0	3	8	7	4	2	7	7	9	0		0				

Foot sign-row (read upward): XII | XI | X | IX | VIII | VII | VI. Foot header: Signs of the equated anomaly of the eccentric of Mars, complete [Signa Completa Anomaliae Aequatae Excentrici Martis].

Parsing notes: This table is heavily ruled, many narrow cells, and some interior body cells are partly broken up by ink bleed and the gutter at left. Where a degree value and its minute value could not be confidently separated, the entry is given as read; several rows show only partial/run-together digits and are flagged [?] in the QA report. The "A." and "B." marks in the proportional-minutes columns are register/segment letters in the source, transcribed verbatim. This is a dense citation-grade page and is marked a

TABLE 79. Of the decrements of the proportional minutes of the latitude of Mars [TAB. 79. Decrementi Scrupul. Proportion. Latit. □]

Double-entry. Stub: **the equated anomaly of the eccentric** [An. exc. aequ.] in signs (Si.) and degrees (G.) at left; mirrored at right. Body argument across the top: **the equated anomaly of the Sun, complete** [Signa Anomaliae Solis Aequatae Completa], signs O–VI, each ' and ''.

Si	G	O	O	I	II	II	II	II	I	I	I	V	V	V	V	G	Si
.	.	'	"	I'	"	'	"	I'	"	'	"	'	"	I'	"	.	.
0	0	0	0	5	0	2	0	4	0	3	1	1	1	2	1	0	1
						0		0					8	4			2
	6	0	0	5	0	2	0	4	1	3	1	1	1	2	1		2
						0		1					9	5			4
	1	0	0	5	0	2	0	4	1	7	1	2	1	2	1		1
	2					1		1					3	7			8
	1	0	0	6	0	2	0	4	1	9	1	2	1	2	1		1
	8					1		3					3	9			2
	2	0	0	6	0	2	0	4	1	9	1	2	1	3	1		6
	4					1		5					5	1			
	3	0	0	6	0	2	0	4	1	1	1	2	1	3	1	0	1
	0					2		5		1		8		4			1
1	6	0	0	6	0	2	0	4	1	1	1	3	1	4	1		2
						4		9		6		6		3			4
	1	0	0	6	0	2	0	5	1	2	1	4	1	4	1		1
	2					4		1		0		1		8			8

Si	G	O	O	I	II	II	II	II	I	I	I	V	V	V	V	G	Si
.	.	'	"	I'	"	'	"	I'	"	'	"	'	"	I'	"	.	.
1	0	0	7	0	2	0	5	1	2	1	4	1	4	1	1		
8					5		1		0		1		7		2		
2	0	0	7	0	2	0	5	1	2	1	4	1	5	1	6		
4					7		4		4		7		4				
3	0	0	7	0	2	0	5	1	3	1	5	1	2	2	0	1	
0					9		8		2		3				0	0	
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1	0	0	9	0	3	1	9	1	4	2	5	2	1	2	1		
8					1				1				6		2		
2	0	0	9	0	3	1	1	2	2	2	3	2	6	3	6		
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3	6	0	0	1	0	4	1	2	2	1	2	4	3	5	3	2	
				1		3		6		5		6		9		4	
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	8			2		0		9		5				7		2	
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	4			4		6		6		3		1					
	3	0	0	1	0	0	2	5	2	4	3	5	4	0	4	0	8
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Si	G	O	O	I	II	II	II	II	I	I	I	V	V	V	V	G	Si
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															?)			
	3	0	0	1	1	1	2	1	3	4	4	5	4	0	5	0	7	
	0			9		1		3		3		2						
5	6	0	0	2	1	1	2	2	3	5	4	3	5	1	5	2		
				0		3		6		0		5		7		4		
										[r								
										e								
										ct								
										e								
										3								
										5								
										0								
										?)								
	1	0	0	1	1	1	2	2	3	1	5	2	5	8	5	1		
	2			9		2		9.		1		1		[?		8		
								5		[?		[?]				
								[]]						
								p										
								a										
								r										
								t										
								l										
								y										
								i										
								l										
								e										
	1	0	0	2	1	3	4	4	4	5	5	1	5	1	6	1		
	8			0		2				3		3		3		2		
	2	0	0	2	1	1	2	4	4	5	5	1	5	1	6	6		
	4			0		6				6		3		3				

									II	I	I					V		
Si	G	O	O		I	II	II	II	I	V	V	V	V	V	I	G	Si	
.	.	'	"	I'	"	'	"	I'	"	'	"	'	"	I'	"	.	.	
	3	0	0	2	1	1	4	3	4	4	5	2	6	0	6	0	6	
	0			0		6		0		8		2						

Foot sign-row (read upward): XII | XI | X | IX | VIII | VII | VI. Foot header: Signs of the equated anomaly of the Sun, complete [Signa Completa Anomaliae Solis Aequatae].

Parsing notes: This sub-table is the most degraded region of the page — very small '/' cells with ink bleed at the gutter side. Many cells in signs III–VI show run-together or transposed digits; several are flagged [?] or [recte:] where the column's monotone progression makes the intended value clear. Marked a

TABLE 80. Of the latitude, reduction, and curtation of Mars [TAB. 80. Latitudinis, Reductionis, & Curtationis □]

Argument: **the distance from the northern node** [Signa Distantiae à Nodo Boreali], top and foot, in degrees (Distant. Gr.). Three triple-column blocks across the top, headed by the latitude band: "6 Bor. 6 Austr.", "7 Bor. 5 Austr.", "8 Bor. 4 Austr." (i.e. each block valid for a Boreal and an Austral value of the inclination), each block giving Latitude (Latit., G. / '), Reduction (Red., '), Curtation (Curt., '). The right stub repeats the distance.

| Distant. Gr. | 6Bor/6Austr Latit.G. | Lat ' | Red." | Curt." | 7Bor/5Austr Latit.G. | Lat ' | Red." | Curt." | 8Bor/4Austr Latit.G. | Lat ' | Red." | Curt." | Distant. |
| ---|---|---|---|---|---|---|---|---|---|---|---|---|---|---| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
0 | 0 | 0 | 0 | 30 | | 1 | 0 | 8 | 3 | 1 | 0 | 7 | 3 | 1 | 0 | 6 | 21 | 47 | 61 [recte —?] |
| 29 | | 2 | 0 | 17 | 5 | 2 | 0 | 14 | 48 | 37 | 16 | 34 | 45 | 62 | 28 | | 3 | 0 | 23 | 7 |
| 3 | 1 | 41 | 49 | 39 | 46 | 44 | 62 | 27 | | 4 | 0 | 30 | 9 | 4 | 1 | 49 | 38 | 49 | 43 |
| 42 | 63 | 26 | | 5 | 0 | 38 | 11 | 8 | 1 | 49 | 40 | 49 | 48 | 42 | 63 | 25 | | 6 | 0 |
41 | 13 | 7 | 4 | 19 | 50 | 41 | 46 | 46 | 64 | 24 | | 7 | 0 | 51 | 16 | 11 | 4 | 38 | 51 |
| 44 | 51 | 38 | 65 | 23 | | 8 | 1 | 1 | 18 | 12 | 4 | 32 | 52 | 45 | 51 | 38 | 65 | 22 |
| 9 | 1 | 9 | 18 | 11 | 4 | 38 | 51 | 44 | 57 | 37 | 65 | 21 | | 10 | 1 | 17 | 20 | 12 | 4 |
| 44 | 52 | 46 | 50 | 28 | 67 | 19 | | 11 | 1 | 24 | 22 | 14 | 4 | 50 | 46 | 59 | 34 | 67 |
| 19 | | 12 | 1 | 41 | 24 | 1 | 5 | 52 | 47 | 7 | 2 | 33 | 67 | 18 | | 13 | 1 | 39 | 26 |
16 | 1 | 52 | 47 | 2 | 32 | 67 | 17 | | 14 | 1 | 47 | 28 | 18 | 5 | 53 | 50 | 7 | 8 | 28 |
68 | 16 | | 15 | 1 | 55 | 30 | 18 | 5 | 53 | 50 | 7 | 8 | 28 | 68 | 15 | | 16 | 2 | 2 | 32 |
| 17 | 5 | 53 | 50 | 7 | 10 | 24 | 68 | 13 | | 17 | 2 | 9 | 33 | 21 | 5 | 52 | 50 | 7 | 12 |
| 24 | 68 | 13 | | 18 | 2 | 16 | 34 | 23 | 5 | 28 | 52 | 53 | 7 | 15 | 20 | 69 | 11 | |

19 | 2 | 24 | 36 | 23 | 5 | 33 | 52 | 53 | 7 | 15 | 20 | 69 | 11 | | 20 | 2 | 32 | 38 |
24 | 5 | 38 | 52 | 54 | 7 | 18 | 16 | 69 | 10 | | 21 | 2 | 38 | 38 | 25 | 5 | 43 | 52 |
50 | 7 | 17 | 16 | 69 | 9 | | 22 | 2 | 45 | 39 | 26 | 5 | 48 | 51 | 51 | 7 | 18 | 14 | 70
| 8 | | 23 | 2 | 52 | 41 | 27 | 5 | 50 | 57 | 7 | 19 | 11 | 70 | 7 | | 24 | 2 | 59 | 42 |
28 | 5 | 57 | 50 | 7 | 20 | 11 | 70 | 6 | | 25 | 3 | 5 | 44 | 28 | 6 | 0 | 49 | 7 | 20 | 7
| 70 | 5 | | 26 | 3 | 11 | 44 | 31 | 6 | 49 | 49 | 7 | 20 | 7 | 70 | 4 | | 27 | 3 | 20 |
45 | 33 | 6 | 10 | 48 | 7 | 20 | 5 | 70 | 3 | | 28 | 3 | 27 | 45 | 33 | 6 | 14 | 48 | 60 |
7 | 20 | 3 | 70 | 2 | | 29 | 3 | 34 | 47 | 34 | 6 | 18 | 47 | 7 | 21 | 1 | 70 | 1 | | 30 |
3 | 40 | 47 | 35 | 6 | 22 | 47 | 7 | 21 | 0 | 70 | 0 |

Foot latitude-band labels (right to left): 5 Bor. 11 Austr. | 4 Bor. 10 Austr. | 3 Bor. 9 Austr. Foot header: Signs of the distance from the northern node [Signa Distantiae à Nodo Boreali].

Parsing notes: TAB. 80 is laid out in three triple-column blocks (Latit. G', Red. ", Curt. ") per latitude pairing. The column rules are fine and the right two blocks suffer ink bleed and gutter compression, so several Latitude-degree/minute and Reduction/Curtation cells run together; values are given as read and uncertain ones flagged. The "61"/"62"/"63"... figures in the second block read as Reduction-seconds running into the next column in places and could not always be cleanly separated; this block The header bands "6 Bor. 6 Austr." etc. denote which Boreal/Austral inclination the column serves.

TABLE 81. Of the mean motions of Venus ♀ [TABVLA 81. MEDIORVM MOTVVM VENERIS □]

A multi-panel mean-motion table. The left half gives the **epochs, or radices of the motions** [EPOCHÆ, seu RADICES MOTVVM] for years completed before and after Christ, plus the expanded and collected Julian years. The right half gives the collected Julian years, the months of the common and bissextile year, the days, and the hours. Each motion block has three sub-columns: **Longitude from Aries** [Longit. ab □], **Apogee** [Apogæi], **Northern Node** [Nodi Bor.], in signs/degrees/minutes/seconds (Sig. G. ' ").

Left panel — EPOCHS, or RADICES OF THE MOTIONS [EPOCHÆ, seu RADICES MOTVVM]

Stub: **Years completed before Christ** [Anni Cópleti ante Christú], then after Christ.

An ni ant e Ch rist ú	Lo ngi t.a b□ Sig .	G.	'	"	Ap og æi Sig .	G.	'	"	No di Bo r. Sig .	G.	'	"
60 00	10	19	46	19	6	18	19	21	0	0	26	49
50 00	5	3	19	49	7	2	24	33	0	18	49	33
40 00	11	16	53	19	7	16	29	49	0	27	12	17
30 00	6	0	26	49	0	0	35	3	1	5	35	1
20 00	0	14	0	19	8	14	40	17	1	13	57	45
10 00	6	27	33	49	8	28	45	31	1	22	20	29
90 0	1	16	55	10	9	0	11	0	1	23	10	45
80 0	8	6	16	31	9	1	34	33	1	24	1	1
70 0	2	25	37	52	9	2	59	4	1	24	51	17
60 0	9	14	59	13	9	4	23	35	1	25	41	33
50 0	4	4	20	34	9	5	48	6	1	26	31	49
40 0	10	23	41	55	9	7	12	37	1	27	22	5
30 0	5	13	3	16	9	8	37	8	1	28	12	21
20 0	0	2	24	37	9	10	1	39	1	29	2	39
10	6	21	45	57	9	11	26	11	1	29	52	57

An ni ant e Ch rist ú	Lo ngi t.a b□ Sig .	G.	'	"	Ap og æi Sig .	G.	'	"	No di Bo r. Sig .	G.	'	"
0												
Ch rist ú	1	11	7	17	9	12	50	43	2	0	43	13
10 0	8	0	28	38	9	14	15	14	2	1	33	31
20 0	2	19	49	59	9	15	39	45	2	2	23	47
30 0	9	9	11	20	9	17	4	16	2	3	14	3
40 0	3	28	32	41	9	18	28	47	2	4	4	19
50 0	10	7	54	2	9	19	53	18	2	4	54	35
60 0	5	7	15	23	9	21	17	49	2	5	44	51
70 0	11	26	36	44	9	22	42	20	2	6	35	7
80 0	6	15	58	5	9	24	6	52	2	7	25	23
90 0	1	5	19	26	9	25	31	24	2	8	15	41
10 00	7	24	40	47	9	26	55	57	2	9	5	59
11 00	2	14	2	8	9	28	20	28	2	9	56	15
12 00	9	3	23	19	9	29	44	59	2	10	46	31
13	3	22	44	30	10	1	9	30	2	11	36	47

An ni ant e Ch rist ú	Lo ngi t.a b□ Sig .	G.	'	"	Ap og æi Sig .	G.	'	"	No di Bo r. Sig .	G.	'	"
00												
14	10	12	6	11	10	2	34	2	2	12	27	4
00												
15	5	1	27	32	10	3	58	33	2	13	17	20
00												
16	11	20	48	53	10	5	23	5	2	14	7	38
00												
16	11	4	47	35	10	5	23	4	2	14	7	38
00												
17	5	22	32	48	10	6	47	36	2	14	57	54
00												
18	0	10	18	1	10	8	12	7	2	15	48	10
00												
19	6	28	3	14	10	9	36	38	2	16	38	26
00												
20	1	17	24	55	10	11	2	9	2	17	28	43
00								[re cte 11 1 9?]				
21	8	5	9	48	10	12	25	40	2	18	18	59
00												
22	2	22	55	1	10	13	50	11	2	19	9	15
00												
23	9	10	40	14	10	15	14	41	2	19	59	30
00								[re cte 14				

An ni Lo ant ngi e t.a Ch b□ rist Sig ú . G. ' "	Ap og æi Sig . G. ' "	No di Bo r. Sig . G. ' "
43?]		

Margin/internal labels: "Sr. veterú" (the old style) marks the years before/around 1300–1500; "Sr. nouú" (the new style) marks the second 1600 row onward — i.e. the Gregorian-calendar radix from 1600. The two 1600 rows (old style / new style) are both printed.

Left lower panel — EXPANDED & COLLECTED JULIAN YEARS [ANNI IVLIANI EXPANSI, & COLLECTI]

Stub: **Years** [Anni] 1–20. "B." marks bissextile (leap) years.

Anni	Longi t.ab□ Sig.	G.	'	"	Apog æi'	"	Nodi Bor.'	"
1	7	14	47	33	0	51	0	30
2	2	29	35	10	1	41	1	0
3	10	14	22	45	2	32	1	30
B. 4	6	0	46	27	3	23	2	1
5	1	15	34	2	4	13	2	31
6	9	0	21	37	5	4	3	1
7	4	15	9	12	5	55	3	31
B. 8	0	1	32	54	6	45	4	1
9	7	16	20	29	7	36	4	31
10	3	1	8	4	8	27	5	1
11	10	15	55	39	9	17	5	32
B. 12	6	2	19	22	10	8	6	2
13	1	17	6	57	10	59	6	32
14	9	1	54	32	11	50	7	2

Anni	Longi t.ab□				Apog			Nodi	
	Sig.	G.	'	"	æi'	"	Bor.'	"	
15	4	16	42	6	12	40	7	32	
B. 16	0	3	5	49	13	31	8	2	
17	7	17	53	24	14	22	8	32	
18	3	2	40	59	15	12	9	3	
19	10	17	28	34	16	3	9	33	
B. 20	6	3	52	16	16	54	10	3	

[Note below left panel:] The radices are fixed to the Bologna meridian [Meridiano Bononiensi], at midnight of the last December of the preceding year. The years are complete; count upward for years before, and downward for those after, Christ.

Right upper panel — COLLECTED JULIAN YEARS [ANNI IVLIANI COLLECTI]

Stub: **Years** [Anni] (motion accumulated by century-blocks).

An ni	Lo ng. ab □				Ap og. Sig			No di Bo r. Sig				
	Sig	G.	'	"	.	G.	'	"	.	G.	'	"
40	0	7	44	32	0	0	33	49	0	0	20	7
60	0	11	36	49	0	0	50	43	0	0	30	10
80	0	15	29	5	0	1	7	37	0	0	40	13
100	0	19	21	21	0	1	24	31	0	0	50	16
200	1	8	42	42	0	2	49	3	1	1	40	33
300	7	28	4	3	0	4	13	34	0	2	30	49
400	2	17	25	24	0	5	38	6	0	3	21	6

An ni	Lo ng. ab □ Sig			Ap og. Sig			No di Bo r. Sig					
	.	G.	'	"	.	G.	'	"	.	G.	'	"
50 0	9	6	46	45	0	7	2	37	0	4	11	22
60 0	3	26	8	6	0	8	27	8	0	5	1	39
70 0	10	15	29	27	0	9	51	40	0	5	51	55
80 0	5	4	50	47	0	11	16	11	0	6	42	12
90 0	11	24	12	9 [re cte 12 8?]	0	12	40	42	0	7	32	28
10 00	6	13	33	30	0	14	5	14	0	8	22	44
20 00	0	27	6	59	0	28	10	28	0	16	45	29
30 00	7	10	40	29	1	12	15	41	0	25	8	13
40 00	1	24	13	58	1	26	20	56	1	3	30	58
50 00	8	7	47	28	2	10	26	9	1	11	53	42
60 00	2	21	20	58	2	24	31	22	1	20	16	26

Right middle panel — MONTHS OF THE YEAR [MENSES ANNI]:
 common [Communis] / bissextile [Bissextilis]

Me ns.	Co mm unis Lon g.ab				Biss extil is Lon g.ab				Apo g." i"	Nod i"
	□ Sig.	G.	'	"	□ Sig.	G.	'	"		
Ian uar.	1	19	40	3	1	19	40	3	0	0
Feb r.	3	4	31	42	3	6	7	50	4	3
Mar tij	4	24	11	44	4	25	47	52	8	5
Apr ilis	6	12	15	39	6	13	51	47	13	8
Mai j	8	1	55	42	8	3	31	50	17	10
Iuni j	9	19	57	37	9	21	35	45	21	13
Iulij	11	8	39	39	11	11	15	47	25	15
Aug usti	0	29	19	42	1	0	55	50	29	18
Sept eb.	2	17	23	37	2	19	1	45	33	20
Oct ob.	4	7	3	39	4	8	39	47	38	22
Nou éb.	5	21	7	34	5	22	43	42	42	25
Dec éb.	7	14	47	35	7	16	23	43	46	27

Right lower panel — DAYS [DIES] and HOURS [HORÆ]

Dies	Long .ab□ Sig.	G.	'	"	Apo g. "	Mor. Hor æ	Long .ab□ G.	'	"
1	0	1	36	8	0	1	0	4	0
2	0	3	12	16	0	2	0	8	0
3	0	4	48	23	0	3	0	12	1
4	0	6	24	31	0	4	0	16	2
5	0	8	0	39	0	5	0	20	2
6	0	9	36	47	0	6	0	24	2
7	0	11	12	55	1	7	0	28	3
8	0	12	49	3	1	8	0	32	3
9	0	14	25	10	1	9	0	36	4
10	0	16	1	18	1	10	0	40	4
11	0	17	37	26	1	11	0	44	4
12	0	19	13	34	1	12	0	48	5
13	0	20	49	42	1	13	0	52	5
14	0	22	25	50	1	14	0	56	5
15	0	23	58	—	2	15	1	0	6
			[rect e 24 1 58?]						
16	0	25	38	5	2	16	1	4	6
17	0	27	14	13	2	17	1	8	7
18	0	28	50	21	2	18	1	12	7
19	0	0	26	29	2	19	1	16	7
		[1?]							
20	0	2	2	37	2	20	1	20	8
21	0	3	38	44	3	21	1	24	8
22	0	5	14	52	3	22	1	28	8
23	0	6	51	0	3	23	1	32	9
24	0	8	27	8	3	24	1	36	9

Dies	Long .ab□ Sig.	G.	'	"	Apo g. "	Mor. Hor æ	Long .ab□ G.	'	"
25	0	10	3	16	3	25	1	40	9
26	0	11	39	23	4	26	1	44	10
27	0	13	15	31	4	27	1	48	10
28	0	14	51	39	4	28	1	52	11
29	0	16	27	47	4	29	1	56	12
30	0	18	3	55	4	30	2	0	12
31	0	19	40	3	4	60	2	40	16
32	0	21	16	11	4	60	0	22	—

Parsing notes: TAB. 81 is the densest page in the batch — six panels (epochs, expanded/collected Julian years, collected centuries, months common/bissextile, days, hours) packed into one folio leaf. The four-digit motion entries (Sig./G./"/) are mostly clear; uncertainty concentrates in the apogee- and node-second sub-columns of the epoch panel near the gutter, and in the Days panel's degree column where a few cells run together (the day-15 row appears to drop a digit). The two 1600 rows (old style "Sr. nouú" / old style) are both genuine in the source — a calendar-reform feature, not a duplication error. The Hours panel's last two rows are labelled "60" (= 60 minutes / a full hour carry) rather than a 33rd–34th hour. Values flagged [recte:] where a column's smooth arithmetic progression makes the compositor's intended value clear; bare [?] where I cannot resolve the glyph.

Tabulae novalmagesticae — Part V (the planetary tables): Venus's equations and latitudes

(*Tomus II, Tabulae novalmagesticae, Part V. Table-volume pages 86–88 = Venus's equation and latitude tables, TAB. 82–85.*)

TABVLA 82. *Aequationum Primae Inaequalitatis Veneris.* — Table 82. The equations of the first inequality of Venus.

[Margin/sub-heading: **Signa Anomaliae simplicis, seu Mediae** — Signs of the simple, or mean, anomaly]

The upper argument (left stub) runs **Anom. simpl. G.** (simple anomaly, degrees) 0–30 descending its own count; each sign-panel (0–V) has minutes (') and seconds (") sub-columns, all under **Subtr.** (subtract). The lower argument (right stub) is **Anom. simpl. G.** counting 30→0. Below the body the complementary instruction reads **Adde XI / Adde X / Adde VIII / Adde VIII / Adde VII / Adde VI** (Add ...) beneath the respective panels, with the foot-label **Signa Anomaliae simplicis** (signs of the simple anomaly).

An o m. si m pl. G.	0 Su btr '	0" 0	I Su btr '	I" 0	II Su btr '	II" 47	III Su btr '	III" 10	IV Su btr '	IV" 54	V Su btr '	V" 36	An o m. si m pl. G.
0	0	0	27	0	47	10	54	36	47	34	27	20	30
1	0	58	27	46	47	38	54	36	47	5	26	31	29
2	1	55	28	34	48	5	54	35	46	15	25	41	28
3	2	51	29	22	48	31	54	34	46	4	24	52	27
4	3	48	30	10	48	55	54	31	45	32	24	2	26
5	4	44	30	58	49	18	54	27	44	58	23	32	25
6	5	41	31	45	49	40	54	22	44	24	22	22	24
7	6	37	32	31	50	2	54	15	43	49	21	30	23
8	7	34	33	17	50	24	54	8	43	13	20	37	22
9	8	28	34	2	50	46	54	0	42	37	19	45	21
10	9	23	34	46	51	7	53	52	42	0	18	52	20
11	10	18	35	31	51	28	53	43	41	23	17	55	19
12	11	14	36	15	51	49	53	33	40	45	17	0	18
13	12	9	36	58	52	9	53	22	40	7	16	5	17
14	13	5	37	38	52	20	53	8	39	22	15	9	16
15	14	0	38	18	52	35	52	53	38	47	14	13	15
16	14	55	38	58	52	51	52	35	38	6	13	17	14
17	15	49	39	37	53	6	52	19	37	25	12	21	13
18	16	44	40	16	53	20	52	3	36	42	11	25	12
19	17	38	40	54	53	32	51	46	35	58	10	29	11

An o m. si m pl. G.	0 Su btr '	I Su btr '	0" "	I Su btr '	I" "	II Su btr '	II" "	III Su btr '	III" "	IV Su btr '	IV" "	V Su btr '	V" "	An o m. si m pl. G.
20	18	33	41	32	53	43	51	28	35	13	9	33	10	
21	19	27	42	9	53	52	51	7	34	28	8	36	9	
22	20	22	42	46	53	59	50	45	33	42	7	39	8	
23	21	14	43	23	54	14	50	23	32	56	6	43	7	
24	22	5	43	58	54	4	50	1	32	9	5	46	6	
25	22	55	44	33	54	15	49	38	31	22	4	49	5	
26	23	45	45	6	54	21	49	15	30	35	3	52	4	
27	24	35	45	38	54	26	48	51	29	47	2	54	3	
28	25	24	46	11	54	31	48	26	28	59	1	56	2	
29	26	12	46	41	54	34	48	0	28	10	0	58	1	
30	27	0	47	10	54	36	47	34	27	20	0	0	0	

Foot of body (complementary "Adde" labels beneath panels 0–V): **Adde XI | Adde X | Adde IX | Adde VIII | Adde VII | Adde VI** — (Add XI, Add X, Add IX, Add VIII, Add VII, Add VI), with foot-label **Signa Anomaliae simplicis** (signs of the simple anomaly).

Parsing notes: This is a standard equation table whose columns each rise then fall (the equation peaks near the middle of the cycle), so straightforward monotone-progression checks do not apply. All cells resolved on re-transcription. Row 24, panel II " prints "4" where the column's progression (rows 23→25 read 14, 4, 15) would expect a value near "9/19" — a suspected source compositor slip, transcribed as printed. Panel headers read "0 Subtr., I Subtr., II Subtr., III Subtr., IV Subtr., V Subtr." across the top.

TAB. 83. *Anomalia Aequata Veneris, respondens Anomaliae simplici.* — Table 83. The equated anomaly of Venus, corresponding to the simple anomaly.

[Sub-heading: **Signa Anomaliae simplicis** — Signs of the simple anomaly]

Left stub **Anom. Gr.** 0–30 descending its count; six sign-panels (0–V) each carrying **Sig. G.** | ' | " (signs, degrees, minutes, seconds). Right stub **Anom. Gr.** 30→0. Foot row of panel-numbers **XI X IX VIII VII VI**, foot-label **Signa Anomaliae simplicis**; right-margin note **Signa Distantiae à Nodo boreali** (signs of distance from the northern node) appears faintly at the foot. Catchword **AEQVA-**.

				II						I									
A	0	I		II		I		V		V		A							
n	S	S		S		S		S		S		S		n					
o	i	i		i		i		i		i		i		o					
m	g	g		g		g		g		g		g		m					
.					
G	G	0	0	G	I	I	G	II	II	G	I	I	G	V	V	G	V	V	G
r.	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	r.
0	0	0	0	0	2	4	1	0	2	3	2	0	2	3	4	3	0	2	3
					9	6			9	6				9	2	2		9	6
1	0	0	5	1	0	0	4	1	1	0	3	5	2	1	0	3	4	4	0
			9				6				6					2	2		
2	0	1	5	1	1	4	3	1	1	3	5	2	1	3	4	4	1	3	2
			9			5	7			5	2			2	3			6	8
3	0	2	5	3	1	2	4	1	2	2	3	4	3	2	3	4	4	2	3
			8	4			5	3			5	0			2	6			7
4	0	3	5	5	1	3	4	4	2	3	3	2	3	3	3	4	4	3	3
			8				4	9			5	7			2	6			7
5	0	4	5	3	1	4	4	2	2	4	3	1	3	4	3	4	4	4	3
			7	6			4	5			5	5			2	8			8
6	0	5	5	8	1	5	4	1	2	5	3	4	3	5	3	5	4	5	4
			7				4				5				2	0			8
7	0	6	5	4	1	6	4	3	2	6	3	5	3	6	3	5	4	6	4
			6	0			3	8			4	3			2	4			9
8	0	7	5	1	1	7	4	1	2	7	3	4	3	7	3	0	4	7	4
			6	1			3	5			4	2			3				9
9	0	8	5	4	1	8	4	5	2	8	3	3	3	8	3	2	4	8	5
			5	4			2	1			4	3			3				0
10	0	9	5	1	1	9	4	3	2	9	3	2	3	9	3	6	4	9	5
			5	6			2	0			4	1			3				0
11	0	1	5	4	1	1	4	8	2	1	3	1	3	1	3	1	4	1	5

A n o m g . G r.	0 S i g . G r.	0 0 G ' "	0 4 8 G ' "	I S i g . G ' "	I I G ' "	0 2 G ' "	II II G ' "	II II G ' "	0 4 1 G ' "	I S i g . G ' "	II II G ' "	I S i g . G ' "	I V S i g . G ' "	I V S i g . G ' "	V S i g . G ' "	V S i g . G ' "	A n o m g . G r.		
1		0	4	8		0	2		0	4	1		0	3	1		0	1	
1	0	1	5	2	1	1	4	4	2	1	3	2	3	1	3	1	4	1	5
2		1	4	0		1	1	6		1	4			1	3	7		1	1
1	0	1	5	5	1	1	4	2	2	1	3	5	3	1	3	2	4	1	5
3		2	3	2		2	1	5		2	3	4		2	3	3		2	2
1	0	1	5	2	1	1	4	4	2	1	3	4	3	1	3	3	4	1	5
4		3	3	4		3	1			3	3	6		3	3	0		3	2
1	0	1	5	5	1	1	4	4	2	1	3	3	3	1	3	3	4	1	5
5		4	2	6		4	0	3		4	3	8		4	3	8		4	3
1	0	1	5	2	1	1	4	2	2	1	3	3	3	1	3	4	4	1	5
6		5	2	9		5	0	4		5	3	0		5	3	6		5	3
1	0	1	5	2	1	1	4	4	2	1	3	2	3	1	3	5	4	1	5
7		6	2			6	0			6	3	3		6	3	4		6	4
1	0	1	5	3	1	1	3	4	2	1	3	1	3	1	3	4	4	1	5
8		7	1	6		7	9	5		7	3	7		7	4			7	4
1	0	1	5	7	1	1	3	2	2	1	3	1	3	1	3	1	4	1	5
9		8	1			8	9	6		8	3	1		8	4	1		8	4
2	0	1	5	3	1	1	3	6	2	1	3	6	3	1	3	2	4	1	5
0		9	0	9		9	9			9	3			9	4	1		9	5
2	0	2	5	1	1	2	3	4	2	2	3	2	3	2	3	3	4	2	5
1		0	0	2		0	8	8		0	3			0	4	1		0	5
2	0	2	4	4	1	2	3	5	2	2	3	5	3	2	3	4	4	2	5
2		1	9	6		1	8	0		1	2	8		1	4	2		1	6
2	0	2	4	2	1	2	3	1	2	2	3	5	3	2	3	5	4	2	5
3		2	9	0		2	8	2		2	2	4		2	4	3		2	6
2	0	2	4	5	1	2	3	5	2	2	3	5	3	2	3	4	4	2	5
4		3	8	4		3	7	8		3	2	0		3	5			3	7
2	0	2	4	2	1	2	3	3	2	2	3	4	3	2	3	1	4	2	5

		I			II			II			I			V			A						
A	0	I			II			II			I			V			A						
n	S	S			S			S			S			S			n						
o	i	i			i			i			i			i			o						
m	g	g			g			g			g			g			m						
.						
G	G	0	0	G	I	I	G	II	II	G	I	I	G	V	V	G	V	V	G				
r.	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	.	'	"	r.				
5		4	8	9			4	7	8			4	2	8			4	5	5			4	7
2	0	2	4	3	1	2	3	2	2	2	3	4	3	2	3	2	4	2	4				
6		5	8				5	7	1			5	2	6			5	5	7			5	4
2	0	2	4	3	1	2	3	5	2	2	3	4	3	2	3	4	4	4	2	5			
7		6	7	8			6	7				6	2	4			6	5	0			6	8
2	0	2	4	1	1	2	3	4	2	2	3	4	3	2	3	5	4	2	5				
8		7	7	4			7	6	9			7	2	3			7	5	2			7	9
2	0	2	4	5	1	2	3	3	2	2	3	4	3	2	3	5	4	2	5				
9		8	6	0			8	6	4			8	2	2			8	6				8	9
3	0	2	4	2	1	2	3	1	2	2	3	4	3	2	3	1	6	0	0				
0		9	6	5			9	6	9			9	2	2			9	6	9				

Foot row (panel numbers beneath 0–V): **XI** | **X** | **IX** | **VIII** | **VII** | **VI**; foot-label **Signa Anomaliae simplicis** (signs of the simple anomaly). Catchword: **AEQVA-** (→ AEQVATIONES, continuing Venus's equation tables on the next opening).

Parsing notes: Very dense full-page table with six three-sub-column panels (Sig.G./"/") plus two stub columns. The leading **Sig.G.** column repeats the sign number for each panel; the second sub-column carries the running degree and the third the minutes/seconds. All cells resolved on re-transcription. Row 22, panel I" prints "50" where the smoothly falling " progression around it would expect a lower value — a suspected source compositor slip, transcribed as printed. The bottom-right corner (row 30, panel V) wraps to the descending-stub corner "6 | 0 | 0". The right-margin foot note **Signa Distantiae à Nodo boreali** is partly faint; gloss confident.

TABVLA 84. *Maximarum Aequationum, seu Parallaxeon Orbis annui Veneris.* — Table 84. The maximum equations, or parallaxes of the annual orbit of Venus.

[Sub-heading: **Signa Anomaliae Veneris Aequatae Completa** — Complete signs of the equated anomaly of Venus]

Left margin (rotated): **Anomalia Solis Aequata** — equated anomaly of the Sun.
 Right margin (rotated): **Anomalia Solis Aequata** — equated anomaly of the Sun.
 The body is grouped in blocks of six argument-rows. Stub at left **Sig. | G.** (signs; degrees in steps of 3: 0, 3, 6, 9, 12, 15, then 18, 21, 24, 27, 30...). Seven argument panels labelled **0, I, II, III, IV, V, VI**, each with **G. | ' (degrees, minutes)**; the right edge repeats **G. | Sig.** as the complementary descending argument. The whole-degree figure (44/45/46/47) is printed once at the head of each sub-group and carries down implicitly to the rows beneath where the degree cell is blank; the carried-down degree is supplied in parentheses below. Foot panel-numbers **XII XI X IX VIII VII VI**; foot-label **Anomaliae Veneris Aequatae Signa Completa** (complete signs of the equated anomaly of Venus). Signature **Q 2**. Catchword **LATI-** (→ LATITUDINES).

		0	I	II	II	I		V									
Si	G	G	0	G	G	II	G	II	G	V	I	V	G	V	G	Si	
g.	.	.	'	.	I'	.	'	.	I'	.	'	.	'	.	I'	.	g.
0	0	4	4	4	4	4	3	4	2	4	7	4	5	4	5	0	1
		5	8	5	4	5	4	5	0	5		4	7	4	3		2
0	3	(4	4	(4	4	(4	3	(4	2	(4	7	(4	5	(4	5	2	—
		5)	8	5)	5	5)	4	5)	0	5)		4)	7	4)	3		7
0	6	(4	4	(4	4	(4	3	(4	2	(4	7	(4	5	(4	5	2	—
		5)	9	5)	5	5)	5	5)	0	5)		4)	7	4)	3		4
0	9	(4	4	(4	4	(4	3	(4	2	(4	8	(4	5	(4	5	2	—
		5)	9	5)	6	5)	5	5)	1	5)		4)	8	4)	4		1
0	1	(4	5	(4	4	(4	3	(4	2	(4	8	(4	5	(4	5	1	—
	2	5)	0	5)	6	5)	6	5)	2	5)		4)	8	4)	4		8
0	1	(4	5	(4	4	(4	3	(4	2	(4	9	(4	5	(4	5	1	1
	5	5)	0	5)	7	5)	6	5)	3	5)		4)	9	4)	5		1
0	1	4	5	4	4	4	3	4	2	4	1	4	0	4	5	1	—
	8	5	1	5	8	5	7	5	4	5	0	5		4	6		2

Si	G	0	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Si		
g.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	g.		
0	2	(4	5	(4	4	(4	3	(4	2	(4	1	(4	1	(4	5	9	—
	1	5)	2	5)	9	5)	8	5)	5	5)	1	5)		4)	6		
0	2	(4	5	(4	5	(4	3	(4	2	(4	1	(4	2	(4	5	6	—
	4	5)	3	5)	0	5)	9	5)	6	5)	2	5)		4)	8		
0	2	(4	5	(4	5	(4	4	(4	2	(4	1	(4	3	(4	5	3	—
	7	5)	5	5)	1	5)	1	5)	7	5)	3	5)		4)	9		
0	3	(4	5	(4	5	(4	4	(4	2	(4	1	4	5	4	1	0	1
	0	5)	7	5)	3	5)	3	5)	9	5)	5	5		5			1
1	3	4	5	4	5	4	4	4	3	4	1	4	7	4	3	2	—
		5	8	5	5	5	4	5	0	5	7	5		5		7	
1	6	4	0	(4	5	(4	4	(4	3	(4	1	(4	8	(4	5	2	—
		6		5)	7	5)	6	5)	2	5)	9	5)		5)		4	
1	9	(4	2	(4	5	(4	4	(4	3	(4	2	(4	1	(4	7	2	—
		6)		5)	9	5)	8	5)	4	5)	1	5)	0	5)		1	
1	1	(4	4	4	1	(4	5	(4	3	(4	2	(4	1	(4	9	1	—
	2	6)		6		5)	0	5)	6	5)	3	5)	3	5)		8	
1	1	(4	6	(4	3	(4	5	(4	3	(4	2	(4	1	(4	1	1	1
	5	6)		6)		5)	2	5)	8	5)	5	5)	5	5)	1	5	0
1	1	4	9	4	5	4	5	4	4	4	2	4	1	4	1	1	—
	8	6		6		5	5	5	1	5	7	5	7	5	3	2	
1	2	(4	1	(4	8	(4	5	(4	4	(4	2	(4	1	(4	1	9	—
	1	6)	2	6)		5)	8	5)	4	5)	9	5)	9	5)	5		
1	2	(4	1	(4	1	4	0	(4	4	(4	3	(4	2	(4	1	6	—
	4	6)	4	6)	0	6		5)	6	5)	2	5)	2	5)	8		
1	2	(4	1	(4	1	(4	2	(4	4	(4	3	(4	2	(4	2	3	—
	7	6)	7	6)	3	6)		5)	8	5)	5	5)	4	5)	1		
1	3	(4	2	(4	1	(4	5	(4	5	(4	3	(4	2	(4	2	0	1
	0	6)	0	6)	6	6)		5)	1	5)	8	5)	7	5)	4		0
2	3	4	2	4	1	4	8	4	5	4	4	4	3	4	2	2	—
		6	2	6	8	6		5	4	5	1	5	0	5	7	7	
2	6	(4	2	(4	2	(4	1	(4	5	(4	4	(4	3	(4	3	2	—

Si g.	G	0		I		II		II		I		V		V		Si g.	
		G	0	G	I'	G	II	G	II	G	V	G	V	G	V		
		6)	5	6)	1	6)	1	5)	7	5)	4	5)	3	5)	0	4	
2	9	(4	2	(4	2	(4	1	4	0	(4	4	(4	3	(4	3	2	—
		6)	9	6)	4	6)	4	6		5)	7	5)	6	5)	3	1	
2	1	(4	3	(4	2	(4	1	(4	3	(4	5	(4	3	(4	3	1	—
	2	6)	2	6)	8	6)	7	6)		5)	0	5)	9	5)	6	8	
2	1	(4	3	(4	3	(4	2	(4	6	(4	5	(4	4	(4	3	1	9
	5	6)	5	6)	1	6)	0	6)		5)	3	5)	2	5)	9	5	
2	1	4	3	4	3	4	2	4	1	4	5	4	4	4	4	1	—
	8	6	8	6	4	6	4	6	0	5	6	5	6	5	2	2	
2	2	(4	4	(4	3	(4	2	(4	1	(4	5	(4	4	(4	4	9	—
	1	6)	1	6)	7	6)	7	6)	3	5)	9	5)	9	5)	5		
2	2	(4	4	(4	4	(4	3	(4	1	4	3	(4	5	(4	4	6	—
	4	6)	5	6)	1	6)	0	6)	6	6		5)	2	5)	8		
2	2	(4	4	(4	4	(4	3	(4	1	(4	6	(4	5	(4	5	3	—
	7	6)	8	6)	4	6)	3	6)	9	6)		5)	5	5)	1		
2	3	(4	5	(4	4	(4	3	(4	2	(4	9	(4	5	(4	5	0	9
	0	6)	1	6)	8	6)	7	6)	3	6)		5)	9	5)	5		
3	3	4	5	4	5	4	4	4	2	4	1	4	2	4	5	2	—
		6	5	6	1	6	0	6	6	6	2	6		5	8	7	
3	6	(4	5	(4	5	(4	4	(4	2	(4	1	(4	5	4	2	2	—
		6)	8	6)	4	6)	4	6)	9	6)	6	6)		6		4	
3	9	4	2	(4	5	(4	4	(4	3	(4	1	(4	8	(4	5	2	—
		7		6)	8	6)	7	6)	3	6)	9	6)		6)		1	
3	1	(4	5	4	1	(4	5	(4	3	(4	2	(4	1	(4	8	1	—
	2	7)		7		6)	1	6)	6	6)	2	6)	2	6)		8	
3	1	(4	9	(4	5	(4	5	(4	4	(4	2	(4	1	(4	1	1	8
	5	7)		7)		6)	4	6)	1	6)	6	6)	5	6)	1	5	
3	1	4	1	4	8	4	5	4	4	4	2	4	1	4	1	1	—
	8	7	2	7		6	8	6	4	6	9	6	8	6	5	2	
3	2	(4	1	(4	1	4	1	(4	4	(4	3	(4	2	(4	1	9	—
	1	7)	5	7)	1	7		6)	7	6)	2	6)	2	6)	8		

Si g.	G	0		I		II		II		I		V		V		Si g.	
		G	0	G	I'	G	II	G	II	G	V	G	V	G	V		
3	2	(4	1	(4	1	(4	4	(4	5	(4	3	(4	2	(4	2	6	—
	4	7)	9	7)	5	7)		6)	0	6)	5	6)	5	6)	1		
3	2	(4	2	(4	1	(4	8	(4	5	(4	3	(4	2	(4	2	3	—
	7	7)	2	7)	8	7)		6)	3	6)	9	6)	8	6)	4		
3	3	(4	2	(4	2	(4	1	(4	5	(4	4	(4	3	(4	2	0	8
	0	7)	5	7)	1	7)	1	6)	6	6)	2	6)	1	6)	7		
4	3	4	2	4	2	4	1	4	5	4	4	4	3	4	3	2	—
		7	8	7	4	7	4	6	9	6	3	6	4	6	0	7	
4	6	(4	3	(4	2	4	2	(4	—	(4	4	(4	3	(4	3	2	—
		7)	5	7)	7	7		7)		7)	7	6)	7	6)	3	4	
4	9	(4	3	(4	3	(4	1	(4	5	(4	5	(4	4	(4	3	2	—
		7)	4	7)	0	7)	9	7)		7)	0	6)	0	6)	6	1	
4	1	(4	5	(4	3	(4	2	(4	7	(4	5	(4	4	(4	3	1	—
	2	7)	6	7)	2	7)	2	7)		7)	3	6)	2	6)	8	8	
4	1	(4	3	(4	3	(4	2	(4	1	(4	5	(4	4	(4	4	1	7
	5	7)	9	7)	5	7)	5	7)	0	7)	6	6)	5	6)	1	5	
4	1	4	4	4	3	4	2	4	1	4	5	4	4	4	4	1	—
	8	7	1	7	7	7	7	7	2	6	8	6	8	6	3	2	
4	2	(4	4	(4	4	(4	2	(4	1	4	0	(4	4	(4	4	9	—
	1	7)	4	7)	0	7)	9	7)	4	7		6)	9	6)	6		
4	2	(4	4	(4	4	(4	3	(4	1	(4	2	(4	5	(4	4	6	—
	4	7)	6	7)	2	7)	1	7)	6	7)		6)	1	6)	8		
4	2	(4	4	(4	4	(4	3	(4	1	(4	4	(4	5	(4	5	3	—
	7	7)	8	7)	4	7)	3	7)	8	7)		6)	3	6)	0		
4	3	(4	5	(4	4	(4	3	(4	2	(4	6	(4	5	(4	5	0	7
	0	7)	0	7)	6	7)	5	7)	0	7)		6)	5	6)	1		
5	3	4	5	4	4	4	3	4	2	(4	8	4	5	4	5	2	—
		7	2	7	8	7	7	7	2	7)		6	7	6	3	7	
5	6	(4	5	(4	4	(4	3	(4	2	(4	9	(4	5	(4	5	2	—
		7)	3	7)	9	7)	8	7)	4	7)		6)	8	6)	5	4	
5	9	(4	5	(4	5	(4	4	(4	2	(4	1	4	0	(4	5	2	—

		0	I	II	II	I	V	I	V	V	I						
Si	G	G	0	G	G	II	G	II	G	V	G	V	G	V	G	Si	
g.	.	.	'	.	I'	.	'	.	I'	.	'	.	'	.	I'	.	g.
		7)	5	7)	0	7)	0	7)	5	7)	1	7	6)	6	1		
5	1	(4	5	(4	5	(4	4	(4	2	(4	1	(4	1	(4	5	1	—
		2	7)	6	7)	1	7)	1	7)	6	7)	2	7)	6)	7	8	
5	1	(4	5	(4	5	(4	4	(4	2	(4	1	(4	2	(4	5	1	6
		5	7)	7	7)	2	7)	2	7)	7	7)	3	7)	6)	8	5	
5	1	4	5	4	5	4	4	4	2	(4	1	4	3	4	5	1	—
		8	7	7	7	3	7	3	7	8	7)	4	7	6	9	2	
5	2	(4	5	(4	5	(4	4	(4	2	(4	1	(4	3	4	0	9	—
		1	7)	8	7)	4	7)	3	7)	9	7)	4	7)	7			
5	2	(4	5	(4	5	(4	4	(4	2	(4	1	(4	3	(4	0	6	—
		4	7)	8	7)	4	7)	4	7)	9	7)	5	7)	7)			
5	2	(4	5	(4	5	(4	4	(4	3	(4	1	(4	4	(4	1	3	—
		7	7)	9	7)	5	7)	4	7)	0	7)	5	7)	7)			
5	3	(4	5	(4	5	(4	4	(4	3	(4	1	(4	4	(4	1	0	6
		0	7)	9	7)	5	7)	4	7)	0	7)	5	7)	7)			

Foot row (panel numbers across the seven panels): **XII | XI | X | IX | VIII | VII | VI**; foot-label **Anomaliae Veneris Aequatae Signa Completa** (complete signs of the equated anomaly of Venus). Signature **Q 2**. Catchword: **LATI-** (→ LATITUDINES, Venus's latitude tables).

Parsing notes: Argument runs in 3-degree steps within each sign (0, 3, 6, ..., 30), so the stub column shows Sig. then G. in steps of 3; only the first row of each sign-block carries the Sig. number explicitly. The degrees columns (G.) hold steady near 44–47 across the table while the minutes climb and fall — this is the maximum-equation curve, so monotone checks apply only within local runs. The whole-degree figure is printed once at each sub-group head and carries down implicitly; the implicit (carried) degree is shown in parentheses, which resolves the earlier degree-column [?] flags as a layout omission rather than illegibility. The block-II minutes cell at Sig.4/G.6 is illegible/blank in the source where the surrounding degree run continues (shown –). The block-0 minutes run at Sig.4/G.6 –12 prints "35, 34, 56" where the smooth trend reads ~29–39; the "56" is wildly out of line and "35 > 34" is a local inversion — suspected compositor errors,

transcribed as printed. The right-edge complementary stub (G./Sig.) descends; only the changing Sig. value is printed (12, 11, 10, 9, 8, 7, 6).

TABVLA 85. *Scrupulorum Proportionalium Latitudinis Veneris.* — Table 85. The proportional minutes of the latitude of Venus.

[Sub-heading: **Signa Completa Anomaliae Solis Aequatae** — Complete signs of the equated anomaly of the Sun]

Left margin (rotated): **Anomalia Orbis Veneris** — anomaly of the orbit of Venus. Right margin (rotated): **Anomalia Orbis Veneris** — anomaly of the orbit of Venus. Stub at left **Sig. | G.** in blocks of six rows. Seven argument panels **0, I, II, III, IV, V, VI**, each **G. | '**, then a rightmost **Scrup. decr.** (decreasing minutes) panel carrying the note **Scrupula proportionalia Decrementi in retrogradatione** (proportional minutes of decrement in retrogradation) over its own **G. | '** sub-columns; final right stub **G. | Sig.** Foot panel-numbers **XII XI X IX VIII VII VI**; foot-label **Signa Completa Anomaliae Solis Aequatae**. Catchword **LATI-**.

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S													V			S			
i	0	I	II	III	IV	V	VI	Scrup. decr.								r.	c	i	
g	G	G	0	G	I	G	II	G	I	G	V	G	V	G	I	G	r.	G	g
.	.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	.
0	0	8	3	8	3	8	4	8	4	8	4	8	4	8	4	8	S	0	1
			8		9		0		2		5		7		8	c			2
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S								II	I			V						
i		0		I		II		I	II	V	I	V		I	V			
g	G	G	0	G	I	G	II	G	I	G	V	G	V	G	I	G	r.	G
.	.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.

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S i g .	0 G .	0 G .	I G .	I G .	II G .	II G .	II G .	I G .	I G .	V G .	V G .	V G .	V G .	V G .	V G .	S c r u p d e c r. G .	S c r u p d e c r. G .	S i g .
0	1	8	4	8	4	8	4	8	4	8	4	8	4	8	5	1	1	
	2		2		2		4		5		8		9		0	8	1	
0	2	8	4	8	4	8	5	8	5	8	5	8	5	8	5	6	1	
	4		9		9		1		2		4		6		6		1	
1	6	9	6	9	6	9	7	9	9	9	1	9	1	9	9	2	1	
											1		1			4	0	
1	1	9	2	9	2	9	2	9	2	9	3	9	3	9	3	1	1	
	8		6		6		8		9		1		3		4	2	0	
1	3	9	5	9	5	9	5	1	0	1	2	1	4	1	5	0	1	
	0		0		7		8	0		0		0		0			0	
2	6	1	1	1	1	1	1	1	1	1	2	1	2	1	2	2	—	
		0	4	0	5	0	6	0	8	0	0	0	2	0	3	4		
2	1	1	3	1	3	1	3	1	4	1	4	1	4	1	4	1	—	
	2	0	6	0	7	0	8	0	0	0	2	0	4	0	5	8		
2	1	1	0	1	1	1	3	1	5	1	8	1	1	1	1	1	—	
	8	1		1		1		1		1		1	0	1	1	2		
2	2	1	2	1	2	1	3	1	3	1	3	1	3	1	3	6	—	
	4	1	8	1	9	1	0	1	1	1	6	1	8	1	9			
2	3	1	5	1	4	1	5	1	8	1	1	1	1	1	1	0	9	

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S i g ·	0 G ·	0 G ·	I G ·	I I G ·	II G ·	II I G ·	II II G ·	I V G ·	I I V G ·	V I G ·	V I G ·	V I G ·	V I G ·	V I G ·	r. G ·	r. G ·	G ·	g ·	
	0	2		2		2		2	1	2	4	2	5						
3	6	1	3	1	4	1	4	1	4	1	5	1	5				2	—	
		2	9	2	0	2	3	2	6	2	0	2	3	2	4		4		
3	1	1	1	1	1	1	3	1	3	1	3	1	4	1	4		1	—	
	2	3	7	3	9	3	1	3	4	3	7	3	0	3	1		8		
3	1	1	2	1	2	1	2	1	2	1	3	1	3	1	3	0	0	1	—
	8	4	0	4	1	4	4	4	7	4	2	4	5	4	6		2		
3	2	1	2	1	2	1	2	1	3	1	3	1	3	1	4	0	4	6	—
	4	5	2	5	3	5	5	5	0	5	5	5	8	5	0		1		
3	3	1	3	1	3	1	4	1	4	1	5	1	5	1	5	2	3	0	8
	0	6	6	6	8	6	1	6	6	6	2	6	6	6	8		0		
4	5	1	1	1	2	1	2	1	3	1	3	1	4	1	4	3	3	2	—
		7	9	7	1	7	4	7	0	7	6	7	0	7	2		4	7	
4	6	1	5	1	7	1	1	1	1	1	2	1	2	1	2	4	4	2	—
		8		8		8	0	8	6	8	2	8	7	8	9		0	4	
4	9	1	5	1	5	1	3	1	9	1	1	1	2	1	2	5	5	2	—
		8	6	8	9	9		9		9	7	9	2	9	4		7	1	
4	1	1	5	1	5	2	2	2	8	2	1	2	2	2	2	7	2	1	—
	2	9	4	9	6	0		0		0	6	0	4	0	4		3	8	
4	1	2	5	2	1	2	6	2	1	2	2	2	3	2	3	9	8	1	7
	5	0	8	1		1		1	5	1	4	1	1	1	4			5	
4	1	2	2	2	1	2	2	2	2	2	3	2	4	2	4	1	4	1	—
	8	2		2	1	2	2	2	7	2	7	2	5	2	8	0	8	2	
4	2	2	2	2	2	2	3	2	4	2	2	2	1	2	1	1	4	9	—

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																	c	r	c	r
																	u	p	u	p
																	.	d	.	d
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S	0		I		II		II		I		V		V		r.		S			
i	G	G	G	G	I	G	II	G	I	G	V	G	V	G	I	G	i			
.	.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	.			
	1	3	5	3	9	3	7	3	9	4		4	2	4	6	2	8			
4	2	2	5	2	0	2	1	2	2	2	3	2	5	2	5	1	6			
	4	4	5	5		5	3	5	3	5	9	5	0	5	6	5	6			
4	2	2	3	2	4	2	5	2	9	2	2	2	4	2	4	1	4			
	7	6		6	1	6	4	7		7	9	7	3	7	8	7	3			
4	3	2	2	2	3	2	4	2	4	2	2	2	4	2	5	2	0			
	0	8	5	8	2	8	6	9		9	7	9	4	9	0	0	7			
5	1	2	3	2	9	2	2	2	4	3	6	3	2	3	3	2	2			
		9		9		9	3	9	3	0		0	4	0	0	1	9			
5	2	2	4	2	4	3	3	3	2	3	4	3	6	3	1	2	2			
		9	2	9	8	0		0	4	0	8	1		1	2	2	8			
5	3	3	2	3	3	3	4	3	7	3	3	3	4	3	5	2	2			
		0	4	0	0	0	6	1		1	2	1	9	1	7	3	7			
5	4	3	1	3	1	3	3	3	5	3	2	3	3	3	4	2	2			
		1	0	1	7	1	3	1	5	2	0	2	8	2	5	4	6			
5	5	3	5	3	5	3	2	3	4	3	1	3	3	3	3	2	6			
		1	8	2		2	3	2	4	3	1	3	1	3	8	5	5			
5	6	3	4	3	5	3	1	3	3	3	7	3	2	3	3	2	2			
		2	9	2	5	3	2	3	8	4		4	8	4	5	6	4			
5	7	3	4	3	4	3	5	3	3	3	5	3	3	3	2	2	2			
		3	0	3	7	4		4	2	5		5	3	5	8	8	3			
5	8	3	3	3	4	3	0	3	2	3	2	3	2	3	5	2	2			
		4	2	4	0	5		5	9	6		6	4	5	8	9	8			
5	9	3	2	3	3	3	5	3	2	3	2	3	2	3	3	2	2			

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S	0			I		II		II		I		V		V		S			
i	G	G	0	G	I	G	II	G	I	G	V	G	V	G	I	G	i		
.	.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	.		
		5	4	5	3	5	3	6	6	7		7	8	7	9	1	2	1	
5	1	3	1	3	2	3	5	3	2	3	5	3	3	3	4	3	4	2	6
		0	6	9	6	9	6	2	7	6	8		8	3	8	3	2	9	0
5	1	3	7	3	2	3	5	3	2	3	9	3	3	3	4	3	2	1	—
		1	7		7	9	7	3	8	9	9		9	8	9	9	4	0	9
5	1	3	1	3	2	3	5	3	3	4	1	4	4	4	5	3	5	1	—
		2	8	5	8	8	8	4	9	1	0	5	0	7	0	9	6	2	8
5	1	3	1	3	3	3	5	4	3	4	2	4	5	4	9	3	2	1	—
		3	9	6	9	0	9	7	0	5	1	2	1	6	1		8	7	7
5	1	4	1	4	3	4	2	4	4	4	3	4	1	4	2	3	4	1	—
		4	0	7	0	2	1		1	1	2	4	3	0	3	3	9		6
5	1	4	1	4	3	4	8	4	4	4	4	4	2	4	4	4	4	1	6
		5	1	9	1	5	2		2	7	3	7	4	4	4	0	0	0	5
5	1	4	2	4	3	4	1	4	4	4	2	4	0	4	0	4	3	1	—
		6	2	2	2	4	3	0	4		5		6		6		2	0	4
5	1	4	2	4	3	4	1	4	1	4	1	4	1	4	1	4	1	1	—
		7	3	2	3	7	4	4	5	3	6	7	7	4	7	4	4	4	3
5	1	4	2	4	4	4	2	4	2	4	3	4	2	4	2	4	5	1	—
		8	4	4	4	2	5	1	6	4	7	2	8	2	8	2	5	7	2
5	1	4	2	4	4	4	2	4	3	4	4	4	3	4	5	4	3	1	—
		9	5	2	5	3	6	8	7	1	8	4	9	7	9	8	7	7	1
5	2	4	2	4	4	4	3	4	3	4	5	5	5	5	1	4	1	1	6
		0	6	0	6	3	7	3	8	7	9	6	0	3	0	5	9	7	0
5	2	4	0	4	3	4	2	4	4	5	7	5	9	5	3	5	4	9	—

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																	d	.	
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S																c	e	S	
i	0	I	II	II	I	V	I	V	V	I	V	r.	c	i					
g	G	G	0	G	I	G	II	G	I	G	V	G	V	G	G	G	g		
.	.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	.		
	1	7		7	9	8	7	9	4	1		2		2	1	1	8		
5	2	4	1	4	3	4	2	5	4	5	1	5	2	5	4	5	2	8	—
	2	8	2	8	2	9	4	0	7	2	3	3	0	3	4	3	1		
5	2	4	5	4	2	5	2	5	4	5	2	5	2	5	5	5	5	7	—
	3	9		9	7	0	2	1	8	3	1	4	8	4	4	3	2		
5	2	4	5	5	2	5	1	5	4	5	2	5	3	5	1	5	1	6	—
	4	9	9	0	2	1	9	2	8	4	5	5	8	6		5	9		
5	2	5	5	5	1	5	1	5	4	5	1	5	2	5	5	5	3	5	6
	5	0	4	1	5	2	1	3	0	5	7	6	8	6	5	6	7		
5	2	5	1	5	3	5	4	5	1	5	0	5	0	5	4	5	2	4	—
	6	1	3	1	8	2	4	4	5	6		7		7	5	7	3		
5	2	5	4	5	7	5	1	5	5	5	0	5	3	5	1	5	3	3	—
	7	1	1	2		3	6	4	0	8		8	0	8	6	8			
5	2	5	9	5	3	5	4	5	2	5	2	5	4	5	1	5	9	2	—
	8	2		2	5	3	6	5	7	7	1	8	3	9	6	9			
5	2	5	2	5	4	5	2	5	4	5	4	5	4	5	3	5	3	1	—
	9	2	2	2	9	4		5	1	9		9	0	9	8	9	1		
6	0	5	3	5	0	5	1	5	1	5	5	5	2	6	0	6	0	0	6
		2	3	3		4	4	6		7	5	9	4	0		0			

Foot row (panel numbers across the seven panels): **XII | XI | X | IX | VIII | VII | VI**; foot-label **Signa Completa Anomaliae Solis Aequatae** (complete signs of the equated anomaly of the Sun). Catchword: **LATI-** (→ **LATITUDINES**, continuing Venus's latitude tables on the next opening).

Parsing notes: Wide ten-panel table (seven argument panels 0–VI of G./, plus a rightmost **Scrup. decr.** [scrupula decrescientia] panel carrying the rubric **Scrupula proportionalia Decrementi in retrogradatione** — proportional minutes of decrement in retrogradation — which begins printing numeric values only from row "Sig.3/G.18" downward, the upper cells of that panel being occupied by the spelled-out rubric). The argument steps vary: 12-degree intervals in the first signs, then tightening to 3-degree and finally 1-degree steps in the upper signs (rows Sig.4/G.5 through Sig.6/G.0), where the latitude rises steeply toward conjunction. All cells resolved on re-transcription. Several cells in the dense lower rows break the smooth column progression and are suspected source compositor errors, transcribed as printed: panel 0 at Sig.5/G.26 (prints "51 | 13", interrupting the rising 50 54 → 51 41 run); the disordered VI column near the foot (Sig.5/G.7–G.9 reading 35 28, 35 58, 37 39, internally non-monotone); panel IV at Sig.5/G.27 ("58 | 0", out of trend); and panel I at Sig.2/G.30 ("12 | 4" against neighbouring "12 5"). The final row's VI/decr. entry "60 | 0" is a whole-degree limit marking the cycle close, not a minutes overflow. The rightmost descending stub (G./Sig.) is preserved; only the changing Sig. is printed (12, 11, 10, 9, 8, 7, 6).

Tabulae novalmagesticae — Part V (the planetary tables), continued

LATITUDES OF VENUS [LATITVDINES VENERIS]

*(Table-volume page 89 = *

TABLE 86. The Proportional Minutes of the Decrement of the Latitude of Venus [*Scrupulorum Proportionalium Decrementi Latitudinis Veneris*]

Top margin (column band): **Complete Signs of the Equated Anomaly of the Sun** [*Signa Completa Anomaliae Solis Aequatae*]. Bottom margin (column band, read from the foot, right-to-left): **Complete Signs of the Equated Anomaly of the Sun** [*Signa Completa Anomaliae Solis Aequatae*].

The outer stub on each side is the **Anomaly of Venus** [*Anomal. Aeq. □*], given as Sig./Gr. (signs and degrees). The six interior double-columns are headed with the sign-count of the Sun's equated anomaly (0, I, II, III, IV, V across the top; reading from the foot they continue XII, XI, X, IX, VIII, VII, VI). Each interior column gives

Gr./' (degrees and minutes) — these are the proportional-minute values. The left stub reads top-to-bottom; the right stub reads bottom-to-top.

A n o m . □ (L)														A n o m . □ (R)	
Si g.		0		I		II		III		IV		V		Si g.	
G r.		— 0		— I		— II		— III		— IV		— V		G r.	
r.		'		'		'		'		'		'		r.	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
	6		1		1		1		1		1		1	24	18
	12		2		2		2		2		2		1	18	
	18		4		4		4		4		5		5	12	
	24		7		7		7		8		8		8	6	
	30		11		11		11		12		12		13	0	11
I	6	0	15	0	15	0	15	0	16	0	17	0	17	0	18
	12		20		20		21		21		23		23	24	18
	18		26		26		27		29		30		30	31	12
	24		33		33		34		36		37		38	39	6
	30		40		40		42		44		46		47	48	0
2	6	0	48	0	48	0	50	0	53	0	55	0	56	0	57
	12		56		56		58	1	1	1	3	1	5	1	7
	18	1	4	1	4	1	6		10		14		16	17	12
	24		12		12		12		15		19		23	26	6
	30		20		21		24		28		33		36	37	0
3	6	1	28	1	30	1	33	1	38	1	43	1	46	1	47
	12		36		38		42		47		52		56	57	18
	18		44		46		50		56	2	1	2	7	7	12
	24		52		54		58	2	4		10		16	17	6
	30	2	0	2	2	2	6		13		19		25	26	0
4	6	2	7	2	9	2	14	2	21	2	28	2	34	2	35

A n o m . □ (L)		0	I	II	III	IV	V	A n o m . □ (R)							
Sig.	Gr.	0	I	II	III	IV	V	Gr.	Sig.						
		12	14	16	21	28	35	42	44	18					
		18	20	22	27	35	42	49	50	12					
		24	25	27	33	41	48	55	56	6					
		30	29	31	37	45	53	3	1	3	1				
5	6	2	33	2	35	2	41	2	49	2	57	3	4	3	6
		12	36	38	44	53	3	3	7	9	18				
		18	38	40	46	55	5	10	12	12					
		24	39	41	47	56	6	13	13	6					
		30	40	42	48	57	5	12	14	0					
(f oo t si g ns)		XI	XI	X	IX	VI	VI	VI							
		I				II	I								

Parsing notes: This is a folio-wide proportional-minutes table. The left and right outer stubs are the two halves of Venus's anomaly argument (left runs Sig. 0–5 top-down at 6° steps; the right outer column runs Gr. then Sig. bottom-up, 12 down to 6). Within each interior sign-column the Gr. value is printed only when it changes; blank Gr. cells repeat the value above. A few of the very small interior minute digits in the upper rows are faint; the values given are my best reading.

TABLE 87. The Latitude, Reduction, and Curtation of Venus
[Latitudinis, Reductionis, & Curtationis Veneris]

(Table-volume page 89 = lower panel)

Top margin (column band): **Signs of the Distance of Venus from the Northern Node** [*Signa Distantiae Veneris à Nodo Boreali*]. Bottom margin (column band, read from foot, right-to-left): **Signs of the Distance of Venus from the Northern Node** [*Signa Distantiae Veneris à Nodo Boreali*].

The outer stubs (both sides) are the **Distance from the Node** [*Dist. à Ω*] in degrees (*Gr.*); the left runs 0–30 top-down, the right runs 30–0 bottom-up. The interior holds two paired sign-groups. The first group is headed at top **0 Boreal / VI Austral** [*O Boreal. / VI Austral.*] and at foot **V Boreal / XI Austral** [*V Boreal. / XI Austral.*], with sub-columns Latitude (*Gr.'*), Reduction (*'"*), Curtation (*'"*). The second group is headed **I Boreal / VII Austral** [*I Boreal. / VII Austral.*] (foot: **IV Boreal / X Austral**) and the third **II Boreal / VIII Austral** [*II Boreal. / VIII Austral.*] (foot: **III Boreal / IX Austral**), each likewise with Latitude, Reduction, Curtation.

	I	II	
0	B	B	
B	o	o	
o	r	r	
r	/	/	
/	V	V	
V	II	II	
II	A	A	
A	u	u	D
D u	s	s	i
i s	t	t	s
s t	r	r	t.
t. r	—	—	Ω
Ω —			

(	L	L	R	C	C	L	L	R	C	C	L	L	R	C	C	(
)	t.	a	e	d	r	r	t.	a	e	d	r	r	t.	a	e	d	r	r)		
G	t.	d	.	"	'	"	G	t.	d	.	"	'	"	G	t.	d	.	"	'	"	G
r.	r.	'	'	"	'	"	r.	'	'	"	'	"	r.	'	'	"	'	"	r.		
0	0	0	0	0	0	0	5	3	2	3	2	5	8	3	2	3	5	8	3		
								5		5		8		0		3					0
1	0	1	0	7	0	6	5	1	2	3	3	4	8	5	2	3	5	1	2		
		0						5		8				6		2		3	9		

O B o r / V I A D u i s s t r Ω —	I B o r / V I A u s t r —	II B o r / V II I A u s t r —	D i s t. Ω
--	---	--	------------------------

(	L		R	C	C	L		R	C	C	L		R	C	C	(
)	t.	a	e	d	r	r	t.	a	e	d	r	r	t.	a	e	d	r	r)
G	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G
r.	r.	'	'	"	'	"	r.	'	'	"	'	"	r.	'	'	"	'	"	r.
2	0	2	0	1	0	1	5	2	2	4	3	9	9	1	2	2	5	1	2
		1		3		2		4		2					8		4		8
3	0	3	0	1	0	1	5	3	2	4	3	1	9	6	2	2	5	1	2
		2		9		9		3		5		3			5		7		7
4	0	4	0	2	0	2	5	4	2	4	3	1	9	1	2	2	5	2	2
		3		6		5		2		7		7		0		1		0	6
5	0	5	0	3	0	3	5	5	2	5	3	2	9	1	2	1	5	2	2
		3		2		2		1		0		3		5		6		3	5
6	1	4	0	3	0	3	6	0	2	5	3	2	9	1	2	1	5	2	2
				8		8				2		9		9		2		5	4
7	1	1	0	4	0	4	6	8	2	5	3	3	9	2	2	8	5	2	2
		4		5		4				4		4		3				8	3
8	1	2	0	5	0	5	6	1	2	5	3	3	9	2	2	3	5	3	2
		5		1		0		6		5		9		7				0	2
9	1	3	0	5	0	5	6	2	2	5	3	4	9	3	1	5	5	3	2
		5		7		6		5		6		4		1		9		3	1
1	1	4	1	2	1	2	6	3	2	5	3	4	9	3	1	5	5	3	2

O B o r / V I A D u s t r Ω —	I B o r / V I A u s t r —	II B o r / V I I A u s t r —	D i s t. Ω
--	---	---	------------------------

(	L	L	R	C	C	L	L	R	C	C	L	L	R	C	C	(
) t.	a	L	e	d	r	r	t.	a	e	d	r	r	t.	a	e	d	r	r)	
G	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G	r.
r.	r.	'	.'	"	'	"	r.	'	.'	"	'	"	r.	'	.'	"	'	"	r.	r.
0	6						4	6	9	5	4	5	0							
1	1	5	1	8	1	8	6	4	2	5	3	5	9	3	1	5	5	3	1	
1		6						2	7		4		9		0		7	9		
1	2	7	1	1	1	1	6	4	2	5	3	5	9	4	1	4	5	3	1	
2				3		4		9		8		8		2		5		8	8	
1	2	1	1	1	1	2	6	5	2	5	4	3	9	4	1	4	5	4	1	
3		8		8		1		7		8				6		0		0	7	
1	2	2	1	2	1	2	7	5	2	5	4	7	9	4	1	3	5	4	1	
4		8		4		7				9				9		4		1	6	
1	2	3	1	2	1	3	7	1	2	5	4	1	9	5	1	2	5	4	1	
5		8		9		3		3		9		2		2		9		4	5	
1	2	4	1	3	1	3	7	2	2	5	4	1	9	5	1	2	5	4	1	
6		8		4		8		1		9		6		4		4		5	4	
1	2	5	1	4	1	4	7	2	2	5	4	2	9	5	1	1	5	4	1	
7		9		0		4		8		8		1		7		8		7	3	
1	3	9	1	4	1	5	7	3	2	5	4	2	9	5	1	1	5	4	1	
8				5		0		5		8		5		9		3		8	2	

O B o r / V I A D u s t r t. r — Ω	I B o r / V I A u s t r — —	II B o r / V II I A u s t r — —	D i s t. r Ω
--	--	---	-----------------------------

(	L		R	C	C	L		R	C	C	L		R	C	C	(
)	t.	a	e	d	r	r	t.	a	e	d	r	r	t.	a	e	d	r	r)
G	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G
r.	r.	'	'	"	'	"	r.	'	'	"	'	"	r.	'	'	"	'	"	r.
1	3	1	1	5	1	5	7	4	2	5	4	2	1	1	1	8	5	4	1
9		9		0		6		2		7		9	0					9	1
2	3	2	1	5	2	2	7	4	2	5	4	3	1	3	1	2	5	5	1
0		9		4				9		6		3	0					0	0
2	3	3	1	5	2	8	7	5	2	5	4	3	1	5	0	5	5	5	9
1		9		9				6		6		7	0		7		1		
2	3	4	2	3	2	1	8	2	2	5	4	4	1	6	0	5	5	5	8
2		9				3				5		0	0		1		2		
2	3	5	2	8	2	1	8	9	2	5	4	4	1	7	0	4	5	5	7
3		9				9				4		4	0		5		3		
2	4	8	2	1	2	2	8	1	2	5	4	4	1	8	0	3	5	5	6
4				2		5		5		2		8	0		8		4		
2	4	1	2	1	2	3	8	2	2	5	4	5	1	9	0	3	5	5	5
5		9		6		1		1		0		2	0		2		4		
2	4	2	2	2	2	3	8	2	2	4	4	5	1	1	0	2	5	5	4
6		8		1		6		7		7		5	0	0	6		5		
2	4	3	2	2	2	4	8	3	2	4	4	5	1	1	0	1	5	5	3

O B o r / V I A D u i s s t t. r Ω —	I B o r / V II A u s t r —	II B o r / V II I A u s t r —	D i s t. Ω
--	--	--	------------------------

(L L a L R e u u a L R e u u a L R e u u a L R e u u a R C C () t. a e d r r t. a e d r r t. a e d r r t. a e d r r) G G t. d . t. t. G t. d . t. t. G t. d . t. t. G t. d . t. t. G r. r. ' . ' " ' " r. ' . ' " ' " r.

7	8	5	2	3	5	8	0	1	9	6									
2	4	4	2	2	2	4	8	3	2	4	5	1	1	1	0	1	5	5	2
8	8	8	8	7	9	2	0	1	3	6									
2	4	5	2	3	2	5	8	4	2	3	5	5	1	1	0	7	5	5	1
9	7	2	3	5	8	0	2	6											
3	5	6	2	3	2	5	8	5	2	3	5	8	1	1	0	0	5	5	0
0		5	8	0	5	0	2	6											

(f V o B o o t r g / r X p I) A u s t	I V B o r / X A u s t	II I B o r / I X A u s t	
--	---	---	--

O	I	II	
B	B	B	
o	o	r	
r	r	/	
/	/	V	
V	V	II	
I	II	I	
A	A	A	
D u	u	u	D
i s	s	s	i
s t	t	t	s
t. r	r	r	t.
Ω —	—	—	Ω

(L	R C C L	R C C L	R C C (
L a L	L R e u u a	L R e u u a	L R e u u R
) t. a e d r r	t. a e d r r	t. a e d r r	) t. a e d r r
G G t. d . t. t.	G t. d . t. t.	G t. d . t. t.	G t. d . t. t. G
r. r. ' . ' " ' "	r. ' . ' " ' "	r. ' . ' " ' "	r. ' . ' " ' " r.
r	r	r	

Parsing notes: A triple-argument latitude/reduction/curtation table. Each of the three interior groups carries three sub-fields (Latitude Gr./, Reduction '"/, Curtation '"/). I have aligned the Latitude as Gr.+' , Reduction as '+"/, and Curtation as '+"/ per the printed sub-headers. The left outer stub (Dist. from Node, 0–30 down) and right outer stub (30–0 up) frame the body. A handful of the "-column digits in the densest rows (rows 11–17) are faint; values are my best reading.

MEAN MOTIONS OF MERCURY [MOTVS MERCVRII]

*(Table-volume page 90 = *

TABLE 88. The Mean Motions of Mercury ☿ [*Mediorum Motuum Mercurii* ☿]

This is a folio-wide epoch-and-motion page divided into several stacked panels. Headers throughout: **Longitude from ♈ (Aries)** [*Longit. ab ♈*], **Apogee** [*Apogaei*], **Northern Nodes** [*Nodi Bor.*], each given as Sig./Gr./'"/.

Panel 1 (left): EPOCHS, or ROOTS OF THE MOTIONS [EPOCHAE, seu RADICES MOTVVM]

Stub: Complete Years before / after Christ [Anni Completi ante / post Christum].

An ni Co mp l.	Lo ngi t. ab □ Sig				Ap og aei Sig				No di Bo r. Sig			
	.	Gr.	'	"	.	Gr.	'	"	.	Gr.	'	"
60 00 (a. C.)	5	18	27	55	1	37	50	—	2	6	20	43
50 00	6	12	23	13	2	0	34	23	7	17	16	33
40 00	7	6	18	31	2	29	31	16	8	13	49	36
30 00	8	0	13	49	3	28	28	9	9	10	22	39
20 00	8	24	9	7	4	27	25	3	10	6	55	43
10 00	9	18	4	24	5	26	21	58	11	3	28	47
90 0	9	2	27	56	5	29	15	39	11	6	8	5
80 0	2	16	51	28	6	2	9	20	11	8	47	23
70 0	5	1	15	0	6	5	3	2	11	11	26	41
60 0	7	15	38	32	6	7	56	42	11	14	6	0
50 0	10	0	2	4	6	10	50	20	11	16	45	18
40	0	14	25	36	6	13	44	0	11	19	24	36

An ni Co mp l.	Lo ngi t. ab □ Sig .	Ap og aei Sig			No di Bo r. Sig							
		Gr.	'	"	Gr.	'	"					
0												
30	2	28	49	8	6	16	38	—	11	22	3	54
0												
20	5	13	12	40	6	19	31	41	11	24	43	13
0												
10	7	27	36	12	6	22	25	18	11	27	22	32
0												
Ch rist i	10	11	59	40	6	25	18	48	0	0	1	50
0												
10	0	26	23	13	6	28	12	29	0	2	41	8
0												
(p. C.)												
20	3	10	46	44	7	1	6	10	0	5	20	26
0												
30	5	25	10	16	7	3	59	50	0	7	59	44
0												
40	8	9	33	48	7	6	53	31	0	10	39	2
0												
50	10	23	57	19	7	9	47	12	0	13	18	21
0												
60	1	8	20	51	7	12	40	53	0	15	57	39
0												
70	3	22	44	23	7	15	34	33	0	18	36	57
0												
80	6	7	7	55	7	18	27	54	0	21	16	15
0												
90	8	21	31	27	7	21	21	34	0	23	55	33

An ni Co mp l.	Lo ngi t. ab □ Sig .	Ap og aei Sig			No di Bo r. Sig							
		Gr.	'	"	Gr.	'	"					
0												
10 00	11	5	54	58	7	24	15	15	0	26	34	52
11 00	1	20	18	30	7	27	8	56	0	29	14	10
12 00	4	4	42	2	8	0	2	37	1	1	53	28
13 00	6	19	5	34	8	2	56	18	1	4	32	46
(St. vet eri s)												
14 00	9	3	29	6	8	5	49	58	1	7	12	4
15 00	11	17	52	38	8	8	43	39	1	9	51	23
16 00	2	2	16	10	8	11	37	20	1	12	30	41
16 00	2	20	50	44	8	11	37	17	1	12	30	40
(St. no vo)												
17 00	5	5	14	16	8	14	30	58	1	15	9	59
18 00	7	19	37	48	8	17	24	39	1	17	49	17
19	7	21	14	4	8	20	18	20	1	20	28	35

An ni Co mp l.	Lo ngi t. ab □ Sig			Ap og aei Sig			No di Bo r. Sig					
	Gr.	'	"	Gr.	'	"	Gr.	'	"			
00												
20	10	6	38	16	8	23	12	0	1	23	7	56
00												
21	10	16	56	16	8	26	5	41	1	25	47	8
00												
22	12	27	14	13	8	28	59	22	1	28	26	26
00												
23	5	7	32	15	9	1	53	2	2	1	5	45
00												

Parsing notes: This Epochs panel runs "Years before Christ" (top, 6000 down to 100), then **Christi** (the radix), then "Years after Christ" (100 up to 2300). The 1300 row is marked *St. veteris* (Old Style) and there are paired 1600 rows marked *St. novo* (New Style) — the Gregorian-reform doubling. A few terminal-second cells (rows 6000, 300) show a dash where the print is blank/illegible; flagged. Several "-column digits in the longitude block are faint.

Panel 2 (lower-left): JULIAN YEARS EXPANDED & COLLECTED [ANNI IVLIANI EXPANSI, & COLLECTI]

Stub: **Motion / Years** [*Motus / Anni*]. (B. = bissextile/leap year.) Headers: Longit. ab □ (Sig./Gr./""); Apogaei (""); Nodi Bor. ("").

Anni	Longi			Apog.		Nodi	
	t. Sig.	Gr.	'	"	'	"	Nodi ' "
1	1	23	43	15	1	44	1 36
2	3	17	26	30	3	28	3 11
3	5	11	9	45	5	12	4 47
4 (B.)	7	8	58	32	6	57	6 22
5	9	2	41	47	8	41	7 58
6	10	26	25	2	10	25	9 33

Anni	Longi			Apog.			Nodi		
	t. Sig.	Gr.	'	"	'	"	Nodi'	"	
7	0	20	8	17	12	9	11	9	
8 (B.)	2	17	57	5	13	54	12	45	
9	4	11	40	20	15	38	14	20	
10	6	5	23	35	17	22	15	56	
11	7	29	6	50	19	6	17	31	
12	9	26	55	37	20	51	19	7	
(B.)									
13	11	20	38	52	22	35	20	43	
14	1	14	22	7	24	19	22	18	
15	3	8	5	22	26	3	23	54	
16	5	5	54	10	27	48	25	29	
(B.)									
17	6	29	37	25	29	32	27	5	
18	8	23	20	40	31	16	28	40	
19	10	17	3	55	33	0	30	16	
20	0	14	52	42	34	44	31	52	
(B.)									

Panel 3 (top-right): COLLECTED JULIAN YEARS [ANNI IVLIANI COLLECTI]

Stub: Motion / Years [*Motus / Anni*].

Anni	Lo ng. ab □ Sig	Apog.			No di Bo r. Sig	Nodi						
		Gr.	'	"		Gr.	'	"				
40	0	29	45	25	0	1	9	28	0	1	3	43
60	1	14	38	7	0	1	44	12	0	1	35	35
80	1	29	30	50	0	2	18	58	0	2	7	27
100	2	14	23	32	0	2	53	41	0	2	39	18
200	4	28	47	4	0	5	47	23	0	5	18	37

Panel 4 (mid-right): YEARS — Common / Bissextile [MENSES ANNI: Communis / Bissextilis]

Stub: **Motion / Months** [*Mot. / Ment.*]. Headers (each side): Long. ab □ (Sig./Gr./"/), then Apog. ' ", Nodi B. ' ".

Me nse s	Co m m. Lo ng. Sig				Bis sex t. Lo ng. Sig				Ap og. '	Ap og. "	No di B.'	No di B."
	.	Gr.	'	"	.	Gr.	'	"				
Ian ua r.	4	6	51	50	4	6	51	50	0	9	0	8
Fe br.	8	1	27	3	8	5	32	35	0	17	0	16
Ma rtij	0	8	18	53	0	12	24	25	0	26	0	24
Ap rili s	4	11	1	4	4	15	10	43	0	35	0	33
Ma ij	8	17	57	1	8	17	57	1	1	22	0	39
Iu nij	0	20	43	19	0	24	48	51	0	52	0	49
Iuli j	4	27	35	5	4	5	40	41	1	0	0	55
Au gus ti	9	4	26	59	9	8	32	31	1	9	1	4
Se pte b.	1	7	13	17	1	11	18	49	1	18	1	12
Oct ob.	5	14	5	7	5	18	10	39	1	27	1	20

Me nse s	Co m m. Lo ng. Sig	Gr.	'	"	Bis sex t. Lo ng. Sig	Gr.	'	"	Ap og.	Ap og.	No di B.'	No di B."
	.				.				'	"	B.'	B."
No ue b.	9	16	51	25	9	20	56	57	1	35	1	28
De ce b.	1	23	43	15	1	27	48	47	1	44	1	36

Panel 5 (lower-right, left half): DAYS [DIES]

Stub: **Motion / Days** [*Mot. / Dies*]. Headers: Long. ab □ (Sig./Gr./"/), Apog. '.

Dies	Long. Sig.	Gr.	'	"	Apog. '
1	0	4	5	32	0
2	0	8	11	5	0
3	0	12	16	38	1
4	0	16	22	10	1
5	0	20	27	43	1
6	0	24	13	16	2
7	0	28	38	48	2
8	1	2	44	21	2
9	1	6	49	53	3
10	1	10	55	26	3
11	1	15	0	58	3
12	1	19	6	31	4
13	1	23	12	4	4
14	1	27	17	36	4
15	2	1	23	9	5
16	2	5	28	41	5
17	2	9	34	14	6

Dies	Long. Sig.	Gr.	'	"	Apog. '
18	2	13	39	47	6
19	2	17	45	19	6
20	2	21	50	52	6
21	2	25	56	24	7
22	3	0	1	57	7
23	3	4	7	30	7
24	3	8	13	2	8
25	3	12	18	35	8
26	3	16	24	7	8
27	3	20	29	40	9
28	3	24	35	13	9
29	3	28	40	45	9
30	4	2	46	18	9
31	4	10	56	50	10 [?]

Panel 6 (lower-right, right half): HOURS [HORAE]

Stub: **Motion / Hours** [*Mot. / Horae*]. Header: Long. ab □ (Gr./"/").

Horae	Long. Gr.	'	"
1	0	10	14
2	0	20	28
3	0	30	42
4	0	40	56
5	0	51	9
6	1	1	23
7	1	11	37
8	1	21	51
9	1	32	5
10	1	42	19
11	1	52	32
12	2	2	46
13	2	13	0

Horae	Long. Gr.	'	"
14	2	23	14
15	2	33	28
16	2	43	41
17	2	53	55
18	3	4	9
19	3	14	23
20	3	24	37
21	3	34	51
22	3	45	4
23	3	55	18
24	4	5	32
(extra) 60	9	15	50

Marginal note (foot of left-bottom block) [*Radices affixae sunt Meridiano Bononiensi, in meridie ultimo Decembris praecedentis. Anni sunt Completi, sive numeres sursum ante Christum, sive deorsum post Christum.*]: [Margin: "The roots are fixed to the Bologna meridian, at noon on the last day of the preceding December. The years are complete, whether you count upward (before Christ) or downward (after Christ)."]

Parsing notes: This page packs six panels around the central rule. I have transcribed them as six separate pipe-tables. The Hours panel carries a stray "60 — 9 15 50" entry at its foot (an hourly-rate extension row); transcribed as printed. Several "-digits in the dense Epochs longitude column are faint; flagged in the QA report.

EQUATIONS OF MERCURY [AEQVATIONES MERCVRII]

*(Table-volume page 91 = *

TABLE 89. The Equations of the First Inequality of Mercury [*Aequationum Primae Inaequalitatis Mercurij*]

Top margin (column band): **Signs of the Simple Anomaly of the Eccentric of Mercury** [*Signa Anomaliae simplicis Excentrici Mercurij*]. Bottom margin (column band): **Signs of the Simple Anomaly of the Eccentric of Mercury** [*Signa Anomaliae simplicis Excentrici Mercurij*].

Outer stubs: **Simple Anomaly** [*Anom. simpl.*] in degrees (*Gr.*); left 0–30 down, right 30–0 up. The six interior double-columns are headed at top **0 / I / II / III / IV / V Subtract** [*O Subtr. ... V Subtr.*] and at foot **Add XI / Add X / Add IX / Add VIII / Add VII / Add VI** [*Adde XI ... Adde VI*]. Each interior column gives *Gr./'"/*.

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l.	u	u		u		u		u		u		u						l.	
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)	r	r		r		r		r		r		r)	
G	G	G		G		G		G		G		G						G	
r.	r.	'	"	r.	'	"	r.	'	"	r.	'	"	r.	'	"	r.	'	"	r.
0	0	0	0	9	2	2	1	5	1	2	2	1	2	1	1	1	5	0	3
					4		7	0	8	3	7	4	3	6	7	4	5		0
1	0	1	1	9	4	1	1	5	1	2	3	3	2	7	5	1	3	3	2
		9	8		2	1	8		0	3	3	2	3		0	4	0	3	9
2	0	3	5	1	0	1	1	1	4	2	3	2	2	5	0	1	4	2	2
		8		0		6	8	9	7	3	9	9	2	9		4		7	8
3	0	5	7	1	1	2	1	3	1	2	4	5	2	4	7	1	3	5	2
		7		0	8	7	8	4	1	3	4	9	2	9		3	8	1	7
4	1	1	2	1	3	3	1	4	1	2	5	9	2	3	6	1	1	2	2
		6	0	0	6	3	8	8	7	3	0		2	9		3	2		6
5	1	3	1	1	5	2	1	2	1	2	5	5	2	2	1	1	4	1	2
		5	4	0	4	9	9		9	3	4	2	2	8	8	2	5	4	5
6	1	5	1	1	1	1	1	1	9	2	5	2	2	1	5	1	1	1	2
		4	4	1	2	0	9	6		3	9		2	6	5	2	8	7	4
7	2	1	1	1	3	7	1	2	4	2	2	4	2	5	5	1	5	3	2
		3	7	1	0		9	9	4	4		8	2			1	0	9	3
8	2	3	1	1	4	4	1	4	2	2	6	1	2	5	3	1	2	3	2

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r.	r.	'	"	r.	'	"	r.	'	"	r.	'	"	r.	'	"	r.	'	"	r.
		2	9	1	7	0	9	3		4		5	1	2	3	1	2	9	2
9	2	5	1	1	5	2	1	5	1	2	9	1	2	3	3	1	5	2	2
		1	6	2		0	9	6	9	4		9	1	9	3	0	4	2	1
1	3	1	2	1	2	5	2	9	3	2	1	5	2	2	4	1	2	3	2
0		0	0	2	2	8	0			4	1	2	1	6	4	0	5	9	0
1	3	2	1	1	4	5	2	2	4	2	1	4	2	1	1	9	5	3	1
1		9	8	2	0	1	0	1	3	4	3	9	1	1	9		6	6	9
1	3	4	4	1	5	7	2	3	8	2	1	1	2	5	2	9	2	1	1
2		8		2	8		0	4		4	5	8	0	6	9		7	2	8
1	4	7	1	1	1	2	2	4	1	2	1	2	2	4	2	8	5	2	1
3			2	3	5	2	0	6	9	4	6	1	0	1			7	5	7
1	4	2	1	1	3	2	2	5	1	2	1	1	2	2	1	8	2	1	1
4		6	2	3	2	0	0	8	4	4	7		0	5	0		7	6	6
1	4	4	5	1	4	3	2	9	5	2	1	2	2	8	4	7	5	1	1
5		4	4	3	9	3	1		6	4	7	0	0		0		7	1	5
1	5	3	5	1	6	3	2	2	1	2	1	4	1	5	3	7	2	4	1
6			1	4		1	1	1	2	4	6	2	9	1	9		6	9	4
1	5	2	4	1	2	1	2	3	2	2	1	4	1	3	5	6	5	4	1
7		2	3	4	3	9	1	2	8	4	6		9	3	9		5	9	3
1	5	4	2	1	4	8	2	4	3	2	1	1	1	1	6	6	2	4	1
8		1	8	4	0		1	3		4	4	8	9	6			4	0	2

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2	9	6	0	1	3	1	2	2	1	2	2	5	1	1	2	0	3	3	1
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3	9	2	2	1	5	1	2	2	1	2	1	1	1	5	0	0	0	0	0
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	X			X			I			V			V			V			
	I						X			II			II			I			
										I									

Parsing notes: A first-inequality (eccentric-equation) table, six interior sign-columns each Gr./"/, with the standard "Subtract" (top) / "Add" (foot) sense-labels and the mirror-stub argument (0–30 / 30–0). A few "-digits in the middle rows are faint; values are my best reading.

TAB. 90. The Equated Anomaly of Mercury [*Anomalia Aequata Mercurij*]

(Table-volume page 91 = lower panel)

Top margin (column band): **Signs of the Simple Anomaly of Mercury [*Signa Anomaliae simplicis Mercurij*]**. Bottom margin (column band): **Signs of the Simple Anomaly of Mercury [*Signa Anomaliae simplicis Mercurij*]**.

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			9	8			4		6	6			5	9	5		8	8	6		9	1			2
9	0	7	7	0	1	1	2	1	1	2	4	2	2	2	1	3	3	2	3	1	5	4	4	5	2
							4	1		7	1	3		7		0		9	6	4			0	3	1
1	0	7	5	3	1	2	1	2	1	2	3	5	2	2	3	3	4	0	4	2	5	5	5	4	2
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1	0	8	4	1	1	3	4	4	1	2	3	3	3	0	5	5	4	1	5	4	5	7	4	4	1
1			1	0				2		9	2	5			7			2	1					1	9
1	0	9	2	4	1	3	5	1	2	0	2	3	3	1	8	3	4	3	1	8	5	8	1	4	1
2			9	9			5	0			8	0			2								6	0	8
1	0	1	1	3	1	4	4	4	2	1	2	3	3	1	1	2	4	4	9	4	5	9	2	4	1
3			0	7	0		5	7			4	8			1	2				4		8	4	7	
1	0	1	5	1	1	5	3	3	2	2	2	5	3	2	1	2	4	5	1	1	5	1	4	5	1
4			1		4		6	3			0	9			4	2			8	1		0	0	3	6
1	0	1	5	0	1	6	2	2	2	3	1	3	3	3	1	3	4	6	2	0	5	1	5	0	1
5			1	3			7	7			7	4			7	4			7			1	3		5
1	0	1	4	4	1	7	1	3	2	4	1	2	3	4	2	5	4	7	3	3	5	1	5	1	1
6			2	0	0		8	1			4	2			0	9			6	3		3		4	4
1	0	1	2	4	1	8	9	4	2	5	1	2	3	5	2	3	4	8	4	4	5	1	1	3	1
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1	0	1	4	4	1	9	5	4	2	7	5	5	3	7	3	3	4	1	4	4	5	1	4	1	1
9		5		1		2	1					7			2	5		1		2		6	2	0	1
2	0	1	5	4	1	1	4	2	2	8	3	3	3	8	3	5	4	1	1	2	5	1	5	3	1
0		5	2	6		0	4	3				6			6	3		2	4	3		7	4	4	0
2	0	1	4	5	1	1	3	1	2	9	1	3	3	9	4	2	4	1	2	1	5	1	7	0	9
1		6	0	6		1	6	4				0			1	3		3	4	1		9			
2	0	1	2	1	1	1	2	1	2	9	5	3	3	1	4	6	4	1	3	7	5	2	1	2	8
2		7	9	1		2	8	6				9	6		0	6			4	4		0	9	8	
2	0	1	1	3	1	1	2	2	2	1	5	5	3	1	5	0	4	1	4	1	5	2	3	5	7
3		8	7	1		3	0	9		0	7	5		1	1			5	4	2		1	1	8	
2	0	1	5	5	1	1	1	5	2	1	5	2	3	1	5	5	4	1	5	2	5	2	4	3	6
4		9		6		4	2	8		1	6	7		2	6			6	4	5		2	4	0	
2	0	1	5	2	1	1	5	2	2	1	5	1	3	1	1	2	4	1	4	4	5	2	5	3	5
5		9	4	7		5		9		2	5	3		4		7		8		6		3	7		
2	0	2	4	1	1	1	5	1	2	1	5	1	3	1	6	5	4	1	1	1	5	2	9	3	4
6		0	3			5	8	4		3	4	3		5		8		9	5	6		5		7	
2	0	2	3	4	1	1	5	9	2	1	5	2	3	1	1	4	4	2	2	4	5	2	2	1	3
7		1	1	0		6	1			4	3	6		6	2	1		0	5	9		6	2	2	

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8		2	0	5		7	4	7		5	2	2		7	8	3		1	6	5		7	4	7	
2	0	2	9	1	1	1	3	3	2	1	5	3	3	1	2	4	4	2	4	2	5	2	4	1	1
9		3		2		8	7	5		6	2	2		8	4	4		2	7	0		8	7	3	
3	0	2	5	1	1	1	3	4	2	1	5	2	3	1	3	4	4	2	5	1	6	0	0	0	0
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Parsing notes: An equated-anomaly table for Mercury — six interior sign-groups each Sig./Gr./"', framed by the mirror argument (0–30 down on the left, 30–0 up on the right) with the top/foot sign-banners (0–V / XI–VI). The values are highly

dense; a number of the "-column digits in the central rows are faint and represent my best reading.

[Margin (lower-left, sideways): "LATI-" — bleed-through / page-locator fragment]

THE EQUATIONS OF MERCURY

TABLE 91. Of the maximum equations, or of the parallaxes of Mercury's orbit.

Completed signs of the equated solar anomaly.

Top sign-banner (completed signs of the equated solar anomaly): **0 | I | II | III | IV | V | VI**

	0		I		II		I		V		I		V		I			
Si	G	G	0	G	G	II	G	II	G	V	G	V	G	V	G	V	G	Si
g.	r.	.	'	.	I'	.	'	.	I'	.	'	.	'	.	I'	r.	g.	
0	0	2	1	2	2	2	3	2	5	2	7	2	1	2	2	0	1	
		7	8	7	5	7	4	7	1	8		8	9	8	3		2	
	6		1		2		3		4		5		1		2	2		
			7		1		3		9				7		1	4		
	1		1		1		2		4		0		1		1	1		
	2		1		6		8		4				2		6	8		
	1		3		8		1		3	2	5	2	3		8	1		
	8						9		5	7	1	8				2		
	2	2	5	2	5		8		2		3		5	2	5	6		
	4	6	2	6	6				3		9		1	7	5			
	3	2	3		4	2	5		8		2		3		4	0	1	
	0	6	7		1	6	3				4		6		0		1	
1	3	2	2	2	3	2	4	2	0	2	1	2	2	2	3	2		
		6	9	6	3	6	4	7		7	5	7	7	7	1	7		
	6		2		2		3	2	5		6		1		2	2		
			0		4		5	6	1				8		2	4		
	9		1		1		2		4	2	5		7		1	2		
			0		4		5		1	6	6				2	1		
	1		0		4		1		3		4	2	5		1	1		

Si	G	0	I	II	II	I	I	V	I	V	V	I	V	G	Si		
g.	r.	.	'	.	I'	.	'	.	I'	.	'	.	'	.	I'	r.	g.
	2						5	0		5	6	7				8	
	1	2	4	2	5		4		1		3		4	2	4	1	1
	5	5	9	5	3				8		4		5	6	9	5	0
1	1	2	3		4	2	5	2	7	2	2	2	3	2	3	1	
	8	5	7		1	5	2	6		6	2	6	3	6	7	2	
	2		2		2		4	2	5		1		2		2	9	
	1		5		9		0	5	5		0		1		5		
	2		1		1		2		4	2	5		7		1	6	
	4		2		6		7		2	5	7				2		
	2	2	5	2	3		1		2		4	2	5	2	5	3	
	7	4	9	4			4		9		3	5	4	5	8		
	3	2	4	2	5		0		1		2		4		4	0	1
	0	4	6	4	0				5		9		0		4		0
2	2	2	3	2	4	2	5	2	5	2	2	2	3	2	3	2	
		4	7	4	1	4	1	5		5	0	5	1	5	5	8	
	4		2		3		4	2	5		1		2		2	2	
			8		2		2	4	5		0		1		5	6	
	6		1		2		3		4		0		1		1	2	
			8		2		2		6				1		5	4	
	8		9		1		2		3	2	5	2	1		5	2	
					2		2		6	4	0	4				2	
	1	2	[?		2		1		2		4		5	2	5	2	9
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2	1	2	5	2	5	2	2	2	1	2	3	2	4	2	4	1	
	2	3	9	3		4		4	6	4	0	4	9	4	4	8	
	1		4		4	2	5		6		2		3		3	1	
	4		9		2	3	2				0		0		4	6	
	1		3		3		4	2	5		1		2		2	1	
	6		9		2		2	3	6		0		0		3	4	
	1		2		2		3		4	2	5	2	1		1	1	
	8		9		2		2		5	3	9	3	0		2	2	

Si	G	0	I	II	II	I	I	V	V	V	I	V	G	Si			
g.	r.	.	'	.	I'	.	'	.	I'	.	'	.	I'	r.	g.		
	2		1		1		2		3		4		5	2	2	1	9
	0		8		2		2		5		9		9	3		0	
2	2	2	5	2	1	2	1	2	2	2	3	2	4	2	5	8	
	2	2	8	3		3	2	3	5	3	8	3	8	3	1		
	2		4	2	5		1		1		2		3		4	6	
	4		8	2	1				4		7		7		1		
	2		3		4	2	5		4		1		2		3	4	
	6		8		1	2	1				6		7		0		
	2		2		3		4	2	5		6		1		1	2	
	8		8		1		1	2	4				6		9		
	3		1		2		3		4	2	5		5		8	0	9
	0		7		0		0		3	2	3						
3	2	2	7	2	1	2	1	2	3	2	4	2	5	2	5	2	
		2		2	0	2	9	2	3	2	6	2	5	2	8	8	
	4	2	5	2	5		8		2		3		4		4	2	
		1	6	1	9				2		5		4		7	6	
	6		4		4	2	5		1		2		3		3	2	
			6		9	1	4		1		4		3		6	4	
	8		3		3		4	2	1		1		2		2	2	
			6		9		8	2			4		3		6	2	
	1		2		2		3	2	5		3	2	1		1	2	8
	0		5		8		7	1	0			2	1		5	0	
3	1	2	1	2	1	2	2	2	4	2	5	2	1	2	4	1	
	2	1	5	1	8	1	6	1	0	1	2	2		2		8	
	1	2	5		8		1		2		4		5	2	5	1	
	4	0					6		9		1		0	1	3	6	
	1		5	2	5		7		1		3		4		4	1	
	6		6	0	9				9		2		0		3	4	
	1		4		5	2	5		9		2		3		3	1	
	8		6		0	0	7				2		0		3	2	
	2		3		4		4	2	5		1		2		2	1	8

Si g.	G r.	0		I		II		II		I		V		V		G r.	Si g.
		G	G	0	G	G	II	I	I	V	V	I	V	I			
		.	'	.	I'	.	'	.	I'	.	'	.	'	.	I'		
		0	6	0	0	7	0	9	2	0	3	0					
3	2	2	2	2	3	2	3	2	4	2	1	2	1	2	1	8	
	2	0	6	0	0	0	7	0	9	1		1	0	1	3		
	2		1		2		2		4	2	5	2	0		3	6	
	4		7		1		8		0	0	2	1					
	2		8		1		1		3		4		5	2	5	4	
	6				2		8		0		2		0	0	3		
	2	1	5		3		9		2		3		4		4	2	
	8	9	9						1		2		1		4		
	3		5	1	5	1	0	2	1		2		3		3	0	8
	0		0	9	4	9		0	2		3		2		5		
4	3	1	3	1	4	1	4	1	5	2	1	2	1	2	2	2	
		9	7	9	0	9	7	9	9	0	0	0	9	0	2	7	
	6		2		2		3		4	1	5	1	5		8	2	
			4		8		4		6	9	7	9				4	
	9		1		1		2		3		4	1	5	1	5	2	
			1		5		1		4		5	9	3	9	6	1	
	1		1		4		1		2		3		4		4	1	
	2						0		2		3		1		4	8	
	1	1	5	1	5		0		1		2		3		3	1	7
	5	8	0	8	4				0		1		1		3	5	
4	1	1	3	1	4	1	5	1	0	1	1	1	1	1	2	1	
	8	8	9	8	2	8	0	9		9	1	9	8	9	2	2	
	2		3		3		4	1	5		1		9		1	9	
	1		0		3		0	8	0						1		
	2		2		2		3		4	1	5	1	0		2	6	
	4		0		3		1		1	8	2	8					
	2		1		1		2		3		4	1	5	1	5	3	
	7		1		3		2		2		3	8	0	8	3		
	3	1	4	1	1		1		2		3		4		4	0	7
	0	8		8	4		4		4		5		2		5		

		0	I	II	II	I	I	V	V	V	I						
Si	G	G	0	G	G	II	G	II	G	V	I	V	G	V	G	Si	
g.	r.	.	'	.	I'	.	'	.	I'	.	'	.	'	.	I'	r.	g.
5	6	1	5	1	5	1	0	1	1	1	2	1	2	1	3	2	
		7	0	7	5	8		8	0	8	1	8	8	8	1	4	
	1		4		4	1	4	1	5		9		1		1	1	
	2		0		3	7	9	7	9				6		9	8	
	1		3		3		4		5		1		8		1	1	
	8		2		5		1		1						1	2	
	2		2		3		3		5	1	5	1	4		2	6	
	4		7		0		7		7	7	7	7					
	3	1	2	1	1	1	3		4		5		0		0	0	6
	0	7	5	7	8	7	5		5		7						

Foot sign-banner (completed signs of the equated solar anomaly): **XII | XI | X | IX | VIII | VII | VI**

Completed signs of the equated solar anomaly.

THE LATITUDES OF MERCURY

TABLE 92. Of the proportional minutes [scruples] of Mercury's latitude.

Completed signs of the equated eccentric anomaly of Mercury.

Top sign-banner (completed signs of the equated eccentric anomaly of Mercury):

0 | I | II | III | IV | V | VI

S
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S D
c e
r S c

S i g .	G r .	S c r .	0 G .	I G .	I G .	I G .	I G .	I G .	V G .	V G .	V G .	V G .	V G .	V G .	V G .	2 G .	2 G .	3 G .	3 G .	3 G .	2 G .	S c r .	D e c r .	S c r .	S c r .	G i g .
1	6	5	5	1	2	1	5	1	1	1	4	2	1	2	1	2	3	5	3	3	2					
		2	4	6	8	6	4	8	2	9	5	1	2	2	3	2	1	4	6	3	4					
	1	5	4		3	1	5		2	2	4		3		3		5	5	1	3	1					
	2	0	0		9	7		4	0				3		5		4	2	8	2	8					
	1	4	3		5		2		4		2		5	2	5		2	4	2	3	1					
	8	7	7		4		1		3		4		4	3			4	9	2	0	2					
	2	4	4	1	1		4	1	6		4	2	1		2		4	4	3	2	6					
	4	4	0	7	1		0	9		8	2	8		5		9	6	8	9							
	3	4	4		3	1	1		3	2	1		4		5	2	2	4	1	2	0					
	0	0			1	8			4	1	5		9		8	4	3	3	2	8						
2	6	3	2	1	5	1	2	2	4	2	4	2	2	2	3	2	2	3	1	2	2					
		6	3	7	4	8	8	0	0	1	7	3	5	4	6	5		9	8	6	4					
	1	3	1	1	1	1			3	2	2	2	5	2	1		4	3	6	2	1					
	2	0	8	8	9	9			6	2	1	4		5	8		4	5	5	8						
	1	2	2		4	1	2	2	1		5	2	0	2	3		5	3	0	2	1					
	8	4	4		8	9	6	1	3		7	5		6	5		0	0	3	2						
	2	1	6	1	1	2	0		5	2	3		2		1	2	4	2	0	2	6					

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S i g .	G r .	S c r .	S c r .	0 G .	I G .	I G .	I G .	I G .	I G .	V G .	V G .	V G .	V G .	V G .	V G .	2 G .	2 G .	2 G .	2 G .	S c r .	D e c r .	S c r .	G i g .
3	1	6	5	2	5	2	4	2	1	2	3	3	9	3	5	3	4	4	3	1	1		
	8		6	1	2	2	5	5	8	7	0	0		2		2	8		1		3	2	
	2	9	2	2	1	2	9		4	2	0		3	3	3	3	4	8	1		1	9	
	1		1	2	5	3			6	8			3	3	8	3	8		8		8	2	
	2	1	5		3		3	2	1		4	3	3	3	3	3	2	1	6		1	6	
	4	1	5		8		4	6	6		2	1	7	4	4	4	8	2			1		
	2	1	3	2	2	2	0		4	2	2	3	2		3		2	7	5		1	3	
	7	4	0	3		4			8	9	2	2	4		3		2		9		0		
	3	1	1		2		2	2	2	3	3		5	3	1	3	3	2	1		1	0	
	0	7	1		6		8	7	0	0			3	5	3	5	2		1		0		
4	3	1	4	2	5	2	5	2	5	3	4	3	4	3	5	3	2	1	2		9	2	
		9	0	3	0	4	6	7	3	0	4	3	1	5	7	7	6	2	3			7	
	6	2	2	2	1	2	2	2	2	3	2	3	4	3	3	3	3	1	4		8	2	
		2	3	4	5	5	0	8	4	1	7	4	9	7	7	8	2	4	3			4	
	9	2	5		4		4		5	3	1	3	4	3	4	3	4	1	1		7	2	
		5			1		7		6	2	2	5	1	8	3	9	3	7	3			1	
	1	2	5	2	7	2	1	2	3		5	3	4	3	5	4	5	1	4		7	1	

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2	7	4	5	6	7	9	0	8	6	3	9	3	0	6	9	8	8						
1	3	4	3	4	3	4	3	4	3	4	4	7	4	1	2	1	6	1					
5	0	3	3	3	0	3	7	7	1	1	2	2	2	2			5						
4	1	3	3	2	5	2	1	3	3	3	3	3	4	4	2	4	2	2	2	5	1		
8	3	2	5	9	7	2	0	9	4	5	8	8	2	5	3	6	6	6			2		
																					[?]
2	3	2	2	2	2	1	3	1	3	2	3	5	4	4	4	5	2	1			4	9	
1	6	1	6	5	8		1	1	5	4	9	5	3	4	4	8	8	7					
2	3	1		5	2	9	3	4	3	1	4	4	4	5	4	2	3	2			4	6	
4	9	2		2	8		1	7	6	5	1		4	9	6	6	1	1					
2	4	5	2	1		3	3	2	3	5		5	4	4	4	3	3	2			3	3	
7	1	5	7	7		7	2	1	7			3	6	7	7	5	4	8					
																					[?]

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S i g .	G r .	S c r .	0 G .	I G .	I G .	I G .	I G .	I G .	V G .	V G .	V G .	V G .	V G .	2 G .	2 G .	3 G .	3 G .	S c r .	D e c r .	S c r .	G i g .	
	3	4	3	4	2	3	3	5	3	5	4	4	4	4	4	2	3	3		3	0	
	0	4	0	0	9		2	2	7	5	2	7	7	9	9	4	7	4				
5	3	4	1	2	4	2	2	3	2	3	4	4	6	4	1	5	5	4	4		2	2
	7	5	8		9	7	5	5	8	4	4		9	5	0	2	0	1			7	
6	4	5		2		5		5	3	3		5	5	3	5	2	4	5		2	2	
	9	0		8		4		5	9	3		0	0	6	2	6	3	7			4	
9	5	1		4	3	1	3	3	4	1	4	3	5	2	5	5	4	1		1	2	
	2			8	0	4	4	1	0	4	6	8	2		3	4	7	2			1	
1	5	3	2	4		3		4		5	4	3	5	1	5	3	4	5		1	1	
2	3	8	9			3		5		3	7	6	3	6	6	1	9	4			8	
1	5	5		1		4	3	4	4	2	4	2	5	2	5	3	5	3		1	1	
5	5			7		7	5		1	7	8	9	4	3	6	1	2	4			5	
5	1	5	2	2	2	3	0	3	2	4	5	4	1	5	3	5	5	5		0	1	
	8	6	7	9	9	1		5	1	1	7	9	5	5	3	7	5	4	9			2
2	5	4	2	4		1		3	4	2		5	5	1	5	3	5	1		0	9	
1	7	0	9	0		2		5	2	1		6	6	6	8	8	6	7				
2	5	4		4		2	3	0		5	5	2	5	1	5	1	5	2		0	6	

S c r . p r o p . i n c r & d e																				S	D		
S	c	S	0		I		I	I	V		V		V	2	c	r	S	c	S				
i	G	r	c		I		I	I		I		I		I	V		I	V	r	.	G	i	
g	r	G	r	G	0	G	I	G	I	G	I	G	V	G	V	G	I	G	2	σ	r	g	
.	.	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	
4	8	1		9		2	6			0	0	5	7	7	9	7	8	8					
								[
								?															
]															
2	5	2		5		3	5	4	7		5		1	5	4	5	2		0	3			
7	9	9		6		0	9	3		4		7	9	2	9	2							
								[
								?															
]															
3	6	0	3	1		3	3	4	4	4	5	1	5	3	6	0	6	0		0	0		
0	0		0			6	6	3	3		1	1	7	4	0	0							

Foot sign-banner (completed signs of the equated eccentric anomaly of Mercury):
XII | XI | X | IX | VIII | VII | VI

Completed signs of the equated eccentric anomaly of Mercury.

Parsing notes: TABLE 92 is extremely dense (twenty body columns plus two argument columns and the conjunction-decrement column). It sits at the scan's DPI floor: the increment/decrement reversal sub-blocks (Sig.3 g3–g15 and the

Sig.4/Sig.5 middle sign-blocks) are physically faint and ink-spread across the gutter, so the residual [?] flags here are genuine illegibility, not mere misalignment. The further table-reprocess confirmed this zone could not be resolved at the available resolution; the residual [?] cells are retained verbatim and TABLE 92's reversal sub-blocks remain a review-within for a higher-resolution pass. The "A." (max, =60) at top and "B." (min, =0) at the proportional-minutes turning point are printed as in the source.

THE LATITUDES OF MERCURY (continued)

TABLE 93. Of the decrement of the proportional minutes [scruples] of Mercury's latitude in retrograde conjunction; when the anomaly of the orbit corresponds to the lower minutes [scruples] of the next-to-last column of the preceding table.

Completed signs of the equated eccentric anomaly of Mercury.

Top sign-banner (completed signs of the equated eccentric anomaly of Mercury):

0 | I | II | III | IV | V | VI

0	I	II	III	IV	V	VI	Sig.	Gr.	0 G.	0'	I G.	I'	II G.	II'	III G.	III'	IV G.	IV'	V G.	V'	VI G.	VI'	Gr.	Sig.																																																																																																																																																																																																																																																
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0	0	3	46	3	38	18	2	46	10	1	39	1	29	0	12	6	45	37	17	45	10	39	29	24	12	43	35	15	44	9	38	28	18	18	41	33	13	43	8	38	28	12	24	37	30	10	40	6	36	26	6	30	32	26	7	37	3	33	24	0	11	1	6	3	28	3	21	3	2	2	33	1	59	1	29	1	22	24	12	22	15	57	29	56	26	20	18	18	15	9	51	25	52	23	17	12	24	8	2	43	19	48	21	14	6	30	2	54	2	54	38	12	43	19	11	0	10	2	6	2	50	2	41	2	29	2	7	1	38	1	16	1	7	24	12	40	35	20	1	58	33	8	[?]	0	59	18	18	30	25	11	51	27	0	59	0	55	12	24	19	19	2	43	20	55	6	[?]	6	30	2	8	2	4	1	52	35	13	0	57	50	0	9	3	6	1	56	1	52	1	41	1	26	1	7	0	52	48	24	12	44	39	31	17	50	[?]	47	41	18	18	29	25	19	8	0	55	[?]	42	35	12	24	17	13	8	0	59	46	36	31	6	30	1	6	1	4	58	49	38	30	27	0	8	4	6	0	55	0	53	0	48	0	40	0	32	0	25	0	22	24	12	44	42	38	32	25	20

| | 18 | 18 | | | 18 | | 33 | | 31 | | 28 | | 24 | | 18 | | 14 | | 13 | 12 | | | 24 |
 | 23 | | 22 | | 20 | | 18 | | 14 | | 9 | | 9 | 6 | | | 30 | | 17 | | 16 | | 13 | | 13 | |
 10 | | 7 | | 7 | 0 | 7 | | 5 | 6 | 0 | 12 | 0 | 12 | 0 | 11 | 0 | 9 | 0 | 7 | 0 | 5 | 0 | 5 |
 24 | | | | 12 | | 11 | | 7 | | 7 | | 6 | | 5 | | 4 | | 4 | 18 | | | 18 | | 3 | | 4 | | 5 |
 | 3 | | 3 | | 3 | | 3 | 12 | | | 24 | | 1 | | 1 | | 2 | | 1 | | 1 | | 1 | | 1 | 6 | | |
 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |

Foot sign-banner: XII | XI | X | IX | VIII | VII | VI

TABLE 87. Of the latitude, reduction, and curtation of Mercury.

Signs of Mercury's distance from the ascending [boreal] node.

Block 1 — **0 Boreal. / VI Austral.**; Block 2 — **I Boreal. / VII Austral.**; Block 3 — **II Boreal. / VIII Austral.**

	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
D	1	B	B	1	1	1	2	B	B	2	2	2	3	B	B	3	3	3	D
i	L	1	1	R	C	C	L	2	2	R	C	C	L	3	3	R	C	C	i
s	a	L	R	e	u	u	a	L	R	e	u	u	a	L	R	e	u	u	s
t.	t.	a	e	d	r	r	t.	a	e	d	r	r	t.	a	e	d	r	r	t.
G	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G
r.	.	'	'	"	'	"	.	'	'	"	'	"	.	'	'	"	'	"	r.
0	0	0	0	0	0	0	3	1	1	3	5	1	5	5	1	3	8	5	3
								4	1			1		5	1			9	0
1	0	7	0	2	0	1	3	1	1	1	5	2	5	5	1	4	9	9	2
				8		1		6	1	6		1		2	1	9			9
2	0	1	0	5	0	2	3	2	1	2	5	3	5	4	1	3	9	9	2
		3		4		2		5	1	7		0		2	0	4			8
3	0	2	1	2	0	3	3	3	1	3	5	3	5	4	1	1	9	1	2
		0		2		3		1	1	9		9		3	0	9		4	7
4	0	2	1	4	0	4	3	3	1	5	5	4	5	4	1	3	9	1	2
		7		6		4		6	1	0		8		8	0			9	6
5	0	3	2	1	0	5	3	4	1	5	5	5	5	5	9	4	9	2	2
		4		3		5		2	1	9		7		1		6		4	5
6	0	4	2	3	1	8	3	4	1	5	6	6	5	5	9	2	9	2	2
		1		9				8	2					4		8		8	4
7	0	4	3	5	1	1	3	5	1	1	6	1	5	5	9	1	9	3	2
		7				6		4	2	5		5		7		0		2	3

	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	
D	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3	D	
i	L	L	R	C	C	L	L	R	C	C	L	L	R	C	C	C	i		
s	a	a	e	d	r	r	a	e	d	r	r	a	e	d	r	r	s		
t.	t.	t.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	t.		
G	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G	t.	d	.	t.		
r.	.	'	'	"	'	"	.	'	'	"	'	"	.	'	'	"	'	r.	
8	0	5	3	3	1	2	3	5	1	2	6	2	5	5	8	5	9	3	2
		4		0		6		9	2	2		3		9		1		6	2
9	1	0	3	5	1	3	4	4	1	3	6	3	6	2	8	3	9	4	2
				6		7			2	3		2				2		0	1
1	1	7	4	2	1	4	4	9	1	3	6	4	6	4	8	1	9	4	2
0				1		8			2	3		0				2		4	0
1	1	1	4	4	1	5	4	1	1	3	6	4	6	6	7	5	9	4	1
1		4		7		9		4	2	8		8				1		8	9
1	1	2	5	1	2	1	4	1	1	4	6	5	6	8	7	2	9	5	1
2		1		1		0		9	2	6		6				9		2	8
1	1	2	5	3	2	2	4	2	1	5	7	4	6	1	7	8	9	5	1
3		7		6		0		4	2	1				0				5	7
1	1	3	5	5	2	3	4	2	1	4	7	1	6	1	6	4	9	5	1
4		4		9		0		9	2	4		2		2		6		8	6
1	1	4	6	2	2	4	4	3	1	4	7	2	6	1	6	2	1	1	1
5		0		3		1		4	2	5		0		4		3	0		5
1	1	4	6	4	2	5	4	3	1	4	7	2	6	1	5	5	1	4	1
6		6		6		1		8	2	4		8		5		9	0		4
1	1	5	7	8	3	2	4	4	1	4	7	3	6	1	5	3	1	7	1
7		3						3	2	7		5		7		6	0		3
1	1	5	7	2	3	1	4	4	1	4	7	4	6	1	5	1	1	1	1
8		9		9		2		7	2	0		2		8		1	0	0	2
1	2	6	7	5	3	2	4	5	1	3	7	4	6	1	4	4	1	1	1
9				1		3		2	2	8		9		9		7	0	1	1
2	2	1	8	1	3	3	4	5	1	3	7	5	6	2	4	2	1	1	1
0		2		2		3		6	2	3		7		0		3	0	3	0
2	2	1	8	3	3	4	5	1	1	2	8	4	6	2	3	5	1	1	9
1		9		2		3			2	8				2		6	0	5	
2	2	2	8	5	3	5	5	5	1	2	8	1	6	2	3	3	1	1	8

	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	
D	1	B	B	1	1	1	2	B	B	2	2	2	3	B	B	3	3	3	D
i	L	1	1	R	C	C	L	2	2	R	C	C	L	3	3	R	C	C	i
s	a	L	R	e	u	u	a	L	R	e	u	u	a	L	R	e	u	u	s
t.	t.	a	e	d	r	r	t.	a	e	d	r	r	t.	a	e	d	r	r	t.
G	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G	t.	d	.	t.	t.	G
r.	.	'	'	"	'	"	.	'	'	"	'	"	.	'	'	"	'	"	r.
2	5		1		3			2	3		1		3	0	0	6			
2	2	3	9	1	4	3	5	9	1	1	8	1	6	2	3	9	1	1	7
3		1		0					2	8		7		4			0	7	
2	2	3	9	2	4	1	5	1	1	1	8	2	6	2	2	3	1	1	6
4		7		8		3		3	2	2		3		5		9	0	8	
2	2	4	9	4	4	2	5	1	1	5	8	2	6	2	2	1	1	1	5
5		4		6		3		7	1	9		9		5		3	0	9	
2	2	5	1	3	4	3	5	2	1	5	8	3	6	2	1	4	1	2	4
6		0	0			3		1	1	0		5		6		6	0	0	
2	2	5	1	1	4	4	5	2	1	3	8	4	6	2	1	2	1	2	3
7		6	0	9		3		5	1	9		1		6		2	0	1	
2	3	2	1	3	4	5	5	2	1	2	8	4	6	2	0	5	1	2	2
8			0	4		2		8	1	7		7		7		4	0	1	
2	3	8	1	4	5	2	5	3	1	1	8	5	6	2	0	2	1	2	1
9			0	9				2	1	6		3		7		7	0	2	
3	3	1	1	3	5	1	5	3	1	3	8	5	6	2	0	0	1	2	0
0		4	1			1		5	1			9		7			0	2	

Block footers (reading upward): **V Boreal. XI Austral. | IV Boreal. X Austral. | III Boreal. IX Austral.**

Signs of Mercury's distance from the ascending [boreal] node.

Parsing notes: TABLE 87 — the Reductio and Curtation sub-columns of Blocks 2 and 3 are tightly set against the gutter; the further table-reprocess resolved the bulk of the earlier minute/second [?] flags against the smooth column progressions. The B2 Latitudo-G degree column was reported as column-slip-prone in the reprocess (its leading 5/1 digits confuse), but the batch readings (5°-series, physically consistent with the latitude growing with node distance) are retained as printed; the reprocess's alternate degree readings were not adopted where they broke the column's internal consistency. The Latitudo G. column in

Block 1 jumps from 0 to 1 around distance 9°, as expected for the latitude growing with node distance. Residual [?]: B3 Red." at Dist.23 (9[?]) and B2 Red.' at Dist.26 (50[?]) remain faint at the DPI floor.

Astronomiae Reformatae — Tomus II, *Tabulae novalmagesticae*, Part V (batch 183, PDF pp. 547–549)

All three pages of this batch belong to a single multi-page table: **TABVLA 95, the orbital prostaphaereses** [*Prostaphaeresis Orbis*] for the five planets (Saturn ♄, Jupiter ♃, Mars ♂, Venus ♀, Mercury ☿). The table is the *maximum* (composite) equation as a function of the planet's distance (the argument). The pages are paginated 95, 96, 99 in the source (a printed pagination jump between p. 96 and p. 99 — flagged in the report).

The table is read in two directions: the heading **ADDE** ("ADD") applies when entering from the top with the argument increasing downward, and the foot label **SVBTRAHE** ("SUBTRACT") applies when entering from the bottom with the argument increasing upward. The outer **G.** columns (left and right) give the degree of the argument; the **S** marks at the four corners denote the entry sense (top vs. foot). Each interior column is headed by its argument-degree value (5, 6, 7, ... 18) and is divided into sub-columns **Gr. ' "** (degrees, minutes, seconds of the equation).

TABVLA 95. *Prostaphaeresis Orbis* ♄, ♃, ♂, ♀, ☿, à Clariss. Dn. de S. Legier, Aucion. excogitata, & exactè computata. ("TABLE 95. The orbital prostaphaeresis of Saturn, Jupiter, Mars, Venus, and Mercury, devised by the most distinguished Monsieur de Saint-Légier of Avignon, and exactly computed.")

Sub-heading: *Æquatio maxima, seu composita* — "The maximum, or composite, equation." Top label: **ADDE** ("ADD").

The argument column headers run **5, 6, 7, 8, 9, 10, 11, 12, 17, 18** (degrees), with the left stub **G.** giving the argument degree 1–30 (in groups of five), and a right stub **G.** counting 29 → 1. Each cell is ° ' " of the equation; the leading degree digit (0–5) is given once per cell.

Parsing note: this is a very dense full-page sexagesimal table; values are transcribed as read. Where a glyph could not be resolved with confidence it is marked [?].

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
1	04 49	05 41	06 31	07 20	08 7	08 52	09 36	0 10	0 13	0 14	29
								20	34	11	
2	09 37	0 11	0 13	0 14	0 16	0 17	0 19	0 20	0 27	0 28	28
		22	2	40	14	45	13	39	9	20	
3	0 14	0 17	0 19	0 22	0 24	0 26	0 28	0 30	0 40	0 42	27
	26	2	33	0	21	38	49	59	43	30	
4	0 19	0 22	0 26	0 29	0 32	0 35	0 38	0 41	0 54	0 56	26
	14	42	3	19	28	30	25	18	17	38	
5	0 24	0 28	0 32	0 36	0 40	0 44	0 48	0 51	17 50	1 10	25
	2	22	33	38	34	21	0	36		47	
6	0 28	0 34	0 39	0 43	0 48	0 53	0 57	11 54	1 21	1 24	24
	49	1	3	56	38	12	35		23	55	
7	0 33	0 39	0 45	0 51	0 56	12 3	17 11	1 12	1 34	1 39	23
	36	41	33	14	43			11	55	3	
8	0 38	0 45	0 52	0 58	14 48	1 10	1 16	1 22	1 48	1 53	22
	23	20	2	31		53	45	28	27	10	
9	0 43	0 50	0 58	15 48	1 12	1 19	1 26	1 32	21 57	27 16	21
	9	57	30		51	42	18	44			
10	0 47	0 56	14 57	1 13	1 20	1 28	1 35	1 43	2 15	2 21	20
	55	34		3	54	30	51	0	27	21	
11	0 52	12 11	1 11	1 20	1 28	1 37	1 45	1 53	2 28	2 35	19
	40		23	18	56	17	23	14	56	25	
12	0	17	1	1	1	1	1	23	2	2	18

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	57	46	17	27	36	46	54	27	42	49	
	24		48	32	57	3	53		23	28	
13	1 2	1	1	1	1	1	2 4	2	2	3 3	17
	7	13	24	34	44	54	22	13	55	30	
		21	13	45	56	48		37	49		
14	1 6	1	1	1	1	2 3	2	2	3 9	3	16
	49	18	30	41	52	32	13	23	14	17	
		55	37	57	54		50	47		30	
15	1	1	1	1	2 0	2	2	2	3	3	15
	11	24	36	49	52	12	23	33	22	31	
	31	28	59	7		15	16	56	37	29	
16	1	1	1	1	2 8	2	2	2	3	3	14
	16	30	43	56	48	20	32	44	35	45	
	22	0	21	17		56	40	3	59	26	
17	1	1	1	2 3	2	2	2	2	3	3	13
	20	35	49	25	16	29	42	54	49	59	
	51	30	40		42	35	3	9	19	22	
18	1	1	1	2	2	2	2	3 4	4 2	4	12
	25	40	55	10	24	38	51	13	36	13	
	29	58	58	31	34	12	25			16	
19	1	1	2 2	2	2	2	3 0	3	4	4	11
	30	46	15	17	32	46	45	14	15	27	
	6	26		35	25	48		16	51	7	
20	1	1	2 8	2	2	2	3	3	4	4	10
	34	51	31	24	40	55	10	24	29	40	
	42	53		38	14	22	3	16	8	57	
21	1	1	2	2	2	3 3	3	3	4	4	9
	39	57	14	31	48	54	19	34	42	54	
	16	17	44	39	2		19	13	20	45	
22	1	2 2	2	2	2	3	3	3	4	5 8	8
	43	40	20	38	55	12	28	44	55	30	
	49		56	38	47	25	32	8	30		
23	1	2 8	2	2	3 3	3	3	3	5 8	5	7
	48	2	27	45	30	20	37	54	38	22	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	21		6	36		53	44	2		13	
24	1	2	2	2	3	3	3	4 3	5	5	6
	52	13	33	52	11	29	46	54	21	35	
	51	22	14	31	11	18	52		42	53	
25	1	2	2	2	3	3	3	4	5	5	5
	57	18	39	59	18	37	55	13	34	49	
	19	39	20	23	49	41	59	43	44	32	
26	2 1	2	2	3 6	3	3	4 5	4	5	6 3	4
	46	23	45	13	26	46	3	23	47	7	
		55	24		26	2		29	44		
27	2 6	2	2	3	3	3	4	4	6 0	6	3
	10	29	51	13	34	54	14	33	41	16	
		9	26	3	0	20	3	11		39	
28	2	2	2	3	3	4 2	4	4	6	6	2
	10	34	57	19	41	35	23	42	13	30	
	33	21	25	49	31		1	52	35	9	
29	2	2	3 3	3	3	4	4	4	6	6	1
	14	39	21	26	48	10	31	52	26	43	
	54	31		32	59	48	58	28	25	36	
30	2	2	3 9	3	3	4	4	5 2	6	6	30
	19	44	17	33	56	18	40	4	39	56	
	13	38		14	25	58	51		13	59	
1	2	2	3	3	4 3	4	4	5	6	7	29
	23	49	15	39	48	27	49	11	51	10	
	31	42	9	51		5	40	37	57	19	
2	2	2	3	3	4	4	4	5	7 4	7	28
	27	54	20	46	11	35	58	21	14	23	
	46	46	59	27	8	8	26	3		16	
3	2	2	3	3	4	4	5 7	5	7	7	27
	31	59	26	53	18	43	9	30	17	36	
	59	48	46	0	25	9		27	14	49	
4	2	3 4	3	3	4	4	5	5	7	7	26
	36	45	32	59	25	51	15	39	29	49	
	9		31	29	40	6	49	48	42	57	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
5	2	39	3	45	4	4	5	5	7	83	25
	40	40	38	56	32	59	24	49	41	3	
	18		12		51	0	25	5	18		
6	2	3	3	4	4	56	5	5	7	8	24
	44	14	43	12	39	50	32	58	54	16	
	24	32	50	19	58		58	20	44	4	
7	2	3	3	4	4	5	5	67	87	8	23
	48	19	49	18	47	14	41	30	6	29	
	28	23	26	39	2	37	27			1	
8	2	3	3	4	4	5	5	6	8	8	22
	52	24	54	24	54	22	49	16	19	41	
	29	10	58	54	2	20	51	35	14	56	
9	2	3	40	4	50	5	5	6	8	8	21
	56	28	27	31	58	29	58	25	31	54	
	27	53		5		59	11	37	37	44	
10	30	3	45	4	57	5	66	6	8	97	20
	23	33	53	37	51	37	28	34	43	26	
		35		15		34		35	55		
11	34	3	4	4	5	5	6	6	8	9	19
	16	38	11	43	14	45	14	43	55	20	
		13	15	24	40	4	41	28	50	8	
12	38	3	4	4	5	5	6	6	97	9	18
	7	42	16	49	21	52	22	52	49	32	
		48	34	27	28	28	49	16		43	
13	3	3	4	4	5	5	6	71	9	9	17
	11	47	21	55	28	59	30	1	19	45	
	54	20	51	26	5	55	53		41	13	
14	3	3	4	51	5	67	6	79	9	9	16
	15	51	27	21	34	13	38	40	31	57	
	39	49	3		43		52		34	39	
15	3	3	4	57	5	6	6	7	9	10	15
	19	56	32	12	41	14	46	18	43	10	
	21	15	14		16	28	46	14	19	6	
16	3	40	4	5	5	6	6	7	9	10	14

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	23	36	37	12	47	21	54	26	54	22	
	0		18	59	44	37	36	44	58	14	
17	3	4 4	4	5	5	6	7 2	7	10	10	13
	26	54	42	18	54	28	21	35	6 5	34	
	36		17	41	7	41		16		24	
18	3	4 9	4	5	6 0	6	7	7	10	10	12
	30	10	47	24	27	35	10	43	18	46	
	9		12	19		41	1	28	0	28	
19	3	4	4	5	6 6	6	7	7	10	10	11
	33	13	52	29	41	42	17	51	29	58	
	39	21	4	53		36	36	42	22	21	
20	3	4	4	5	6	6	7	7	10	11	10
	37	17	56	35	12	49	25	59	40	10	
	5	29	54	22	51	26	6	51	39	19	
21	3	4	5 1	5	6	6	7	8 7	10	11	9
	40	21	37	40	18	56	32	54	51	22	
	28	33		47	56	11	30		49	6	
22	3	4	5 6	5	6	7 2	7	8	11	11	8
	43	25	17	46	24	50	39	15	2	33	
	47	25		7	55		48	51	52	45	
23	3	4	5	5	6	7 9	7	8	11	11	7
	47	29	10	51	30	23	47	23	13	45	
	5	27	53	21	50		1	42	45	18	
24	3	4	5	5	6	7	7	8	11	11	6
	50	33	15	56	36	15	54	31	24	56	
	14	19	24	31	39	51	8	28	50	45	
25	3	4	5	6 1	6	7	8 1	8	11	12	5
	53	37	19	37	42	22	9	39	35	8 6	
	23	7	50		22	12		8	24		
26	3	4	5	6 6	6	7	8 8	8	11	12	4
	56	40	24	38	48	28	4	46	46	19	
	30	52	12		3	28		41	23	20	
27	3	4	5	6	6	7	8	8	11	12	3
	59	44	28	11	53	34	14	54	56	30	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	32	30	30	33	37	38	53	7	36	28	
28	4 2	4	5	6	6	7	8	9 1	12	12	2
	29	48	32	16	59	40	21	36	7 6	41	
		5	42	23	8	49	36			17	
29	4 5	4	5	6	7 4	7	8	9 8	12	12	1
	24	51	36	21	33	46	28	56	17	51	
		36	49	8		48	12		26	3	
30	4 8	4	5	6	7 9	7	8	9	12	13	10
	14	55	40	25	47	52	34	15	27	3 3	
		2	50	47		40	42	48	26		

Foot label: **SVBTRAHE** ("SUBTRACT"). Signature: **R 2**.

Page number **96** top left.

TABVLA 95. *Prostaphaeresis Orbis* ♃, ♄, ♂, ♀, ♁. (continuation of Table 95 — same five planets).

Sub-heading: *Æquatio maxima, seu composita* — "The maximum, or composite, equation." Top label: **ADDE** ("ADD"). Argument-degree column headers: **5, 6, 7, 8, 9, 10, 11, 12, 17, 18**. Left stub continues the argument count; right stub counts downward.

Parsing note: this page is more faded than p. 547, with several columns lightly inked at the right edge near the gutter; doubtful glyphs are flagged [?]. The left-stub group markers (2, 3, 4 in the margin) denote the running sign/group of the argument as on the facing page.

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
1	4	4	5	6	7	7	8	9	12	13	29
	11	58	44	30	14	58	41	22	37	13	
	0	23	49	20	51	27	6	48	27	41	
2	4	5 1	5	6	7	8 4	8	9	12	13	28
	13	41	48	34	19	7	47	29	47	24	
	42		41	47	54		23	41	20	9	
3	4	5 4	5	6	7	8 9	8	9	12	13	27
	16	52	52	39	24	40	53	36	57	34	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	20		29	10	52		32	26	7	31	
4	4	5 8	5	6	7	8	8	9	13	13	26
	18	0	56	43	29	15	59	43	6	44	
	54		10	26	44	7	35	5	49	44	
5	4	5	5	6	7	8	9 5	9	13	13	25
	21	11	59	47	34	20	30	49	16	54	
	24	3	47	37	29	27		37	13	47	
6	4	5	6 3	6	7	8	9	9	13	14	24
	23	14	17	51	39	25	11	56	25	4	
	50	1		41	8	40	18	0	32	45	
7	4	5	6 6	6	7	8	9	10	13	14	23
	26	16	43	55	43	30	16	2	34	14	
	12	51		39	41	48	59	15	43	29	
8	4	5	6	6	7	8	9	10	13	14	22
	28	19	10	59	48	35	22	8	43	24	
	30	42	3	33	5	48	33	25	46	6	
9	4	5	6	7 3	7	8	9	10	13	14	21
	30	22	13	19	52	40	28	14	52	33	
	42	26	18		25	39	0	28	41	35	
10	4	5	6	7 6	7	8	9	10	14	14	20
	32	25	16	57	56	45	33	20	1	42	
	50	3	26		35	21	15	14	24	14	
11	4	5	6	7	8 0	8	9	10	14	14	19
	34	27	19	10	40	49	38	25	9	51	
	54	35	28	30		56	25	56	59	3	
12	4	5	6	7	8 4	8	9	10	14	15	18
	36	30	22	13	38	54	43	31	18	1 4	
	54	2	22	56		24	25	11	25		
13	4	5	6	7	8 8	8	9	10	14	15	17
	38	32	25	17	28	58	48	36	26	9 3	
	48	25	14	16		50	16	56	36		
14	4	5	6	7	8	9 3	9	10	14	15	16
	40	34	27	20	12	2	53	42	34	18	
	38	42	58	30	12		4	14	45	34	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)	
15	4	5	6	7	8	9	7	9	10	14	15	15
	42	36	30	23	15	4	57	47	42	27		
	24	53	36	36	46		42	22	23	0		
16	4	5	6	7	8	9	10	10	14	15	14	14
	44	38	33	26	19	11	2	7	52	50	35	
	4	17	8	37	14	6		11	23	17		
17	4	5	6	7	8	9	10	10	14	15	13	13
	45	40	35	29	22	14	6	57	57	43		
	40	38	34	25	33	55	27	11	56	24		
18	4	5	6	7	8	9	10	11	15	15	12	12
	47	42	37	32	25	18	10	1	5	51		
	12	55	54	11	46	36	37	53	18	20		
19	4	5	6	7	8	9	10	11	15	15	11	11
	48	44	40	34	28	22	14	6	12	55		
	38	41	8	50	51	9	39	33	29	1		
20	4	5	6	7	8	9	10	11	15	16	10	10
	49	46	42	37	31	25	18	10	19	6		
	59	25	13	21	48	31	30	43	28	37		
21	4	5	6	7	8	9	10	11	16	16	9	9
	51	48	44	39	34	38	22	14	13	13		
	15	0	11	43	35	46	12	54	56	56		
22	4	5	6	7	8	9	10	11	15	16	8	8
	52	49	47	41	37	31	25	18	32	21		
	26	34	7	59	15	52	44	55	49	5		
23	4	5	6	7	8	9	10	11	15	16	7	7
	53	50	47	44	39	34	29	22	39	28		
	33	57	48	6	47	49	8	46	14	0		
24	4	5	6	7	8	9	10	11	15	16	6	6
	54	52	49	46	42	37	32	26	45	34		
	35	16	28	7	10	37	22	26	19	43		
25	4	5	6	7	8	9	10	11	15	16	5	5
	55	53	51	48	44	40	35	29	51	41		
	30	30	0	0	25	14	27	57	13	14		
26	4	5	6	7	8	9	10	11	15	16	4	4

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	56	54	52	49	46	42	38	33	57	47	
	21	37	26	44	33	43	20	16	5	30	
									[?]		
27	4	5	6	7	8	9	10	11	16	16	3
	57	55	53	51	48	45	41	36	2	53	
	7	35	45	21	28	1	4	24	37	34	
28	4	5	6	7	8	9	10	11	16	16	2
	57	56	55	52	50	47	43	39	7	59	
	47	32	0	50	16	3	37	21	55	22	
29	4	5	6	7	8	9	10	11	16	17	1
	58	57	56	54	51	49	45	42	12	4	
	23	20	12	10	55	13	59	6	59	58	
30	4	5	6	7	8	9	10	11	16	17	30
	58	58	56	55	53	51	48	44	17	10	
	52	2	24	24	27	3	10	42	50	20	
1	4	5	6	5	7	8	9	10	11	16	29
	59	58	57	56	57	56	54	50	47	22	
	17	39	43	27	23	1	16	9	5	26	
2	4	5	5	7	8	9	10	11	16	17	28
	59	59	58	57	56	54	52	49	26	24	
	36	8	21	23	1	16	0	22	47	53	
3	4	5	5	7	8	9	10	11	16	17	27
	59	59	58	58	57	55	53	51	30	27	
	49	42	39	11	0	34	7	27	57	21	
4	4	5	5	7	8	9	10	11	16	17	26
	59	59	59	58	57	56	55	53	34	29	
	57	47	25	49	58	44	7	7	48	17	
5	5 0	5	5	7	8	9	10	11	16	17	25
	0	59	59	59	58	57	56	54	38	31	
		57	44	21	47	43	13	42	24	26	
6	5 0	6 0	5	7	8	9	10	11	16	17	24
	0	0	59	59	59	58	57	56	41	33	
			56	42	15	33	11	0	4	0	
7	4	5	7 0	7	8	9	10	11	16	17	23

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	59	59	0	59	59	59	58	56	44	34	
	49	55		55	40	6	24	17	12	26	
8	4	5	6	7	8	9	10	11	16	17	22
	59	59	59	59	59	59	58	57	45	40	
	35	48	51	51	37	6	35	12	47	56	
9	4	5	6	7	8	9	10	11	16	17	21
	59	59	59	59	59	59	58	58	46	43	
	16	31	24	24	53	35	35	18	35	56	
10	4	5	6	7	8	10	10	11	16	17	20
	58	59	59	59	59	0 0	59	59	47	46	
	50	7	24	35	53		54	35	26	36	
11	4	5	6	7	8	11	11	12	16	17	19
	58	58	58	58	59	0 0	59	0 0	54	56	
	20	37	57	57	54		54		25	0	
12	4	5	6	7	8	10	12	12	16	17	18
	57	58	58	58	59	59	0 0	0 0	56	56	
	41	5	22	48	11	9			0	0	
13	4	5	6	7	8	9	10	11	16	17	17
	57	57	58	58	58	59	59	59	58	56	
	4	16	0	8	40	8	39	8	35	0	
14	4	5	6	7	8	9	10	11	16	17	16
	56	56	57	58	58	58	59	58	59	56	
	16	27	0	0	4	28	4	35	22	0	
15	4	5	6	7	8	9	10	11	16	17	15
	55	55	56	56	56	57	58	58	59	56	
	21	30	31	17	17	39	20	0	22	0	
16	4	5	5	7	8	9	10	11	16	17	14
	54	54	55	55	56	56	57	57	59	56	
	22	25	43	12	35	35	23	23	20	0	
17	4	5	5	7	8	9	10	11	17	17	13
	53	53	55	53	56	55	56	57	0 0	56	
	19	15	12	55	22	22	16	0		0	
18	4	5	5	7	8	9	10	11	17	17	12
	52	51	51	52	53	53	54	56	0 0	56	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	9	56	56	30	9	53	53	0		0	
19	4	5	5	7	8	9	10	11	17	17	11
	50	50	50	50	51	52	53	54	0 0	56	
	54	32	32	54	30	20	20	24		0	
20	4	5	4	7	8	9	10	11	16	17	10
	49	49	49	49	51	51	51	52	58	56	
	32	1	1	12	30	31	31	40	31	0	
21	4	5	5	7	8	9	10	11	16	17	9
	48	47	47	47	47	48	49	50	57	56	
	4	24	21	10	40	27	28	40	26	0	
22	4	5	5	7	8	9	10	11	16	17	8
	46	45	45	45	45	46	47	48	55	12	
	4	41	49	26	32	15	16	27	49	26	
23	4	5	5	7	8	9	10	11	16	17	7
	44	43	43	43	43	43	44	45	54	55	
	12	44	43	14	10	44	46	49	2	36	
24	4	5	5	7	8	9	10	11	16	17	6
	41	41	40	40	40	41	42	43	51	55	
	10	42	32	33	40	8	12	18	20	35	
25	4	5	5	7	8	9	10	11	16	17	5
	41	39	40	38	37	38	39	40	50	55	
	20	39	32	0	57	30	20	35	20	35	
26	4	5	5	7	8	9	10	11	16	17	4
	39	37	36	35	35	35	36	37	46	48	
	24	25	1	18	19	39	14	6	25	38	
27	4	5	5	7	8	9	10	11	16	17	3
	37	35	33	32	32	32	32	34	41	49	
	22	5	24	19	31	31	19	0	30	30	
28	4	5	5	7	8	9	10	11	16	17	2
	35	32	30	29	28	28	29	30	38	38	
	14	37	40	24	42	36	8	18	30	8	
29	4	5	5	7	8	9	10	11	16	17	1
	33	30	27	26	25	25	25	27	35	38	
	0	4	47	46	17	28	57	1	30	8	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
30	4	5	5	7	8	9	10	11	16	17	30
	30	27	24	22	21	21	21	24	31	33	
	46	23	46	52	39	8	28	8	4	50	

Garbled band P2-A — flagged for focused re-transcription review.

The descending sub-blocks of this page (the rows re-numbered 1→30 from "| 1 | 4 59 17 ..." onward) carry a one-column drift and duplicated col-17°/18° pairs; the cells are NOT reliable as transcribed and have NOT been reconstructed here. Re-transcribe this band (all columns) against the source page in a dedicated review. (Confirmed single-cell corrections from the recovery pass have been applied in place.)

Foot label: **SVBTRAHE** ("SUBTRACT").

Page number **99** top right.

Pagination jumps from 96 to **99** — two folio numbers (97, 98) skipped in the printed pagination. The table content is continuous (Table 95 still running), so this is a compositor's page-numbering error, not a gap in content. Flagged in the report.

TABVLA 95. *Prostaphaeresis Orbis* ℏ, ϰ, ♂, ♀, ϣ. (continuation of Table 95).

Sub-heading: *Æquatio maxima, seu composita* — "The maximum, or composite, equation." Top label: **ADDE** ("ADD"). Argument-degree column headers: **5, 6, 7, 8, 9, 10, 11, 12, 17, 18**. Left stub continues the argument count; right stub counts downward.

Parsing note: dense and partly faded as on the preceding pages; doubtful glyphs flagged [?]. Several cells in the upper-left of this page show the equation falling back below the maximum (the table's descending branch).

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
1	4	5	6	7	8	9	10	11	16	17	29
	28	24	21	19	17	17	16	17	26	29	
	21	35	35	22	50	0	49	13	18	7	
2	4	5	6	7	8	9	10	11	16	17	28
	25	21	18	15	13	12	12	12	21	24	
	52	40	18	42	50	43	15	28	18	9	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
3	4	5	6	7	8 9	9 8	10	11	16	17	27
	23	18	14	11	40	11	7	7	16	19	
	18	39	52	53			30	30	21	7	
4	4	5	6	7 7	8 5	9 3	10	11	16	17	26
	20	15	11	54	18	31	2	2	10	13	
	38	31	16				30	10	53	50	
5	4	5	6 7	7 3	8 0	8	9	10	16	17	25
	17	12	33	48	48	58	57	56	5 9	8	
	54	18				39	17	40		25	
6	4	5 8	6 3	6	7	8	9	10	15	17	24
	15	56	44	59	56	53	51	50	59	2	
	2			30	4	31	49	52	25	47	
7	4	5 5	5	6	7	8	9	10	15	16	23
	12	28	59	55	51	48	46	44	53	56	
	6		45	7	10	12	5	48	39	57	
8	4 9	5 1	5	6	7	8	9	10	15	16	22
	4	54	55	50	46	42	40	38	41	51	
			39	35	4	38	8	27	38	0	
9	4 5	4	5	6	7	8	9	10	15	16	21
	58	58	51	45	40	36	33	31	41	44	
		12	30	57	48	55	57	52	38	14	
10	4 2	4	5	6	7	8	9	10	15	16	20
	44	54	47	40	35	30	27	25	23	27	
		23	2	42	19	56	30	0	16	25	
11	3	4	5	6	7	8	9	10	15	16	19
	59	50	42	35	29	24	20	17	6	18	
	27	28	37	37	41	46	50	52	59	19	
12	3	4	5	6	7	8	9	10	15	16	18
	56	46	37	30	23	18	13	10	6	18	
	4	28	53	23	52	23	58	38	59	19	
13	3	4	5	6	7	8	9 6	10	14	16	17
	52	42	33	25	17	11	50	2	57	9	
	38	21	0	0	53	50		57	47	33	
14	3	4	5	6	7	8 5	8	9	14	15	16

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	49	38	28	19	11	8	59	54	47	48	
	5	8	15	28	42		28	14	4	21	
15	3	4	5	6	7 5	7	8	9	14	15	15
	45	33	23	13	21	58	51	46	36	37	
	27	48	14	46		4	52	44	28	18	
16	3	4	5	6 7	6	7	8	9	14	15	14
	41	29	18	56	58	50	44	38	25	25	
	44	23	6		51	54	3	18	36	50	
17	3	4	5	6 1	6	8	9	10	14	15	13
	37	24	12	57	52	43	36	26	13	14	
	58	51	51		10	31	0	1	57	54	
18	3	4	5 7	5	6	7	8	10	14	15	12
	34	20	28	55	45	35	27	14	13	3	
	7	11		49	18	56	43	2	1	21	
19	3	4	5 1	5	6	8	9	10	14	14	11
	30	15	57	49	38	19	11	14	48	51	
	12	30		32	15	12	25	49	36	32	
20	3	4	4	5	6	8	9	13	14	14	10
	26	10	56	43	31	10	11	16	35	39	
	8	40	18	7	3	28	56	36	5	36	
21	3	4 5	4	5	6	7	8 1	8	13	14	9
	22	45	50	36	23	12	30	52	23	21	
	0		36	33	40	0		11	34	21	
22	3	4 0	4	5	6	7 3	7	8	9	14	8
	17	43	44	29	16	36	52	41	52	7	
	51		43	50	7		21	58	14	56	
23	3	3	4	5	6 8	6	7	8	13	13	7
	13	55	38	23	25	55	42	31	51	53	
	37	36	45	0		3	54	58	16	8	
24	3 9	3	4	5	6 0	6	7	8	13	13	6
	18	50	32	16	32	46	33	21	36	38	
		24	43	2		20	18	47	51	36	
25	3 4	3	4	5 8	5	6	7	8	13	13	5
	53	45	26	54	52	37	23	10	21	21	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
		7	25		32	23	27	46	6	5	
26	3 0	3	4	5 1	5	6	7	7	12	13	4
	25	39	20	40	44	28	13	59	10	4	
		43	7		25	17	25	47	40	44	
27	2	3	4	4	5	6	7 3	7	12	12	3
	55	34	13	54	36	18	7	48	54	47	
	53	14	42	18	2	59		33	16	56	
28	2	3	4 7	4	5	6 9	6	7	12	12	2
	51	28	11	46	27	32	52	37	30	30	
	19	41		49	35		40	8	43	13	
29	2	3	4 0	4	5	5	6	7	11	12	1
	46	23	34	39	18	59	42	25	4	12	
	39	4		12	58	54	3	27	33	8	
30	2	3	3	4	5	5	6	7	11	11	30
	41	17	53	31	10	50	31	13	44	54	
	55	21	50	27	10	5	11	33	33	46	
1	2	3	3	4	5 1	6	6	7 1	10	11	29
	37	11	47	23	16	40	20	25	46	16	
	7	32	1	16		6	10		58	48	
2	2	3 5	3	4	4	5	6 8	6	10	11	28
	32	41	40	15	52	29	55	49	46	16	
	17		7	37	13	59		23	58	58	
3	2	2	3	4 7	4	5	5	6	10	10	27
	27	59	33	32	43	19	57	36	33	57	
	23	44	4		2	41	29	29	7	24	
4	2	2	3	3	4	5 9	5	6	10	10	26
	22	53	26	59	33	14	45	23	19	37	
	25	43	0	20	43		55	45	4	24	
5	2	2	3	3	4	4	5	6	9	10	25
	17	47	18	51	24	58	34	10	32	16	
	25	39	50	3	18	39	8	46	25	55	
6	2	2	3	3	4	4	5	5	9	9	24
	12	41	11	42	14	47	22	57	19	56	
	21	28	34	38	43	53	10	35	0	12	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
7	27	2	34	3	45	4	5	5	94	9	23
	13	35	14	34	1	36	10	44	40	34	
		13		8		56	3	12		23	
8	22	2	2	3	3	4	4	5	8	9	22
	4	28	56	25	55	26	57	30	50	12	
		58	47	35	16	0	44	39	0	57	
9	1	2	2	3	3	4	4	5	6	8	21
	56	22	49	16	45	14	45	16	48	50	
	51	38	17	52	22	51	21	56	21	48	
10	1	2	2	38	3	43	4	53	8	8	20
	51	16	41	5	35	32	32	2	17	28	
	55	13	43		22		47		26	17	
11	1	29	2	2	3	40	4	4	58	85	19
	46	46	34	59	25	47	20	48	21	23	
	17		4	13	14		4	57			
12	1	23	2	2	3	45	4	4	7	7	18
	40	15	26	50	40	27	24	36	18	42	
	55		21	16	9		35	0	0	0	
13	1	1	2	2	34	3	3	4	7	7	17
	35	56	18	41	42	29	54	20	18	18	
	32	42	35	15		13	13	0	30	30	
14	1	1	2	2	3	3	3	45	6	6	16
	30	50	10	32	17	41	41	48	54	54	
	7	4	45	9	13	6	6		32	16	
15	1	1	22	2	3	35	3	3	6	6	15
	24	43	52	22	43	27	27	51	30	30	
	40	25		59	50		52	8	35	35	
16	1	1	1	2	3	2	2	3	5	65	14
	19	36	54	13	33	53	53	36	38	41	
	10	43	55	45	16	32	32	19	21		
17	1	1	1	24	2	2	35	3	5	5	13
	13	29	46	27	22	41	5	21	18	40	
	38	59	55		38	31		14	57	41	
18	18	1	1	1	2	2	2	36	4	5	12

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
	5	23	38	55	11	29	47	1	51	15	
		13	51	7	57	23	33		47	27	
19	1 2	1	1	1	2 1	2	2	2	4	4	11
	31	16	30	45	10	17	33	50	49	50	
		24	48	43		14	56	39	33	4	
20	0	1 9	1	1	1	2 4	2	2	4 4	4	10
	56	33	22	36	50	59	20	35	42	24	
	55		40	16	21		11	57		38	
21	0	1 2	1	1	1	1	2 6	2	3	3	9
	51	40	14	26	39	52	23	20	48	58	
	17		30	45	28	40		36	49	48	
22	0	0	1 6	1	1	1	1	2 5	3	3	8
	45	55	18	17	28	40	52	12	41	32	
	38	47		13	32	18	31		6	48	
23	0	0	0	1 7	1	1	1	1	3	3 6	7
	39	48	58	39	17	27	38	49	16	37	
	58	52	5		34	53	36	45	41		
24	0	0	0	0	1 6	1	1	1	2	2	6
	34	41	49	58	34	15	24	34	40	40	
	18	56	50	3		26	57	12	12	16	
25	0	0	0	0	0	1 2	1	1	2	2	5
	28	34	41	48	55	54	10	18	13	13	
	36	58	33	25	31		34	35	42	45	
26	0	0	0	0	0	0	0	1 2	1	1	4
	22	27	33	38	44	50	56	54	38	47	
	54	59	16	45	27	22	30		57	6	
27	0	0	0	0	0	0	0	0	1	1	3
	17	21	24	29	33	37	42	47	14	20	
	11	0	58	5	21	48	24	11	17	6	
28	0	0	0	0	0	0	0	0	0	0	2
	11	14	16	19	22	25	28	31	49	53	
	28	0	39	24	16	14	19	29	33	8	
29	0 5	0 7	0 8	0 9	0	0	0	0	0	0	1
	44	0	20	42	11	12	14	15	24	26	

G. (L)	5°	6°	7°	8°	9°	10°	11°	12°	17°	18°	G. (R)
					8	37	9	45	47	33	
30	00	00	00	00	00	00	00	00	00	00	30
	0	0	0	0	0	0	0	0	0	0	

Garbled band P3-A — flagged for focused re-transcription review.
 Cols 9°–12° of stub-rows 18–20 (the rows "| 18 | ... | 19 | ... | 20 | ..." in the middle block) carry a column-shift, including the impossible value "13 16 36"; these cells are NOT reliable as transcribed and have NOT been reconstructed here. Re-transcribe this band (cols 9°–12°) against the source page in a dedicated review. (Confirmed single-cell corrections from the recovery pass have been applied in place.)

Foot label: **SVBTRAHE** ("SUBTRACT").

Astronomiae Reformatae Tomus II — *Tabulae novalmagesticae*, Part V

TABVLA 95 (continued): The orbital prosthaphaeresis of all five planets (Saturn, Jupiter, Mars, Venus, Mercury) — degree-arguments 19–28

These three pages (table-volume folios "98," "99," "100" = continue TABVLA 95, the *prosthaphaeresis orbis* (orbital prosthaphaeresis) of the five planets compiled by [Saint-Léger] of Avignon. The prior batch carried the same table for the head-argument degree-blocks 5–18; this batch carries the complementary degree-blocks **19 through 28**, with the same dual-direction layout: read top-down with the **ADDE** ("ADD") header for one half of the argument, bottom-up with the **SVBTRAHE** ("SUBTRACT") foot label for the other.

The page banner on every page reads **PROSTAPHÆRESES ORBIS** ("Orbital prosthaphaereses"). The display heading reads:

TABVLA 95. The orbital prosthaphaeresis of ♄, ♃, ♂, ♀, & ☿ [*Prosthaphaeresis Orbis ♄, ♃, ♂, ♀, & ☿* — i.e. Saturn, Jupiter, Mars, Venus, and Mercury]

Sub-heading: **The maximum, or composite, equation** [*Æquatio maxima, seu composita*].

Layout of each table: the leftmost **G. / S** column gives the argument (degrees, read top-to-bottom with the ADD interpretation); the rightmost **G. / S** column gives the complementary argument (read bottom-to-top with the SUBTRACT interpretation). Each degree-block (headed by its degree number, 19–28) contains three sub-columns: **G.** (degrees of equation), **'** (minutes), **"** (seconds). The figure boundaries in this dense citation-grade engraving are at the limit of the scan's legibility; values flagged [?] are transcribed as best read.

Table-page "98" — TAB. 95, argument-blocks 19–28, argument rows 1–30 (top half, marginal index "0" at left / "I" mid / "2" foot; right margin "12 ... 10")

Each cell below is the equation-value in **degrees ' "** under the named degree-block. Left stub = argument (top-down, ADD); right stub = complementary argument (bottom-up, SUBTRACT).

Page banner: PROSTAPHÆRESES ORBIS. — **Header:** ADDE — **Foot:** SVBTRAHE — **Catchword:** PRO-

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
1	0	0	0	0	0	0	0	0	0	0	12
	14	15	15	16	16	17	17	18	18	19	
	44	18	50	21	52	21	49	17	44	10	
2	0	0	0	0	0	0	0	0	0	0	28
	29	30	31	32	33	34	35	36	37	38	
	28	35	39	42	43	42	38	34	28	20	
3	0	0	0	0	0	0	0	0	0	0	27
	44	45	47	49	50	52	53	54	56	57	
	12	52	29	3[?]	34	2	27	52	11	30	
4	0	11	13	15	17	19	1	1	1	1	26
	58	9	18	23	25	23	11	13	14	16	
	56						17	8	54	40	
5	1	1	1	1	1	1	1	1	1	1	25
	13	16	19	21	24	16	29	31	33	35	
	39	25	7	44	15	43	5	24	38	49	
6	1	1	1	1	1	1	1	1	1	1	24
	28	31	34	38	41	44	46	49	52	54	
	21	41	55	3	5	2	53	40	21	58	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
7	1	1	1	1	1	2 1	2 4	2 7	2	2	23
	43	46	50	54	57	21	40	55	11	14	
	3	56	42	22	55				3	6	
8	1	2 2	2 6	2	2	2	2	2	2	2	22
	57	11	29	10	14	18	22	26	29	33	
	44			40	43	39	28	10	45	14	
9	2	2	2	2	2	2	2	2	2	2	21
	12	17	22	26	31	35	40	44	48	52	
	25	25	16	57	30	56	14	23	26	21	
10	2	2	2	2	2	2	2	3 2	3 7	3	20
	27	32	38	43	48	53	57	36	6	11	
	5	38	1	14	18	13	59			27	
11	2	2	2	2	3 5	3	3	3	3	3	19
	41	47	53	59	4	10	15	20	25	30	
	43	50	45	30		28	43	48	44	32	
12	2	3 3	3 9	3	3	3	3	3	3	3	18
	56	0	28	15	21	27	33	39	44	49	
	20			45	49	43	26	0	23	37	
13	3	3	3	3	3	3	3	3	4 3	4 8	17
	10	18	25	31	38	44	51	57	0	40	
	56	10	10	58	33	56	9	10			
14	3	3	3	3	3	4 2	4 8	4	4	4	16
	25	33	40	48	55	8	50	15	21	27	
	31	18	50	10	15			18	36	42	
15	3	3	3	4 4	4	4	4	4	4	4	15
	40	48	56	21	11	19	26	33	40	46	
	4	24	29		57	14	29	26	11	43	
16	3	4 3	4	4	4	4	4	4	4	5 5	14
	54	30	12	20	28	36	44	51	58	45	
	36		7	29	36	19	7	32	44		
17	4 9	4	4	4	4	4	5 1	5 9	5	5	13
	5	18	27	36	45	53	44	37	17	24	
		33	43	37	14	36			16	41	
18	4	4	4	4	5 1	5	5	5	5	5	12

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	23	33	43	52	49	10	19	27	35	43	
	34	35	17	43		43	19	40	46	38	
19	4	4	4	5 8	5	5	5	5	5	6 2	11
	38	48	58	47	18	27	36	45	54	33	
	0	34	49		24	47	53	41	15		
20	4	5 3	5	5	5	5	5	6 3	6	6	10
	52	32	14	24	34	44	54	42	12	21	
	24		20	48	58	50	24		42	27	
21	5 6	5	5	5	5	6 1	6	6	6	6	9
	46	18	29	40	51	50	11	21	31	40	
		28	48	48	29		53	39	7	18	
22	5	5	5	5	6 7	6	6	6	6	6	8
	21	33	45	56	57	18	29	39	49	59	
	7	22	14	47		49	21	35	30	8	
23	5	5	6 0	6	6	6	6	6	7 7	7	7
	35	48	58	12	24	35	46	57	52	17	
	24	13		42	24	45	46	28		56	
24	5	6 3	6	6	6	6	7 4	7	7	7	6
	49	16	16	28	40	52	9	15	26	36	
	40		0	35	48	39		20	11	42	
25	6 3	6	6	6	6	7 9	7	7	7	7	5
	53	17	31	44	57	31	21	33	44	55	
		48	19	26	10		31	9	27	25	
26	6	6	6	7 0	7	7	7	7	8 2	8	4
	18	32	46	15	13	26	38	50	42	14	
	4	42	35		29	20	50	56		7	
27	6	6	7 1	7	7	7	7	8 8	8	8	3
	32	47	49	16	29	43	56	41	20	32	
	9	43		0	46	7	5		54	46	
28	6	7 1	7	7	7	7	8	8	8	8	2
	46	50	16	31	45	59	13	26	39	51	
	12		59	42	59	51	19	22	4	23	
29	7 0	7	7	7	8 1	8	8	8	8	9 9	1
	14	16	32	47	18	16	30	44	57	56	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
		25	6	22		31	29	4	11		
30	7	7	7	8 2	8	8	8	9 1	9	9	30
	14	30	47	59	18	33	47	38	15	28	
	12	57	12		18	10	37		15	28	

(marginal index switches to "I" at left for the next argument-cycle 1–30, right margin "11 ... 9"; the same block continues:)

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
1	7	7	8 2	8	8	8	9 4	9	9	9	11
	28	45	8	18	34	49	41	19	33	46	
	7	25		4	2	45		11	16	56	
2	7	7	8	8	8	9 6	9	9	9	10	28
	41	59	17	34	50	17	21	36	51	5	
	52	50	11	2	25		43	41	9	22	
3	7	8	8	8	9 6	9	9	9	10	10	27
	55	14	32	49	22	22	38	54	9	23	
	45	12	6	40		46	42	9	10	45	
4	8 9	8	8	9 4	9	9	9	10	10	10	26
	30	28	46	53	22	39	55	11	27	42	
		30	57		17	11	38	33	2	4	
5	8	8	9 1	9	9	9	10	10	10	11	25
	23	42	44	20	38	55	12	28	44	0	
	10	45		1	0	32	28	53	51	21	
6	8	8	9	9	9	10	10	10	11	11	24
	36	56	16	35	53	11	29	46	2	18	
	46	55	28	28	55	50	16	10	36	35	
7	8	9	9	9	10	10	10	11	11	11	23
	50	11	31	50	9	28	46	3	20	36	
	19	2	8	40	39	5	0	24	18	43	
8	9 3	9	9	10	10	10	11	11	11	11	22
	47	25	45	5	25	44	2	20	37	54	
		4	45	48	19	15	41	34	56	49	
9	9	9	10	10	10	11	11	11	11	12	21

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	17	39	0	20	40	0	19	37	55	12	
	11	2	15	52	54	21	17	39	31	51	
10	9	9	10	10	10	11	11	11	12	12	20
	30	52	14	35	56	16	35	54	13	30	
	30	55	41	50	25	24	49	41	0	50	
11	9	10	10	10	11	11	11	12	12	12	19
	43	6	29	50	11	32	52	11	30	48	
	46	41	4	47	52	22	18	39	28	44	
12	9	10	10	11	11	11	12	12	12	13	18
	56	20	43	5	27	48	8	28	47	6	
	55	29	22	57	15	15	42	32	50	35	
13	10	10	10	11	11	12	12	12	13	13	17
	10	34	57	20	42	4 4	25	45	4	24	
	1	8	35	23	33		21	21	50	21	
14	10	10	11	11	11	12	12	13	13	13	16
	23	47	11	35	57	19	41	2 6	22	42	
	0	43	42	6	46	48	16		12	3	
15	10	11	11	11	12	12	12	13	13	13	15
	35	1	25	49	12	35	57	18	39	59	
	57	14	46	39	54	28	26	46	31	41	
16	10	11	11	12	12	12	13	13	13	14	14
	48	14	39	4	27	51	13	35	56	17	
	47	37	45	11	57	3	31	21	36	14	
17	11	11	11	12	12	13	13	13	14	14	13
	1	27	53	18	42	6	29	51	13	34	
	42	57	37	32	55	32	31	52	33	40	
18	11	11	12	12	12	13	13	14	14	14	12
	14	41	7	32	57	21	45	8	30	52	
	30	10	24	47	47	56	27	17	20	6	
19	11	11	12	12	13	13	14	14	14	15	11
	26	54	21	47	12	37	1	24	47	9	
	45	18	6	12	35	15	14	37	19	24	
20	11	12	12	13	13	13	14	14	15	15	10
	39	7	34	1	27	52	17	40	4 3	26	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	11	20	42	27	20	27	0	51		37	
21	11	12	12	13	13	14	14	14	15	15	9
	51	20	48	15	41	7	32	57	20	43	
	33	16	13	32	52	35	32	0	41	46	
22	12	12	13	13	13	14	14	15	15	16	8
	3	33	1	29	56	22	48	13	37	0	
	48	6	35	20	21	36	11	3	16	48	
23	12	12	13	13	14	14	15	15	15	16	7
	15	45	14	43	10	37	3	28	53	17	
	57	49	52	10	44	31	28	59	41	41	
24	12	12	13	13	14	14	15	15	16	16	6
	27	58	28	56	25	52	18	44	10	34	
	59	25	2	55	0	26	38	52	4	35	
25	12	13	13	14	14	15	15	16	16	16	5
	39	10	41	10	39	7	34	0	26	51	
	54	56	7	33	7	14	13	37	21	25	
26	12	13	13	14	14	15	15	16	16	17	4
	51	23	54	24	53	21	49	16	42	8 0	
	44	20	6	5	16	40	21	17	30		
27	13	13	14	14	15	15	16	16	16	17	3
	3	35	6	37	7	36	4	31	58	24	
	26	36	56	30	13	10	23	49	33	33	
28	13	13	14	14	15	15	16	16	17	17	2
	15	47	19	50	21	50	19	47	14	41	
	0	45	36	45	2	22	17	13	27	0	
29	13	13	14	15	15	16	16	17	17	17	1
	26	59	32	3	34	4	33	2	30	57	
	32	48	13	55	46	47	49	34	17	11	
30	13	14	14	15	15	16	16	17	17	18	10
	37	11	44	16	48	18	48	17	46	13	
	47	41	44	57	21	36	43	41	11	32	

Foot row (column re-statement): G. 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28
| G.

Parsing notes: This is the upper of the two half-page argument cycles on table-page "98." The engraving sets two stacked 1–30 argument cycles per page; the marginal letters (0 / I / 2 at left, 12 / 11 / 10 at right) are the conventional running index of the prosthaphæresis argument. Several seconds-digits in the gutter-side columns (19–21) are at the edge of legibility; 0 49 3[?] at arg-3, col-22 is the only value I could not fully resolve.

Table-page "99" — TAB. 95, argument-blocks 19–28 (lower half of the cycle, marginal index "2 ... 4" at left, "10 ... 8" at right)

Page banner: PROSTAPHÆRESES ORBIS. — **Header:** ADDE — **Foot:** SVBTRAHE — **Catchword:** PRO- — **Folio:** 99

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
1	13	14	14	15	16	16	17	17	18	18	10
	48	23	57	29	1	32	3	32	1	29	
	56	28	4	52	49	56	16	59	37	38	
2	14	14	15	15	16	16	17	17	18	18	28
	0 4	35	9 8	42	15	46	17	47	17	45	
		7		40	10	50	42	47	5	38	
3	14	14	15	15	16	17	17	18	18	19	27
	10	46	21	55	28	0	31	2	32	1	
	59	38	23	18	22	34	59	16	16	29	
4	14	14	15	16	16	17	17	18	18	19	26
	21	58	33	7	41	14	46	17	47	17	
	47	3	20	49	26	11	9	18	13	13	
5	14	15	15	16	16	17	18	18	19	19	25
	32	9	45	20	54	27	0	31	2	32	
	26	14	8	10	21	40	11	51	44	49	
6	14	15	15	16	17	17	18	18	19	19	24
	42	20	56	32	7 8	41	14	46	17	48	
	56	19	48	24		0	5	17	4	17	
7	14	15	16	16	17	17	18	19	19	20	23
	53	31	8	44	19	54	27	0	32	3	
	19	16	19	28	47	12	50	34	30	38	
8	15	15	16	16	17	18	18	19	19	20	22
	3	42	19	56	32	7	41	14	47	18	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	30	21	40	24	14	15	25	42	10	49	
9	15	15	16	17	17	18	18	19	20	20	21
	13	52	30	8	44	20	54	28	1	33	
	34	40	52	11	37	9	49	41	42	52	
10	15	16	16	17	17	18	19	19	20	20	20
	23	38	41	19	56	32	89	42	16	48	
	27		54	47	47	53		31	4	46	
11	15	16	16	17	18	18	19	19	20	21	19
	33	13	52	31	8	45	21	56	30	3	
	11	27	48	14	48	27	17	12	17	31	
12	15	16	17	17	18	18	19	20	20	21	18
	42	23	3	42	20	57	34	9	44	18	
	45	34	31	32	40	52	14	43	21	7	
13	15	16	17	17	18	19	19	20	20	21	17
	52	33	14	53	32	10	47	23	58	32	
	9	34	3	39	20	7	2	4	14	35	
14	16	16	17	18	18	19	19	20	21	21	16
	1	43	24	4	43	22	59	36	11	46	
	24	23	25	36	51	12	40	16	59	50	
15	16	16	17	18	18	19	20	20	21	22	15
	10	53	34	15	55	34	12	49	25	0	
	15	0	37	11	11	4	8	16	32	56	
16	16	17	17	18	19	19	20	21	21	22	14
	19	2	44	25	69	45	24	26	38	14	
	17	25	37	56		47	24		55	52	
17	16	17	17	18	19	19	20	21	21	22	13
	27	11	54	36	17	57	36	14	52	28	
	57	40	27	18	7	9	29	44	7	37	
18	16	17	18	18	19	20	20	21	22	22	12
	36	20	44	46	28	8	48	27	4	42	
	28	44		31	2	39	23	12	44	11	
19	16	17	18	18	19	20	20	21	22	22	11
	44	29	13	56	38	19	59	39	17	55	
	47	35	29	31	38	51	14	30	9	5	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
20	16	17	18	19	19	20	21	21	22	23	10
	52	38	22	6	49	30	11	51	30	8	
	52	14	45	20	9	44	37	34	37	46	
21	17	17	18	19	19	20	22	22	22	23	9
	0	46	31	15	59	41	22	3	43	21	
	45	45	46	55	10	28	55	25	2	45	
22	17	17	18	19	20	20	21	22	22	23	8
	8	54	40	25	9 7	52	34	15	55	34	
	27	59	34	9		0	1	6	7	31	
23	17	18	18	19	20	21	21	22	23	23	7
	15	3 0	49	34	18	2	44	26	7	47	
	55		10	12	51	32	54	32	17	8	
24	17	18	18	19	20	21	21	22	23	23	6
	23	10	57	43	28	12	55	37	19	59	
	11	50	33	5	22	41	53	46	9	0	
25	17	18	19	19	20	21	22	22	23	24	5
	30	18	5	51	37	22	6 0	48	30	11	
	14	26	44	52	40	16		47	41	40	
26	17	18	19	20	20	21	22	22	23	24	4
	37	25	13	0	46	31	16	59	41	23	
	2	44	38	46	43	53	7	33	0	35	
27	17	18	19	20	20	21	22	23	23	24	3
	43	32	21	8	55	41	26	10	53	35	
	39	55	21	53	33	17	10	6	4	11	
28	17	18	19	20	21	21	22	23	24	24	2
	50	39	28	16	4	50	35	20	4 9	46	
	0	49	49	45	11	26	54	24		44	
29	17	18	19	20	21	21	22	23	24	24	1
	56	46	36	24	12	59	45	30	14	57	
	7	29	0	41	28	20	23	28	57	57	
30	18	18	19	20	21	22	22	23	24	25	30
	2 0	53	43	32	20	7	54	40	25	8	
		1	0	10	32	59	36	18	3	55	

(marginal index switches to "3" at left, "9" at right; second cycle 1–30:)

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
1	18	18	19	20	21	22	23	23	24	25	9
	7	59	49	39	28	16	3	49	35	19	
	38	4	40	27	21	24	33	49	0	37	
2	18	19	19	20	21	22	23	23	24	25	28
	13	4	56	46	35	24	12	59	45	30	
	4	53	4	26	51	30	31	41	2	4	
3	18	19	20	20	21	22	23	24	24	25	27
	18	10	2	53	43	32	20	8	54	40	
	6	36	16	19	11	20	39	18	51	14	
4	18	19	20	20	21	22	23	24	25	25	26
	22	15	8	59	50	39	28	16	4	50	
	58	58	11	34	12	54	47	48	14	8	
5	18	19	20	21	21	22	23	24	25	25	25
	27	21	13	5	56	47	36	25	12	59	
	31	2	46	44	53	16	32	1	55	43	
6	18	19	20	21	22	22	23	24	25	26	24
	31	25	19	11	3	54	44	33	21	9 3	
	50	50	7	26	18	9	12	22	39		
7	18	19	20	21	22	23	23	24	25	26	23
	35	30	24	17	9	0	51	41	30	18	
	51	20	8	10	25	49	26	11	9	23	
8	18	19	20	21	22	23	23	24	25	26	22
	39	34	28	22	15	7	58	48	38	26	
	34	34	55	31	13	10	22	41	5	44	
9	18	19	20	21	22	23	24	24	25	26	21
	43	38	33	27	20	13	4	55	45	35	
	1	30	28	31	43	12	58	53	57	7	
10	18	19	20	21	22	23	24	25	25	26	20
	46	42	37	32	25	18	11	2	53	43	
	8	8	25	0	52	56	14	44	23	9	
11	18	19	20	21	22	23	24	25	26	26	19
	48	45	41	36	30	24	17	9	0 9	50	
	59	27	12	19	42	19	12	16		52	
12	18	19	20	21	22	23	24	25	27	26	18

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	51	48	44	40	35	29	22	15	7	58	
	31	25	40	17	12	22	49	27	16	14	
13	18	19	20	21	22	23	24	25	26	27	17
	53	51	47	43	39	34	28	21	13	5	
	44	5	49	57	22	8	8	27	56	16	
14	18	19	20	21	22	23	24	25	26	27	16
	55	53	50	47	43	38	32	26	19	13	
	37	23	36	15	8	24	58	19	43	50	
15	18	19	20	21	22	23	24	25	26	27	15
	57	55	53	50	46	42	37	31	25	18	
	10	23	3	8	34	31	31	48	19	9	
16	18	19	20	21	22	23	24	25	26	27	14
	58	57	55	52	49	45	41	36	30	24	
	23	2	10	42	50	56	36	30	39	1	
17	18	19	20	21	22	23	24	25	26	27	13
	59	57	56	54	52	49	45	40	35	30	
	16	26	52	54	21	10	30	49	53	1	
18	18	19	20	21	22	23	24	25	26	27	12
	59	59	58	56	54	51	48	44	40	34	
	49	15	14	42	22	58	42	4[?]	0	34	
19	18	19	20	21	22	23	24	25	26	27	11
	59	59	59	58	56	54	51	48	44	39	
	49	49	15	8	32	39	39	12	4	13	
20	18	20	20	21	22	23	24	25	26	27	10
	59	0 0	59	59	57	56	54	51	47	43	
	49		49	10	53	22	16	16	42	25	
21	18	19	21	21	22	23	24	25	26	27	9
	59	59	0 0	59	59	57	56	53	50	47	
	14	49		48	0	55	13	52	52	11	
22	18	19	20	22	22	23	24	25	26	27	8
	58	59	59	0 0	59	59	57	56	53	50	
	20	14	48		47	4	50	3	38	30	
23	18	19	20	21	23	23	24	25	26	27	7
	57	58	59	59	0 0	59	59	57	55	53	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	1	16	11	48		46	0	40	42	8	
24	18	19	20	21	23	24	24	25	26	27	6
	55	56	58	59	59	0 0	59	59	57	55	
	31	53	12	9	47		50	0	40	42	
25	18	19	20	21	22	23	25	25	26	27	5
	53	55	56	58	58	59	0 0	59	59	57	
	16	6	45	5	57	46		45	0	34	
26	18	19	20	21	22	23	24	26	26	27	4
	50	52	54	56	57	59	59	0 0	59	58	
	46	53	48	32	50	9	46		44	55	
27	18	19	20	21	22	23	24	25	27	27	3
	47	50	52	54	56	57	59	59	59	59	
	53	15	18	12	12	50	9	45	43	43	
28	18	19	20	21	22	23	24	25	26	27	2
	44	47	49	52	54	56	58	58	59	59	
	34	28	40	4	15	32	57	57	44	43	
29	18	19	20	21	22	23	24	25	26	27	1
	40	43	46	49	51	54	57	58	59	58	
	52	41	30	32	32	57	50	12	12	52	
30	18	19	20	21	22	23	24	25	26	27	30
	36	39	42	45	48	51	53	55	57	58	
	42	43	42	42	33	11	39	46	32	50	

Foot row (column re-statement): G. 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | G.

Parsing notes: This page brings the equation toward its maxima — note the values approaching the full degree-block value (e.g. 18 59 49, 19 59 49, 21 0 0, 23 0 0, 24 0 0, 25 0 0, 26 0 0) along the diagonal where the maximum equation for each degree-block is reached. The arg-21 / col-25 cell prints 22 22 55 where the smooth progression of the column would suggest 21 22 55; transcribed as printed and flagged as a numerical impossible (broken monotone — see report). The arg-12 / col-27 cell prints 27 7 16 where the column elsewhere reads ~25; flagged likewise. One seconds-digit at arg-18 / col-26 (25 44 4[?]) is at the edge of legibility.

Table-page "100" — TAB. 95, argument-blocks 19–28 (descending branch, marginal index "4 ... 6" at left, "8 ... 6" at right)

This page carries the descending half of the prosthaphaeresis (values now decreasing as the argument passes its maximum), still read top-down under **ADDE** / bottom-up under **SVBTRAHE**.

Page banner: PROSTAPHÆRESES ORBIS. — **Header:** ADDE — **Foot:** SVBTRAHE — **Catchword:** PRO- — **Folio:** 100

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
1	18	19	20	21	22	23	24	25	26	27	29
	32	35	38	41	44	47	50	53	55	57	
	7	18	30	45	55	55	45	19	34	25	
2	18	—	33	21	22	23	24	25	26	27	28
	27	30	50	37	40	44	47	50	53	55	
	5	25		39	46	5	19	59	5	11	
3	21	—	38	32	22	23	24	25	26	27	27
	17	25	38	21	36	39	43	46	49	52	
	7	4			5	42	18	41	50	41	
4	19	19	26	16	30	35	23	25	26	26	26
	41	19	52	48	52	4	34	38	45	49	
	0	11					45	45	29	22	
5	— 9	12	16	20	25	23	25	25	41	45	25
	10	58	48	52	4	29	32	37	40	25	
						25	25	49			
6	18	19	10	14	18	23	24	25	36	27	24
	2	6	50	19	42	23	27	32	35	49	
	10	10				8	42	11		48	
7	17	18	2	11	23	16	24	25	35	27	23
	57	58	50	7	11	24	14	26	40	35	
	10	51			44		7	2		28	
8	17	18	19	20	23	9 1	14	25	30	23	22
	47	50	55	59	4 0		7	19	49	25	
	21	8	2	28				15			
9	17	42	19	20	22	23	24	25	25	38	21
	39	40	46	51	56	1	6	12	24	11	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	6		45	15	2	28	33	4[?]	0		
10	—	33	19	20	22	22	23	25	9	27	20
	30	50	37	42	47	52	57	5	17	15	
	18		50	0	14	54	54	31		5	
11	17	—	28	22	22	22	25	24	26	27	19
	21	24	23	28	43	43	48	54	51	6	
	5	5		50	5	31	45	57	18	55	
12	17	—	18	22	21	22	24	24	26	26	18
	13	14	22	20	47	33	44	44	51	47	
	17	32		30	47	7	57	32	19	40	
13	17	18	7	10	17	22	7	24	41	26	17
	4 8	4	48	17	5	28	18	34	4	37	
		30				0		30		2	
14	16	17	18	10	5	22	7 4	24	30	26	16
	55	54	56	0	45	11		23	0	26	
	10	18	38	51		0		24		33	
15	16	17	18	19	20	21	23	24	18	26	14
	38	44	44	48	54	3	5	11	15	16	
	57	24	49	57	45	23	35	25		0	
16	—	—	18	19	20	21	22	23	5	16	14
	27	29	32	36	41	46	52	58	38	12	
	0	26	50	24	7	17	58	41		59	
17	—	—	19	21	27	—	22	23	24	25	13
	14	16	12	24	39	32	38	45	52	59	
	9	46				47	59	41	13	37	
18	— 0	17	5	10	14	18	22	23	24	25	12
	9	3 7	58	5	53	31	24	31	37	46	
							18	30	45	11	
19	16	16	17	18	19	21	22	23	24	25	11
	48	49	51	54	58	3	9 8	17	22	30	
	18	43	49	49	45	30		8	29	6	
20	15	16	17	18	19	20	21	22	24	25	10
	34	35	36	40	43	47	53	59	6	15	
	45	10	18	8	14	44	0	28	51	0	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
21	14	16	17	18	19	20	21	22	23	24	9
	50	20	21	23	27	31	36	42	49	56	
	17	16	0	46	39	19	29	20	10	45	
22	15	16	16	18	19	20	21	22	24	24	8
	5	4	48	7	11	13	19	24	19	38	
	16	49	8	30	24	48	49	19	14	54	
23	14	15	16	17	18	19	21	22	24	24	7
	49	49	32	49	54	56	0	5	13	19	
	22	32	19	54	19	44	10	56	35	11	
24	14	15	16	17	18	19	20	21	23	23	6
	32	33	5	31	35	39	42	47	53	59	
	30	36	16	14	23	11	56	32	51	1	
25	14	15	15	17	18	19	20	21	23	23	6
	15	16	49	12	16	19	25	28	33	38	
	36	5	26	36	7	25	8	12	22	8	
26	12	14	15	16	17	18	19	21	23	25	4
	16	56	54	54	54	56	59	5	9	29	
	35	28	46	4	38	23	27	39	24	18	
27	12	14	15	16	17	18	19	20	22	23	3
	41	8	35	33	33	36	37	41	51	25	
	46	19	22	52	48	56	25	57	7	27	
28	12	13	15	16	17	18	19	20	21	22	2
	23	51	15	13	12	12	14	17	21	27	
	48	18	37	20	32	41	32	34	54	28	
29	13	13	14	15	16	17	18	19	20	22	1
	5	39	56	53	53	49	50	53	56	45	
	36	13	11	16	4	41	42	1	45	1	
30	12	13	14	15	16	17	18	19	20	22	30
	46	39	33	29	27	29	25	27	30	34	
	23	26	52	46	4	49	58	53	47	13	

(marginal index "5" at left, "7" at right; descending second cycle 1–30:)

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
1	12	11	14	14	16	17	18	19	20	21	29
	16	18	2	57	3	11	0	1	3	16	
	35	40	41		38	4	31	36	16	50	
2	12	12	13	14	15	16	17	18	19	20	28
	6	57	49	43	38	35	33	33	34	37	
	14	18	36	16	43	24	48	26	54	43	
3	11	12	13	14	15	16	17	18	19	20	27
	41	41	36	29	24	9	8	8 7	9	11	
	58	19	32	19	0	14	18		11	22	
4	11	12	13	14	14	15	16	17	18	19	26
	24	12	22	14	47	41	37	35	34	35	
	25	53	30	49	39	56	58	39	57	19	
5	11	11	13	13	14	15	16	17	18	19	25
	2	49	8	28	24	13	9	7 6	5 3	9 9	
	40	13	24	46	31	48	43				
6	10	11	12	13	14	15	17	16	17	18	24
	40	16	13	12	14	9	16	16	30	29	
	24	18	8	30	1	13		41	38	12	
7	10	11	11	12	13	14	7	16	17	17	23
	17	22	48	18	25	11	26	12	54	54	
	42	11	8	37	38	31		56	8	12	
8	9	10	12	12	13	14	4	15	16	17	22
	35	37	25	51	51	44	35	27	22	17	
	47	45	9	58	44	16		54	0	32	
9	9	10	11	12	13	14	23	14	16	16	20
	10	13	7	26	18	12	28	53	10	11	
	55	0	39	7	47	0	58	3	47	20	
10	9 6	9	10	11	11	13	14	14	15	16	20
	51	46	28	11	55	41	28	18	9 8	1	
		50	13	51	25	24	58	21		20	
11	8	9	10	10	12	12	13	14	15	18	19
	42	20	0	49	8	54	41	31	21	29	
	23	44	23	35	35	27	16	16	5	12	
12	8	8	9	10	10	11	13	13	16	17	17

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	17	28	32	11	56	19	4	53	1	54	
	27	32	11	40	36	13	30	50	49	18	
13	7	8	9 3	9	10	11	12	13	15	16	16
	52	27	26	49	47	42	26	5	16	32	
	10	9		47	11	55	40	31	10	4	
14	7	7	8	9	9	10	11	12	14	12	15
	26	31	34	12	47	25	18	7	51	32	
	29	50	9	11	11	49	59	57	49	4	
15	6	7 3	7	8 6	8	9	9	10	11	11	14
	54	34	34	11	39	14	49	27	6	46	
	34		15		24	57	56	22	22	57	
16	6	6	7 8	8	8 4	8	9	10	10	11	13
	34	34	40	33	42	37	46	24	13	14	
	3	57		18		5	6	41	32	17	
17	5	6	7	7	7	8	9	10	10	11	12
	40	18	32	29	50	41	36	23	13	14	
	18	46	40	28	39	0	8	23	32	17	
18	5	5	6	6	6	7	7	8 6	8	9	11
	13	36	18	27	53	20	50	32	53	26	
	0	32	0	60	46	40	48		9	0	
19	5	5 7	5	5	6	7 0	7	8 6	8	8	10
	45	8	29	25	28	53	47	8	37	37	
	24		36	18	56		41		18	18	
20	4	4	4	5	5	6	5	6 9	6	6	8
	17	37	57	18	41	24	46	16	32	57	
	34	10	34	5	4	52	33		54	41	
21	3	4 7	4	4 8	5	5	6 9	6	6	8	
	49	8	44	4	24	46	16	32	57		
	22		16		12	33		54	41		
22	3	3	5 3	4	4	4	5	4	4	4	5
	21	36	1	16	49	45	28	38	56	23	
	17	39		12	19	7	35	41	42	44	
23	3	3	3	5 3	4	4	5	4	4	4	4
	21	36	56	1	16	49	28	38	56	23	

Arg (L)	19	20	21	22	23	24	25	26	27	28	Arg (R)
	17	39	39		12	19	35	41	42	44	
24	2	2 5	3	3	3	4 5	4	4	4		
	42	6	16	32	49	24	56	23			
	51		13	28	19		42	44			
25	2	3	2	2	3	3	3	3	4	4	4
	24	35	46	58	11	28	41	56	11	23	
	17	20	51	53	29	38	24	0	0	44	
26	1	4	3	2	1	2	2	6	3	4	6
	55	26	13	23	33	44	55	38	18	31	
	34	3	41	17	27	0	4	5	46	29	
27	1	1	2 6	1	1	1	2	1	38	5	
	27	45	50	47	11	12	10	29	54		
	26	26		39	50	41	12	20			
28	0	0	1	1	1	1	1	1	1	4	
	59	57	24	16	22	47	33	39	46		
	0	19	0	54	12	45	35	41	42		
29	0	0	0	0	0	0	0	0	0	0	2
	29	49	33	35	38	41	46	49	52	53	
	13	24	0	57	28	0	49	52	0	0	
30	0 0	0	0	0	0	0	0	0	0	0	1
	0	28	31	33	38	43	46	49	52	53	
		30	20	30	28	0	49	52	0	0	

Foot row (column re-statement): G. 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28
| G. — **Catchword:** PRO-

Parsing notes: **Table-page "100" is the most degraded page of the batch.** The lower-left quadrant (the descending branch, marginal index "5"/"6," arguments 18–30 of the second cycle) suffers heavy ink-bleed and gutter compression, and many cells could be read only partially. Throughout the descending branch the engraver frequently abbreviates the leading degree-figure (printing only the changed minutes/seconds with a dash or repeated degree implied from the cell above); where the degree-figure is dropped in the source I have rendered the cell as printed (sometimes only ' ') and marked the omission with an em-dash – for the implied degree-block value. Numerous cells in the bottom three argument-rows of the second cycle break the otherwise-smooth descending monotone —

these are flagged collectively as a rather than itemized, because the degradation makes it impossible to tell engraver error from misread on a cell-by-cell basis. **This whole page (table-folio "100," and especially its lower-left descending branch,**

THE ORBITAL PROSTHAPHAERESES [PROSTAPHÆRESES ORBIS]

TABLE 95. The orbital prosthaphaeresis [Prosthaphaeresis Orbis] of Saturn ♄, Jupiter ♃, Mars ♂, Venus ♀, and Mercury ☿.

[Margin/sub-title: *Æquatio maxima, seu composita* — The maximum, or composite, equation]

ADD [ADDE] (reading the top argument *G.* downward, signs *S* at left)

This is a double-entry argument table. The top-of-page argument runs in two halves down the page (the left "S/G." stub gives the degree argument, the right "G./S." stub the complementary argument); each major column heading (29, 30, 34, 35, 36, 37, 38, 39, 40, 41 degrees) carries paired sub-columns of degrees-and-minutes-and-seconds of the equation (printed as *G. / ' / "*, where the leading whole-degree figure is 0 unless shown). The banner at the page foot reads **SUBTRACT** [SVBTRAHE]; the catchword is **PRO-** (continuing *PROSTAPHÆRESES* on the next page).

Because the body of this table is a dense grid of sexagesimal equation values with no intervening prose, it is transcribed below as a single pipe-table per source page, preserving the left and right argument stubs verbatim. Where the leading whole-degree digit is blank in the source it represents 0.

Page "101" — first half (signs/argument block, rows 1–30, sub-cycle "O / I" at left; "I / II" at right)

Columns: each heading 29...41 is one composite column carrying degrees-minutes-seconds. The first sub-block (left margin "O", right margin "II") rows 1–30:

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
1	0	0	0	0	0	0	0	0	0	0	29 /
	19	20	21	22	22	22	22	23	23	23	12

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	35	0	51	52	13	32	51	10	28	46	
2	0	0	0	0	0	0	0	0	0	0	28
	39	40	43	43	44	45	45	46	46	47	
	10	0	2	44	26	0	43	20	57	32	
3	0	10	14	15	16	17	18	19	1	1	27
	58	1	33	36	38	38	35	31	10	11	
	46								25	18	
4	1	1	1	1	1	1	1	1	1	1	26
	18	19	26	27	28	30	31	32	33	34	
	21	59	4	28	50	10	26	41	54	4	
5	1	1	1	1	1	1	1	1	1	1	25
	37	39	47	49	51	52	54	55	57	58	
	55	58	35	19	2	41	17	51	22	50	
6	1	1	29	2	2	2	2	2	2	2	24
	57	59	5	11	13	15	17	19	20	22	
	30	57		11	14	13	8	0	50	35	
7	2	2	2	2	2	2	2	2	2	2	23
	17	19	30	33	35	37	39	42	44	46	
	3	55	34	1	25	46	59	10	17	20	
8	2	2	2	2	2	30	32	35	37	3	22
	36	39	52	54	57	15	49	19	45	10	
	36	53	2	52	36					5	
9	2	2	3	3	3	3	3	3	3	3	21
	56	59	13	16	19	22	25	28	31	33	
	9	50	31	42	47	45	39	27	11	49	
10	3	3	3	3	3	3	3	3	3	3	20
	15	19	34	38	41	45	48	51	54	57	
	41	47	59	31	56	13	28	35	37	33	
11	3	3	3	40	44	47	4	4	4	4	19
	35	39	56	19	5	44	11	14	18	21	
	12	43	26				16	42	2	16	
12	3	3	4	4	4	4	4	4	4	4	18
	54	59	17	22	26	30	34	37	41	44	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	42	37	53	7	13	12	4	49	27	58	
13	4	4	4	4	4	4	4	5 0	5 4	5 8	17
	14	19	39	43	48	52	56	55	51	40	
	11	30	18	53	29	40	51				
14	4	4	5 0	5 5	5	5	5	5	5	5	16
	33	39	43	39	10	15	19	24	28	32	
	38	22			26	6	37	0	15	21	
15	4	4	5	5	5	5	5	5	5	5	15
	53	59	22	27	32	37	42	47	51	56	
	4	14	4	24	22	32	22	14	37	2	
16	5	5	5	5	5	5	6 5	6	6	6	14
	12	19	43	49	54	59	7	10	14	19	
	29	4	29	8	37	57		7	59	41	
17	5	5	6 4	6	6	6	6	6	6	6	13
	31	38	50	10	16	22	27	33	38	43	
	53	53		51	41	21	50	10	19	20	
18	5	5	6	6	6	6	6	6	7 1	7 6	12
	51	58	26	32	38	44	50	56	39	57	
	15	40	10	32	43	43	32	11			
19	6	6	6	6	7 0	7 7	7	7	7	7	11
	10	18	47	54	44	4	13	19	24	30	
	36	26	29	13			13	11	58	34	
20	6	6	7 8	7	7	7	7	7	7	7	10
	29	38	46	15	22	29	35	42	48	54	
	56	11		52	44	25	53	10	15	10	
21	6	6	7	7	7	7	7	8 5	8	8	9
	49	57	30	37	44	51	58	8	11	17	
	14	53	2	29	43	44	32		32	44	
22	7 8	7	7	7	8 6	8	8	8	8	8	8
	30	17	51	59	40	14	21	28	34	41	
		34	16	5		1	9	4	47	17	
23	7	7	8	8	8	8	8	8	8	9 4	7
	27	37	12	20	28	36	43	50	58	50	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	43	13	29	39	35	17	45	59	1		
24	7	7	8	8	8	8	9 6	9	9	9	6
	46	56	33	42	50	58	20	13	21	28	
	55	50	40	12	29	31		53	14	20	
25	8 6	8	8	9 3	9	9	9	9	9	9	5
	5	16	54	43	12	20	28	36	44	51	
		25	49		21	44	52	45	25	49	
26	8	8	9	9	9	9	9	9	10	10	4
	25	35	15	25	34	42	51	59	7	15	
	12	58	56	13	12	55	23	36	35	17	
27	8	8	9	9	9	10	10	10	10	10	3
	44	55	37	46	56	5 5	13	22	30	38	
	17	28	2	40	1		52	25	43	44	
28	9 3	9	9	10	10	10	10	10	10	11	2
	19	14	58	8 5	17	27	36	45	53	2 9	
		57	5		47	12	18	12	49		
29	9	9	10	10	10	10	10	11	11	11	1
	22	34	19	29	39	49	58	7	16	25	
	22	23	6	28	32	18	47	58	54	32	
30	9	9	10	10	11	11	11	11	11	11	30
	41	53	40	50	1	11	21	30	39	48	
	20	46	5	49	14	22	11	42	56	53	

[Left margin band: "I" between the two halves; right margin band: "II"]

Page "101" — second half (rows 1–30, sub-cycle "I" at left / "II" continuing)

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
1	10	10	11	11	11	11	11	11	12	12	29
	0	13	1 1	12	22	33	43	53	2	12	
	14	6		8	55	19	22	14	57	13	
2	10	10	11	11	11	11	12	12	12	12	28

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	19	32	21	33	44	55	5	16	25	35	
	5	24	47	24	33	21	52	1	56	31	
3	10	10	11	11	12	12	12	12	12	13	27
	37	51	42	54	6 9	17	28	38	49	0 7	
	55	40	47	38		19	40	53	53		
4	10	11	12	12	12	12	12	13	13	13	26
	56	10	3	15	27	39	50	1	11	22	
	41	52	25	49	43	14	25	16	47	10	
5	11	11	12	12	12	13	13	13	13	13	25
	15	30	24	36	49	1 1	12	23	34	45	
	24	2	22	59	14		50	40	40	12	
6	11	11	12	12	13	13	13	13	13	14	24
	34	49	45	58	10	22	34	46	57	8	
	3	7	6	5	42	56	49	20	31	24	
7	11	12	13	13	13	13	13	14	14	14	23
	52	8 9	5	19	32	44	56	8	20	31	
	40		46	9	7	44	53	49	19	29	
8	12	12	13	13	13	14	14	14	14	14	22
	11	27	26	40	53	6	19	31	43	54	
	13	9	24	9	30	28	3	15	5	35	
9	12	12	13	14	14	14	14	14	15	15	21
	29	46	46	1 7	14	28	41	53	5	17	
	42	4	58		50	10	6	38	48	37	
10	12	13	14	14	14	14	15	15	15	15	20
	48	4	7	22	36	49	3 5	15	28	40	
	8	57	30	1	7	48		59	29	37	
11	13	13	14	14	14	15	15	15	15	16	19
	6	23	27	42	57	11	25	38	51	3	
	30	45	58	53	21	24	2	17	7	35	
12	13	13	14	15	15	15	15	16	16	16	18
	24	42	48	3	18	32	46	0	13	26	
	48	30	23	40	32	57	57	32	43	30	
13	13	14	15	15	15	15	16	16	16	16	17

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	43	1	8	24	39	54	8	22	36	49	
	2	11	44	25	39	27	48	44	15	23	
14	14	14	15	15	16	16	16	16	16	17	16
	1	19	29	45	0	15	30	44	58	12	
	11	47	1	6	42	53	35	53	45	13	
15	14	14	15	16	16	16	16	17	17	17	15
	19	38	49	5	21	37	52	70	21	34	
	17	20	15	44	44	17	21		12	59	
16	14	14	16	16	16	16	17	17	17	17	14
	37	56	9	26	42	58	14	29	43	57	
	18	48	25	18	42	36	3	3	36	43	
17	14	15	16	16	17	17	17	17	18	18	13
	55	15	29	46	3	19	35	51	5	20	
	13	11	31	48	34	52	41	2	56	22	
18	15	15	16	17	17	17	17	18	18	18	12
	13	33	49	7	24	41	57	12	28	43	
	5	30	33	14	24	4	15	58	13	1	
19	15	15	17	17	17	18	18	18	18	19	11
	30	51	9	27	45	2	18	34	50	5	
	52	44	31	36	9	13	46	51	26	35	
20	15	16	17	17	18	18	18	18	19	19	10
	48	9	29	47	5	23	40	56	12	28	
	36	53	25	53	50	17	13	40	36	6	
21	16	16	17	18	18	18	19	19	19	19	9
	6	27	49	87	26	44	1	18	34	50	
	10	58	13		28	18	36	25	42	34	
22	16	16	18	18	18	19	19	19	19	20	8
	23	45	8	28	47	5	22	40	56	12	
	41	57	56	15	0	13	55	6	45	57	
23	16	17	18	18	19	19	19	20	20	20	7
	41	3	28	48	7	26	44	1	18	35	
	6	50	33	19	29	5	9	41	44	16	
24	16	17	18	19	19	19	20	20	20	20	6

S/G. (L)	29 (^{o'''})	30	34	35	36	37	38	39	40	41	G./ S. (R)
	58	21	48	8	27	46	5	23	40	57	
	26	38	10	19	52	52	17	11	38	33	
25	17	17	19	19	19	20	20	20	21	21	5
	15	39	7	28	48	7	26	44	2	19	
	41	21	40	13	10	34	27	44	30	46	
26	17	17	19	19	20	20	20	21	21	21	4
	32	56	27	48	8	28	47	6	24	41	
	50	58	4	5	26	11	29	10	18	55	
27	17	18	19	20	20	20	21	21	21	22	3
	49	14	46	7	28	48	7	27	46	3	
	52	29	23	48	38	48	50	30	0	59	
28	18	18	20	20	20	21	21	21	22	22	2
	6	31	5	27	48	9	29	48	7	25	
	47	53	37	26	40	16	18	45	37	58	
29	18	18	20	20	21	21	21	22	22	22	1
	23	49	24	47	8	29	49	9	29	47	
	37	11	45	0	36	38	58	53	9	54	
30	18	19	20	21	21	21	22	22	22	23	30 /
	40	6	43	6	28	49	10	31	50	9	10
	19	24	46	28	30	58	47	2	40	45	

— reading the bottom argument upward; right-stub S / G.: 29, 30, 34, 35, 36, 37, 38, 39, 40, 41.]

TABLE 95 (continued). The orbital prosthaphaeresis of Saturn ♄, Jupiter ♃, Mars ♂, Venus ♀, and Mercury ☿.

[Sub-title: *Æquatio maxima, seu composita* — The maximum, or composite, equation] — **ADD** [ADDE]

Page "102" — first half (left band "2", rows 1–30)

S/G. (L)	29 (^{o'''})	30	34	35	36	37	38	39	40	41	G./ S. (R)
1	18	19	21	21	21	22	22	22	23	23	29 /

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	56	23	2	25	48	10	31	52	12	31	10
	55	29	42	50	19	11	24	2	4	31	
2	19	19	21	21	22	22	22	23	23	23	28
	13	40	21	45	8 1	30	51	13	33	53	
	24	27	33	7		18	56	23	23	12	
3	19	19	21	22	22	22	23	23	23	24	27
	29	57	40	4	27	50	13	33	54	14	
	46	18	16	17	37	19	4	48	36	49	
4	19	20	21	22	22	23	23	23	24	24	26
	46	14	58	23	47	10	32	54	15	36	
	0	3	53	21	7	14	42	4	43	20	
5	20	20	22	22	23	23	23	24	24	24	25
	2 7	30	17	42	6	30	52	15	36	57	
		39	23	18	31	4	57	11	47	46	
6	20	20	22	23	23	23	24	24	24	25	24
	18	47	35	1 9	25	49	7 6	35	57	19	
	5	8	47		48	47		44	56	7	
7	20	21	22	23	23	24	24	24	25	25	23
	33	4	54	19	44	9	33	56	18	40	
	57	30	4	53	59	24	8	13	36	23	
8	20	21	23	23	24	24	24	25	25	26	22
	49	19	12	38	4 4	28	53	16	39	1	
	39	41	13	30		54	3	33	22	32	
9	21	21	23	23	24	24	25	25	26	26	21
	5	35	30	57	23	48	12	36	0 1	22	
	14	48	14	0	2	18	53	48		36	
10	21	21	23	24	24	25	25	25	26	26	20
	20	51	48	15	41	7	32	56	20	43	
	39	43	8	24	49	34	35	56	34	33	
11	21	22	24	24	25	25	25	26	26	27	19
	35	7	5	33	0	26	51	16	41	4	
	56	31	55	35	21	43	40	57	1	14	
12	21	22	24	24	25	25	26	26	27	27	18

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	51	23	23	51	19	45	11	36	1	25	
	3	10	33	43	5	45	40	52	21	9	
13	22	22	24	25	25	26	26	26	27	27	17
	6 1	38	41	9	37	4	30	56	21	45	
		39	3	41	22	39	11	39	40	47	
14	22	22	24	25	25	26	26	27	27	28	16
	20	54	58	27	55	23	50	16	41	6	
	50	0	25	32	41	25	14	19	40	18	
15	22	23	25	25	26	26	27	27	28	28	15
	35	9	15	45	13	42	9	35	1	26	
	28	10	37	13	51	1	27	51	38	43	
16	22	23	25	26	26	27	27	27	28	28	14
	49	24	32	2	32	0	28	55	21	47	
	56	10	40	35	2	25	17	16	30	0	
17	23	23	25	26	26	27	27	28	28	29	13
	4	38	49	20	49	18	47	14	41	7 9	
	14	57	33	8	55	54	47	32	30		
18	23	23	26	26	27	27	28	28	29	29	12
	18	53	6	37	7	37	5	33	0	27	
	21	32	16	23	39	6	47	41	48	12	
19	23	24	26	26	27	27	28	28	29	29	11
	32	8 0	22	54	25	55	24	52	20	47	
	18		50	31	11	11	20	41	47	6	
20	23	24	26	27	27	28	28	29	29	30	10
	46	22	39	11	42	13	42	11	40	6	
	2	25	17	23	38	4	20	33	0	52	
21	23	24	26	27	27	28	29	29	29	30	9
	59	36	55	28	59	30	0	30	58	26	
	35	32	30	7	52	49	56	15	44	39	
22	24	24	27	27	28	28	29	30	30	30	8
	12	50	11	44	16	48	19	7	36	45	
	56	25	33	41	57	24	0	10	38	18	
23	24	25	27	28	28	29	36	30	30	31	7

S/G. (L)	29 (°)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	26	4 7	27	1 6	33	5	56	7	36	4	
	2		25		51	47	54	10	38	[?]	
24	24	25	27	28	28	29	29	30	30	31	6
	39	17	43	17	50	23	54	25	55	24	
	0	37	6	16	34	1	38	30	20	28	
25	24	25	27	28	29	29	30	30	31	31	5
	51	30	58	33	7 6	40	12	43	13	43	
	44	54	34	17		4	11	27	53	30	
16	25	25	28	28	29	29	30	31	31	32	4
	4	43	11	49	21	56	29	1	31	2	
	11	57	50	5	24	56	33	20	26	20	
17	25	25	28	29	29	30	30	31	31	32	3
	16	56	28	4	39	13	46	19	50	21	
	20	48	15	42	36	37	41	2	26	2	
18	25	26	28	29	29	30	31	31	32	32	2
	28	21	43	20	55	30	3	32	9	39	
	36	46	48	0	32	4	36	7	22	33	
19	25	26	28	29	30	30	31	31	32	32	1
	40	21	59	35	11	46	20	53	26	57	
	19	46	6	10	16	21	17	1	16	53	
30	25	26	29	29	30	—	31	32	32	33	30
	51	33	12	50	26		36	10	43	16	
	52	54	49	5	47		41	53	51	2	

Parsing notes (p.554 first half): the left stub column degrades from "26/27/28/29/30" to a misprinted/over-inked "16/17/18/19" sequence in the lower block — transcribed as printed; these are the second-decade rows (26–30). Several seconds-cells in rows 22–23 of the 38–41° columns are ink-bled and ambiguous (e.g. the "36 56 54" at row 23/38° is almost certainly a misread of a value near 29 39, and the 41° row-23 value is [?]).

Page "102" — second half (left band "3", rows 1–30)

S/G. (L)	29 (°)	30	34	35	36	37	38	39	40	41	G./ S. (R)
1	26	26	29	30	30	31	31	32	33	33	29 /
	3	45	26	5 0	40	18	53	27	1	33	9
	14	46	9		42	16	9	54	18	59	
2	26	26	29	30	30	31	32	32	33	33	28
	14	57	40	19	57	33	9	44	18	51	
	12	25	6	30	9	53	42	37	37	45	
3	26	27	29	30	31	31	32	33	33	34	27
	24	8	54	33	11	49	26	1 6	35	9	
	56	44	36	45	18	46	28		28	18	
4	26	27	30	30	31	32	32	33	33	34	26
	35	19	8 3	47	24	4	41	17	52	26	
	26	49		47	36	25	27	22	5	38	
5	26	27	30	31	31	32	32	33	34	34	25
	45	30	21	1	40	14	56	33	9 2	43	
	37	36	22	31	13	19	0	23		46	
6	26	27	30	31	31	32	33	33	34	35	24
	55	41	34	15	54	32	11	49	25	0	
	12	7	16	4	8	39	2	21	41	41	
7	27	27	30	31	32	32	33	34	34	35	23
	5 8	51	46	28	8 4	47	24	4	41	17	
		19	41	14		4	44	44	10	21	
8	27	28	30	31	32	33	33	34	34	35	22
	14	1	59	41	21	0	39	19	56	33	
	16	12	0	4	17	51	17	13	7	46	
9	27	28	31	31	32	33	33	34	35	35	21
	23	10	11	53	34	16	53	35	11	49	
	24	48	4	47	32	10	24	8	35	57	
10	27	28	31	32	32	33	34	34	35	36	20
	32	20	22	6 6	47	29	6	49	25	5	
	3	3	47		28	36	20	48	28	52	
11	27	28	31	32	33	33	34	35	35	36	19
	40	28	34	18	0 8	43	24	4	43	21	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	22	59	11	8		43	11	16	23	41	
12	27	28	31	32	33	33	34	35	35	36	18
	48	37	45	29	12	56	37	18	58	36	
	21	41	17	51	25	8	46	0	12	1	
13	27	28	31	32	33	34	34	35	36	36	17
	55	45	56	41	24	8	51	32	12	51	
	59	49	2	21	12	44	5	20	35	14	
14	28	28	32	32	33	34	35	35	36	37	16
	3	53	6	52	35	20	48	45	26	5	
	17	41	36	33	41	6		56	50	49	
15	28	29	32	33	33	34	35	35	36	37	15
	10	1	16	3	47	31	16	59	40	20	
	4	10	51	24	8	50	53	47	40	49	
16	28	29	32	33	33	34	35	36	36	37	14
	16	8	26	11	59	44	28	12	54	35	
	34	15	6	14	21	0	48	1	14	24	
17	28	29	32	33	34	34	35	36	37	37	13
	22	14	35	23	10	55	40	26	7	49	
	39	59	26	11	0	51	43	26	49	19	
18	28	29	32	33	34	35	35	36	37	38	12
	28	21	44	32	20	6	51	36	20	2	
	20	16	11	44	7	45	24	36	49	49	
19	28	29	32	33	34	35	36	36	37	38	11
	33	27	52	41	30	17	1	48	32	15	
	35	9	44	6	1	22	23	56	47	48	
20	28	29	33	33	34	35	36	37	37	38	10
	38	32	0	50	39	27	11	0 2	44	28	
	35	36	48	35	25	16	3		53	43	
21	28	29	33	33	34	35	36	37	37	38	9
	42	37	8 8	58	48	36	24	11	56	41	
	47	34		13	2	56	29	3	47	9	
12	28	29	33	34	34	35	36	37	38	38	8
	46	42	14	6	56	46	34	21	7	53	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	42	9	53	43	55	18	25	41	55	10	
13	28	29	33	34	35	35	36	37	38	39	7
	50	46	21	14	4	54	43	31	18	4	
	7	21	4	6	59	44	51	50	47	47	
14	28	29	33	34	35	36	36	37	38	39	6
	53	49	28	21	12	3	53	41	29	15	
	13	44	18	0	16	11	8	30	16	56	
15	28	29	33	34	35	36	37	37	39	39	5
	55	53	33	27	19	11	1	50	19	26	
	32	9	48	24	11	28	28	38	16	41	
26	28	29	33	34	35	36	37	37	38	39	4
	57	55	39	33	26	18	9	59	48	36	
	17	21	2	38	29	24	12	33	47	53	
27	28	29	33	34	35	36	37	38	38	39	3
	58	57	43	38	32	25	17	7	56	46	
	51	4	33	40	55	11	30	59	44	35	
28	28	29	33	34	35	36	37	38	39	39	2
	59	58	47	43	37	31	24	16	6	55	
	43	28	26	7	55	18	30	9	20	43	
29	29	29	33	34	35	36	37	38	39	40	1
	0 0	59	51	47	42	36	30	23	14	4	
		42	0	17	26	36	56	18	12	12	
30	28	30	33	34	35	36	37	38	39	40	30 /
	59	0 0	54	51	47	42	36	29	21	12	8
	42		16	23	17	19	26	35	44	54	

Parsing notes (p.554 second half): left stub again degrades mid-column from "21/22/23/24/25" to over-inked "12/13/14/15"; these are the rows 21–25 of the second decade, transcribed as printed. At row 29/29° the value reaches "29 0 0" and at row 30/30° "30 0 0" — the maxima where the argument equals the column-degree, as expected for the descending branch.

; right-stub S / G.: 29, 30, 34, 35, 36, 37, 38, 39, 40, 41.]

TABLE 95 (continued). The orbital prosthaphaeresis of Saturn ♄, Jupiter ♃, Mars ♂, Venus ♀, and Mercury ☿.

[Sub-title: *Æquatio maxima, seu composita* — The maximum, or composite, equation] — **ADD** [ADDE]

Page "103" — first half (left band "4", rows 1–30)

S/G.	29										G./
(L)	(^o ′′′)	30	34	35	36	37	38	39	40	41	(R)
1	28	29	35	34	35	36	37	38	39	40	29 /
	58	59	56	54	55	46	41	35	18	20	8
	48	41	55	25	4	51	43	39	35	33	
2	28	29	33	34	35	36	37	38	39	40	28
	57	58	58	56	54	50	46	41	34	27	
	17	45	36	49	12	45	24	7	50	36	
3	28	29	33	34	35	36	37	38	40	40	27
	55	57	59	58	50	54	50	45	28	34	
	9	10	39	19	42	0	26	56	0	2	
4	28	29	0 0	34	35	36	37	38	39	40	26
	52	54	0	59	50	55	53	50	47	39	
	51	56		38	30	35	48	0	45	50	
5	—	—	33	35	35	36	37	—	39	40	25
	48	52	59	0 0	59	58	56	53	49	45	
	55	3	39		38	29	29	36	45	0	
6	28	—	33	34	36	36	37	—	39	—	24
	44	48	58	59	0 0	59	58	56	53	49	
	47	26	34	38		36	25	21	22	25	
7	28	—	33	34	35	37	37	—	39	—	23
	39	44	56	58	59	0 0	59	58	56	53	
	53	5	43	21	38		6	22	12	0	
8	28	—	33	34	35	36	38	38	39	—	22
	34	38	54	56	58	59	0 0	59	58	56	
	18	59	4	35	30	36		11	17	4	
9	28	29	33	34	35	36	37	39	39	—	21
	27	33	50	53	56	58	59	0 0	59	58	
	58	0	38	51	18	36	50		34	15	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
10	28	29	33	34	35	36	37	40	40	40	20
	20	26	46	50	53	56	58	0 0	0 0	59	
	50	28	19	16	35	18	19			32	
11	28	29	33	34	35	36	37	38	41	41	19
	12	0	45	45	49	53	56	58	0 0	0 0	
	54	53	46	49	51	20	10	14			
12	28	29	—	34	35	36	—	—	39	40	18
	4	10	35	40	45	49	53	56	58	59	
	11	42	5	23	11	27	5	1	50	31	
13	27	29	—	34	35	36	—	—	39	40	17
	54	1	34	34	39	44	49	52	55	58	
	37	32	4	4	49	36	2	50	50	16	
14	27	28	—	34	35	36	—	—	39	40	16
	44	51	20	26	32	38	43	48	52	55	
	11	28	5	44	57	45	59	36	1	42	
15	—	28	—	34	35	36	—	—	39	40	15
	32	40	11	18	25	31	37	43	47	52	
	51	29	5	22	18	50	52	0	8	14	
16	—	28	33	34	35	36	37	—	39	40	14
	20	35	1	8	16	23	30	36	42	47	
	39	19	14	58	34	51	41	59	1	14	
17	27	—	32	33	35	36	—	39	39	40	13
	7	15	49	58	6	14	22	29	36	42	
	30	42	57	33	44	41	11	29	12	0	
18	26	— 1	32	33	34	36	—	20	39	40	12
	53	49	37	46	55	4	11	46	28	35	
	22		43	48	44	20	49		12	5	
19	26	27	32	33	34	35	36	38	39	40	11
	38	46	24	33	43	52	1 0	10	19	26	
	15	16	18	58	30	55		48	6	54	
20	26	27	32	33	34	35	36	37	39	40	10
	22	30	9	19	30	40	49	59	8	17	
	10	57	42	53	0	5	58	2	42	25	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
21	26	27	31	33	34	—	36	37	38	40	9
	5 1	13	53	4	15	25	36	46	56	6	
		54	51	30	13	55	31	52	54	32	
22	25	26	31	32	33	35	36	37	38	39	8
	46	55	36	47	59	10	21	32	43	54	
	49	45	42	49	4	22	37	46	4	10	
23	25	26	31	32	33	34	36	17	38	39	7
	27	36	18	29	41	53	5	12	28	40	
	33	29	14	45	50	35	20		42	13	
24	25	26	30	32	33	34	—	37	38	39	6
	7	16	58	10	22	35	47	0 0	12	24	
	12	4	28	18	53	23	23		31	50	
25	24	25	30	31	33	34	35	36	37	39	5
	45	54	37	49	1	14	28	41	54	7	
	41	26	5	19	55	51	0	0	12	37	
26	24	25	25	31	32	33	35	36	37	38	4
	23	31	14	26	39	53	6	20	34	48	
	16	22	26	53	48	11	52	45	42	40	
27	23	25	29	31	32	33	34	35	37	38	3
	59	7	50	2	16	29	44	58	13	27	
	14	31	7	45	0	49	26	35	41	50	
28	23	24	29	30	31	33	34	35	36	38	2
	8 2	42	24	37	50	4	19	35	51	6 4	
		1	9	7	24	44	41	13	13		
29	23	24	28	30	31	32	33	35	36	37	1
	8 0	15	56	9	23	37	52	9	27	43	
		28	35	44	21	42	41	53	11	24	
30	22	23	28	29	30	32	33	34	35	37	30 /
	40	47	27	40	54	9 0	24	40	56	13	7
	0	37	30	35	18		5	0	24	14	

Parsing notes (p.555 first half): this block is the apex of the descending branch. Where the leading whole-degree figure repeats unchanged from the row above, the source leaves it blank; transcribed as "—" in those cells (the degree carries

from the preceding row, e.g. "—48 55" = "28 48 55"). Several near-maximum cells where the equation crosses its peak (e.g. "0 0 0" at row 4/34°, and the "39 0 0", "40 0 0", "41 0 0" turning-points) are the points where each column's argument equals its heading-degree. A handful of badly ink-bled cells in rows 17–18 of the 38–39° columns are ambiguous and may be misread.

Page "103" — second half (left band "5", rows 1–30, closing to band "6")

S/G. (L)	29 (°)	30	34	35	36	37	38	39	40	41	G./ S. (R)
1	22	23	27	29	30	31	32	34	35	36	29
	11	18	57	9	23	38	53	9	26	44	
	55	22	4	43	23	1	40	44	35	0	
2	21	22	27	28	29	31	32	33	34	36	28
	42	47	24	36	50	5 9	20	37	54	12	
	0	45	32	58	31		4	13	27	21	
3	21	22	26	28	29	30	31	33	34	35	27
	10	15	50	2	15	30	45	3 6	19	38	
	45	43	14	19	39	10	49		55	47	
4	20	21	26	27	28	29	33	32	33	35	26
	38	42	14	25	38	53	8	25	42	1	
	18	25	6	45	44	2	33	53	53	51	
5	20	21	26	26	28	29	30	31	33	34	25
	4	7	0 0	47	0 0	13	30	45	4	22	
	34	39		12		44	0	45	33	8	
6	19	20	24	26	27	28	29	31	32	33	24
	29	31	56	6	18	31	46	3	20	39	
	28	27	13	34	30	58	55	15	54	49	
7	18	19	24	25	26	27	29	30	31	32	23
	53	53	14	23	35	47	2	18	33	54	
	8	32	53	54	4	54	22	20	45	4	
8	18	19	23	24	25	27	28	29	30	32	22
	15	14	30	39	49	1	15	30	47	6	
	29	53	36	9	22	25	11	38	0	13	
9	17	18	22	23	25	26	27	28	31	31	21
	36	34	44	52	1	12	25	40	4	16	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
	35	30	32	21	22	24	24	0	12	5	
10	16	17	21	23	24	25	26	27	29	30	20
	56	52	57	3	11	20	32	46	2 0	19	
	20	19	9	24	2	58	50	39		53	
11	16	17	21	22	23	24	25	26	28	29	19
	14	9	7	11	18	26	37	50	4	21	
	51	29	19	48	19	54	28	12	54	35	
12	15	16	20	21	22	23	24	25	27	28	18
	32	24	15	18	23	30	39	50	4 0	19	
	6	53	30	18	10	11	22	41		38	
13	14	15	19	20	21	22	23	24	26	27	17
	48	38	21	22	25	30	38	48	0 0	14	
	10	57	43	37	50	53	22	16		39	
14	14	14	18	19	20	21	22	23	24	26	16
	3 7	51	25	24	25	28	34	42	52	5	
		40	45	44	41	56	22	18	47	38	
15	13	14	17	18	19	20	21	22	23	24	15
	16	3 7	28	24	23	24	27	33	41	51	
	41		12	42	24	12	42	16	35	49	
16	12	13	16	17	18	19	20	21	22	23	14
	29	13	28	22	18	17	18	21	27	35	
	14	16	31	30	42	11	4	0	9	29	
17	11	12	15	16	17	18	19	20	21	22	13
	40	22	26	18	12	7	5	6 7	9	13	
	42	15	59	41	30	26	33		12	40	
18	10	11	14	15	16	16	17	18	20	20	12
	51	30	23	11	5	55	50	47	50	53	
	8	2	31	58	26	0	9	50	33	12	
19	10	10	13	14	14	15	16	17	18	19	11
	0	36	18	3	50	40	32	26	23	22	
	51	44	30	42	58	27	4	13	5	25	
20	9 9	9	12	12	13	14	15	16	16	17	10
	7	42	11	53	37	22	11	2 4	55	50	

S/G. (L)	29 (^o)	30	34	35	36	37	38	39	40	41	G./ S. (R)
		23	42	53	24	53	33		12	35	
21	8	8	11	11	12	13	13	14	15	16	9
	16	47	3	41	21	48	48	34	23	15	
	46	4	21	41	6		23	56	49	13	
22	7	7	9	10	11	11	12	13	13	14	8
	23	50	53	28	41	42	22	56	50	38	
	39	51	33	19		41	11		56	9	
23	6	6	8	9	9	10	10	11	12	12	7
	30	53	42	13	45	19	55	32	12	54	
	50	51	18	7	24	53	28	36	37	35	
24	5	5	7	7	8	8	9	9	10	11	6
	35	56	30	56	24	54	25	57	33	9	
	21	7	7	45	16	19	28	33	1	45	
25	4	4	6	6	72	7	7	8	8	9	5
	40	57	16	39	47	27	54	21	51	22	
	19	44	44	7		42	1	49	12	19	
26	3	3	52	5	5	5	6	6	77	7	4
	44	58	29	20	39	59	21	43	24	32	
	49	50		34	39	47	4	35		40	
27	2	2	3	41	4	4	4	53	5	5	3
	48	59	47	10	15	30	46	57	22	41	
	57	31	31		35	49	55		0	10	
28	1	1	2	2	2	30	3	3	3	3	2
	52	59	31	41	50	53	11	23	35	48	
	48	51	59	7	47		38	22	22	15	
29	0	0	1	1	1	1	1	1	1	1	1
	56	59	16	20	25	30	36	41	47	54	
	27	59	5	40	31	39	17	48	54	22	
30	00	—	—	—	—	—	—	—	—	—	30/
	0										6

; right-stub S / G.: 29, 30, 34, 35, 36, 37, 38, 39, 40, 41. Signature: **S 2.**]

Parsing notes (p.555 second half): this is the closing descending branch of TABLE 95 — the equation falls smoothly toward 0 0 0 at row 30/29° (where argument = column-degree on the far side of the cycle). The leading degree digit is again suppressed where it repeats from the row above. The final row (30) reads 0 0 0 for the 29° column and the remaining columns close at their own zero in the continuation; cells shown "—" are blank in the source at the very foot. Numerous near-zero cells are clean. A few mid-block seconds in the 38–40° columns (rows 4, 9) are ink-bled (e.g. "33 8 33" at row 4/38° and "31 4 12" at row 9/40° break the otherwise smooth monotone descent and are likely compositor or scan artifacts — flagged below).

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae, Part V

TABVLA 95 (continued) — The orbital prosthaphaereses of Saturn, Jupiter, Mars, Venus, and Mercury

These three pages (table-volume pages 104–106) continue **TABVLA 95**, *Prosthaphaeresis Orbis* ♄, ♃, ♂, ♀, & ☿ ("The orbital prosthaphaeresis of Saturn, Jupiter, Mars, Venus, and Mercury"), carrying the argument-degree column-groups **Gr. 42 through Gr. 48**. The running banner across the top of each page reads **PROSTAPHAERESES ORBIS** ("Orbital prosthaphaereses"). The sub-heading line reads *Æquatio maxima, seu composita* ("The maximum, or compound, equation") on the left and **ADDE** ("ADD") as the operative instruction for the upper (descending-argument) half; the foot of each page carries **SVBTRAHE** ("SUBTRACT") for the lower half.

Each column-group is headed by the whole-degree argument value (42, 43, ... 48) and a degree-marker, and is subdivided into **Gr. | ' | "** (degrees | minutes | seconds). The outermost left and right columns are the argument stub columns **S / G.** (Signs / Degrees), counting the minute-argument 1–30 downward on the left and the complementary 29→0 upward on the right. On page 104 the far-right panel carries the *Sinus omnium gr. maxima aequationis* ("Sine of the greatest equation for every degree") values.

Layout note on implicit carried-down degrees: within each column-group the compositor prints the whole-degree figure only on the row where it changes; on the following rows the degree column is left blank and the *same degree carries down* until a new one is printed. In the tables below, a carried-down degree that

is not re-printed in the source is supplied **in parentheses** so each cell (deg) min sec is complete. Parenthesized degrees are NOT illegible — they are simply not re-printed in the source. This layout feature accounted for the large majority of the first-pass [?] flags (now resolved); [?] is retained only on the small number of cells whose minute/second glyphs are themselves degraded at the scan resolution.

[Title line: TABVLA 95. *Prosthaphaeresis Orbis* †, ‡, §, ¶, & †.] [Sub-heading: *Æquatio maxima, seu composita* — ADDE.]

Left stub block marker: **S** ... (signs/degrees argument); the two outer Sign-markers printed in the left margin read **0** (top block) and **11** (lower block), with **I** likewise at the descending mid-table marker. Right outer markers read **12, 11, 10**.

G.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	G.
1	0	3	0	20	0	16	0	51	0	6	0	20	0	35	29
	24		24		24		24		25		25		25		
2	0	7	0	39	0	11	0	42	0	12	0	40	0	10	28
	48		48		49		49		50		50		51		
3	1	10	1	59	1	47	1	33	1	18	1	1	1	44	27
	12		12		13		14		15		16		16		
4	1	12	1	18	1	22	1	24	1	24	1	20	1	19	26
	36		37		38		39		40		41		42		
5	2	15	2	38	2	58	2	15	2	30	2	40	2	13	25
	0		1		2		4		5		7		7		
6	2	17	2	57	2	32	2	5	2	35	2	0	2	27	24
	24		25		27		29		30		32		33		
7	2	19	2	16	2	7	2	56	2	40	2	20	2	1	23
	48		50		52		53		55		57		59		
8	3	21	3	33	3	41	3	45	3	45	3	40	3	35	22
	12		14		16		18		20		22		24		
9	3	22	3	51	3	15	3	35	3	50	3	0	3	8	21
	36		38		41		43		45		48		50		
10	4	22	4	9	4	49	4	24	4	54	4	20	4	41	20
	0		3		5		8		10		13		15		
11	4	23	4	26	4	22	4	13	4	58	4	38	4	14	19
	24		27		30		33		35		38		41		
12	4	23	4	42	4	54	4	1	5	1	5	56	5	46	18

G.	42	42	43	43	44	44	45	45	46	46	47	47	48	48	G.
	'	"	'	"	'	"	'	"	'	"	'	"	'	"	
	48		51		54		58		1		3		6		
13	5	22	5	58	5	26	5	48	5	4	5	14	5	17	17
	12		15		19		22		26		29		32		
14	5	20	5	13	5	58	5	35	5	6	5	31	5	48	16
	36		40		43		47		51		54		57		
15	6	18	6	28	6	28	6	21	6	8	6	47	6	19	15
	0		4		8		12		16		19		23		
16	6	15	6	41	6	58	6	7	6	9	6	2	6	49	14
	24		28		32		37		41		45		48		
17	6	12	6	54	6	27	7	52	7	9	7	18	7	18	13
	48		52		57		1		6		10		14		
18	7	7	7	5	7	55	7	36	7	9	7	32	7	47	12
	12		17		21		26		31		35		39		
19	7	0	7	16	7	23	7	19	7	8	8	45	8	14	11
	36		41		46		51		56		0		5		
20	7	53	8	26	8	49	8	2	8	5	8	58	8	42	10
	59		5		10		16		21		25		30		
21	8	45	8	35	8	14	8	43	8	1	8	10	8	8	9
	23		29		35		40		46		51		56		
22	8	36	8	43	8	39	9	23	9	57	9	21	9	34	8
	47		53		59		5		10		16		21		
23	9	25	9	50	9	2	9	2	9	52	9	31	9	58	7
	11		17		24		30		35		41		46		
24	9	14	9	56	9	24	9	41	10	46	10	39	10	25	6
	35		41		48		54		0		6		12		
25	9	1	10	0	10	45	10	18	10	39	10	47	10	44	5
	59		6		12		19		25		31		37		
26	10	47	10	3	10	5	10	54	10	30	10	54	11	6	4
	22		30		37		43		50		56		3		
27	10	31	10	4	11	23	11	29	11	21	11	0	11	27	3
	46		54		1		8		15		22		28		
28	11	14	11	4	11	40	11	2	11	10	11	4	11	46	2
	10		18		25		33		40		47		53		

	42	42	43	43	44	44	45	45	46	46	47	47	48	48	
G.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	G.
29	11	55	11	3	11	56	11	33	12	58	12	7	12	3	1
	33		42		49		57		4		12		19		
30	11	35	12	1	12	11	12	4	12	44	12	9	12	19	30
	57		6		14		22		29		37		44		
1	12	12	12	55	12	23	12	33	12	29	13	9	13	35	29
	21		29		38		46		54		2		9		
2	12	48	12	49	13	33	13	10	13	22	13	9	13	50	28
	44		53		2		11		19		27		34		
3	13	23	13	41	13	41	13	26	13	54	13	6	14	3	27
	8		17		26		35		43		52		0		
4	13	54	13	31	13	49	13	50	14	35	14	2	14	14	26
	31		41		50		59		8		17		25		
5	13	25	14	19	14	54	14	13	14	33	14	47	14	24	25
	55		5		14		24		33		41		50		
6	14	53	14	5	14	58	14	33	14	50	15	49	15	32	24
	18		29		38		48		57		6		15		
7	14	19	14	49	15	0	15	52	15	26	15	41	15	39	23
	42		52		3		12		22		31		40		
8	15	43	15	31	15	0	15	8	15	59	15	30	16	44	22
	5		16		27		37		46		56		5		
9	15	4	15	10	15	57	16	23	16	30	16	16	16	47	21
	29		40		50		1		11		21		30		
10	15	23	16	49	16	52	16	36	16	59	16	3	16	48	20
	52		3		14		25		35		46		55		
11	16	40	16	24	16	45	16	46	17	27	17	47	17	48	19
	15		27		38		49		0		10		20		
12	16	55	16	57	17	36	17	53	17	51	17	29	17	45	18
	38		50		2		13		24		35		45		
13	17	6	17	27	17	25	17	1	17	15	18	8	18	41	17
	2		14		26		38		49		0		10		
14	17	15	17	55	17	11	18	4	18	36	18	46	18	35	16
	25		37		50		2		13		24		35		
15	17	22	18	20	18	55	18	6	18	53	18	21	19	26	15

	42	42	43	43	44	44	45	45	46	46	47	47	48	48	
G.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	G.
	48		1		13		26		37		49		0		
16	18	25	18	42	18	35	18	4	19	11	19	54	19	16	14
	11		24		37		50		2		13		25		
17	18	25	18	2	19	13	19	59	19	24	19	25	19	3	13
	34		48		1		13		26		38		50		
18	18	23	19	19	19	49	19	55	19	35	20	53	20	47	12
	57		11		24		37		50		2		14		
19	19	17	19	32	19	21	20	45	20	44	20	19	20	30	11
	20		34		48		1		14		27		39		
20	19	8	19	42	20	53	20	33	20	50	20	41	21	10	10
	43		57		11		25		38		51		4		
21	20	56	20	50	20	17	20	18	21	53	21	4	21	47	9
	5		20		35		49		2		16		28		
22	20	40	20	54	20	40	21	0	21	53	21	20	21	7	8
	28		43		58		13		26		40		53		
23	20	20	21	54	21	0	21	38	21	49	22	34	22	53	7
	51		6		22		36		50		4		17		
24	21	57	21	51	21	16	22	13	22	41	22	45	22	36	6
	13		29		45		0		14		28		42		
25	21	30	21	45	22	30	22	46	22	34	22	55	23	49	5
	36		52		8		23		38		52		6		
26	21	0	22	35	22	40	22	15	23	22	23	1	23	13	4
	59		15		31		47		2		17		31		
27	22	25	22	21	22	45	23	41	23	8	23	8	23	4	3
	21		38		54		10		26		41		55		
28	22	46	23	3	23	48	23	2	23	47	24	1	24	50	2
	43		1		17		34		49		5		19		
29	23	4	23	41	23	46	23	20	24	16	24	52	24	41	1
	6		23		40		57		13		28		44		
30	23	16	23	14	24	40	24	34	24	58	24	41	25	14	30
	28		46		3		20		36		52		8		

Foot stub: **S** | G. 42 | 0 | 34 [recte 43?] | 0 | 44 | 0 | 45 | 0 | 46 | 0 | 47 | 0 | 48 | 0
| G. **S** [Foot instruction: **SVBTRAHE.**]

Right-hand panel — *Sinus omnium gr. maxima aequationis* ("Sine of the greatest equation for every degree"):

(gr.)	Sinus
5	244005
6	225829
7	210480
8	197203
9	185512
10	175072
11	165648
12	157064
13	122973 [suspected source error — see Numerical impossibles]
14	117435 [suspected source error — see Numerical impossibles]
15	112218
16	107288
17	101619
18	98188
19	93973
20	89959
21	86128
26	82469
27	78968
28	75614
29	72399
30	69314
34	58126
35	55186
36	53139
37	50780
38	48505

(gr.)	Sinus
39	46311
40	44194
41	42150
42	40177
43	38273
44	36433
45	34657
46	32942
47	31286
48	29686

Parsing notes (page 104): the right-hand *Sinus* panel is printed in a narrow column with irregular row spacing, and the argument labels are printed slightly offset from their sinus rows; the list is non-contiguous (it skips arguments 1–4, 22–25, 31–33), and the labels are transcribed as printed. The values at arguments 13 and 14 (122973, 117435) break the smooth monotone decrease of the sine column (157064 at gr. 12 → expected $\approx 147k / \approx 138k \rightarrow 112218$ at gr. 15); these are almost certainly compositor digit-transposition errors and are transcribed as printed — see Numerical impossibles. The main table's left/right stub blocks switch between ascending (1–25) and the continuation numbering (16–30, then 1–30) exactly as printed; this reflects the table's sign-block layout, not a transcription error.

[Title line: TABVLA 95. *Prosthaphaeresis Orbis* ♃, ♁, ♂, ♀, & ♄.] [Sub-heading: *Æquatio maxima, seu composita* — ADDE.]

Left outer Sign-markers: **2, 3**; right outer markers: **10, 9, 8**. (The three rightmost column-groups on this page are ruled but blank — the table runs only through Gr. 48; no values are printed in the empty right panels.)

G.	42	42	43	43	44	44	45	45	46	46	47	47	48	48	G.
1	23	24	24	44	24	30	24	44	25	27	25	39	25	22	29
	50		8		26		43		0		16		32		
2	24	27	24	9	24	16	25	51	25	53	25	24	25	25	28
	12		31		49		6		23		40		56		
3	24	26	24	29	25	57	25	53	25	15	26	5	26	25	27
	34		53		11		29		47		4		20		

G.	42	42	43	43	44	44	45	45	46	46	47	47	48	48	G.
	'	"	'	"	'	"	'	"	'	"	'	"	'	"	
4	24	20	25	45	25	35	25	50	26	33	26	43	26	22	26
	56		15		34		52		10		27		44		
5	25	8	25	55	25	7	26	43	26	47	26	16	27	14	25
	18		37		57		15		33		51		8		
6	25	52	26	1	26	34	26	32	26	56	27	45	27	2	24
	39		0		19		38		56		14		32		
7	26	31	26	2	26	57	27	17	27	0	27	10	27	47	23
	1		22		41		1		20		38		55		
8	26	3	26	57	27	14	27	55	27	0	28	30	28	26	22
	23		43		4		23		43		1		19		
9	26	31	27	48	27	27	27	29	28	56	28	46	28	0	21
	44		5		26		46		5		24		43		
10	27	52	27	32	27	34	28	58	28	46	28	57	29	33	20
	5		27		48		8		28		47		6		
11	27	7	27	11	28	35	28	22	28	31	29	3	29	0	19
	27		49		10		31		51		11		30		
12	27	16	28	44	28	31	28	40	29	11	29	4	29	22	18
	48		10		32		53		14		34		53		
13	28	19	28	10	28	21	29	52	29	45	29	0	30	39	17
	9		32		54		15		36		57		16		
14	28	15	28	31	29	5	29	59	29	15	30	51	30	51	16
	30		53		16		37		59		19		39		
15	28	4	29	44	29	43	30	0	30	38	30	36	31	57	15
	51		14		37		0		21		42		2		
16	29	46	29	51	29	13	30	54	30	55	31	16	31	58	14
	11		35		59		21		43		5		25		
17	29	22	29	51	30	38	30	45	31	6	31	49	31	54	13
	32		56		20		43		6		27		48		
18	29	50	30	44	30	56	31	24	31	12	31	18	32	44	12
	52		17		41		5		28		50		11		
19	30	10	30	31	31	6	31	0	31	10	32	39	32	28	11
	13		38		3		27		50		12		34		
20	30	22	30	9	31	10	31	27	32	2	32	54	32	6	10

	42	42	43	43	44	44	45	45	46	46	47	47	48	48	
G.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	G.
	33		59		24		48		12		34		57		
21	30	27	31	39	31	6	32	48	32	47	32	3	33	38	9
	53		19		45		9		33		57		19		
22	31	22	31	1	32	54	32	2	32	25	33	5	33	2	8
	13		40		5		31		55		19		42		
23	31	9	32	15	32	34	32	7	33	56	33	1	34	21	7
	33		0		26		52		16		41		4		
24	31	48	32	21	32	6	33	5	33	19	34	47	34	32	6
	52		20		47		13		38		2		26		
25	32	17	32	18	33	30	33	35	33	34	34	28	34	37	5
	12		40		7		33		59		24		48		
26	32	37	33	5	33	44	33	36	34	41	34	0	35	34	4
	31		0		27		54		20		46		10		
27	32	47	33	43	33	49	34	8	34	40	35	25	35	24	3
	50		19		47		15		41		7		32		
28	33	47	33	11	34	46	34	32	35	30	35	41	35	5	2
	9		39		7		35		2		28		54		
29	33	36	33	30	34	33	34	47	35	12	35	49	36	39	1
	28		58		27		55		23		49		15		
30	33	16	34	38	34	10	35	52	35	44	36	48	36	4	30
	47		17		47		15		43		10		37		
1	34	43	34	36	35	37	35	47	36	7	36	38	36	20	29
	5		36		6		35		4		31		58		
2	34	0	34	23	35	53	35	32	36	20	36	18	37	28	28
	24		55		25		55		24		52		19		
3	34	4	35	57	35	58	36	6	36	24	37	49	37	26	27
	42		13		44		15		44		12		40		
4	34	56	35	21	36	51	36	29	37	15	37	10	38	15	26
	59		32		3		34		4		33		1		
5	35	36	35	32	36	33	36	41	37	57	37	20	38	53	25
	17		50		22		53		23		53		21		
6	35	2	36	30	36	3	37	43	37	27	38	20	38	22	24
	35		8		41		12		43		13		42		

G.	42	42	43	43	44	44	45	45	46	46	47	47	48	48	G.
	'	"	'	"	'	"	'	"	'	"	'	"	'	"	
7	35	15	36	15	36	23	37	30	38	46	38	9	39	39	23
	52		26		59		31		2		33		2		
8	36	14	36	47	37	24	37	5	38	53	38	45	39	46	22
	9		43		17		50		21		52		22		
9	36	59	37	5	37	9	38	28	38	47	39	11	39	41	21
	25		1		35		8		40		12		42		
10	36	29	37	9	37	51	38	37	38	28	39	23	40	24	20
	42		18		52		26		59		31		2		
11	36	43	37	57	38	14	38	33	39	56	39	23	40	55	19
	58		34		10		44		17		50		21		
12	37	41	37	31	38	21	39	14	39	11	40	10	40	13	18
	14		51		27		2		36		9		41		
13	37	23	38	48	38	14	39	41	39	11	40	43	41	19	17
	30		7		44		19		54		27		0		
14	37	47	38	48	39	49	39	51	40	55	40	1	41	5	16
	45		23		0		36		11		46		19		
15	38	54	38	31	39	8	39	45	40	24	41	5	41	47	15
	0		39		17		53		29		4		37		
16	38	41	38	55	39	10	40	23	40	37	41	52	41	9	14
	15		54		33		10		46		21		56		
17	38	11	39	3	39	54	40	44	41	35	41	25	42	16	13
	30		10		48		26		3		39		14		
18	38	20	39	50	40	19	40	47	41	14	41	40	42	7	12
	44		24		4		42		20		56		32		
19	38	8	39	18	40	9	40	31	41	35	42	38	42	42	11
	58		39		19		58		36		13		49		
20	39	35	39	25	40	41	41	36	41	38	42	13	43	59	10
	11		53		33		13		52		30		6		
21	39	39	40	9	40	35	41	59	42	20	42	39	43	57	9
	24		7		48		28		8		46		23		
22	39	21	40	32	41	39	41	42	42	43	43	41	43	32	8
	37		20		2		43		23		2		40		
23	39	38	40	30	41	19	41	4	42	44	43	12	43	57	7

	42	42	43	43	44	44	45	45	46	46	47	47	48	48	
G.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	G.
	49		33		16		58		38		18		56		
24	40	31	40	6	41	36	42	3	42	24	43	43	44	18	6
	1		46		29		12		53		33		12		
25	40	58	40	15	41	29	42	37	43	41	43	41	44	37	5
	12		58		42		25		7		48		28		
26	40	57	41	59	41	55	42	47	43	34	44	16	44	53	4
	23		9		54		38		21		3		43		
27	40	28	41	15	42	55	42	35	43	2	44	24	44	47	3
	34		21		6		51		35		17		58		
28	40	30	41	1	42	27	43	48	43	4	44	12	45	16	2
	44		32		18		3		48		31		13		
29	40	56	41	16	42	22	43	38	44	32	44	32	45	50	1
	53		42		29		15		0		44		27		
30	41	1	41	6	42	5	43	58	44	45	44	24	45	58	0
	3		52		40		26		12		57		40		

Foot stub: **S** | G. 42 | 0 | 43 | 0 | 44 | 0 | 45 | 0 | 46 | 0 | 47 | 0 | 48 | 0 | G. **S**
[Foot instruction: **SVBTRAHE.**]

Parsing notes (page 105): the three column-groups to the right of the Gr. 48 block are ruled but contain no printed values (the table closes at 48 degrees of argument). The row at left-stub 15 in the Gr. 45 group reads exactly **30 0 0** — a clean round value at mid-table, consistent with the table's symmetric construction (the 30°-of-arc crossing). Page 105 is clean throughout; no residual illegible cells.

[Title line: TABVLA 95. *Prosthaphaeresis Orbis* ᵿ, ʌ, σ, Ϙ, & ϙ.] [Sub-heading: *Æquatio maxima, seu composita* — ADDE.]

Left outer Sign-markers: **4, 5**; right outer markers: **8, 7, 6**. On this page the printing of the left column-groups (Gr. 42, Gr. 43, especially the degree component) is faint and intermittent — in many rows the whole-degree figure is not re-printed (it carries down from the row where it last changed), so only the minute and second components show. Per the layout note above, the carried-down degree is supplied **in parentheses** so each cell (deg) min sec is complete; only a handful of cells whose minute/second glyphs are themselves degraded retain [?]. The three rightmost column-groups are again ruled but blank.

	42	42	43	43	44	44	45	45	46	46	47	47	48	48	
G.	'	"	'	"	'	"	'	"	'	"	'	"	'	"	G.
1	41	27	42	20	42	7	43	47	44	21	45	48	45	7	29
	11		1		50		37		24		9		54		
2	41	19	42	0	42	34	43	4	44	27	45	41	46	48	28
	19		10		59		48		35		21		6		
3	41	53	42	5	42	30	43	48	44	0	45	33	46	59	27
	26		18		8	[s	57		46		33		18		
						us									
						pe									
						ct									
						ed									
						so									
						ur									
						ce									
						er									
						ro									
						r									
						—									
						se									
						e									
						S									
						E-									
						2]									
4	41	12	(4	33	43	49	44	57	44	59	45	52	46	38	26
	33		2)		16		6		55		43		30		
			25												
5	41	12	(4	24	43	31	44	30	45	24	45	7	46	44	25
	39		2)		24		15		5		54		47		
			32												
6	(4	30	42	34	43	32	(4	24	45	10	46	46	46	15	24
	1)		38		31		4)		14		3		52		
	44						23								
7	41	5	(4	1	(4	55	(4	38	45	17	46	47	47	9	23
	49		2)		3)		4)		22		12		2		
			44		37		30								
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	1)		2)		3)		4)		29		21		11		
	52		48		43		37								
9	(4	56	(4	41	(4	22	(4	57	45	27	46	41	47	59	21
	1)		2)		3)		4)		36		28		19		
	55		52		48		42								
10	(4	9	42	49	43	23	(4	57	45	23	46	41	47	50	20
	1)		55		52		4)		43		35		27		
	58						47								
11	41	31	(4	6	(4	40	(4	31	45	34	46	49	47	56	19
	59		2)		3)		4)	[?	47		41		34		
			58		55		51]							
12	42	0	42	31	(4	3	(4	31	45	14	46	10	47	8	18
	0		59		3)		4)		51		47		41		
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13	41	30	43	0	43	30	(4	55	45	22	46	38	47	46	17
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14	41	2	42	30	44	0	44	29	45	54	46	12	47	23	16
	58		59		0		59		57		55		51		
15	41	33	42	59	43	49	45	0	45	27	46	49	47	3	15
	55		57		59		0		59		57		55		
16	41	56	42	24	43	55	44	28	46	0	46	26	47	26	14
	51		55		57		59		0		59		57		
17	41	13	(4	40	(4	13	44	50	45	27	47	0	47	0	13
	47		2)		3)		57		59		0		59		
			51		55										
18	41	6	(4	40	(4	21	44	3	45	45	46	25	48	0	12
	41		2)		3)		55		57		59		0		
			46		51										
19	41	5	(4	17	(4	13	44	0	45	50	46	40	47	26	11
	34	[?	2)		3)		51		54		57		59		

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20	41	34	(4	4	(4	48	44	40	45	40	46	37	47	36	10
	25		2)		3)		45		50		54		57		
			33		39										
21	41	38	42	10	(4	58	44	58	45	6	46	16	47	28	9
	15		24		3)		38		45		50		54		
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	4		13		3)		30		38		44		49		
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	51		1		3)		21		5)		37		44		
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	36		48		3)		9		5)		28		36		
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25	40	31	41	8	42	14	43	48	(4	42	46	49	47	5	5
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26	40	29	41	4	(4	16	43	58	44	4	46	27	47	4	4
	2		16		2)		41		54		5		16		
					29										
27	39	31	40	4	(4	10	43	10	44	29	(4	5	47	47	3
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2	37	45	38	40	40	45	41	59	42	12	44	16	45	2	28
	39		49		8		27		47		6		25		
3	36	13	38	46	39	43	40	53	42	12	43	28	44	57	27
	57		16		36		56		17		37		57		
4	36	58	37	7	39	48	40	53	41	14	43	40	44	7	26
	20		41		1		22		44		5		27		
5	35	55	37	55	38	55	39	48	41	8	42	8	43	25	25
	41		2		23		45		8		33		53		
6	34	50	36	52	37	45	39	23	40	35	41	12	43	8	24
	59		20		42		5		28		52		16		
7	34	40	35	50	37	17	38	31	38	36	41	9	42	10	23
	14		37		0		21		58		10		35		
8	33	17	34	51	36	17	36	32	38	41	40	2	41	9	22
	26		47		10		44		7		24		50		
9	32	33	33	50	35	33	35	2	37	27	39	50	40	[?	21
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11	30	14	32	48	33	5	34	7	36	41	37	44	39	27	19
	40		0		23		47		12		39		8		
12	29	28	30	15	32	36	33	39	35	7	36	15	38	0	18
	37		57		19		42		8		35		4		

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13	28	49	29	35	31	29	32	29	33	22	35	30	36	20	17
	30		49		10		35		58		25		54		
14	27	9	28	32	29	15	31	18	32	27	34	1	35	42	16
	20		37		57		19		43		10		38		
15	26	23	27	5	28	17	30	0	31	31	32	48	34	42	15
	5		21		39		0		23		48		6	[?	
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16	24	26	26	5	27	22	28	20	29	59	31	15	32	13	14
	46		0		16		35		56		21		48		
17	23	20	24	30	25	26	27	12	28	50	29	20	31	43	13
	23		34		48		5		24		47		12		
18	21	59	23	15	24	24	25	1	26	34	28	44	29	0	12
	55		4		15		30		46		6		30		
19	20	29	21	24	22	15	23	7	25	7	26	18	27	59	11
	24		29		37		48		2		19		39		
20	18	31	19	57	20	59	22	4	23	14	24	16	25	58	10
	48		49		55		1		11		24		41		
21	17	14	18	3	19	44	20	27	21	22	22	39	23	16	9
	9		6		5		8		14		23		36		
22	15	49	16	51	17	40	18	29	19	20	20	32	21	16	8
	25		17		12		10		11		15		23		
23	13	51	14	32	15	1	16	13	17	23	18	47	19	33	7
	38		26		15		7		7		0		9		
24	11	31	12	37	13	5	13	8	14	59	15	45	16	43	6
	48		29		13		59		47		39		34		
25	9	16	10	13	11	17	11	12	12	27	13	55	14	17	5
	55		30		7		46		28		12		0		
26	7	27	8	53	8	7	9	15	10	30	10	59	11	57	4
	59		27		58		30		4		40		19		

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	1		23		46		10		36		4		34		
28	4	46	4	30	4	0	4	32	5	12	5	6	5	21	2
	1		10		32		48		6		25		45		
29	2	15	2	34	2	23	2	42	2	37	2	8	2	12	1
	1		8		16		24		33		43		53		
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
	0		0		0		0		0		0		0		

Foot stub: **S** | G. 42 | 0 | 43 | 0 | 44 | 0 | 45 | 0 | 46 | 0 | 47 | 0 | 48 | 0 | G. **S**
[Foot instruction: **SVBTRAHE.**]

Parsing notes (page 106): this is the most degraded page of the batch. The Gr. 42 and Gr. 43 column-groups on the upper-left are faint, and in many rows the whole-degree figure was not re-printed by the compositor (the table only re-prints the degree when it changes), so the leading "41" / "42" / "43" carries down implicitly; these carried degrees are supplied in parentheses, e.g. (42) 25 33. Re-transcription resolved the great majority of the first-pass [?] flags as this carry-down layout feature rather than illegibility. Only a small set of cells whose minute/second glyphs are themselves ink-degraded retain [?]: see notes PN-5 through PN-9 below (and PN-2/PN-3 elsewhere on this page). The descending lower half of the table closes at the final row (left-stub 30 / right-stub 0) with all groups at **0 0 0**, exactly as expected for the end of the prosthaphaeresis argument — confirming TABVLA 95 finishes here at 48° of argument and 90° of anomaly. Rows 12–18 of the upper block show the table's maximum-equation crossing, where successive groups read the round maxima for each whole-degree argument (**42 0 0 / 43 0 0 / 44 0 0 / 45 0 0 / 46 0 0 / 47 0 0 / 48 0 0** in turn down the diagonal) — these clean round values are a feature of the table construction, not transcription artifacts.

Residual illegible cells on page 106 (genuine DPI-floor ink-loss, NOT the layout feature; best readings given above):

- PN-2 (Gr. 45, upper-block arg 11): (44) 51 31 — the seconds 31 is faint; reading tentative.
- PN-3 (Gr. 42, upper-block arg 19): 41 34 5 — final seconds digit faint (could be 5 or 8).

- PN-5 (Gr. 45, lower-block arg 1): 40 45 [?] — degree and minutes printed but the seconds field is partly lost; third position unresolved.
- PN-6 (Gr. 45, lower-block arg 7): 37 33 38 — value sits below the local trend and glyphs are faint; possible misread and/or trend-break.
- PN-7 (Gr. 48, lower-block arg 9): 40 57 [?] — seconds field lost at right edge / gutter.
- PN-8 (Gr. 48, lower-block arg 15): 34 6 42 — faint; minutes uncertain.
- PN-9 (Gr. 45, lower-block arg 29): 1 24 42 — leading degree reads 1 but the column trend wants 2; faint.

Suspected source errors on page 106 (monotone-breaks / out-of-order values, transcribed as printed — NOT smoothed; for editorial footnoting):

- SE-2 (Gr. 44, upper-block arg 3): 42 8 30 sits far below its neighbours (42 18 5 above, 43 16 49 below) and breaks the rising trend; the degree is almost certainly mis-set or a figure dropped. As printed.
- SE-3 (Gr. 42, upper-block arg 13): 41 59 30 is a small dip after 42 0 0 (arg 12) — consistent with the table's turning point near the Gr. 42 maximum (~42°0'), so plausibly correct turning-point behaviour rather than an error; noted for verification.
- SE-4 (Gr. 47, upper-block arg 27): (46) 5 5 breaks the descent (46 17 49 above at arg 25, 45 34 5 below at arg 28) and the degree carry is ambiguous (46 vs 45). Suspected mis-set. As printed.
- SE-5 (Gr. 42, upper-block arg 30): 38 10 20 drops steeply from 38 56 35 (arg 29); flagged though it may be a genuine steep gradient near the SVBTRAHE fold. As printed.
- SE-6 (Gr. 43, lower-block arg 9): 34 55 50 is out of order — it exceeds arg 8 (34 47 51) where the column is descending; almost certainly should be ~33 5x. Suspected compositor digit error. As printed.

Astronomiae Reformatae Tomus II — Tabulae novalmagesticae, Part V

TABVLA 96 (table-page 107)

TABVLA 96. The General Latitude of the Five Planets (*Generalis Latitudinis Quinque Planetarum*).

Sub-heading: **Degrees of the circle up to 10** (*Gradus Circuli usque ad 10*).

The argument (stub) is **Scrupula Graduum** ["minutes of degrees," read vertically down the left margin], running 0–60. Each whole-degree column (headed 0, 1, 2, ... 9) gives a pair of values **G. | '** (degrees | minutes). Per the foot note, these are sines.

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0	0	0	1	3	2	6	3	8	4	1	5	1	6	1	7	1	8	2	9	2
										1	4	6	9	1	3					
1	0	1	1	4	2	7	3	9	4	1	5	1	6	1	7	2	8	2	9	2
										2	5	7	0	2	4					
2	0	2	1	5	2	8	3	1	4	1	5	1	6	1	7	2	8	2	9	2
								0	3	6	8	1	3	5						
3	0	3	1	6	2	9	3	1	4	1	5	1	6	1	7	2	8	2	9	2
								2	4	7	9	2	4	6						
4	0	4	1	7	2	1	3	1	4	1	5	1	6	2	7	2	8	2	9	2
						0	3	5	8	0	3	5	7							
5	0	5	1	8	2	1	3	1	4	1	5	1	6	2	7	2	8	2	9	2
						1	4	6	9	1	4	6	8							
6	0	6	1	9	2	1	3	1	4	1	5	2	6	2	7	2	8	2	9	2
						2	5	7	0	3	5	7	9							
7	0	7	1	1	2	1	3	1	4	1	5	2	6	2	7	2	8	2	9	3
				0	3	6	8	1	4	6	8	0								
8	0	8	1	1	2	1	3	1	4	1	5	2	6	2	7	2	8	2	9	3
				1	4	7	9	2	5	7	9	1								
9	0	9	1	1	2	1	3	1	4	2	5	2	6	2	7	2	8	3	9	3

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			2	5	8	0	3	6	8	0	2									
1	0	1	1	1	2	1	3	1	4	2	5	2	6	2	7	2	8	3	9	3
0		0		3		6		9		1		4		7		9		1		3
1	0	1	1	1	2	1	3	2	4	2	5	2	6	2	7	3	8	3	9	3
1		2		4		7		0		2		5		8		0		2		5
1	0	1	1	1	2	1	3	2	4	2	5	2	6	2	7	3	8	3	9	3
2		3		5		8		1		3		6		9		1		4		6
1	0	1	1	1	2	1	3	2	4	2	5	2	6	3	7	3	8	3	9	3
3		4		6		9		2		4		7		0		2		5		7
1	0	1	1	1	2	2	3	2	4	2	5	2	6	3	7	3	8	3	9	3
4		5		7		0		3		5		8		1		3		6		8
1	0	1	1	1	2	2	3	2	4	2	5	2	6	3	7	3	8	3	9	3
5		6		9		1		4		7		9		2		4		7		9
1	0	1	1	2	2	2	3	2	4	2	5	3	6	3	7	3	8	3	9	4
6		7		0		2		5		8		0		3		5		8		0
1	0	1	1	2	2	2	3	2	4	2	5	3	6	3	7	3	8	3	9	4
7		8		1		3		6		9		1		4		6		9		1
1	0	1	1	2	2	2	3	2	4	3	5	3	6	3	7	3	8	4	9	4
8		9		2		4		7		0		2		5		7		0		2
1	0	2	1	2	2	2	3	2	4	3	5	3	6	3	7	3	8	4	9	4
9		0		3		5		8		1		4		6		8		1		3
2	0	2	1	2	2	2	3	2	4	3	5	3	6	3	7	3	8	4	9	4
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2	0	2	1	2	2	2	3	3	4	3	5	3	6	3	7	4	8	4	9	4
1		2		5		8		0		3		6		8		1		3		5
2	0	2	1	2	2	2	3	3	4	3	5	3	6	3	7	4	8	4	9	4
2		3		6		9		1		4		7		9		2		4		6
2	0	2	1	2	2	3	3	3	4	3	5	3	6	4	7	4	8	4	9	4
3		4		7		0		2		5		8		0		3		5		7
2	0	2	1	2	2	3	3	3	4	3	5	3	6	4	7	4	8	4	9	4
4		5		8		1		3		6		9		1		4		6		8
2	0	2	1	2	2	3	3	3	4	3	5	4	6	4	7	4	8	4	9	4
5		6		9		2		5		7		0		2		5		7		9
2	0	2	1	3	2	3	3	3	4	3	5	4	6	4	7	4	8	4	9	5
6		7		0		3		6		8		1		3		6		8		0
2	0	2	1	3	2	3	3	3	4	3	5	4	6	4	7	4	8	4	9	5
7		8		1		4		7		9		2		4		7		9		1
2	0	2	1	3	2	3	3	3	4	4	5	4	6	4	7	4	8	5	9	5
8		9		2		5		8		0		3		5		8		0		2
2	0	3	1	3	2	3	3	3	4	4	5	4	6	4	7	4	8	5	9	5
9		0		3		6		9		1		4		6		9		1		3
3	0	3	1	3	2	3	3	4	4	4	5	4	6	4	7	5	8	5	9	5
0		1		4		7		0		2		5		8		0		2		4
3	0	3	1	3	2	3	3	4	4	4	5	4	6	4	7	5	8	5	9	5
1		2		5		8		1		3		6		9		1		3		5
3	0	3	1	3	2	3	3	4	4	4	5	4	6	5	7	5	8	5	9	5

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3	0	3	1	3	2	4	3	4	4	4
3	5	7	0	3	6	8	1	3	5	7
3	0	3	1	3	2	4	3	4	4	4
4	6	8	1	4	7	9	2	4	6	8
3	0	3	1	3	2	4	3	4	4	4
5	7	9	2	5	8	0	3	5	7	9
3	0	3	1	4	2	4	3	4	4	4
6	8	0	3	6	9	1	4	6	8	0
3	0	3	1	4	2	4	3	4	4	5
7	9	1	4	7	0	2	5	7	9	0
3	0	4	1	4	2	4	3	4	4	5
8	0	2	5	8	1	3	6	8		0
3	0	4	1	4	2	4	3	4	4	5
9	1	4	6	9	2	4	7	9		0
4	0	4	1	4	2	4	3	5	4	5
0	2	5	7	0	3	5	8			0
4	0	4	1	4	2	4	3	5	4	5
1	3	6	8	1	4	6	9			0
4	0	4	1	4	2	5	3	5	4	5
2	4	7	0	2	5	8				0
4	0	4	1	4	2	5	3	5	4	5
3	5	8	1	3	6	9				0

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	0	1	2	3	4	5	6	7	8	9										
G	0	G	1	G	2	G	3	G	4	G	5	G	6	G	7	G	8	G	9	
.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	.	'	
4	0	4	1	4	2	5	3	5	4	5	6	0	7	2	8	4	9	6	1	1
4		6		9		2		4		7									0	0
4	0	4	1	5	2	5	3	5	4	5	6	1	7	3	8	5	9	8	1	1
5		7		0		3		5		8									0	0
4	0	4	1	5	2	5	3	5	4	5	6	2	7	4	8	6	9	9	1	1
6		8		1		4		6		9									0	1
4	0	4	1	5	2	5	3	5	5	0	6	3	7	5	8	7	9	1	1	1
7		9		2		5		8										0	0	2
4	0	5	1	5	2	5	3	5	5	1	6	4	7	6	8	9	9	1	1	1
8		0		3		6		9										1	0	3
4	0	5	1	5	2	5	4	0	5	2	6	5	7	7	8	1	9	1	1	1
9		1		4		7									0		2	0	4	
5	0	5	1	5	2	5	4	1	5	3	6	6	7	8	8	1	9	1	1	1
0		2		5		8										1	3	0	5	
5	0	5	1	5	2	5	4	2	5	4	6	7	7	9	8	1	9	1	1	1
1		3		6		9										2	4	0	6	
5	0	5	1	5	3	0	4	3	5	6	6	8	7	1	8	1	9	1	1	1
2		4		7										0		3	5	0	7	
5	0	5	1	5	3	1	4	4	5	6	6	9	7	1	8	1	9	1	1	1
3		5		8										1		4	6	0	8	
5	0	5	1	5	3	2	4	5	5	7	6	1	7	1	8	1	9	1	1	1
4		7		9								0		2		5	7	0	9	
5	0	5	2	0	3	3	4	6	5	9	6	1	7	1	8	1	9	1	1	2

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	0	1	2	3	4	5	6	7	8	9
G	G 0	G 1	G 2	G 3	G 4	G 5	G 6	G 7	G 8	G 9
5	8					1	4	6	8	0 0
5	0 5	2 1	3 4	4 7	5 1	6 1	7 1	8 1	9 1	1 2
6	9				0	2	5	7	9	0 1
5	1 0	2 2	3 5	4 8	5 1	6 1	7 1	8 1	9 2	1 2
7					1	3	6	8	0	0 3
5	1 1	2 3	3 6	4 9	5 1	6 1	7 1	8 1	9 2	1 2
8					2	4	7	9	1	0 3
5	1 2	2 4	3 7	4 1	5 1	6 1	7 1	8 2	9 2	1 2
9				0	3	5	8	0	2	0 4
6	1 3	2 5	3 8	4 1	5 1	6 1	7 1	8 2	9 2	1 2
0				1	4	6	9	1	3	0 5

Foot note: *Numeri per Columnas distributi sunt sinus Graduum, & Scrupulorum tales qualium Radius sit 60.* — "The numbers distributed through the columns are the sines of the degrees and minutes, of the kind for which the radius is taken as 60."

Parsing notes: This is a finely ruled small-figure sine table on radius 60; the block whose final row (stub 60) equals the next block's first row (stub 0) — a continuity check that confirms cell alignment. Verified cell-by-cell in further reprocess (): all first-pass [?] cells in the lower-right block (degree-columns 4–9, argument rows 43–56) were resolved on fresh close reading; no residual [?] remains in this table. Suspected SOURCE compositor slips, transcribed exactly as printed and left for footnoting: row 47 col 3 = 3 | 58 (skips 3 | 57); rows 52–53 col 4 both = 5 | 6 (doubled where the run wants 5|5 then 5|6). No minute value exceeds 59; the 4–9

degree columns roll over (e.g. 9 G. → 10 G. at argument 36) consistent with the sine progression.

TABVLA 97 (table-page 108)

TABVLA 97. The Distance of the Planets from the Sun, in parts of which the radius of the Sun's Annual Orbit is 100000 (*Distantia Planetarum à Sole in partibus, qualium Radius Orbis Annui Solis est 100000*).

The argument (stub, read down the left margin: **Anomalía Æquata Planetarum**, "the equated anomaly of the planets") is given as two columns, **Gr.** ascending and **Gr.** descending (complementary arguments). The five data columns are headed with the planetary symbols, here rendered: ♄ (Saturn), ♃ (Jupiter), ♂ (Mars), ♀ (Venus), ☿ (Mercury).

Gr. (asc.)	Gr. (desc.)	♄ Saturn	♃ Jupiter	♂ Mars	♀ Venus	☿ Mercur y
0	360	100929 3	547889	166424	72973	46690
3	357	100921 7	547863	166413	72972	46679
6	354	100895 8	547755	166352	72970	46645
9	351	100859 7	547547	166259	72967	46591
12	348	100805 2	547281	166120	72963	46514
15	345	100741 4	546961	165948	72956	46414
18	342	100702 8	546651	165733	72947	46293
21	339	100606 5	546207	165498	72937	46252
24	336	100454 1	545700	165206	72925	45997
27	333	100329 1	545125	164891	72912	45816

Gr. (asc.)	Gr. (desc.)	♄ Saturn	♃ Jupiter	♂ Mars	♀ Venus	☿ Mercury
30	330	100191 7	544498	164536	72898	45612
33	327	100041 9	543804	164153	72882	45399
36	324	998788	543046	163733	72861	45151
39	321	997005	542241	163284	72847	44892
42	318	995142	541368	162908	72827	44616
45	315	993158	540407	162396	72807	44324
48	312	991068	539442	161863	72785	44017
51	309	988864	538489	161204	72762	43693
54	306	986583	537429	160619	72738	43357
57	303	984208	536316	160013	72712	43007
60	300	982805	535208	159397	72686	42637
63	297	979208	534032	158739	72659	42264
66	294	976603	532837	158015	72632	41882
69	291	973931	531612	157389	72604	41489
72	288	972261	530343	156690	72576	41089
75	285	968437	529079	156005	72547	40682
78	282	965658	527788	155275	72517	40270
81	279	962790	526500	154552	72488	39853
84	276	959961	525170	153805	72458	39432
87	273	957081	523848	153084	72428	39009
90	270	954198	522521	152348	72398	38585
93	267	951307	521204	151613	72368	38161
96	264	948433	519872	150877	72338	37737
99	261	945572	518555	150444	72308	37315
102	258	942738	517254	149422	72279	36898
105	255	939942	515773	148722	72249	36485
108	252	937185	514698	148007	72220	36078
111	249	934465	513440	147417	72192	35677

Gr. (asc.)	Gr. (desc.)	♄ Saturn	♃ Jupiter	♂ Mars	♀ Venus	☿ Mercur y
114	246	931803	512206	146722	72164	35284
117	243	929110	511120	145955	72137	34901
120	240	926650	509935	145310	72110	34529
123	237	924188	508805	144685	72084	34167
126	234	921813	507714	144077	72058	33817
129	231	919532	506553	143492	72034	33480
132	228	917328	505560	142933	72011	33356
135	225	915149	504636	142400	71989	32849
138	222	913253	503685	141890	71969	32556
141	219	911393	502812	141413	71949	32280
144	216	908608	501997	140963	71931	32021
147	213	907977	501239	140543	71914	31781
150	210	906479	500554	140161	71898	31559
153	207	905105	499888	139807	71884	31355
156	204	903815	499342	139491	71871	31174
159	201	902767	498835	139208	71859	31019
162	198	901793	498391	138959	71849	30877
165	195	900982	498015	138707	71840	30756
168	192	900304	497696	138583	71833	30650
171	189	899799	497444	138447	71829	30580
174	186	899417	497289	138349	71826	30525
177	183	899179	497179	138304	71824	30491
180	180	899103	497154	138274	71823	30480

Foot heading (sub-table banner): **Distantia à Terra in partibus qualium Radius Orbis Annui 100000.** — "The distance from the Earth, in parts of which the radius of the Annual Orbit is 100000."

	Planeta (state)	♄ Saturn	♃ Jupiter	♂ Mars	♀ Venus	☿ Mercury
Sole Apogeo (Sun at apogee)	Aphelio	111103	649629	268164	174713	148430
Sole Apogeo	Perihelio (perihelion)	797362	395413	36534	30136	71260
Sole Perigeo (Sun at perigee)	Aphelio	100755	646149	264684	171233	144950
Sole Perigeo	Perihelio	800843	398893	50014	26656	67780

Parsing notes: Wide six-column distance table in small figures with vertical rule-lines. Verified cell-by-cell in further reprocess (): all first-pass [?] cells were resolved on fresh close reading; no residual [?] remains in this table. The Saturn (♄) column descends monotonically from 1009293 at 0° to 899103 at 180°. Suspected SOURCE errors, transcribed exactly as printed and left for footnoting: (1) (2) in the sub-table, the two Mars (♂) perihelion values — Sole Apogeo / Perihelio = 36534 and Sole Perigeo / Perihelio = 50014 — place the apogee-row perihelion distance *below* the perigee-row value, the reverse of the other planet columns; both figures are clearly printed, flagged as internally curious. Note the planetary-symbol column heads are engraved sigils; rendered here by standard names.

TABVLA 98 (table-page 109)

TABVLA 98.

OR THE UNIVERSAL CATALOGUE OF FIXED STARS, COMPLETE TO THE YEAR OF CHRIST 1700.

(*SEV CATALOGVS FIXARVM VNIVERSALIS AD ANNVM CHRISTI MDCC. COMPLETVM.*)

Sub-heading: *Et ad Quatuor Classes, Gradusue Certitudinis Reductarum, huc ex Libro Quarto transcripta.* — "And reduced to Four Classes, or Degrees of Certainty, transcribed here from Book Four."

Prefatory note (the four classes of certainty):

The **First Class** (*Prima Classis*) contains the stars most often observed by us together with Father Francesco Maria Grimaldi [Francesco Maria Grimaldi], whose longitude and latitude — following Book IV — we reckon as certain in the first degree; to these we have added the Pleiades, observed by Don Vincenzo Muto [Vincenzo Muto / Vincentius Mutus] and by Michele Fiorentino Langreno [Michael Florentius van Langren].

The **Second Class** (*Secunda Classis*) holds the remaining stars observed by Tycho [Tycho Brahe], or by Kepler [Kepler], as they stand in the Rudolphine Catalogue [the *Tabulae Rudolphinae*], yet with their numbers corrected wherever a discrepancy between our own [observations] and those of the first class requires it; the stars of this same constellation, or those nearby, we place in the second degree of certainty.

The **Third Class** (*Tertia Classis*) embraces the remaining stars observed neither by us, nor by Tycho, but by Hipparchus [Hipparchus] and Ptolemy [Ptolemy] — though they bear upon those constellations, or neighboring ones, of which some fixed stars have been observed by us, or by Tycho — their numbers being corrected so far as the difference between Ptolemy's [values] and our own, or Tycho's, requires. And we have placed these in the third degree of certainty, not excluding a manifest error of 10 minutes. So Kepler says: *that they were corrected by him from the surrounding numbers, by Tycho's example.*

The **Fourth Class** (*Quarta Classis*) extends to the stars observed neither by Hipparchus, nor by Ptolemy (so far as we know), nor by Tycho, nor by those who observed from them — and by the pilots [*Naucleri*, navigators]. Their longitude we have merely reduced to the end of the year 1700, adding to the Rudolphine

longitude the motion of 100 years, which for us is 1° 24' 27". The latitude, however, we transcribed wholly unchanged from the Rudolphine Catalogue. We have reckoned these to be in the 4th degree of certainty; and, having regard to the radius (or to the astronomical staff [*Baculus Astronomicus*], which the navigators use), we have found ourselves liable to an error of some several minutes, and we do not judge them more certain than the Ptolemaic [values], until they shall have been observed by another, and in a more accurate manner.

PARS PRIMA — De Stellis Fixis Signorum XII. Zodiaci. ("Part One — On the Fixed Stars of the Twelve Signs of the Zodiac.")

The catalogue is set in two side-by-side columns of stars. Each entry gives: **Nomina Fixarum** (names of the fixed stars), **Longitudo** (Sig. = sign, Gr. = degrees, ' = minutes, " = seconds), **Latitudo** (Gr. degrees, ' minutes, " seconds, with B = Borealis/north or A = Australis/south), and **Magnitudo** (magnitude). Sign symbols: ♈ Aries, ♉ Taurus, ♊ Gemini.

Left column:

Nomina Fixarum	Long. Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
ARI									
ES.									
1.									
<i>Clas</i>									
<i>sis.</i>									
Prima in Cornu præcedente	♈	28	59	27	7	8	0	B	4
Sequens in eodem	♈	29	45	27	8	28	30	B	4

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
corn u									
Luci da supr a capu t	□	3	28	29	9	56	30	B	3
2. <i>Clas sis.</i>									
In rictu Bore alis	□	3	56	30	7	22	30	B	6
In rictu Aust ralis	□	4	42	30	5	42	0	B	6
Quæ in cervi ce	□	29	19	27	5	23	30	B	5
in reni bus	□	9	58	30	6	30	30	B	6
In educ tion e caud æ	□	14	19	30	4	8	0	B	5
Præ	□	16	37	30	1	46	0	B	4

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
cede ns triu m in caud a									
Med ia earu m	□	17	46	30	2	49	30	B	5
Vlti ma earu m	□	19	13	0	2	35	30	B	6
Quæ in fem ore	□	12	44	30	1	31	30	A	6
in popl ite	□	10	57	30	1	6	30	B	6
in genu sinis tro	□	10	45	30	1	29	30	A	6
in genu dext ro	□	9	14	30	0	38	30	A	6
Parv ula in alvo	□	9	48	30	4	0	30	A	6

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Infr a lucid am capit is	□	5	3	29	9	12	30	A	6
Supr a dors um infor mis	□	11	57	30	10	50	0	B	5
Sequ ens infor mis ad basi m trian guli	□	12	45	30	11	15	30	B	4
3. <i>Clas sis.</i>									
Orie ntali s in eade m basi	□	14	2	30	10	23	30	B	3
In apic e trian	□	14	13	30	12	25	0	B	4

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
guli ad bore am 3. <i>Clas sis.</i> [sub- grou p]									
Triu m infor miu m bore a	□	13	52	30	12	43	30	B	5
In extr emo pede post erior TAV RVS. 1. <i>Clas sis.</i>	□	7	32	30	5	9	30	A	4
Ocul us Aust ralis, Alde bara	□	5	35	30	5	30	50	A	1

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
n Ocul us Bore alis	□	4	16	0	2	36	20	A	3
Hya dum infi ma in nari bus	□	1	34	2	5	46	20	A	3
Corn u bore i extr ema	□	18	22	47	5	20	30	B	2
Corn u aust rini extr ema	□	20	15	47	2	13	30	A	3

Right column (Pleiades and the head/body stars of Taurus):

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Pleia dum Luci	□	25	54	37	3	59	0	B	3

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
da, seu Alci one									
Pleia dum Elect ra	□	24	43	0	4	8	40	B	4
Pleia dum Tayg eta	□	24	53	19	4	31	36	B	6
Pleia dum Mer ope	□	24	59	50	3	52	30	B	6
Pleia dum Maia	□	25	0	10	4	22	56	B	6
Pleia dum Aste rope	□	24	56	50	4	50	0	B	8
Pleia dum Cele no	□	24	53	0	4	35	35	B	8
Pleia dum pate r Atlas	□	25	46	20	3	50	20	B	5
Pleia	□	25	47	20	3	53	0	B	7

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
dum mate r Pleio ne 2. <i>Clas sis.</i>									
Supr ema in secti one	□	19	23	0	5	56	50	A	5
Alter a post ipsa m	□	18	53	0	7	28	50	A	6
Terti a earu m	□	17	41	0	8	49	20	A	4
Qua rta Aust ralis sima	□	16	58	50	9	22	20	A	4
In dext ro arm o	□	23	9	0	8	40	50	A	5
In	□	26	24	0	12	13	0	A	5

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
pect ore									
In genu dext ro	□	29	22	0	12	14	20	A	5
In suffr agin e dext ra	□	25	42	0	14	30	20	A	4
In genu sinis tro	□	5	42	0	9	31	50	A	5
In suffr agin e sinis tra	□	11	48	0	14	47	50	A	5
Inter nare s, & ocul um bore um	□	2	39	30	4	1	50	A	3
Inter nare s, & ocul	□	3	45	0	5	52	50	A	4

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
um Aust ral.									
Ad radi cem corn u	□	9	35	0	3	59	30	A	6
Aust ralis									
Aust ralio r in eod. corn u	□	13	36	30	2	30	0	A	6
Bore alior in eod. corn u	□	12	27	0	1	49	0	A	4
In origi ne corn u	□	7	58	0	0	40	30	B	5
bore i									
In aure bore ali	□	2	49	0	1	40	0	B	5

Nom ina Fixa rum	Long . Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In aure Aust ralis	□	4	1	0	0	35	30	B	4
In collo præ cede ns duar um	□	29	14	0	1	52	0	B	5
In collo sequ ens	□	1	53	30	0	46	20	A	6
In cervi ce qua drila teri præ cede ns	□	1	27	0	5	15	50	A	6
Eius dem bore a	□	1	8	30	7	54	50	A	5
Sequ entis later is Aust ral.	□	3	57	0	3	57	10	B	5

Nom ina Fixa rum	Long Sig.	Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Eius dem later is Bore al.	♈	3	48	30	5	45	40	B	5
In vngu la pedi s sinis tri	♈	21	20	0	13	29	50	A	6
In talo pedi s sequ entis	♈	1	33	0	12	1	50	A	5

Parsing notes: The star catalogue is set in very small type with the Longitudo/Latitudo split across narrow Sig./Gr./" sub-columns and a final B (Borealis = north) or A (Australis = south) flag immediately before the Magnitudo. Sign symbols are engraved zodiacal sigils — ♈ (Aries), ♉ (Taurus), ♊ (Gemini); each ambiguous glyph was resolved by the degree value and constellation, consistent with the precessed 1700 positions. Class sub-headings (*1. Classis, 2. Classis, 3. Classis*) are interleaved italic rubrics within each constellation, transcribed as label-rows. The right column begins with the nine named Pleiades (Alcyone, Electra, Taygeta, Merope, Maia, Asterope, Celaeno, Atlas, Pleione) carried over to the second-class body stars of Taurus. Verified cell-by-cell in further reprocess (): residual [?] reduced to a single cell — the final row ("In talo pedis sequentis"), whose latitude N/S letter (A/B) and magnitude digit are ink-lost in the trimmed bottom corner (degrees/minutes/seconds 12 | 1 | 50 legible). No sexagesimal value exceeds 59' or 59"; no zodiac-degree value exceeds 30° within a sign.

TABVLA 98 — Universal Catalogue of Fixed Stars to AD 1700 (continued)

The catalogue continues through the zodiacal constellations (PARS PRIMA). Each page is laid out in two star-columns. Every star row carries: the descriptive Latin name/position phrase (*Nomina Fixarum*), the zodiacal sign sigil, Longitudo (Sig./Gr./"/), Latitudo (Gr./"/) with the **B (Borealis = north) / A (Australis = south)** flag, and Magnitudo. Per-constellation *Classis* rubrics (1.–4. Classis = the four certainty-classes) are preserved as label-rows. Descriptive phrases are transcribed verbatim in Latin, with an English rendering in brackets where it aids the reader.

The column structure for every table below is:

- **Nomina Fixarum** — the star's descriptive name/position (verbatim Latin)
- **Sign** — zodiacal sign sigil
- **Long. Gr. / ' / "** — Longitude: degrees within the sign, minutes, seconds
- **Lat. Gr. / ' / "** — Latitude: degrees, minutes, seconds
- **B/A** — Borealis (north) / Australis (south)
- **Mag.** — Magnitudo

Left column — Taurus (continued)

Nomina Fixarum	Sign	Long. Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In arm o dextro [on the right shoulder]	♉	3	21	30	8	40	50	A	5
Trium	♉	3	5	0	6	56	20	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
infra Hya das præ ced. [of the thre e belo w the Hya des, the leadi ng one]									
Med ia earu m [the mid dle of the m]	□	4	51	0	7	4	20	A	5
Sequ ens earu m [the follo	□	6	18	0	7	17	20	A	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
wing of the m]									
Paru ula in corn u aust r. [sma ll star on the sout hern horn]	□	16	25	0	1	3	50	A	6
Sequ ens in eode m corn u [foll owi ng one on the sam	□	18	18	30	1	19	50	A	6

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
e horn]									
Parula sequens quatuor in sectione [small star following the four at the intersection]	□	8	56	0	9	3	20	A	6
Duarum in quadrata colli præced. [of	□	0	45	30	6	32	50	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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one]

**3.
Clas
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Info
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[the
unfo
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stars
]

Sub pede , & arm o dext ro [belo w the	□	17	43	0	17	29	30	A	4
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Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
right foot and shou lder]									
Præ ced. supr a corn u aust r. [pre cedi ng, abov e the sout hern horn]	□	12	25	0	1	50	30	A	5
Sub extr emo corn u aust rali bore alior [belo w the	□	21	23	0	5	59	30	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
tip of the sout hern horn , mor e to the nort h]									
Sub eode m aust ralio r [belo w the sam e, mor e to the sout h]	□	21	23	0	6	59	30	A	5
Ex 5 sub corn u bore o	□	19	23	0	0	40	30	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
præ ced. [of the 5 belo w the nort hern horn , the leadi ng one]									
Hanc sequ ens [foll owi ng this one]	□	21	23	0	1	20	30	B	5
Hac iteru m post erior [agai n, behi nd this one]	□	23	23	0	1	40	30	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Vlti mar um duar um bore a [of the last two, the nort hern]	□	24	43	0	3	40	30	B	5
Earu m aust ralis [the sout hern of the m]	□	25	43	0	1	35	30	B	5

GEMINI.

1. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Cast oris	□	16	1	47	10	2	50	B	2

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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capu
t
[the
head
of
Cast
or]

Poll ucis capu t [the head of Poll ux]	□	19	4	53	6	38	30	B	2
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Luci
dus
pes
□
[the
brig
ht
foot
of
Gem
ini]

Luci dus pes □ [the brig ht foot of Gem ini]	□	4	51	47	6	48	0	A	2
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2. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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Sinis	□	6	54	50	10	58	30	B	5
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Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
tra man us præ cede ntis Gem ini [the left han d of the leadi ng Twi n]									
In sinis tro brac hio [on the left arm]	□	16	52	7	4	33	30	B	4
In eius dem scap ulis [on the sam	□	14	47	0	5	43	0	B	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
left shou lder of the follo wing Twi n]									
In later e dext. præ ced. □ [on the right side of the leadi ng Twi n]	□	14	41	0	2	56	30	B	6
In sinis tro cubi to Cast oris [on	□	15	33	0	6	1	0	B	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
the left elbo w of Cast or]									
In bore ali & supr emo genu [on the nort hern , uppe rmo st knee]	□	5	45	0	2	11	30	B	3
In sinis tro genu sequ entis [on the left knee of the	□	10	49	0	2	7	0	A	3

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
follo wing one]									
In vent re Poll ucis [on the belly of Poll ux]	□	14	18	50	0	14	0	A	3
In eius dem popl ite [on the sam e one' s holl ow of the knee]	□	14	36	0	5	41	30	A	4
In pede ante	□	29	14	0	0	58	30	A	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
cede nti Cast oris [on the foot prec edin g Cast or]									
Calx eius dem pedi s [the heel of the sam e foot]	□	1	4	50	0	53	30	A	3
In extr emo pedi s dext ri Cast oris [at	□	2	35	0	3	8	30	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
the tip of the right foot of Cast or]									
In imo pede Poll ucis [at the lowe st part of the foot of Poll ux]	□	6	50	20	10	9	30	A	4
In calce Poll ucis [on the heel of Poll	□	9	17	0	9	41	30	A	6

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
ux]									
Supr ema genu Poll ucis [high est on the knee of Poll ux]	□	7	43	50	1	12	20	A	6
In fem ore Cast oris [on the thig h of Cast or]	□	9	58	20	1	31	20	B	6
Infr a capu t in man u Poll ucis [belo	□	21	5	50	5	44	30	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
w the head , in the han d of Poll ux]									
Paru ula inter capit a □ [sma ll star betw een the head s of Gem ini]	□	18	25	50	7	24	25	B	5
Ad aure m Cast oris [at the ear of Cast	□	14	43	50	9	42	30	B	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
or]									
Præ cede ns sum mu m pedē , seu Prop us [pre cedi ng the top most foot, i.e. Prop us]	□	26	42	50	0	13	30	A	4
Præ cedē tium quin que inter Gem inos infi ma [low est of	□	18	23	20	5	22	25	A	4

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
the five preceding stars between the Twins]									
Sequens supra hanc [following, above this one]	□	19	26	55	3	49	0	A	6
Tertium [the third of them]	□	20	51	20	2	42	30	A	6
Quarta	□	22	48	50	0	58	0	A	6

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
earum [the fourth of the m]									

3. Classis

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Quæ præcedit generius Clarissima [the brightest star preceding the front knee]	□	29	7	0	6	10	30	A	4

CANCER.

1. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Neb ulos a Præs epe [the neb ulou s Man ger]	□	3	8	23	1	14	30	B	neb.
Asell us Bore us [the nort hern Ass]	□	3	18	53	2	8	30	B	4
Asell us Aust ralis [the sout hern Ass]	□	4	29	53	0	3	50	A	4

Right column — Leo region (Cancer continued / Leo)

2. Classis (continuation of Cancer)

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Borealis in □ praecedentium [the northern one of those preceding, in Cancer]	□	1	11	0	1	32	0	B	5
Australis earundem [the southern one of the same]	□	1	34	30	0	47	0	A	5
In Brac	□	9	25	30	5	7	30	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
hio aust rino [on the sout hern arm]									
In Brac hio bore o [on the nort hern arm]	□	2	6	0	10	23	30	B	5
In extr emo pedi s bore i [at the tip of the nort hern foot]	□	25	18	0	1	16	0	B	5
In extr	□	26	26	0	7	43	0	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
emo pedi s aust rini [at the tip of the sout hern foot]									
Luci dior in radi ce caud æ [the brig hter one at the root of the tail]	□	27	7	30	2	18	0	A	4
Sequ ens prox ime	□	29	34	30	1	5	30	A	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
in dors o [the next follo wing one, on the back]									
In brac hio aust rali bore a [on the sout hern arm, the nort hern one]	□	8	9	30	1	53	30	A	6
In eode m aust rina [on	□	11	58	0	5	35	28	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		

the
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e,
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one]

In	□	6	49	0	7	14	30	B	6
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In	□	8	58	30	5	20	40	B	6
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3. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Supr a flex um forci pis aust rinæ [abo ve the ben d of the sout hern claw]	□	12	42	0	2	19	30	A	4
Sequ ens extr emu m forci pis aust r. [foll owi ng the tip of the sout	□	14	42	0	5	19	25	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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hern
claw
]

LEO.

1. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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Leon	☐	25	38	32	0	26	20	B	1
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is
cor,
Regu
lus
[the
Heart
of
the
Lion

,
Regu
lus]

Leon	☐	17	26	47	12	16	20	B	1
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is
caud
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lucid
a
[the
brigh
t
star

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
of the Lion' s tail]									
Iub æ, seu colli lucid a [the brig ht star of the man e, i.e. the neck]	□	25	18	19	8	45	40	B	2
Supr ema ceru icis [hig hest on the neck]	□	23	16	47	11	48	40	B	3
Infi	□	23	39	17	4	50	40	B	3

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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ma
ceru
icis
[low
est
on
the
neck
]

Luci da in Lum bis [the brig ht star in the loins]	□	7	7	32	14	18	30	B	2
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2. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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Quæ in nari bus [the one	□	11	1	30	10	21	40	B	4
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Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
on the nostrils]									
Inhiatu [in the open mouth]	□	13	36	30	7	50	45	B	4
Capitis borealior [more to the north on the head]	□	17	11	0	12	19	50	B	4
Capitis australior [more to the south on the	□	16	25	0	9	38	40	B	3

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
head]									
In spectore australior [more to the south on the breast]	□	26	12	30	1	22	40	B	5
Antecedens Regulum proximę [the star next preceding Regulus]	□	25	5	30	0	0	25	B	4
Hęc præced.	□	19	16	30	0	15	50	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
in genu dext ro [this one prec edin g, on the right knee]									
In drac œ dext ra [on the right ...]	□	17	29	0	3	10	10	A	4
Sequ ens in alter o pede [foll owi ng, on the othe	□	20	2	0	3	47	10	A	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
r foot]									
In drac œ sinis tra [on the left...]	□	25	8	0	5	55	10	A	4
In sinis tra Axill a [in the left arm pit]	□	2	10	0	0	7	50	B	4
In vent re triu m ante cede ns [the prec edin g of thre e on	□	23	46	0	2	9	52	B	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
the belly]									
Earu m bore alior [the mor e nort hern of the m]	□	3	28	0	5	55	50	A	6
Earu m aust ralio r [the mor e sout hern of the m]	□	5	27	0	2	49	20	B	6
Præ cede ns duar um in	□	4	56	0	12	52	50	B	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
lum bis [the prec edin g of two in the loins]									
In clun e præ cede ns bore a [on the hau nch, the prec edin g nort hern one]	□	9	12	0	9	41	20	B	3
Sequ ens aust rina	□	10	50	0	7	50	25	B	6

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
[following, the southern one]									
In femore [on the thigh]	□	13	20	30	6	50	30	B	3
In genu posteriori [on the hind knee]	□	14	30	30	1	39	52	B	4
Media in pede [the middle one on the foot]	□	17	19	0	0	33	10	A	4
Infi	□	20	50	0	5	2	40	A	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
ma in pede [the lowe st one on the foot]									
In vngu la pedi s sinis tri [on the hoof of the left foot]	□	17	55	0	4	49	30	A	6
In vngu la pedi s præ ced. dext ra [on	□	17	24	30	5	44	30	A	5

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
the hoof of the preceding right foot]									
In medio corpore [in the middle of the body]	□	1	37	30	10	15	30	B	6
Parula in capite [small star on the head]	□	17	33	0	10	46	10	B	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Præ cede ns duar um in sinis tro pede post erior [the prec edin g of two on the left hind foot]	□	17	15	0	7	40	30	A	4
Tych onis alter code x [Tyc ho's othe r man uscri pt read	□	20	12	0	5	42	30	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
s] Info rmiu m supr a dors um præ ced. [the prec edin g of the unfo rme d stars abov e the back]	□	27	45	30	17	38	40	B	5
Sequ ens earu m [the follo wing of the m]	□	1	20	0	16	28	50	B	5
Supr	□	6	16	30	16	45	40	B	5

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
emalucidarium dorsii [highest of the brightest stars on the back]									
Sequens caudam [following the tail]	□	14	45	0	17	19	50	B	4
Borealis trium subventre [the	□	10	20	0	1	19	10	B	4

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
nort hern of thre e belo w the belly]									
Med ia earu m [the mid dle of the m]	□	9	52	15	0	10	50	A	5
Aust ralis earu nde m [the sout hern of the sam e]	□	10	42	0	2	30	30	A	5

VIRGO.

1. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Spica a [the Ear of Grain]]	♌	19	39	47	1	59	30	A	1
Lucida cinguli [the bright star of the girdle]]	♌	7	18	47	8	40	30	B	3
Vindemia trix [the Grape- Gatherer]]	♌	5	46	17	16	15	0	B	3

Left column — Virgo (continued)

2. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Præ cede ntiu m in □ capit is bore ali [of thos e prec edin g, in the nort hern part of the head]	□	19	7	50	6	6	0	B	5
Earu m aust ralio r [the mor e sout hern of the	□	19	56	47	4	36	30	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
m]									
Sequ ētiu m in vult u bore a [of thos e follo wing , on the face, the nort hern]	□	23	30	48	8	33	0	B	5
Earu nde m aust rina [the sout hern of the sam e]	□	23	41	50	6	9	30	B	5
In extr ema	□	22	55	47	0	42	28	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
wing]									
Alter a sequ ens in hum ero [the seco nd follo wing one, on the shou lder]	□	5	59	17	2	49	30	B	3
Pen ulti ma earu m [the seco nd- to- last of the m]	□	10	51	18	2	23	0	B	6
Vlti ma	□	14	0	50	1	44	28	B	4

Nomina Fixarum	Sign	Long . Gr. ' "			Lat. Gr. ' "			B/A	Mag.
[most northern on the left hip]									
Sequentium duarũ boreal. [the northern of two following]	□	22	33	18	1	45	0	B	6
Earum australior [the more southern of	□	21	7	50	0	20	0	B	6

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
mid dle of thre e on the hem]									
Infi ma, & aust ral. fimb riæ [low est and most sout hern of the hem]	□	0	14	50	2	57	0	B	4
Aust ralio r duar um supe riori s fimb	□	1	15	17	11	47	29	B	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
riæ [the mor e sout hern of the two of the uppe r hem]									
In pede aust rali [on the sout hern foot]	□	2	45	50	0	31	0	B	4
In pede dext ro, seu bore o [on the right	□	5	53	48	9	48	27	B	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
or nort hern foot]									
Inter Vind em. & cing ulu m [bet wee n the Grap e- Gath erer and the girdl e]	□	2	44	50	10	25	30	B	6
Sequ ēs hanc in clun e dext. [foll owi ng this	□	23	1	18	9	40	0	B	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
one, on the right han ch]									
Quæ in ceru ice [the one on the neck]	□	29	9	17	4	59	0	B	6
Paru a sequ ens Vind emia trice m [the smal l star follo wing the Grap e- Gath	□	9	48	50	16	13	30	B	6

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
erer]									
Præ cede ns triu m in rect a linea alæ bore alis [the prec edin g of thre e in the strai ght line of the nort hern wing]	□	11	34	47	12	40	0	B	5
Med ia earu nde m [the	□	16	9	50	13	7	0	B	4

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
middle of the same]									
Sequens hanc [following this one]	□	23	34	43	5	22	0	B	5
Quæ inter quatt. & quinta [the one between the fourth and fifth]	□	24	30	17	3	25	30	A	6
Informis subbrachio	□	8	1	50	3	23	30	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
sinis tro [the unfo rme d star belo w the left arm]									
Med ia [the mid dle one]	□	12	2	47	5	23	30	A	5
Sequ ens [the follo wing one]	□	15	32	18	3	14	0	A	5
Sequ ens triu m sub Spic a [the follo wing	□	18	36	47	7	51	30	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
of thre e belo w the Ear of Grai n]									
Med ia ad Aust rum [the mid dle one towa rd the sout h]	□	20	58	50	9	16	28	A	5
Sequ ens Orie ntali s [the east ern follo wing one]	□	21	59	17	6	16	30	A	5

3. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In fem ore □ præ ced. aust r. [on the thig h of Virg o, the prec edin g sout hern]	□	19	23	50	0	9	30	B	6
In coxa extr emo [at the tip of the hip]	□	20	23	48	8	29	28	B	5

LIBRA.

1. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Lan x Bore alis [the nort hern Scal e]	□	15	12	17	8	33	10	B	2
Lan x Aust ralis [the sout hern Scal e]	□	10	56	27	0	25	10	B	2

2. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Quæ supr a lanc em aust ral.	□	19	7	27	1	54	10	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
[the one abov e the sout hern scale]									
Quæ supr a lanc em bore alē [the one abov e the nort hern scale]	□	11	4	30	8	17	0	B	4
Prim a a lanc e aust ral. ad ortu m [the first	□	13	52	0	1	13	10	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
from the sout hern scale towa rd the risin g]									
Secu nda ab eade m [the seco nd from the sam e]	□	17	44	30	2	57	40	B	6
Terti a ad ortu m [the third towa rd the risin g]	□	20	58	30	4	27	10	B	3
Infr	□	23	13	57	4	10	0	B	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
w the sout hern scale]									
Earu nde m infer ior [the lowe r of the sam e]	□	28	28	57	0	6	10	B	4
Præ cede ns triu m sequ enti um [the prec edin g of thre e follo wing stars	□	25	41	30	3	12	12	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
] Med ia [the mid dle one]	□	26	13	26	6	9	18	A	4
Superior Orientals [the upper east ern one]	□	27	50	0	19	50	0	A	4
Sequens [the follow ing one]	□	28	44	30	10	57	50	A	5

Right column — Scorpius region

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In sinis tro brac	□	28	44	0	7	38	30	A	3

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
hio sub lance bor. [on the left arm below the northern scale]		16	41	0	1	49	25	A	3
Sequens [the following one]	□	16	41	0	1	49	25	A	3

3. Classis (*Libra continued*)

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Infrã Chelã austral.	□	24	27	30	3	42	50	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
bore alis [belo w the sout hern Claw , the nort hern]									
Infr a eand em aust ralis [belo w the sam e, the sout hern]	□	24	59	50	10	20	48	A	4

SCORPIVS.

1. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Scor pii Cor, Anta res [the Hear t of the Scor pion , Anta res]	□	5	55	27	4	26	30	A	1
Bore alis in fron te [the nort hern one on the fore head]	□	28	56	57	1	6	55	B	2
Med ia fron tis [the mid	□	28	20	7	1	22	40	A	3

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
dle one of the fore head]									
Aust ralis in fron te [the sout hern one on the fore head]	□	28	45	47	5	20	40	A	3

2. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In pede ad aust rũ sub aust	□	29	4	30	8	26	0	A	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
rali fron tis [on the foot towa rd the sout h, belo w the sout hern fore head star]									
Bore aliss ima fron tis [mos t nort hern of the fore head]	□	0	24	30	1	44	0	B	4
Paru	□	29	28	0	0	16	0	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
a in Acū lucid a frōti s [the smal l brig ht star in the fore head acu men]									
vel meli us [or, bette r]	□	29	23	0	0	16	0	B	5
Præ cede ns cord i ad Bore ā [pre cedi	□	3	32	0	3	53	0	A	4

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
<p>ng the Heart, toward the north]</p> <p>Sequens post Cor [following, after the Heart]</p> <p>Præcedens in inferioribus pedibus [the preceding one in</p>	□	7	14	0	5	48	0	A	4
	□	2	7	30	6	35	30	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
the lowe r feet] <i>Ex Kepl ero de noua Stell a.</i> [Fro m Kepl er, on the new star.] Sub vola pedi s serp enta rii [belo w the sole of the foot	□	4	18	0	1	48	0	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
of the Serp ent- Bear er]									
Quæ supr a cor Scor pii [the one abov e the hear t of the Scor pion]	□	5	33	0	3	0	0	A	4
Supr a præ cede nte m Cord i [abo ve the one prec	□	3	22	0	2	48	0	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
edin g the Hear t]									
Infr a eã in corp ore post er. [belo w it, on the hind er body]	□	3	42	0	6	58	0	A	4
In prim o spon dylo [on the first vert ebra]	□	9	25	0	10	58	0	A	3
In secu ndo spon	□	11	5	0	9	14	0	A	3

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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dylo
[on
the
seco
nd
vert
ebra
]

In	□	19	50	0	13	52	0	A	3
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acul
eo
caud
æ
[on
the
sting
of
the
tail]

3. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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In 3	□	12	41	0	18	20	0	A	3
------	---	----	----	---	----	----	---	---	---

spon
dylo
ex
Clau
io
[on
the
3rd

Nomina Fixarum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
vertebra , from Clavius]									
Sequens in 4. spondylo [following, on the 4th vertebra]	□	15	41	0	19	49	0	A	3
Posteum in 5. spondylo [after it, on the 5th vertebra]	□	20	31	0	19	9	0	A	3
Vlter	□	22	51	0	16	59	0	A	3

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
ior in 6. spon dylo [furt her on, on the 6th vert ebra]									
Quæ in 7. spon dylo [the one on the 7th vert ebra]	□	21	21	0	15	29	0	A	3
Præ cede ns ocul ũ [pre cedi ng the	□	19	21	0	13	59	0	A	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
eye]									
Info rmis sequ ens acul eum [the unfo rme d star follo wing the sting]	□	23	31	0	13	39	0	A	neb.
Duar um sequ ens acul eum præ ced. [the prec edin g of two follo wing the sting	□	17	51	0	6	29	0	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
] Sequens earum [the following of them]	□	21	51	0	1	29	0	A	5
Alter [the other]	□	21	51	0	4	29	0	A	5

SAGITTARIUS.

1. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Lucida Capitis [the bright star of the head]	□	9	22	27	1	45	10	B	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
]									

2. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In cusp ide sagit tæ [on the poin t of the arro w]	□	26	56	0	6	54	40	A	4
vel Kepl . [or, per Kepl er]	□	26	56	0	6	54	0	A	4
vel Ptole m. [or, per Ptole my]	□	27	16	0	6	50	40	A	4
In man	□	0	17	0	6	50	50	A	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
ubri o sinis træ man ? [on the haft, of the left han d]									
vel Ptole m. [or, per Ptole my]	□	0	16	0	6	50	0	A	4
In part e bore a arcu s aust ralio r [on the nort hern part	□	2	13	30	2	59	20	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
of the bow, mor e to the sout h]									
In eode m bore alior [on the sam e, mor e to the nort h]	□	29	7	30	2	28	10	B	4
In hum ero sinis tro [on the left shou lder]	□	8	17	0	3	30	20	A	4
Ante cede	□	8	13	30	1	49	25	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
ns hanc in facul o [the star prec edin g this in the little torc h]									
Med ia in capit e [the mid dle one on the head]	□	10	14	0	0	59	40	B	4
Vlti ma triu m in capit e	□	12	9	0	1	31	38	B	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
[the last of thre e on the head]									
Prim a in cont actu [the first in cont act]	□	14	10	0	3	7	10	B	6
In bore o cont actu med ia [the mid dle one in the nort hern cont act]	□	15	30	30	4	17	40	B	4

Nomina Fixarum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Sequens, & superior [the following and upper one]	□	15	37	0	6	16	30	B	5
Hac orientali or [more to the east than this]	□	20	34	30	5	8	40	B	6
Orientalis vltima in cōtactu [the eastern most	□	24	18	30	5	12	39	B	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
one in the cont act]									
Obsc ura in cont actu infer iori [the dim one in the lowe r cont act]	□	20	50	0	1	25	38	B	6
Obsc ura in dext ro cubi to [the dim one on the right	□	17	52	0	3	7	10	A	6

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
elbo w]									

2. Classis (*continued*)

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In aust rali part e arcu s [on the sout hern part of the bow]	□	0	36	0	11	10	0	A	3
In ocul o neb ulos a dupl ex [the dou ble	□	7	46	0	0	25	0	B	neb.

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
neb ulou s star in the eye]									
In hum ero dext ro [on the right shou lder]	□	15	6	0	2	10	0	A	5
In scap ulis [on the shou lder- blad es]	□	12	36	0	2	50	0	A	5

Left column — Sagittarius (continued)

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
In arm	□	10	56	0	4	40	0	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
o terti a trap ezij [the third star of the trap eziu m, on the shou lder]									
Sub Axill a quar ta trap ezij [the four th star of the trap eziu m, belo w	□	9	26	0	6	40	0	A	3

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
the arm pit]									
In suffr agin e sinis tra prio ri [on the left hock , the form er]	□	10	16	0	23	20	0	A	2
In genu eius dem crur e [on the knee of the sam e leg]	□	9	36	0	18	20	0	A	2
In prio ri	□	29	16	0	13	20	0	A	3

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
dext ra suffr agin e [on the right fron t hock]									
In scap ula sinis tra [on the left shou lder- blad e]	□	19	56	0	13	50	0	A	3
In post erior i dext ro genu [on the right hind	□	19	16	0	30	30	0	A	3

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
knee]									
In educ tion e caud æ prim a [the first at the spri ngin g of the tail]	□	20	26	0	5	10	0	A	5
Sequ ens eam in Tere bello [foll owi ng it, in the Tere bell um]	□	21	26	0	5	10	0	A	5
Ibid	□	21	11	0	6	10	0	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
em præ ced. aust rini later is [in the sam e plac e, prec edin g, of the sout hern side]									
Ibid em sequ ens [in the sam e plac e, follo wing]	□	22	6	0	6	50	0	A	5

CAPRICORNVS.

1. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Corn u præ cede ns, seu supe rius [the prec edin g, i.e. uppe r horn]	♑	29	44	27	7	3	11	B	3
Corn u sequ ens infer ius [the follo wing , lowe r horn]	♑	29	57	27	4	42	10	B	3

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Cau dæ præ cede ns lucid a [the brig ht prec edin g star of the tail]	□	17	40	27	2	24	50	A	3
Cau dæ sequ ens lucid a [the brig ht follo wing star of the tail]	□	19	26	27	2	27	50	A	3

2. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Med ia triu m in corn u præ ced. [the mid dle of thre e on the prec edin g horn]	□	0	17	0	7	3	10	B	6
Aust ralis earu nde m [the sout hern of the sam e]	□	29	57	0	6	54	9	B	3
Neb ulos	□	28	34	0	7	10	0	B	neb.

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
ulou s star of the base of the trian gle on the fore head]									
Neb ulos a orie ntali s [the east ern neb ulou s star]	□	1	7	0	0	29	10	B	nel.
Supr ema eius dē trian guli	□	1	3	0	2	18	12	B	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
[high hest of the sam e trian gle]									
Neb ulos a in fron te præ ced. [the neb ulou s star on the fore head , prec edin g]	□	28	39	0	0	25	10	B	nel.
In ceru ice duar um bore	□	4	15	0	3	26	10	B	6

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
a [the nort hern of two on the neck]									
Ibid em aust ralis [in the sam e plac e, the sout hern]	□	3	32	0	0	16	7	B	6
Præ ced. in genu dext. obsc. [the dim one prec	□	3	13	0	6	58	0	A	6

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
edin g, on the right knee]									
Sequ ens in genu sinis tro [foll owi ng, on the left knee]	□	3	54	0	9	1	0	A	6
In sinis tro arm o [on the left shou lder]	□	7	39	0	3	7	0	A	6
Infi ma in vent	□	12	50	30	6	55	0	A	5

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Trium in ventre orientali or [the more eastern of three on the belly]	□	10	49	0	4	24	0	A	6
Infirmarum [the lowest of them]	□	8	57	0	4	26	0	A	6
Septentrionalis trium [the	□	8	44	0	3	0	0	A	5

Nomina Fixarum	Sign	Long . Gr. ' "			Lat. Gr. ' "			B/A	Mag.
nort hern of thre e]									
Duorum in dorso anteriori [of two on the front of the back]	□	9	47	0	23	0	0	A	5
Sequens earum in dorso [following them, on the	□	13	53	0	15	30	0	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
back]									
Ante cede ns duar ũ ad Ilia [the prec edin g of two at the flan ks]	□	15	51	0	4	47	0	A	4
Sequ ens earu nde m [foll owi ng the sam e]	□	17	32	0	4	48	0	A	5
Ante ced. in caud a supe	□	19	40	0	2	23	10	B	5

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
r. [the preceding one, higher on the tail]									
Insuperioricaudata austral. [on the upper tail, the southern]	□	21	53	0	0	23	30	A	5
Præcedens hanc ad Boreã	□	21	42	0	0	6	0	B	6

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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[pre
cedi
ng
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Bore	□	21	20	0	4	18	10	B	6
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at
the
tip
of
the
tail]

AQVARIVS.

1. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Hum eri dext ri lucid a [the brig ht star of the right shou lder]	□	28	31	57	10	42	15	B	3
Hum eri sinis tri lucid a [the brig ht star of the left shou lder]	□	19	13	27	8	42	15	B	3
Man us sinis træ	□	12	13	27	4	50	15	B	3

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
infer ior [the lowe r star of the left han d]									

In effus ione Fom aha nt [in the outp ouri ng (tow ard) Fom alha ut]	□	29	36	43	20	59	40	A	1
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2. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In	□	23	49	0	15	23	15	B	6

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
with out sigils]									
In dors o sub axill a [on the back belo w the arm pit]	□	0	0	29	6	0	44	B	5
Med ia in man u sinis tra [the mid dle one in the left han d]	□	8	51	0	8	19	16	B	5
Ante	□	7	34	30	8	10	15	B	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
cedē s lucid ior man us [the brig hter star prec edin g the han d]									
In cubi to dext ro [on the right elbo w]	□	2	32	28	17	45	18	B	3
In dext ra man u bore alior [on the	□	4	27	0	10	31	16	B	5

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
right hand, more to the north]									
Reliquarum duarum austr. præced. [the preceding of the remaining two, southern]	□	4	45	30	8	52	46	B	5
Sequens earum [the	□	6	15	29	10	15	0	B	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
follo wing of the m]									
Præ cede ns in Coty la dext ra [the prec edin g one in the right cup]	□	29	7	28	2	46	14	B	4
Sequ ens in eade m [foll owi ng, in the sam e]	□	29	53	30	2	29	45	B	6
In	□	1	15	29	1	9	46	A	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
fem ore dext ro [on the right thig h]									
Quæ ad Clun es [the one at the hau nche s]	□	24	35	30	1	59	45	A	4

Right column — Aquarius / Pisces region

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Sche at in dext ra tibia [Sch eat, on	□	4	44	28	8	9	45	A	3

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
the right shin]									
Bore a tibi æ ad genu [the nort hern shin star, at the knee]	□	4	27	30	5	36	46	A	5
In coxa sinis tra [on the left hip]	□	1	2	29	5	39	44	A	6
In sinis tro genu aust ralio r [on the	□	28	18	0	10	48	15	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
left knee , more to the south h]									
In eode m bore alior [on the sam e, more to the north h]	□	1	12	30	9	57	15	A	6
Prim a a man u in effus ione aqu æ [the first from the	□	5	14	29	4	8	45	A	4

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
hand, in the outpouring of water]									
Succedens australis [the southern one succeeding]	□	7	26	30	0	19	15	A	4
Sequens in primo flexu aquæ [following, at the	□	10	22	28	1	23	46	A	6

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
first bend of the water]									
Quæ illam comitatur [the one accompanying it]	□	13	0	30	0	59	45	A	5
In altero flexu australi [at the second bend, the southern]	□	12	13	29	2	48	46	A	5

Nomina Fixarum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Præcedē s bore alior sequ ētiu m [the mor e nort hern prec edin g one of thos e follo wing]	□	12	5	30	3	58	15	A	5
Sequens aust ralio r [the mor e sout hern follo wing	□	12	33	29	4	10	14	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
one]									
Prop e hanc decli nans ad aust r. [nea r this one, incli ning sout hwa rd]	□	12	37	0	4	43	45	A	5
Post hanc conti guar um præ ced. [afte r this one, the prec edin g of the	□	15	29	30	10	58	46	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
adjo ning stars]									
Earu nde m sequ ens [the follo wing of the sam e]	□	16	0	29	11	32	45	A	6
In 3. flex u aqu æ bore a triũ [in the 3rd ben d of the wate r, the nort	□	14	25	30	14	28	47	A	5

Nomina Fixarum	Sign	Long . Gr. ' "			Lat. Gr. ' "			B/A	Mag.
hern of thre e]									
Media earum [the middle of the m]	□	15	8	28	15	16	15	A	6
Sequens earum australis [the southern following one]	□	16	6	30	16	22	45	A	6
Trium sequentium borealis [the	□	9	17	0	14	44	46	A	5

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
nort hern of thre e follo wing]									
Med ia earu m [the mid dle of the m]	□	9	43	0	15	29	45	A	5
Aust ralis earu nde m [the sout hern of the sam e]	□	11	12	30	16	30	46	A	5
In vlti mo flex	□	5	47	29	14	25	15	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
u triu m supe rior [the uppe r of thre e at the last ben d]									
Med ia earu m [the mid dle of the m]	□	5	24	30	15	39	47	A	5
Infi ma earũ ẽpe Fom ahāt [the lowe st of the	□	4	39	28	15	52	45	A	5

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
m, near Fom alha ut]									

3. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
In dext ro Clun e [on the right hau nch]	□	22	3	30	4	9	46	A	6
Info rmiu m præ ced. post aqu æ flex um [the prec edin g of	□	19	32	29	15	39	45	A	4

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
the unformed stars, after the bend of the water]									
Sequentium borealis [the northern of these following]	□	23	37	30	14	39	46	A	4
Australis earum [the southern	□	21	42	30	18	19	41	A	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
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[Note appended to Aquarius:]

Adverte Keplerum, & Lõgomontanũ posuisse humeri dextri longitudine in \square gr. 27. 49' $\frac{1}{2}$ vel gr. 27. 48'. Anno 1600. cum Tycho posuerit gr. 27. 9 $\frac{1}{2}$. quare excessit \bar{u} errore 40' minutum.

[Note that Kepler and Longomontanus placed the longitude of the right shoulder at \square 27° 49' $\frac{1}{2}$ — or 27° 48' — for the year 1600, whereas Tycho placed it at 27° 9' $\frac{1}{2}$; hence the discrepancy amounts to an error of 40 minutes.]

PISCES.

1. Classis

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
Pisci s aust ralis occi put [the back of the head of the sout hern	\square	17	12	59	7	17	0	B	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
Fish]									
Luci da in nexu lini [the brig ht star in the knot of the cord]	□	25	9	59	9	4	0	B	4

2. Classis

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
In ore Pisci s aust rini [in the mou th of the	□	14	24	30	9	4	30	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
sout hern Fish]									
Bore alis in occi pite [the nort hern one at the back of the head]	□	18	53	0	8	55	0	B	5
Præ cede ns duar ũ in dors o [the prec edin g of two on the back	□	23	10	0	9	3	30	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
] Sequens in dors o [following, on the back]	□	23	19	0	7	14	0	B	5
] Præcedens in aluo [preceding, on the belly]	□	18	43	29	4	27	30	B	6
] Sequens in aluo [following, on the belly]	□	22	22	30	3	25	28	B	5

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
] In cauda a [on the tail]	□	28	24	29	6	24	0	B	5
Supra hanc ad ortu m [abo ve this one, towa rd the risin g]	□	29	49	28	7	27	30	B	4
Sequens [the follo wing one]	□	3	51	30	5	28	40	B	4
In lino aust rali lucid ior	□	9	58	29	2	11	30	B	4

Nom ina Fixa rum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
triu m præ cede ns [in the sout hern cord , the brig hter, the prec edin g of thre e]									
Earu nde m med ia [the mid dle of the sam e]	□	15	43	30	1	6	0	B	4
Sequ ens [the	□	15	41	30	0	58	0	B	4

Nom ina Fixa rum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
follo wing one]									
In flex u lini bore a [at the ben d of the cord , the nort hern]	□	13	47	28	1	30	30	A	6
Ibid em sequ ens aust ralis [in the sam e plac e, the follo wing sout	□	15	8	30	4	19	0	A	6

Nomina Fixarum	Sign	Long			Lat.			B/A	Mag.
		. Gr.	'	"	Gr.	'	"		
hern]									
Postflexum trium præcedens [after the bend, the preceding of three]	□	18	55	28	3	2	30	A	5
Media earum [the middle of them]	□	21	18	0	4	40	0	A	5
Sequens vltima	□	23	20	0	7	55	30	A	5

Nomina Fixarum	Sign	Long . Gr.	'	"	Lat. Gr.	'	"	B/A	Mag.
[the last following one]									
In lino bore a à nexu præcedens [in the northern cord , preceding from the knot]	□	23	34	29	1	38	0	B	5
Post hanc trium australis [after	□	22	38	30	1	52	0	B	5

Nom	ina	Fixa	Long	Lat.	B/A	Mag.
rum	Sign	. Gr.	' "	Gr.	' "	

this
one,
the
southern
of
three]

Notes on this batch

- **Sign sigils:** The catalogue continues the ecliptic-longitude ordering. Many descriptive phrases use a sign sigil one ahead of the constellation whose stars are being catalogued (e.g. Taurus body-stars listed with ♉/♉ longitudes, Gemini stars with ♊, Leo stars spanning ♌/♌, etc.), because the stars' *longitudes* fall in the next sign — this is normal precession-era reduction to AD 1700 and is transcribed as printed.
- **Greek/Arabic star names:** *Regulus, Antares, Spica, Scheat, Fomahant* (= Fomalhaut), *Vindemiatrix, Propus* transcribed verbatim. *Asellus Boreus/Australis, Praesepe* (the Manger) likewise.
- **Source authorities cited inline:** *Ex Keplero de noua Stella* (Scorpius, 2. Classis); *ex Clauio* [Clavius] (Scorpius, 3. Classis); *vel Kepl. / vel Ptolem.* alternate readings (Sagittarius); *Tychonis alter codex* (Leo region); the Kepler/Longomontanus/Tycho discrepancy note (Aquarius). All preserved.
- Several Latin words are abbreviated with macron/tilde in the source (e.g. *duarũ, frõtis, sinistræ man?, ãpe, Lõgomontanũ*); transcribed with the tilde where it aids fidelity and glossed in brackets.

TABVLA 98 — Universal Catalogue of Fixed Stars to AD 1700 (continued)

This batch concludes PARS PRIMA (the conclusion of Pisces) and begins PARS SECVNDA, the northern extra-zodiacal constellations. Each star row carries: the descriptive Latin name/position phrase (with bracketed English gloss), the

zodiacal sign sigil, Longitudo (Gr./'"), Latitudo (Gr./'") with its B (Borealis = north) / A (Australis = south) flag, and Magnitudo. The *Classis* rubrics (1.–4. Classis) and constellation headings stand as label-rows.

Printed p. 113

Pisces [☿ Fishes] — conclusion (left column)

This first block continues the constellation Pisces. The Longitudo column here carries the sign sigil ☿ (Aries) for most entries — the precessional reduction to AD 1700 runs the longitude one sign ahead of the constellation figure, as throughout PARS PRIMA.

Nom
ina
Fixa
rum
[Na
mes
of
the
stars
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	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Med ia in nexu bore o [mid dle star in the nort hern knot]	☿	22	38	30	5	21	30	B	4
Bore a, & vlti	☿	22	59	0	9	24	28	B	5

Nom
ina
Fixa
rum
[Na
mes
of
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Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
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Bore	□	24	37	30	22	0	30	B	6
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Nom
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[Na
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	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Aust ralis ibid em [sout hern , in the sam e plac e]	□	24	12	0	20	43	28	B	5
Bore a trian guli capit is [nor ther n, of the trian gle of the head]	□	20	45	0	26	55	30	B	6

Nom
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Fixa
rum
[Na
mes
of
the
stars
]

	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Aust ralis trian guli dicti [sout hern , of the said trian gle]	□	19	29	0	19	24	30	B	6
Med ia, & ante cede ns trian guli [mid dle, and prec edin g, of the trian gle]	□	18	26	0	20	24	29	B	6

Nom
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the
stars
]

	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
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In	□	19	19	0	13	21	30	B	5
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Med	□	19	25	0	12	22	0	B	6
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that
one]

Infi ma illar um [low est of the m]	□	19	31	30	11	21	30	B	6
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Bore a duar um in aluo [nor ther n of the two	□	24	40	29	17	26	29	B	5
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Nom
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Sig. Gr. ' " Gr. ' " B/A Mag.

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Sequ ens bore am in aluo ad Bore am [foll owi ng, nort hwa rd in the belly	□	25	33	28	18	31	30	B	6
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Nom
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Fixa
rum
[Na
mes
of
the
stars
]

	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
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In occi pite pisci s bore i [on the back of the head of the nort hern fish]	□	23	3	30	23	3	29	B	6
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3. Classis [Third Class]

Nom
ina
Fixa
rum

	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
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Info	□	19	32	30	15	39	30	A	4
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Nom
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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Sequens [following]	□	24	32	29	2	30	40	A	4
Australis lateris præcedens [southern, of the side, preceding]	□	23	37	30	5	34	29	A	4
Sequens [following]	□	24	52	28	5	29	30	A	4
Prior sequentium hoc □ [former]	□	2	37	30	4	35	29	A	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
of thos e follo wing this squa re]									
Post erior [latt er]	□	7	33	29	4	23	30	A	5

**PARS SECVNDA — *Astra Borealia extra Zodiacum* [Part Two
— The northern stars outside the Zodiac]**

URSA MINOR [Lesser Bear]

1. Classis [First Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Extr ema caud æ, nun c Pola ris [end of the	□	24	26	47	65	59	30	B	2

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
tail, now the Pole Star]									
Luci da hum . olim Pola ris tem pore Eud oxi [the brig ht one of the shou lder, once the the Pole Star in the time of Eud oxus	□	8	45	7	72	48	40	B	2

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
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]

2. Classis [Second Class]

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
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Pen	□	27	6	0	69	46	30	B	4
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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
t-to- last of the tail]									
Quæ in radi ce caud æ [the one at the root of the tail]	□	4	54	0	73	46	0	B	4
Superior duar um in □ sequenti um [upper of the two in the follo	□	22	59	0	74	56	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
wing squa re]									
Infer ior earu m [low er of the m]	□	26	22	0	77	34	30	B	5
Infer ior præ cede ntiũ in □ [low er of thos e prec edin g, in the squa re]	□	16	11	0	75	19	30	B	3
Info rmis ad capu t Vrs æ	□	4	24	0	71	20	0	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
aust ralio r [unf orm ed star at the head of the Bear , mor e sout herl y]									
Quæ supe r hanc [the one abov e this]	□	28	50	0	70	15	0	B	6
Prim a infor miu m in linea	□	18	47	0	35	47	0	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
rect a cum Polo [first of the unfo rme d stars in a strai ght line with the Pole]									
Secu nda [sec ond]	□	18	58	0	37	17	0	B	6
Terti a obsc ura [thir d, faint]	□	19	17	0	40	10	0	B	6
Qua rta [fou rth]	□	19	33	0	42	55	10	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Prim a infor mis circa Pola rem [first unfo rme d star arou nd the Pole Star]	□	23	8	0	57	52	0	B	6
Secu nda [sec ond]	□	23	25	0	70	39	0	B	6
Terti a [thir d]	□	26	1	0	69	0	0	B	6
Qua rta [fou rth]	□	16	37	0	68	40	0	B	6
Quin ta [fifth]	□	8	52	0	67	40	0	B	6
Sext	□	18	27	0	67	19	0	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
a [sixt h]									
Vici nissi ma Polo [nea rest to the Pole]	□	28	0	0	63	52	0	B	6

URSA MAIOR [Greater Bear]

1. Classis [First Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Luci da hum eri Dub he [the brig ht one of the shou lder,	□	10	59	27	49	40	10	B	2

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B/A	Mag.
Dub he]									
Luci da later is sub Dub he [the brig ht one of the flan k, belo w Dub he]	□	15	7	57	45	5	40	B	2

URSA MAIOR — continuation (right column, p. 113)

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Cox æ post erior is lucid a	□	26	10	12	47	8	40	B	2

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
[the brig ht one of the hind er thig h]									
Terg oris lucid a ad eand ã [the brig ht one of the back , near the sam e]	□	26	49	57	51	37	10	B	2
Cau dæ radi x, seu prim	□	4	36	27	54	17	45	B	2

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
a [the root of the tail, or first]									
Med ia caud æ [mid dle of the tail]	□	11	21	53	56	21	10	B	2
Vlti ma caud æ [last of the tail]	□	22	37	7	54	24	10	B	2

2. Classis [Second Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Quæ in rostr	□	19	2	30	40	2	45	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
o [the one in the snou t]									
Sub ocul o sinis tro [ben eath the left eye]	□	18	36	0	43	55	43	B	4
Cont igua sub hac [adja cent belo w this]	□	17	34	0	44	22	15	B	5
Supr a ocul um dext rum [abo ve	□	19	51	0	47	50	50	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the right eye]									
Supr a ocul um sinis tru m [abo ve the left eye]	□	21	10	30	47	44	46	B	4
Ad aure m sinis tram [at the left ear]	□	26	8	30	51	36	42	B	5
Infi ma in paru o Δ colli [low est in the	□	25	16	0	42	30	20	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
smal l trian gle of the neck]									
Sequ ens in eode m Tria ng. [foll owi ng, in the sam e trian gle]	□	26	28	0	45	3	16	B	4
Supr ema in Apic e eius d. Δ [top most , at	□	29	25	0	46	21	48	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the apex of the sam e trian gle]									
Succ eden s ei in collo [nex t to it, on the neck]	□	2	3	0	42	56	18	B	4
Sequ ens infra hanc [foll owi ng, belo w this]	□	5	3	30	38	15	45	B	4
In genu sinis tro	□	1	57	30	34	34	46	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
ante riori [in the left forw ard knee]									
In dext. pede bore älior [in the right foot, mor e nort herl y]	□	27	21	0	29	15	48	B	3
Aust ralio r ibid em [mor e sout herl y, in the	□	28	35	0	28	28	20	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
sam e plac e]									
Infr a genu dext rum [belo w the right knee]	□	28	32	0	33	30	19	B	3
In ipso genu dext ro [in the right knee itself]	□	28	51	0	36	6	15	B	5
Superior sinis tripe dis post erior	□	15	21	30	29	51	45	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
. [upp er of the left hind foot]									
Sequ ens, & aust ralio r [foll owi ng, and mor e sout herl y]	□	16	30	30	28	45	16	B	4
In genu præ cede nte post er. [in the prec edin g	□	23	58	0	35	14	15	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
hind knee]									
Præ cede ns in dext ro pede post er. [pre cedi ng, in the right hind foot]	□	2	15	0	26	14	18	B	4
Sequ ens, & aust ralio r [foll owi ng, and mor e sout herl y]	□	3	1	0	24	54	20	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Info rmis inter caud ã Vrs æ, & Leon is [unf orm ed star betw een the tail of the Bear and Leo]	□	19	8	30	40	6	20	B	2
Quæ in dors o [the one on the back]	□	29	35	0	41	30	15	B	4
In sinis	□	22	27	30	33	1	20	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
tro pede post erior i [in the left hind foot]									
Info rm. inter Vrsa m,& capu t Leon is [unf orm ed star betw een the Bear and the head of Leo]	□	7	42	0	17	55	18	B	5
Quæ supr a	□	9	35	0	20	42	20	B	4

Nom
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Fixa
rum

Sig. Gr. ' " Gr. ' " B Mag.

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Quæ □ 6 25 0 20 5 16 B 4

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Sequ □ 3 12 0 20 51 18 B 4

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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
two befo re thes e]									
Earu m præ cede ns [pre cedi ng of the m]	□	1	7	0	23	41	20	B	4
Inter pedē , & cap. Leon is [bet wee n the foot and the head of Leo]	□	15	57	0	21	53	19	B	4
Sequ ens bore	□	20	20	0	25	4	17	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
alis [foll owi ng, nort hern]									
Sequ ens aust ralis [foll owi ng, sout hern]	□	21	32	0	24	50	20	B	5
Præ cede ns in basi Oxy gonij [pre cedi ng, at the base of the acut e- angl	□	24	47	0	21	28	19	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
ed trian gle]									
Sequ ens [foll owi ng]	□	27	34	0	20	44	20	B	3
Terti a bore al. in dicta basi [thir d, nort hern , in the said base]	□	26	44	0	24	58	15	B	4
Quæ inter crur a Vrs æ [the one betw een the	□	13	41	0	40	30	18	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
legs of the Bear]									
Prim a inter caud am, & corp us [first betw een the tail and the body]	□	22	54	0	58	8	10	B	6
Secu nda [sec ond]	□	25	0	0	47	14	6	B	6
Terti a [thir d]	□	21	14	0	47	30	12	B	6
Prim a inter Vrsa	□	0	42	0	46	50	15	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
m, & Cap ut □ [first betw een the Bear and the Hea d of Leo]									
Secu nda [sec ond]	□	5	33	0	47	5	16	B	6
Terti a [thir d]	□	7	25	0	48	40	14	B	6
Qua rta [fou rth]	□	7	55	0	49	42	18	B	6
Quin ta [fifh]	□	7	44	0	49	42	15	B	6
Sext a [sixe h]	□	20	20	0	49	0	18	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Septi ma [sev enth]	□	19	26	0	49	27	12	B	6
Octa ua [eigh th]	□	27	7	0	48	11	15	B	6
Non a [nint h]	□	17	27	0	52	25	14	B	6
Paru ula tang ens coxa m [tiny one touc hing the thig h]	□	5	6	0	35	40	15	B	6

DRACO [Dragon]

1. Classis [First Class]

Nom
 ina
 Fixa
 rum
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Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
□	23	46	7	75	2	10	B	3

2. Classis [Second Class]

Nom
 ina
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 rum
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Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
□	20	18	30	76	16	0	B	4

Quæ	□	5	36	30	78	14	30	B	4
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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
in ore [the one in the mou th]									
In capit e præ cede ns [pre cedi ng, in the head]	□	7	41	30	75	20	0	B	3
Quæ ad gena m [the one at the chee k]	□	20	25	0	80	20	30	B	4
1. Triu m in	□	18	26	0	81	52	0	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
flex u colli [first of thre e in the ben d of the neck]									
Aust ralis ibid em [sout hern , in the sam e plac e]	□	25	53	0	77	56	0	B	5
Med ia earu m [mid dle of the m]	□	21	55	30	79	50	30	B	5

DRACO — continuation (left column)

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Sequens ad ortum [following, toward the east]	□	10	51	0	80	52	29	B	4
Propere secundum flexum [near the second bend]	□	29	55	0	81	50	0	B	4
Bore a □ secundiflexus	□	13	48	30	82	48	0	B	3

Nom
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Fixa
rum

Sig. Gr. ' " Gr. ' " B Mag.

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Bore □ 16 45 0 78 8 30 B 4

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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
sam e side]									
Sequ entis △ præ cede ns [pre cedi ng of the follo wing trian gle]	□	16	40	0	83	4	0	B	4
Sequ ens hanc ad aust rum [foll owi ng this, to the sout h]	□	21	2	30	80	37	0	B	4
Quæ supr a	□	28	6	0	80	53	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
hanc [the one abov e this]									
In reliq uo △ sequ ens [foll owi ng, in the rem aini ng trian gle]	□	7	56	30	83	5	30	B	4
Aust ralis eand em [sout hern , the sam e]	□	2	50	0	83	27	30	B	4
Præ cede ns bore	□	6	53	0	84	47	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
a Triã guli [pre cedi ng, nort hern , of the trian gle]									
In flex u med iterr ij [in the mid dle ben d]	□	1	6	30	81	3	30	B	3
Polo Zodi aci prox ima [nea rest to the pole of	□	7	48	0	86	52	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the Zodi ac]									
Quæ 24. sequ itur [the one follo wing the 24th]	□	29	43	0	83	17	0	B	5
Succ eden s huic [nex t to this]	□	29	44	0	81	40	0	B	5
Polo vicin ior [nea rer to the pole]	□	28	13	30	84	45	0	B	5
Præ cede ns ante pen	□	9	17	0	78	31	0	B	4

Nom
ina
Fixa
rum

Sig. Gr. ' " Gr. ' " B Mag.

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Ante □ 13 50 30 74 10 30 B 4
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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the next -to- last ben d]									
Pen ulti ma ad flex um [nex t-to- last at the ben d]	□	0	44	0	71	3	0	B	3
Flex um sequ ens secu nda [foll owi ng the ben d, seco nd]	□	0	39	0	65	17	0	B	4
Flex	□	3	32	30	65	35	0	B	2

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
um prox ime sequ ens [foll owi ng the ben d, near est]									
Pen ulti ma caud æ [nex t-to- last of the tail]	□	11	48	0	61	52	0	B	3
Vlti ma caud æ [last of the tail]	□	5	59	30	57	6	0	B	3
Info rmis	□	2	26	0	77	30	30	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
inter 11. & Ceph ei brac hiu m [unf orm ed star betw een the 11th and the arm of Ceph eus]									

CEPHEVS

1. Classis [First Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Cing ulu m Ceph ei [the	□	1	36	30	71	8	30	B	3

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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belt
of
Ceph
eus]

2. Classis [Second Class]

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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Luci
da
hum
eri
[the
brig
ht
one
of
the
shou
lder]

□	8	36	30	68	56	30	B	3
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In
sinis
tro
hum
ero
[in
the
left
shou
lder]

□	29	17	0	62	36	15	B	4
---	----	----	---	----	----	----	---	---

Sequ
ens

□	9	52	30	61	4	30	B	4
---	---	----	----	----	---	----	---	---

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
in tiara ad Bore ã [foll owi ng, in the tiara , to the nort h]									
Aust ralis [sout hern]	□	19	0	0	60	0	0	B	4
Quæ vers us ortu m [the one towa rd the east]	□	15	2	30	58	47	30	B	4
In flex u	□	1	43	30	71	50	15	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
brac hii aust ralio ri [in the ben d of the mor e sout herl y arm]									
Ibid em bore alior [mor e nort herl y, in the sam e plac e]	□	0	17	30	74	11	0	B	4
Quæ in hum eris [the	□	20	9	28	65	43	25	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
one in the shou lders]									
In pede dext ro [in the right foot]	□	28	56	30	75	28	30	B	4
In pede sinis tro [in the left foot]	□	25	46	30	64	29	25	B	3

3. Classis [Third Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Info rmis prop e Tiar am	□	5	53	30	64	2	30	B	5

Nom
ina
Fixa
rum
[unf
orm
ed
star
near
the
tiara
]

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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BOOTES, seu ARCTOPHYLAX [Bootes, or the Bear-Keeper]

1. Classis [First Class]

Nom
ina
Fixa
rum
Arct
urus
in
fimb
ria
[Arct
urus
, in
the
hem
]

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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□	20	4	27	31	0	40	B	1
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□	14	50	27	49	51	0	B	3
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In
hum
ero
sinis
tro
[in
the

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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left
shou
lder]

2. Classis [Second Class]

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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□	25	34	30	58	5	0	B	4
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Secu
nda
[sec
ond]

□	26	58	0	58	49	30	B	4
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Terti
a
[thir
d]

□	28	24	30	60	8	40	B	4
---	----	----	----	----	---	----	---	---

In

□	2	45	0	54	38	29	B	4
---	---	----	---	----	----	----	---	---

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
vl na sinis tra [in the left fore arm]									
In capit e [in the head]	□	20	8	30	54	14	0	B	3
In dext ro hum ero supr a Coro nam [in the right shou lder, abov e the Cro wn]	□	28	54	30	48	59	30	B	3
In coxa	□	23	54	30	49	38	28	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
infra brac hiu m dext. [in the thig h, belo w the right arm]									
Infi ma duar um in dors o [low est of the two on the back]	□	19	41	0	49	9	32	B	4
Superior earu m	□	18	42	30	41	34	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
[upp er of the m]									
In Crur e dext ro [in the right leg]	□	28	51	30	55	33	3	B	4
Crur is supe rior [upp er of the leg]	□	15	7	0	28	7	30	B	4
Med ia Crur is [mid dle of the leg]	□	13	50	0	26	31	29	B	4
Infi ma Crur is	□	15	20	0	25	12	32	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
[low est of the leg]									
Circ a genu infi ma 3. infor miu m [aro und the knee , lowe st of 3 unfo rme d stars]	□	27	38	0	30	26	0	B	4
Med ia [mid dle]	□	28	36	0	31	30	29	B	4
Superior [upp	□	29	17	0	33	30	30	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
er]									
Præ ced. de quat uor man us dext. [pre cedi ng, of the four of the right han d]	□	29	36	0	40	13	0	B	4
Sequ ens Aust ralis & Bore alis [foll owi ng, sout hern and nort	□	1	5	0	40	30	0	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
hern]	□	29	18	0	41	14	30	B	5

Right column, p. 114

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Quæ hanc sequ itur [the one whic h follo ws this]	□	0	41	0	41	53	29	B	6
Præ cede ns in Colo robo aust rali [pre cedi ng, in the sout hern	□	1	9	30	45	4	30	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Colo robu s]									
Sequ ens [foll owi ng]	□	2	51	30	46	50	28	B	5
Super ior in Colo robo [upp er, in the Colo robu s]	□	29	57	0	53	26	0	B	4
Iisfo rmis circa hanc [unf orm ed star arou nd this]	□	0	0	0	53	58	29	B	4
Info rmis duar	□	13	14	0	60	38	28	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
um supr a capu t [unf orm ed star of the two abov e the head]		13	58	0	60	50	30	B	6
Secu nda ipsa rum [sec ond of the m]	□	13	58	0	60	50	30	B	6

3. Classis [Third Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
In Ven abul	□	0	10	0	45	43	30	B	4

Nom

ina

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CORONA BOREA [Northern Crown]

1. Classis [First Class]

Nom

ina

Fixa

rum

Sig.

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2. Classis [Second Class]

Nom

ina

Fixa

rum

Sig.

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B

Mag.

Præ
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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
ns lucid am [pre cedi ng the brig ht one]									
Quæ supr a hanc [the one abov e this]	□	4	34	30	48	25	0	B	5
Sequ ens ad Bore am [foll owi ng, to the nort h]	□	9	26	0	50	21	0	B	4
Sequ ens lucid	□	10	38	30	44	33	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
am [foll owi ng the brig ht one]									
Prox ime sequ ens [nex t follo wing]	□	12	49	0	44	52	0	B	4
Quæ hanc comi tatur [the one acco mpa nyin g this]	□	14	56	0	46	9	30	B	4
Vlti ma omn ium [last of	□	14	26	0	48	24	0	B	6

Nom
ina
Fixa
rum
all]

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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HERCVLES, seu ENGONASI [Hercules, or the Kneeling Man]

1. Classis [First Class]

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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Cap	□	11	58	7	37	22	15	B	3
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Herc
ulis
[the
head
of
Herc
ules]

Hum	□	26	54	37	42	47	15	B	3
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erus
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[the
right
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Hum	□	10	37	7	47	46	15	B	3
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erus
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[the
left
shou
lder]

2. Classis [Second Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Pen ulti ma brac hii dext ri [nex t-to- last of the right arm]	□	25	2	10	40	5	0	B	3
Infi ma in dext ro brac hio [low est in the right arm]	□	21	32	40	37	18	15	B	4
In brac hio sinis tro [in	□	15	48	0	49	22	14	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the left arm]									
Præ cede s in spoli o Leon is [pre cedi ng, in the spoil of the Lion]	□	21	2	12	51	16	0	B	4
Sequ ens in Triã gulo spoli j [foll owi ng, in the trian gle	□	28	45	10	52	18	20	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
of the spoil]									
In basi triãg li ad bore am [at the base of the trian gle, to the nort h]	□	28	45	8	53	45	16	B	4
Med ia in spoli o [mid dle, in the spoil]	□	25	4	10	52	46	20	B	4
In coxa sinis	□	27	28	12	53	10	0	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
tra [in the left thig h]									
Hæc orie ntali or in fem. sinis t. [this one, mor e east erly, in the left thig h]	□	11	41	40	53	20	18	B	3
Præ ced. triu m conti guar . fem oris [pre	□	7	47	40	39	37	15	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
cedi ng of thre e conti guou s of the thig h]									
Med ia earu m [mid dle of the m]	□	8	45	12	60	11	0	B	4
Sequ ens [foll owi ng]	□	11	25	40	60	49	0	B	4
In genu sinis tro [in the left knee]	□	27	22	10	60	46	17	B	3
In	□	15	43	0	69	21	20	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
sinis t. sura ad Cap. drac. [in the left calf, near the head of the Drag on]									
Præ c. triu m in pede sinis tr. [pre cedi ng of thre e in the left foot]	□	8	31	40	71	19	17	B	6
Med ia	□	12	33	10	71	13	0	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
earu m [mid dle of the m]									
Vlti ma neb ulos a [last, neb ulou s]	□	19	26	8	71	4	18	B	neb.
In supe riori fem ore dext ro [in the uppe r right thig h]	□	24	34	40	60	24	0	B	4
Bore alior in eade	□	19	15	39	63	13	20	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
m [mor e nort herl y, in the sam e]									
In genu dext ro [in the right knee]	□	10	9	40	65	54	15	B	4
In supe riore sura [in the uppe r calf]	□	7	23	12	63	50	14	B	4
In crur e [in the leg]	□	4	9	0	64	22	15	B	4
Præ cede	□	17	58	17	62	28	17	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
ns in crur e dext r. [pre cedi ng, in the right leg]									
In tibia pedi s dext ri [in the shin of the right foot]	□	3	54	38	60	15	0	B	4
Extr ema in pede dext ro [out erm ost in	□	28	32	8	57	15	0	B	4

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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the
right
foot]

3. Classis [Third Class]

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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In
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□	2	46	10	55	54	15	B	5
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Sequ
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eade
m
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ng,
in
the

□	3	56	8	58	14	16	B	5
---	---	----	---	----	----	----	---	---

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
sam e]									
Info rmis dext. brac hij aust. [unf orm ed star of the right arm, sout hern]	□	26	15	19	57	29	17	B	5

LYRA, seu VVLTVR VOLANS [Lyre, or the Flying Vulture]

1. Classis [First Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Luci da Lyr æ [the brig ht	□	11	6	27	61	47	0	B	1

Nom
ina
Fixa
rum
one
of
the
Lyre
]

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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2. Classis [Second Class]

Nom
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Fixa
rum
Supr
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Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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□	14	37	30	62	16	30	B	5
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□	13	49	28	60	25	31	B	5
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Infr
a
lucid
am
ad
Euru

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
m [belo w the brig ht one, towa rd the east- sout heas t]									
In educ tion e cord æ [at the dra wing -out of the cord]	□	17	34	0	59	25	29	B	4
Duar um conti guar um ad	□	25	56	0	60	45	30	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Bore am [of two conti guou s, towa rd the nort h]									

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LYRA — continuation (left column)

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Earu nde m ad Aust rum [of the sam e, towa rd the sout h]	□	26	25	30	59	40	28	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
In iugo præ ced. & bore alis [in the yoke , prec edin g and nort hern]	□	14	40	0	56	4	30	B	3
Paru a sub hac [sma ll one belo w this]	□	14	27	0	55	15	29	B	6
In iugo sequ enti um bore	□	17	34	30	55	5	30	B	3

Nom
ina
Fixa
rum

Sig. Gr. ' " Gr. ' " B Mag.

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Paru □ 17 43 29 54 31 0 B 6

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In □ 22 15 30 58 5 30 B 5

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Nom

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Fixa

rum

Sig.

Gr.

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Gr.

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B

Mag.

of

the

body

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CYGNVS [Swan]

1. Classis [First Class]

Nom

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Fixa

rum

Sig.

Gr.

'

"

Gr.

'

"

B

Mag.

Rost

□

27

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31

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3

0

B

3

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Cygn

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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
brea st, anci ent]									
Cau da Cygn i [the tail of the Swa n]	□	1	15	12	59	57	20	B	2
Alæ supe riori s anco n. [the elbo w of the uppe r wing]	□	12	14	47	64	28	30	B	3
Alæ infer ioris anco n. [the	□	23	31	17	49	27	0	B	3

Nom

ina

Fixa

rum

Sig.

Gr.

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Gr.

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B

Mag.

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2. Classis [Second Class]

Nom

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Gr.

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B

Mag.

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neck

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
] Trium in superioriala Australi [of three in the upper southern wing]	□	14	43	0	69	43	0	B	4
] Penultima superioris alæ [next-to-last of the upper wing]	□	14	1	30	71	32	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Vlti ma supe riori s alæ [last of the uppe r wing]	□	10	58	30	73	51	30	B	4
In med io infer ioris alæ [in the mid dle of the lowe r wing]	□	25	40	0	51	42	30	B	4
Extr ema infer ioris alæ	□	29	5	0	43	45	0	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
[out erm ost of the lowe r wing]									
Præ cedē s in pede infer iori [pre cedi ng, in the lowe r foot]	□	1	54	0	55	0	0	B	4
Sequ ens in genu infer iori [foll owi ng, in the	□	6	43	30	56	37	10	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
lowe r knee]									
Cont igua r. in supe r. pede præ cede ns, & Aust r. [of thos e conti guou s in the uppe r foot, prec edin g, and sout hern]	□	24	12	0	63	38	2	B	4
Earu m supe	□	25	56	30	64	18	30	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
rior Bore alis [upp er of the m, nort hern]									
Infer ior infor miu m sequ ẽs alam dext ram [low er of the unfo rme d stars , follo wing the right wing]	□	4	25	30	50	34	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Earu nde m supe rior [upp er of the sam e]	□	6	15	30	51	32	0	B	4
Infr a alam vers us pede m Pega si [belo w the wing , towa rd the foot of Pega sus]	□	5	55	0	38	40	3	B	3
Duar um vers	□	21	19	0	66	16	2	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
one at the holl ow of the wing]									
Ad infer iore m alam [at the lowe r wing]	□	19	37	0	53	13	0	B	6
Ad supe riore m alam [at the uppe r wing]	□	14	40	0	69	43	0	B	6
* Nou a in	□	16	15	0	55	30	0	B	3

Nom
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Fixa
rum

Sig.

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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
in Nov emb er of the year 1659]	□	11	30	10	55	24	10	B	3
In dext ro genu neb ul. [in the right knee , neb ulou s]	□	4	22	0	63	21	0	B	neb.

CASSIOPEIA

1. Classis [First Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Luci da Cath	□	0	55	47	51	17	0	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
edr æ [the brig ht one of the Thro ne]									
Pect oris sche dir [Sch edir, of the brea st]	□	3	39	27	46	36	50	B	3
Flex ura [the ben d]	□	9	49	27	48	47	50	B	3
In genu [in the knee]	□	13	42	57	46	25	50	B	3

2. Classis [Second Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Quæ in Capi te [the one in the head]	□	0	57	0	44	42	0	B	4
In cing ulo [in the belt]	□	6	0	0	47	6	30	B	4
In crur e [in the leg]	□	20	55	30	47	30	29	B	3
Extr ema pedi s [out erm ost of the foot]	□	18	1	0	48	55	31	B	4
In brac hio	□	7	36	30	43	8	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
sinis tro [in the left arm]									
In cubi to sinis tro [in the left elbo w]	□	6	38	0	43	29	30	B	5
In cubi to dext ro [in the right elbo w]	□	26	1	0	49	26	0	B	6
In educ tion e sedis [at the dra	□	8	28	0	51	16	0	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
wing -out of the seat]									
Cath edr æ extr ema [out erm ost of the Thro ne]	□	26	56	0	51	9	28	B	4
In extr emit ate sell æ [at the extr emit y of the seat]	□	26	54	0	52	40	30	B	5
In rect a ferè linea	□	20	50	0	52	49	29	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
cum 11. & 17. [in near ly a strai ght line with the 11th and 17th]									
Scab elli extr ema [out erm ost of the foots tool]	□	23	43	0	56	14	30	B	6
Med ia scab elli vel ex Long omo	□	23	43	0	54	28	31	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
ntan o [mid dle of the foots tool, or acco rdin g to Long omo ntan us]	□	23	54	0	54	28	31	B	6
In scab ello ad plan tã pedi s [in the foots tool, at the sole of the foot]	□	23	20	0	52	10	0	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Quæ sequ itur genu [the one follo wing the knee]	□	24	19	30	44	59	0	B	6
Quæ genu præ cedit [the one prec edin g the knee]	□	11	22	0	45	6	0	B	6
Vmb ilici gyru s [the circl e of the nave l]	□	8	14	0	47	33	0	B	6
Patu la ad	□	0	32	0	45	30	0	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
crin es [spr eadi ng one at the hair]									
Sequ ens Bore al. in Virg a [foll owi ng, nort hern , in the rod]	□	0	54	0	41	16	28	B	6
Earu m præ cede ns [pre cedi ng of the m]	□	29	19	0	41	27	0	B	6

CASSIOPEIA — continuation (right column, p. 115)

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Pen ulti ma Virg æ [nex t-to- last of the rod]	□	28	18	0	39	17	0	B	6
Vlti ma Virg æ [last of the rod]	□	28	16	30	38	10	29	B	6
Triu m infra scab ellū præ c. [pre cedi ng of thre e belo w	□	5	8	0	33	17	28	B	6

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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the
foots
tool]

Septentr. [Northern]

Nom
ina
Fixa
rum

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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Sequ
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□	7	34	0	53	33	29	B	6
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Earu
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□	1	33	0	52	5	30	B	6
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Supr
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vers

□	8	7	0	59	9	28	B	6
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Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
us Polu m [abo ve thes e, towa rd the Pole]									
Prim a inter Auri gam, & * Cassi op. [first betw een Auri ga and * Cassi opei a]	□	18	39	0	35	51	30	B	6
Secu nda [sec ond]	□	28	41	0	55	49	28	B	6
Terti	□	3	55	0	54	50	30	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
a [thir d]									
Qua rta [fou rth]	□	4	22	0	50	23	28	B	6
Triu m in Bore am prim a [first of thre e towa rd the nort h]	□	2	7	0	44	11	10	B	6
Secu nda [sec ond]	□	2	19	0	45	33	28	B	6
Terti a [thir d]	□	27	37	0	45	33	29	B	6
Quæ magi s in Bore	□	1	32	0	54	44	30	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
am, & prim a vers us Vrsa m [the one mor e to the nort h, and first towa rd the Bear]									
Secu nda [sec ond]	□	29	7	0	56	16	28	B	6
Terti a [thir d]	□	5	35	0	56	56	30	B	6
Qua rta [fou rth]	□	1	20	0	59	19	28	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Quin ta [fifth]	□	9	16	0	60	48	39	B	6
Sext a [sixt h]	□	13	32	0	62	5	28	B	6
Septi ma [sev enth]	□	10	59	0	62	47	30	B	6
Octa ua [eigh th]	□	22	10	0	63	18	29	B	6
Nou a Ann o 1572 . erat [a New star; it exist ed in the year 1572]	□	6	54	0	53	45	0	B	6

PERSEVS [Perseus]

1. Classis [First Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Luci dum latus Pers ei [the brig ht side of Pers eus]	□	27	39	55	30	5	40	B	2
Sub plat a com mun is cum □ corn u bor. [belo w the plate , com mon with	□	18	22	47	5	20	30	B	2

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the nort hern horn of Taur us]									
Cap ut Med usæ [the head of Med usa]	□	22	5	57	22	22	40	B	3

2. Classis [Second Class]

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Inuo luta in extr emo man u dext ra [env elop ed,	□	19	59	0	39	1	10	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
at the end of the right han d]									
In cubi to dext ro [in the right elbo w]	□	24	37	0	37	29	12	B	4
In hum ero dext ro [in the right shou lder]	□	25	54	30	34	30	40	B	3
In hum ero sinis tro [in	□	20	32	30	31	35	8	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the left shou lder]									
In verti ce capit is [at the cro wn of the head]	□	23	18	0	34	26	40	B	5
Quæ in dors o [the one on the back]	□	25	1	0	30	37	0	B	4
Infr a later is lucid am [belo w	□	28	32	30	27	59	38	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the brig ht one of the side]									
Paru a hanc sequ ens [sma ll one follo wing this]	□	29	41	30	27	55	40	B	5
Ad flex um later is [at the ben d of the side]	□	0	53	0	27	34	39	B	3
In cubi to sinis tro [in	□	13	34	0	26	4	40	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the left elbo w]									
Quæ sub capit e Med usæ [the one belo w the head of Med usa]	□	21	59	0	20	54	38	B	3
Han c præ cede ns [pre cedi ng this]	□	20	46	0	20	33	40	B	4
Præ cede ns ad Bor. in	□	19	48	0	21	35	40	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
cap. Med usæ [pre cedi ng, to the nort h, in the head of Med usa]									
In popl ite dext ro [in the right ham]	□	7	41	30	28	23	10	B	5
Quæ præ cedit genu dext r. [the one prec	□	5	39	30	28	50	40	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
edin g the right knee]									
Præ c. flex um genu [pre cedi ng, the ben d of the knee]	□	5	33	0	26	11	38	B	5
Med ia in genu dext ro [mid dle, in the right knee]	□	6	42	0	26	39	40	B	4
Infr a genu	□	7	28	0	24	35	39	B	5

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
dext rum [belo w the right knee]									
In plan ta pedi s dext ri [in the sole of the right foot]	□	9	29	0	18	56	40	B	5
In sinis tro fem ore [in the left thig h]	□	29	39	0	22	6	38	B	4
In genu sinis	□	1	36	0	19	4	39	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
tro [in the left knee]									
In crur e sinis tro [in the left leg]	□	0	51	30	14	54	0	B	5
In sinis tro calc aneo [in the left heel]	□	26	51	0	12	8	40	B	4
Sequ ens sinis tri pedi s [foll owi ng, of	□	29	4	0	11	18	0	B	3

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
the left foot]									
Info rmis supr a capu t [unf orm ed star abov e the head]	□	28	13	0	42	26	38	B	5
In supe riori part e fem or. [in the uppe r part of the thig h]	□	4	0	0	29	31	40	B	5
Info	□	17	42	0	20	53	40	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
rmis præ c. cap. Med usæ [unf orm ed star prec edin g the head of Med usa]									
In rect a linea cum Polo, & cum Luci da later is [in a strai ght line with the	□	3	46	0	45	10	39	B	4

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Pole and with the brig ht one of the side]									
Secu nda illar um [sec ond of the m]	□	5	40	0	48	7	40	B	6
ex alter o Cata logo Kepl eri [fro m the othe r Cata logu e of	□	5	30	0	48	7	40	B	6

Nom ina Fixa rum	Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
Kepl er [Joh anne s Kepl er]]									
Terti a illar um [thir d of the m]	□	6	9	0	49	27	38	B	6
Qua rta earu m [fou rth of the m]	□	7	53	0	53	37	40	B	6
ex alter o Cata logo Kepl eri [fro m the	□	7	43	0	53	37	40	B	6

Nom
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Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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3. Classis [Third Class]

Nom
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the
left
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east]

Sig.	Gr.	'	"	Gr.	'	"	B	Mag.
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□	3	38	0	17	50	40	B	5
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Riccioli, *Astronomiae Reformatae Tomi Duo* — TABVLA 98, PARS SECVNDA / PARS TERTIA

Universal Catalogue of Fixed Stars to AD 1700 (TABVLA 98), continued. These pages complete **PARS SECVNDA** — *Astra Borealia extra Zodiacum* (the northern extra-zodiacal constellations) and open **PARS TERTIA** — *Astra Australia* (the southern constellations). Each page is laid out as two side-by-side catalogue blocks (a left and a right column-group), each carrying the same six fields: the descriptive Latin name/position of the star (with an English gloss), the zodiacal sign sigil, Longitude (Gr./'" within the sign), Latitude (Gr./'"), the latitude-direction flag — **B (Borealis = north)** through PARS SECVNDA, switching to **A (Australis = south)** in PARS TERTIA — and Magnitude. The northern blocks all carry the B flag (the header reads *Latitudo B.*); the southern blocks carry *Latit. A.*

The descriptive position-phrases are transcribed verbatim from the Latin, with a bracketed English gloss given once per constellation block where the phrasing recurs; sign sigils are rendered as the standard symbols.

AVRIGA, HENIOCHVS, ERICHTONIVS [Auriga, the Charioteer, Erichthonius]

1. Classis [Certainty-class 1]

Star (Latin) [gloss]	Sign	Long . Gr ' "			Lat. Gr ' "			B/A	Mag.
Cape lla, seu Hirc us [Cap ella, or the She- goat]	♈	17	40	2	22	51	45	B	1

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Lucida humeri dexteri [the bright star of the right shoulder]	☐	27	12	2	21	25	40	B	2

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Præc. & superior Capitis [preceding and upper]	☐	25	2	0	32	16	15	B	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Star of the head]									
Sequens, & inferior [following and lower]	□	25	38	0	30	51	14	B	4
In brachio dextro [in the right arm]	□	25	52	0	13	45	16	B	4
Ex alio Catalogo Longomontan	□	25	22	0	13	45	16	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
o [from another catalogue , after Longomontanus]									
In cubito sinistro [in the left elbow]	□	14	35	0	20	53	15	B	5
Hædorum præcedens [the preceding of]	□	14	39	30	18	1	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
the Kids]									
Hæd oru m sequ ens [the follo wing of the Kids]	□	15	13	30	18	13	0	B	4
In supe riore pede [in the uppe r foot]	□	12	28	30	10	23	15	B	4
Super rior ad lucid am dext ri hum eri	□	25	49	30	27	28	15	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[the upper, toward the bright star of the right shoulder]									
In Lum bis Bore alior [the more northern in the loins]	□	18	16	30	18	36	0	B	6
In Lum bis Aust ralio	□	17	30	0	17	0	15	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
r [the more southern in the loins]									
Huic inferior ad Occasum [lower than this, toward the west]	□	16	22	0	15	23	0	B	5
Sequens [the following]	□	18	33	0	14	5	15	B	6
Adnate	□	15	24	0	15	4	14	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
s [at the butts ocks]									
Præ cede ns duar um in brac hio dext. [the prec edin g of two in the right arm]	□	23	36	30	15	44	0	B	5
Sequ ens earu m [the follo wing of thes e]	□	23	48	0	15	44	13	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Ex alter o Kepl . Cata logo [fro m the othe r catal ogue , after Kepl er]	□	24	8	0	15	44	13	B	5
Sub hac in dext ro crur e [ben eath this, in the right leg]	□	23	59	0	13	50	15	B	6
In	□	18	13	30	11	16	14	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
sinistra tibia [in the left shin]		19	58	0	8	52	16	B	5
In dextro pede [in the right foot]	□	11	28	30	14	52	13	B	5
Præcedens circa Ericthon. [pre cedi ng, about Eric hthonius]	□	11	55	0	14	3	15	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ens Australis [the following southern]									
Borealis informis inter Aurigam, & pedes Gemini [the northern unford d star between Auriga and the	□	29	16	0	6	5	14	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
feet of Gemini]									
Secunda [the second]	□	24	28	0	4	7	15	B	4
Subistam ad ortum [beneath that one, toward the east]	□	25	28	0	2	27	13	B	4
Harum præcedens [the preceding of these]	□	21	20	30	2	29	15	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Vltima omnium [the last of all]	♏	25	24	0	1	7	16	B	4

OPHIVCHVS, seu SERPENTARIVS [Ophiuchus, or the Serpent-bearer]

1. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Ophiuchi Caput [the head of Ophiuchus]	♏	8	17	7	35	56	15	B	3
Manus sinistræ Borealis	♏	28	11	37	17	18	20	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[the more northern of the left hand]									
In genu dextro [in the right knee]	□	13	51	7	17	20	0	B	3
In genu sinistro [in the left knee]	□	5	6	7	11	29	20	B	3
In humero dextro	□	21	12	7	28	0	20	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[in the right shou lder]									

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Sequens in dextro humero [the following in the right shou lder]	□	22	32	0	26	10	0	B	3
Præc. in sinistro humero	□	6	26	30	32	35	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[the preceding in the left shoulder]									
Sequens in sinistro humero [the following in the left shoulder]	□	7	43	0	31	55	20	B	4
In sinistro cubito [in the left elbow]	□	1	30	0	23	30	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
In sinis tra man u aust ralia ri [in the mor e sout hern part of the left han d]	☐	29	24	0	16	30	0	B	4
In dext ro anco ne [in the right elbo w]	☐	21	0	0	15	18	19	B	4
In alter o Cata	☐	20	30	0	15	18	19	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
logo Kepl eri [in the othe r catal ogue , after Kepl er] Aust ralis præ ced. in man u dext r. [the sout hern prec edin g star in the right han	□	25	40	30	13	46	18	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
d]									
Bore alior sequ ens ibid em [the mor e nort hern follo wing star in the sam e plac e]	□	26	41	30	15	19	20	B	5
In dext ro genu [in the right knee]	□	13	51	0	7	17	21	B	3
Sed ex corr	□	13	47	30	7	17	21	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ectio ne Kepl eri [but by Kepl er's corr ectio n]									
In sinis tro genu [in the left knee]	□	5	6	0	11	29	20	B	3
In tibia dext ra [in the right shin]	□	15	50	0	2	11	21	B	3
Quin ta infor m.	□	27	58	0	33	2	0	B	4

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
Post coxa s Ophi uchi [beh ind the hips of Ophi uchu s]	♏	16	16	0	10	20	19	B	4
Sequ enti um Aust ralio r [the mor e sout hern of the follo wing stars]	♏	20	24	0	8	3	18	B	3
Earu m	♏	21	15	0	10	34	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Bore alior [the more e nort hern of thes e]									
Quæ supr a hanc [the star abov e this one]	□	20	12	0	15	17	19	B	4
Inter man um sinis tram ad genu [bet wee n the left han	□	24	0	0	13	48	19	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
e]									
Australis trium [the southern of three]	☐	26	10	0	24	49	20	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Sequens trium [the following of three]	☐	27	25	0	26	9	18	B	4
Præcedit in dextro	☐	15	28	2	15	30	0	B	3

Star (Latin) [gloss]	Sign	Long . Gr ' "			Lat. Gr ' "			B/A	Mag.
pede [the preceding in the right foot]									
Sequens [the following]	□	17	9	0	1	31	19	B	4
Tertia [the third]	□	17	50	0	0	19	20	B	4
Alia sequens [another following]	□	18	39	0	0	28	19	B	5
Quæ tangit calcaneum	□	19	5	0	0	57	20	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[the star touching the heel]									
In crure dextro [in the right leg]	□	18	17	0	7	9	18	B	5
Informis extra crus [the unformed star outside the leg]	□	23	12	0	4	19	20	B	4
Sequens duarum	□	1	34	0	23	33	18	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
in manu [the following of two in the hand]	♏	16	27	0	10	17	19	B	5
In coxa Ophiuchi [in the hip of Ophiuchus]	♏	20	29	0	8	4	20	B	4
Sequens Australis [the following southern]	♏	20	29	0	8	4	20	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ng stars of Class 3, after Kepler, concerning the New Star in Serpentarius]									

3. Classis [continued]

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Trium ante pedem in recta linea	□	27	9	0	9	26	20	B	5

Star (Latin) [gloss]	Sign	Long . Gr ' "			Lat. Gr ' "			B/A	Mag.
præced. bore al. [of thre e befo re the foot, in a strai ght line, the prec edin g nort hern one]									
Med ia [the mid dle]	□	26	14	0	6	41	19	B	5
Infi ma [the lowe st]	□	25	32	0	3	44	20	B	5
Præ	□	2	30	0	13	33	19	B	5

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
feet]									
In crute anteriore [in the front shin, northern]	♁	7	16	0	4	37	19	B	4
Eatum media [the middle of these]	♁	4	14	0	5	41	20	B	4
Eatum Australissima [the most sout	♁	3	34	0	3	10	19	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
hern of these]									
In calcaneopedis anterior. [in the heel of the front foot]	☐	5	31	0	0	25	18	B	4
In femore sequenti [in the following thigh]	☐	17	6	0	17	27	20	B	5
In cubito sequ	☐	20	29	0	14	56	19	B	4

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
enti [in the follo wing elbo w]									
In tibia pedi s sequ entis [in the shin of the follo wing foot]	□	17	9	0	1	56	21	B	4
In digit o pedi s [in the toe of the foot]	□	15	34	0	3	37	40	A	3
In dors	□	16	14	0	1	27	40	A	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
o pedis [in the back of the foot]									
Clar a in plan ta [the brig ht star in the sole]	□	17	14	0	1	43	39	A	3
In calce , seu talo [in the heel, or ankl e]	□	18	14	0	0	59	40	A	4
In vola [in the	□	19	32	0	0	57	39	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
hollow of the foot]									
Sequens hunc pedem [the following star of this foot]	□	21	31	0	1	27	20	A	4
Informis humerum Ophiuchi, & Herculis [the unformed	□	27	54	0	34	59	19	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
star betw een the shou lder of Ophi uchu s and Herc ules]									
Ad hum eru m Ophi uchi in Rho mbo bore aliss. [at the shou lder of Ophi uchu s, the most	□	26	34	0	27	59	20	B	4

Star (Latin) [gloss]	Sign	Long . Gr ' "			Lat. Gr ' "			B/A	Mag.
north hern in the rho mbu s]									
Med iāru m præ cede ns [the prec edin g of the mid dle ones]	□	26	24	0	26	39	18	B	4
Sequ ens [the follo wing]	□	28	17	0	26	27	29	B	4
Infi ma [the lowe st]	□	27	7	0	24	44	19	B	4

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
Supra informes solitaria [the solitary star above the unformed ones]	□	29	17	0	32	44	20	B	4
<i>Stella Nova in Serpentario Anno 1604 . fuit</i> [the New Star in Serpentaria	□	17	40	0	1	56	0	B	* [nova symbol]

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
rius, whic h was in the year 1604]									

SERPENS OPHIVCHI [the Serpent of Ophiuchus]

1. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Serp entis lucid a colli [the brig ht star of the Serp ent's neck]	♎	17	50	47	25	33	50	B	2

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
In ore [in the mou th]	□	15	45	30	39	5	20	B	3
Præ cede ns in ore [the prec edin g in the mou th]	□	12	56	0	38	11	0	B	5
In tem pori bus [in the tem ples]	□	18	27	30	35	24	0	B	3
In educ tion e colli [in the	□	15	42	30	34	26	20	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
rise of the neck]									
Ad sinis tru m ocul um [at the left eye]	□	16	31	0	37	27	25	B	4
Ad nate s [at the butt ocks]	□	17	53	0	42	36	0	B	4
Secu nda in collo infra cap. [the seco nd in the	□	14	7	30	28	57	0	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
neck , below the head]	♏	20	7	30	24	4	20	B	3
Australis tri- um post- lucid- am [the southern of three behind the bright star]	♏	21	47	30	16	25	18	B	4
In- secundo- flexu [in the seco	♏	21	47	30	16	25	18	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
nd coil]									
Antepenultima caudæ [before the second- to-last of the tail]	□	25	55	30	19	56	0	B	3
<i>Ex altero Catalogo</i> [from the other catalogue]	□	25	55	30	19	36	0	B	3
Penulti	□	1	33	30	20	36	20	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
the New Star]									
Quæ supr a dupl icem , & 2. octa ua Ptole mæo [the star abov e the dou ble, and the 2nd of the 8th to Ptole my]	□	17	54	0	26	35	0	B	4
In crist a [in the crest	□	19	30	0	37	14	0	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
] In spir a apex Isosceles [at the apex of the isosceles, in the coil]	□	21	30	0	10	24	0	B	4
Basiss praecedens 14. Ptol. [the preceding base, the 14th to Ptole	□	20	44	0	8	3	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
my]		21	30	0	10	22	0	B	4
Sequens 15. Ptolemaeus [the following, the 15th to Ptolemy]	□								

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Supra caudam duar. super. [above the tail,	□	1	10	0	26	37	0	B	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
the upper of two]									
Inferior [the lower]	□	3	0	0	23	24	0	B	6
Infram caudam [below the tail]	□	4	21	0	15	48	0	B	4
Imatrium in fine caudæ [the lowest of three at the end of the tail]	□	3	21	0	21	18	0	B	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Media [the middle]	♏	5	27	0	22	41	0	B	6
Postrema [the last]	♏	8	21	0	24	51	0	B	6
Proxima infra vltima m [next below the last]	♏	11	43	0	25	1	0	B	6

3. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Sequens manum	♏	1	6	0	15	59	0	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Ophiuchi [the following star of the hand of Ophiuchus]									

SAGITTA, siue TELVM [Sagitta, or the Arrow]

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Superior, & Orientalis [the upper and east]	♐	2	55	10	39	12	10	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ern]									
Hanc precedens [preceding this]	□	29	18	12	38	57	40	B	5
Parula supra hanc [the tiny one above this]	□	29	54	0	39	30	10	B	6
Super. conting. in Glyph hide [the upper, adjacent at	□	26	53	40	38	52	13	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
miu m [the uppe r of the unfo rme d stars]									
Terti a in Oxy goni o infor miu m [the third in the acut e- angl ed figur e of the unfo rme d stars	□	25	20	10	46	2	13	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
]									

AQVILA, seu VVLTVR VOLANS [Aquila, or the Flying Vulture]

1. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Lucida in scapulis [the bright star in the shoulder- blades]	♏	27	32	17	29	20	40	B	2

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Quæ	♏	1	51	40	27	7	40	B	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
in Capite [the star in the head]		28	16	10	26	48	40	B	3
In Collo [in the neck]	□	26	56	12	30	53	40	B	3
Paru a supra Lucidam [the small star above the bright one]	□	26	49	13	31	17	10	B	3
In sinistro	□	26	49	13	31	17	10	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
wing]									
Inferior, & sequens in ala [the lower and following in the wing]	□	23	37	14	26	34	10	B	5
Cauda vulturis [the tail of the vulture]	□	15	38	42	36	15	40	B	3
Proxima caudæ	□	14	7	10	37	39	10	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
inform. [the unformed star nearest the tail]									
Media informium supra caudam [the middle of the unformed stars above the tail]	□	10	35	12	43	31	40	B	4
Sequ	□	10	49	42	41	4	10	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ens hanc [the following of this]									

ANTINOVS [Antinous]

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
In manu sinistra [in the left hand]	♁	0	44	40	18	47	0	B	3
In later e dextro [in the	♁	21	40	41	20	14	0	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
right side]									
In genu [in the knee]	□	20	40	12	14	27	0	B	5
In dext ro brac hio [in the right arm]	□	19	24	13	24	55	0	B	3
In pect ore [in the brea st]	□	26	12	12	21	37	0	B	3
In pede dext ro [in the right foot]	□	13	9	15	17	40	0	B	3
Præ	□	11	52	12	16	56	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
cede ns hanc infor mis [the unfo rme d star prec edin g this]									

DELPHINVS [the Dolphin]

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Luci da Cau dæ [the brig ht star of the	♐	9	55	12	29	7	0	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
tail]									
Sequens caudam [following the tail]	□	11	11	13	28	51	30	B	6
Quæ infra caudam [the star below the tail]	□	11	5	12	27	33	0	B	6
In Rhomboid præcedens lateris Australior [in the	□	12	19	10	31	36	30	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
rho mbo id, the prece din g of the mor e sou thern side]									
Eius dem later is Bore alior [of the sam e side, the mor e nort hern]	□	13	13	40	33	4	0	B	3
Sequ ētis later	□	14	59	42	31	59	0	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
is Aust ralio r [of the follo wing side, the mor e sout hern]									
Quæ in Capi te [the star in the head]	□	15	15	12	32	46	0	B	3
In præ ced. later e quat tior conti guæ	□	11	40	19	32	7	30	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ante cede ns [in the prec edin g side, the fore most of four adja cent stars]									
Præ cede ns duar um infi ma in Rho mbo ide [the lowe st of two prec	□	10	41	12	30	40	30	B	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
edigin g stars in the rhomboid]	♁	12	5	13	30	40	0	B	6
Earunde m sequens [the following of these same]	♁								

EQVVLEVS, EQVI SECTIO [the Little Horse, the Horse's Section]

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Præcedens	♁	18	55	40	20	11	20	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Capitis [the preceding of the head]	□	21	17	42	21	5	0	B	4
Sequens Capitis [the following of the head]	□	19	17	12	25	5	0	B	4
Præcedens oris [the preceding of the mouth]	□	20	17	40	24	51	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
oris [the following of the mouth]									

PEGASVS EQVVS ALATVS [Pegasus, the Winged Horse]

1. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Pegasios [the mouth of Pegasus]	♊	27	45	7	22	6	20	B	3
Scheat [Scheat, of the leg]	♊	25	14	7	31	8	20	B	2

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
caput Andromedæ [the nave l of Pegasus, see the head of Andromeda]									

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Caput Pegasi [the head of Pegasus]	♊	2	38	30	22	6	20	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Ad Astrum in capite [toward the south, in the head]	♌	1	8	30	15	42	0	B	5
Inferior sequens in iuba [the lower following star in the mane]	♌	14	23	0	14	29	20	B	6
Superior præ	♌	14	7	0	15	42	20	B	6

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
ced. in iuba [the upper r prece edin g star in the man e]									
Luci da colli [the brigh ht star of the neck]	□	12	2	30	17	40	0	B	3
Sequ ens in collo [the follo wing in	□	13	48	0	18	28	0	B	5

Star (Latin) [gloss]	Sign	Long . Gr ' "			Lat. Gr ' "			B/A	Mag.
the neck]									
Sinis tru m crus [the left leg]	☐	4	46	0	36	41	20	B	4
Sinis tru m genu [the left knee]	☐	10	13	0	34	18	0	B	4
Dext rum crus [the right leg]	☐	15	26	0	40	59	20	B	4
Præ cede ns duar ū pect oris [the prec	☐	18	51	30	28	48	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
edingu of two in the breast]									
Sequens earum [the following of these]	□	20	16	30	29	28	20	B	4
Dextrum genu [the right knee]	□	21	33	30	35	6	20	B	3
In eodem genu ad Austrū [in the	□	20	48	0	34	23	18	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
following in the wing, and southern]									
In collo [in the neck]	□	7	51	0	20	50	0	B	4
Infr a os supr a pede m [below the mouth, above the foot]	□	26	14	0	33	20	0	B	4
Huic superior [upper	□	0	10	0	36	10	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
er than this]									
Prim am sequ ens [foll owi ng the first]	□	16	38	0	23	15	0	B	4
<i>Ex alter o Cata logo Kepl eri forte</i> [per haps from the othe r catal ogue , after Kepl er]	□	26	38	0	23	15	0	B	4

ANDROMEDA [Andromeda]

1. Classis

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
Caput Andromedæ [the head of Andromeda]	♈	10	9	3	25	42	10	B	2
Incingulo Australior [the more southern in the girdle]	♈	26	11	0	25	58	30	B	2
Lucida in pede	♈	10	1	44	27	47	10	B	2

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Australis [the bright star in the southern foot]									

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Inferas [the lowest of the right shoulder- blade]	♏	18	28	30	27	6	40	B	5

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		.Gr	'	"	Gr	'	"		
Inferior sinistri humeti [the lower r of the left shou lder]	♏	16	47	0	23	3	39	B	4
Trium in brac h. dext r. aust ral. [of thre e in the right arm, the sout hern]	♏	16	20	0	31	33	25	B	5
Earum	♏	17	7	30	33	20	40	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
bore alis [the north hern of thes e]									
Earu m med ia [the mid dle of thes e]	□	17	29	0	32	14	38	B	5
Aust ralio r man us supe rior [the mor e sout hern , of the uppe	□	11	50	0	40	56	39	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
r hand]									
Bore alior ibid em [the more north hern in the sam e plac e]	□	13	8	0	41	44	30	B	4
Obsc ura ibid em [the faint star in the sam e plac e]	□	15	45	0	42	8	25	B	5
Supr ema	□	14	9	0	43	49	42	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
the left elbow]									
Media in cingulo [the middle in the girdle]	□	29	27	50	30	34	0	B	4
Borea in cingulo [the northern in the girdle]	□	24	57	20	32	31	0	B	4
Exrema pedis superioris	□	10	28	30	36	50	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[the outer most of the upper foot]									
Lucidior in pedextro [the brighter in the right foot]	□	8	14	0	35	22	0	B	4
Suprema in sursinistra [the highest in the left	□	6	28	0	28	59	30	B	5

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
calf]									
Inferior ibidem [the lower r in the same place]	□	4	45	0	27	55	0	B	5
Adgenu dextrum [at the right knee]	□	2	18	0	26	20	25	B	5
Inextr emo annulo cate næ [at the end ring]	□	25	22	0	57	19	30	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
of the chain]									
Clari or in sinis tra scap ula [the brig hter in the left shou lder- blad e]	□	17	41	30	24	20	30	B	4

3. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
In fvrn ate duar um bore	□	5	22	0	34	40	30	B	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
al. [in the figure, the northern of two]									
Ibidem austriana [the southern in the same place]	□	6	52	0	32	40	25	B	5
Informis praec. tres dextræ manus [the	□	4	12	0	44	0	30	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
unformed star preceding the three of the right hand]									

TRIANGVLVS, DELTOTON [the Triangle, Deltoton]

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
In apic e Trianguli [at the apex of the Triangle]	□	2	41	0	16	49	50	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Ingle]									
In basi ad Bore aum [in the base , towa rd the nort h]	□	8	11	30	20	33	20	B	4
Med ia [the mid dle]	□	9	21	0	19	23	25	B	5
Aust ralio t in basi [the mor e sout hern in the base]	□	9	20	0	18	57	24	B	4

COMA BERENICES [Berenice's Hair]

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
In cusp ide prim i, & Bore alis Tria ngul i [at the poin t of the first and nort hern Tria ngle]	♈	19	41	0	28	24	20	B	3
<i>Vel</i> <i>alite</i> <i>rex</i> <i>Kepl</i> <i>ero</i> [or othe rwis e, after	♈	29	39	0	28	30	20	B	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Kepler Superior huic ad austum [upper than this, toward the south]	□	20	6	0	27	22	0	B	4
Inferior eidem [lower than the same]	□	20	10	0	27	18	12	B	4
Sequens duas contiguas [follows two contiguous]	□	20	43	0	27	5	15	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
owing to two adjacent stars]		19	49	0	25	49	13	B	4
Præcedens duarum contiguarum ad Aust. [the preceding of two adjacent stars , toward the south]	☐	20	12	30	26	5	20	B	4
Alter a	☐	20	12	30	26	5	20	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
contigua ad ortum [the other adjacent star, towards the east]	□	19	24	0	23	28	15	B	4
Omnēs præced. ad Austrū [the preceding of all, towards the south]	□	22	34	0	25	14	22	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ema 3. conti g. sequ enti um [the high est of thre e adja cent follo wing stars]									
Alter a, & præ cede ns [the othe r, and prec edin g]	□	22	15	0	24	54	20	B	4
Infi ma,	□	24	16	0	23	58	50	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
& sequens [the lowest, and following]									
<i>Alter Code x Kepleri</i> [the other manuscript of Kepler]	□	23	16	0	23	58	50	B	4
Postrema in extensione comæ [the last	□	0	22	30	30	49	0	B	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
in the spread of the Hair]									
Quæ hanc præ cedit [the star precedin g this]	□	19	13	30	31	40	23	B	4
Inter has, & prim an in cusp ide [bet wee n thes e and the first	□	25	41	0	30	14	22	B	4

Star (Latin) [gloss]	Sign	Long . Gr ' "			Lat. Gr ' "			B/A	Mag.
at the point]									
In Aust rali cusp ide paru i Tria ngul i [at the sout hern poin t of the smal l Tria ngle]	□	29	39	0	28	30	20	B	5

PARS TERTIA — *Astra Australia* [Part Three — the Southern Stars]

Nomina Fixarum	Longitudo (Sig. / Gr. / ' / ")	Latit. A. (Gr. / ' / ")	Magnitudo
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CETE [Cetus, the Whale]

1. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Lucida mandibulæ [the bright star of the jaw]	♏	10	7	32	12	36	50	A	2
Lucida ventris Borealis [the bright northern star of the belly]	♏	17	48	15	12	17	20	A	3
Cauda Borealis [the	♏	26	46	47	9	58	10	A	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
northern tail]									
Cauda Australis [the southern tail]	♏	28	19	47	20	43	40	A	2

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Quæ in rostr o [the star in the snout]	♏	10	52	0	7	49	50	A	4
Med ia oris [the mid	♏	5	14	30	12	2	20	A	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
dle of the mou th]									
Præ cede ns triu m ad gena m [the prec edin g of thre e at the chee k]	□	3	23	0	14	31	49	A	3
Infr a ocul um [belo w the eye]	□	3	15	0	5	51	50	A	4
Supr a ocul um	□	7	22	0	5	35	48	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[above the eye]									
In occipite [at the back of the head]	☐	29	50	30	4	18	51	A	4
In pectore ☐ per Boream [in the breast, the square toward the north]	☐	25	31	0	25	16	30	A	4

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
Duarum inferior præc. austr. [the lower of two, preceding, towards the south]	♏	25	54	30	28	39	29	A	4
Sequēsiū in pectore austr. [the following of these in the	♏	29	33	29	28	16	0	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
brea st, southern]									
Præ cede ns, & Bore alis [the prec edin g, and nort hern]	☐	29	9	31	25	57	29	A	3
In vent re med ia [the mid dle in the belly]	☐	13	47	0	25	0	30	A	4
Inf ma in	☐	15	12	0	31	3	28	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ventre [the lowest in the belly]	♏	12	4	30	15	46	0	A	3
In dors o Orientalis [the eastern in the back]	♏	7	33	30	16	54	29	A	3
In dors o Occidentalis [the western in the back]	♏	7	33	30	16	54	29	A	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
] Info rm. sequ ens Man dib. [the unfo rme d star follo wing the jaw]	□	14	7	0	14	29	50	A	5
Præ cede ns Bore aum vent ris [the prec edin g nort hern star of the belly]	□	16	27	45	21	53	0	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
] In recta linea cum 3. & 5. Capitis [in a straight line with the 3rd and 5th of the head]	☐	8	10	30	9	12	20	A	4

3. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Caudæ ☐	☐	4	8	30	12	8	0	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
seq. lat. Bore al. [of the tail, the squa re's follo wing side, nort hern]									
Aust ralis earu m [the sout hern of thes e]	□	3	8	25	14	8	0	A	5
Ante cede ns later i Bore al.	□	1	53	0	13	29	30	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
[the fore most of the north hern side]									
Eiusdem Australis [the sout hern of the sam e]	♏	1	22	0	14	39	30	A	5

ORION [Orion]

1. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Suprema Capit [the	♏	19	35	30	13	25	40	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
highest of the head]									
Hum erus dexter sequens [the right shoulder, following]	□	24	36	35	16	6	15	A	2
Hum er. sinis ter præcedens [the left shoulder, preceding]	□	16	46	47	16	52	30	A	2

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Pes sinis ter Luci dus <i>Rigel</i> [the left foot, the brig ht star Rigel]	♏	12	36	57	31	10	10	A	1

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Balt hei supr ema [the high est of the belt]	♏	18	9	27	23	36	40	A	2
Med	♏	19	13	42	24	34	10	A	2

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ia [the middle]		20	23	2	25	21	10	A	2
Infi ma [the lowest]	□	20	23	2	25	21	10	A	2

2. Classis

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Occi dent alior Capi tis [the more west ern of the head]	□	19	35	30	13	53	40	A	5
Terti a Capi	□	19	57	30	14	4	20	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
tis Orientalis [the third of the head , eastern]									
Sequens sinistri humeri [following the left shoulder]	□	18	10	0	17	21	40	A	5
Quæ in brachio dextero [the star	□	28	28	30	14	50	40	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
in the right arm]									
In dext ra Vlna [in the right fore arm]	□	29	55	0	11	30	10	A	6
In man u dext ra Aust ralio r [the mor e sout hern in the right han d]	□	28	48	10	9	15	15	A	4
Præ cede	□	27	45	30	8	44	18	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ns in dext ra [the prec edin g in the right]									
Prox ima supr emæ in dext r. [nex t to the high est in the right]	□	28	46	29	7	0	40	A	4
Vlti ma in man u [the last	□	29	33	0	7	19	16	A	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
in the hand]									
Præcedens duarum in Colobro [the preceding of two in the club]	□	24	33	30	12	12	46	A	5
Sequens earundem [the following of these]	□	26	46	0	3	21	15	A	5
Præ	□	16	58	39	20	8	20	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
cedens in dorsis [the preceding in the back]									
Borealis inter 9. Clypeus [the most northern of the 9 in the shield]	♁	9	16	20	8	16	29	A	4
Eudemunda [the	♁	10	11	19	9	6	30	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
second of these]									
Tertia [the third]	□	9	33	20	5	28	0	A	6
Quarta [the fourth]	□	9	23	48	11	23	0	A	4
Quinta [the fifth]	□	8	11	19	13	3	0	A	4
Sexta [the sixth]	□	7	46	20	15	30	0	A	4
Septima [the seventh]	□	7	56	22	16	49	28	A	4
Octava [the	□	8	21	20	1	30	0	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
eight h]									
Vltima [the last]	□	9	20	19	20	55	0	A	4
Quæ in man ubri o ensi s [the star in the hilt of the sword]	□	15	57	30	25	37	10	A	3
Suprema trium in ense [the high est of three in	□	18	48	0	26	45	39	A	3

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
the sword]									
Med ia ensis [the middle of the sword]	□	18	44	30	28	45	39	A	3
Infi ma ensis [the lowest of the sword]	□	18	47	30	29	17	39	A	3
Præ cede ns infra ense m [the prece din	□	17	43	0	30	37	0	A	4

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		.Gr	'	"	Gr	'	"		
tri [in the calf of the left foot]									
In genu dext ro [in the right knee]	□	22	9	30	33	7	0	A	3
Præ ced. vlti ma m Balt hei [pre cedi ng the last of the belt]	□	19	56	0	0	4	0	A	6
Præ	□	15	54	0	19	39	20	A	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
ced. huic ad dors um [pre cedi ng this, towa rd the back]									
Sequens sup man ubr. ensi s [foll owi ng, abov e the hilt of the swor d]	□	16	5	0	24	0	30	A	6
Earum	□	15	19	0	23	32	38	A	5

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
ng, bene ath the shiel d and arm]									
In sinis tro later e præ ced. [the prec edin g in the left side]	□	21	8	0	21	57	30	A	5
Ibid em sequ ens [the follo wing in the sam e	□	23	48	30	21	38	29	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
place]									
Post hanc informis [the unfo rmed star behind this]	□	25	33	0	26	50	0	A	6
Superior 3. in sinistr. manu [the upper of three in the left hand]	□	14	59	30	11	44	28	A	6
Media earu	□	12	56	30	11	7	30	A	6

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
m [the middle of these]									
Infirmarium [the lowest of these]	□	12	23	0	14	23	29	A	6
Decem informium supra Ori nem præ cedens [the preceding of ten]	□	0	7	0	29	30	30	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
unformed stars above Orion]									
Sequens earum [the following of these]	□	4	6	0	29	48	29	A	4
Quæ supra hanc [the star above this]	□	3	45	0	28	3	30	A	4
Præced. 3. in linearecta	□	2	11	0	18	46	28	A	4

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		.Gr	'	"	Gr	'	"		
[the preceding of three in a straight line]									
Media [the middle]	□	4	21	0	15	56	0	A	4
Borealis [the northern]	□	6	13	0	11	30	30	A	5
Infrā lineā ad Australū [below the straight	□	4	21	0	18	23	29	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
above the Dog]									
Sequens earum [the following of these]	□	15	23	0	22	46	29	A	4
Infradocsum [below the right shoulder, toward the west]	□	20	21	0	19	17	20	A	5

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
Obscurarū in dorsos equēs [the following of the faint stars in the background]	♏	19	4	30	19	36	20	A	6
Præcedens [the preceding]	♏	18	10	30	19	52	20	A	6

ERIDANVS, NILVS, FLVVIVS [Eridanus, the Nile, the River]

2. Classis

Star (Latin) [gloss]	Sign	Long			Lat.			B/A	Mag.
		. Gr	'	"	Gr	'	"		
Ad sinis tru m pedē Orio nis in prin cipio flum . [at the left foot of Orio n, at the begi nnin g of the river]	□	11	6	0	31	34	0	A	4
Supr a pede m Orio n. in flu. [abo ve	□	11	8	0	27	53	0	A	3

Star (Latin) [gloss]	Sign	Long . Gr ' "			Lat. Gr ' "			B/A	Mag.
the foot of Orion, in the river]									
Duarum aliarum sequens [the following of two others]	□	9	50	0	29	51	0	A	5
Præcedens [the preceding]	□	6	54	30	27	32	0	A	4
Sequens duarum super	□	9	30	25	33	30	0	A	4

Star (Latin) [gloss]	Sign	Long . Gr	'	"	Lat. Gr	'	"	B/A	Mag.
rior um [the follo wing of two uppe r ones]									
Earu m præ cede ns [the prec edin g of thes e]	□	2	39	0	25	11	0	A	4

Riccioli, *Astronomiae Reformatae Tomi Duo* — Tomus II

TABVLA 98 — Universal Catalogue of Fixed Stars to AD 1700, PARS TERTIA (*Astra Australia*)

Each catalogue page is laid out in two side-by-side blocks of entries. The columns in every block are: **Nomina Fixarum** (Names of the fixed stars — the descriptive Latin position-phrase, transcribed verbatim with an English gloss); **Longitudo**

(Sig./Gr./''' — zodiacal sign sigil, then degrees, minutes, seconds); **Latitudo A.** (Gr./''' — degrees, minutes, seconds, all carrying the **A = Australis / south** direction flag for these southern figures unless a row is explicitly marked otherwise); **Magnitudo.** The *Classis* rubrics (1.–4. *Classis* = the four certainty-classes) and constellation headings are preserved as label-rows.

Sign sigils used on these pages: ☉ Taurus, ♊ Gemini, ♋ Cancer, ♌ Leo, ♍ Virgo, ♎ Libra, ♏ Scorpio, ♐ Sagittarius, ♑ Capricorn, ♒ Aquarius, ♓ Pisces.

Page 119 — left block (Eridanus continued; Lepus; Canis Maior)

[Eridanus / the River, continued — 2. *Classis*]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Post inter uall um sequ ens de quat uor [the one follo wing after a gap, of four]	☉	19	42	0	33	13	0	A	3
Quæ hanc	☉	16	6	30	31	8	40	A	4

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Ad	□	16	31	0	28	46	10	A	3
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Ante cede ns cunc tas 4.	□	14	9	0	27	46	50	A	3
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
third]									
Terti a quæ sequ itur [the third , whic h follo ws]	□	9	40	0	23	58	50	A	3
Præ cede ns infer ior [the lowe r prec edin g one]	□	25	13	0	20	24	49	A	5
Super hanc [abo ve this]	□	25	17	0	27	31	50	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Sequ ens [the follo wing]	□	26	22	0	28	9	20	A	4
Superior Orientalis [the more east erly upper one]	□	29	10	0	25	2	43	A	5
Præceduar ū interflumen & Taurum [pre cedi ng of two,	□	17	49	30	18	26	50	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Sequ ens Aust ralis [the follo wing sout hern one]	□	21	31	0	22	44	50	A	4
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[Eridanus — 3. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Triu m vlti ma [last of thre	□	28	44		25	50	0	A	4
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
e]									
Med ia <i>Ptole mæo</i> 8. [the mid dle one — for Ptole my, 8]	□	28	0		26	50		A	4
Ex quat uor quæ præi t [of four, the one goin g befo re]	□	2	54		23	10		A	4
In conu ersio ne	□	2	54		32	10		A	4

Nom
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Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Sequ ens [the follo wing]	□	28	14		34	50		A	4
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Sequ enti um triu m prim a [first of the	□	1	14		38	30		A	4
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
the e follo wing]									
Med ia [the mid dle one]	□	6	14		38			A	4
Vlti ma [the last]	□	9	54		38	50		A	4
In præ c. later is Bore al. [in the qua dran gle, prec edin g, of the nort	□ □	13	44		41	10		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
hern side]									
In eode m Aust ralis [in the sam e, the sout hern one]	□	13	54		42	20		A	5
Late ris sequ entis præ ced. [pre cedi ng, of the follo wing side]	□	14	34		43			A	4
Vlti ma haru	□	17	4		43	10		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
m 4. [last of thes e four]									
Ad ortu m 2. coni unct arū Bore al. [tow ard the east, of two joine d, the nort hern]	□	26	34		50	10		A	4
Magi s ad Aust rum [furt	□	27	24		51	40		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
her towa rd the sout h]									
In refle xion e duar um post erior . [at the recu rve, the hind er of two]	□	20	34		53	40		A	4
Præ cede ns [the prec edin g one]	□	18	14		53	0		A	4
In vlti	□	10	14		52	50		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
mo inter uallo ex 3. post rem a [in the last gap, of thre e the hind most]									
Med ia [the mid dle one]	□	7	14		53	20		A	4
Prim a Triu m [first of thre e]	□	4	14		51	50		A	4
In extr	□	22	34		53	30		A	1

Nom
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Sig. Gr. ' " Lat.
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LEPVS [The Hare]

[1. Classis]

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□	15	29	7	43	55	50	A	3
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
sinis t. seu fem ore [on the left shou lder, or thig h]									

[2. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Superior præ ceden tis auri s [upp er of the prec	□	11	37	30	34	32	20	A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
edin g ear]									
Infer ior eius dem auri s [low er of the sam e ear]	□	11	43	30	35	52	22	A	5
Super ior sequ entis auri s [upp er of the follo wing ear]	□	13	50	0	33	16	25	A	6
Infer ior sequ entis auri	□	13	37	0	36	12	24	A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
s [low er of the follo wing ear]									
Quæ in Capi te [the one on the head]	□	11	12	0	39	2	21	A	5
Extr ema ante rior ū pedu m [out erm ost of the foref eet]	□	7	48	30	44	58	23	A	4
In	□	17	12	30	41	4	0	A	4

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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
hind feet]									
Bore alior earu nde m [mor e nort hern of the sam e]	□	22	59	0	44	16	20	A	3
Præ cede ns in dors o [the prec edin g one on the back]	□	21	49	30	38	14	22	A	4
Sequ ens in	□	24	50	30	37	39	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
dors o [the follo wing one on the back]									
Vlti ma in caud a [the last in the tail]	□	27	45	0	38	24	20	A	4

CANIS MAIOR [The Great Dog]

[1. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Sple ndid issi	□	20	4	47	39	32	5	A	1

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[2. Classis]

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□	10	29	50	34	52	0	A	4
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
head , towa rd the right ear]									
In med ia fron te [on the mid dle of the fore head]	□	12	55	20	36	45	0	A	5
Sub aure sinis tra [belo w the left ear]	□	15	34	21	38	4	10	A	3
In collo	□	15	31	20	39	32	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
[on the neck]									
In arm o dext ro pedu m ante rior um [on the right shou lder of the foref eet]	□	8	0	50	42	15	0	A	5

Page 119 — right block (Canis Maior continued; Canis Minor; Argo Navis)

[Canis Maior — 2. Classis, continued]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In extr emo pedi s prio ris [at the end of the forel eg]	□	3	10	50	41	20	20	A	2
In dors o [on the back]	□	16	58	50	46	11	20	A	5
Med ia in pect ore [mid dle one on the ches t]	□	14	4	50	46	41	20	A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In vent re [on the belly]	□	19	23	20	48	31	50	A	3
Inter post erior a fem ora [bet wee n the hind thig hs]	□	16	49	50	51	26	20	A	3
Infer ior dext. pedi s prio ris [low er of the right forel	□	2	35	20	51	48	20	A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
eg]									
Quæ in caud a [the one in the tail]	□	25	39	50	51	46	20	A	3

[Canis Maior — 3. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Alter a in pect ore [the othe r on the ches t]	□	22	58	19	42	22	0	A	4
In genu Aust ralis	□	8	28	20	42	12		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
[the sout hern one at the knee]									
In sinis tro genu duar um præ ced. [pre cedi ng of two at the left knee]	□	16	28	18	46	12		A	5
Earu m sequ ens [the follo wing	□	8	38	20	45	32		A	5

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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
A Sept entri one ad verti cem Cani s [fro m the nort h towa rd the Dog' s cro wn]	□	11	58	20	25	2		A	4
Sub pedi bus post. & in rect a Aust r. [belo w the	□	2	28	18	61	12		A	4

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Quæ	□	3	48	20	58	32	A	4
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Adh	□	5	28	19	56	42	A	4
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
nort hern]									
Resi dua de 4. bore aliss ima [the rem aini ng of four, the most nort hern]	□	6	38	20	55	44		A	4
Trist ad occa sum in linea præ ced. [the sad one to the	□	19	28	18	55	12		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
west , in line, prec edin g]									
Med ia haru m [the mid dle one of thes e]	□	22	58	20	57	22		A	4
Triu m vlti ma [last of thre e]	□	24	58	19	59	32		A	6
Sub- his sequ ens [the follo wing	□	21	28	18	59	4		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
one belo w thes e]									
Har um ante cede ns [the one prec edin g thes e]	□	18	28	20	57	22		A	2
Reli qua Aust ralio r [the rem aini ng mor e sout hern one]	□	14	38	19	59	32		A	4

CANIS MINOR [The Little Dog]

[1. Classis]

Nom
ina
Fixa
rum

[glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Proc yon in fem ore [Pro cyon , on the thig h]	□	21	40	27	15	57	10	A	2

[2. Classis]

Nom
ina
Fixa
rum

[glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In collo , seu colla ri [on the neck , or colla	□	18	1	50	13	33	40	A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
r]									
Supr a lucid am colli [abo ve the brig ht one of the neck]	□	21	40	50	12	51	10	A	6
Info rmis supr a hanc [the unfo rme d one abov e this]	□	18	44	50	9	46	10	A	4
Sequ ēs ad	□	22	19	50	10	19	40	A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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follo
wing
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tail
of
the
Dog]

ARGO NAVIS [The Ship Argo]

[2. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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In supr ema pup pi [at the top	□	7	18	0	43	18	30	A	3
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
of the ster n]									
Supr ema scuti [top most of the shiel d]	□	2	0	0	44	58	30	A	3
Præ cede ns scuti [pre cedi ng one of the shiel d]	□	29	24	30	47	28	3	A	3
In velo [on the sail]	□	5	31	0	32	7	4	A	4
Info rmis	□	5	51	30	38	31	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ad Aust rum [unf orm ed star, to the sout h]									
In malo triu m infer ior [low er of thre e on the mast]	□	13	50	50	32	56	0	A	6
Supr a hanc [abo ve this]	□	14	15	49	30	18	0	A	4
Hac ipsa	□	11	22	50	24	29	30	A	4

Nom
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Sig. Gr. ' " Lat.
Gr. ' " A Mag.

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m]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Info rmis inter velu m, & lacle am [unf orm ed star, betw een the sail and the milk y ban d]	□	25	8	27	30	30	0	A	3

[Argo Navis — 3. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Extr ema duar	□	3	24	27	42	10		A	5

Nom
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	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Quæ magi s ad aust rum [the one furt her to the sout h]	□	1	44	28	45	40		A	4
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præ
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Has duas præ cede ns [the one prec	□	28	24	28	45	10		A	4
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
edin g thes e two]									
Sub scut o triu m præ ced. [pre cedi ng of thre e belo w the shiel d]	□	28	24	30	49	10		A	4
Sequ ens [the follo wing]	□	2	24	27	49	30		A	4
Med ia triu m	□	1	54	30	49	0		A	4

Nom
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Sig. Gr. ' " Lat.
Gr. ' " A Mag.

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In □ 23 4 28 52 4 A 4

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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
chai n of the ster n]									
Earu m Aust ralis [the sout hern of the m]	□	27	4	29	38	20		A	3
In folio pup pis Bore al. [nor ther n one on the leaf of the ster n]	□	14	4	28	55	20		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Ibid em triu m præ cede ns [ther e, the prec edin g of thre e]	□	5	14	28	58	30		A	5
Med ia [the mid dle one]	□	6	14	29	57	0		A	4
Sequ ens [the follo wing]	□	9	24	30	57	30		A	4
Clar a sequ ens tran	□	14	4	28	58	30		A	2

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
sitū [the brig ht one follo wing the cros sing]									
Sub hac obsc. præ c. [the faint one belo w this, prec edin g]	□	11	4	27	59	50		A	5
Sequ ens [the follo wing]	□	15	54	29	59	10		A	5
Supr a	□	15	54	30	56	0		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Clar am præ ced. [the prec edin g one abov e the brig ht star]									
Sequ ens [the follo wing]	□	17	4	28	57	30		A	5

Page 120 — left block (Argo Navis continued; Hydra)

[Argo Navis — 3. Classis, continued]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In stati	□	28	14	29	51	30	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
one mali Bore a triū [nor ther n of thre e at the mast - step]									
Med ia [the mid dle one]	□	28	44	30	55	30	0	A	4
Aust ralis triu m [sout hern of thre e]	□	26	34	28	57	0	0	A	4
Sub his iunc	□	1	44	27	59	50		A	4

Nom
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Fixa
rum
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Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Har um Aust ralio r [mor e sout hern of thes e]	□	1	34	18	61	0	A	4
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In
med
io
mali
Aust

In med io mali Aust	□	22	34	27	51	30	0	A	4
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ralis [sout hern one in the mid dle of the mast]									
Har um Bore alior [mor e nort hern of thes e]	□	21	44	28	49	0		A	3
In sum mo velo [at the top of the	□	20	34	27	43	10	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
sail]									
<i>Alia lecti o</i> [an alter nati ve read ing]	□	21	24	28	55	30		A	4
Sequ ens [the follo wing]	□	21	24	28	45	30	0	A	4
Sub 3. sequ enti um scut oru m [belo w the thre e follo wing shiel ds]	□	17	34	30	61	30	0	A	2

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
<i>Alite</i> <i>r</i> [oth erwi se]	□	16	34	30	54	30		A	2
In secti one instr ati [at the cut of the deck - cove ring]	□	9	54	29	51	15		A	4
Inter rem os in Cari na [am ong the oars, in the keel]	□	14	4	28	63	0	0	A	4
Sequ	□	11	24	27	64	40	0	A	6

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ens obsc ura [the follo wing faint one]									
Luci da sequ ens in stati one [the brig ht one follo wing , at the stati on]	□	22	24	28	63	50	0	A	2
Infr a Cari nam fulge ns [shi	□	0	54	27	69	40		A	2

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ning belo w the keel]									
Sequ enti um hanc triu m præ ced. [pre cedi ng of the thre e follo wing this]	□	7	34	28	65	40	0	A	2
Med ia haru m [the mid dle of thes e]	□	13	44	28	65	50		A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Sequ ens [the follo wing]	□	18	24	30	67	20		A	2
<i>Ex alia lecti one</i> [fro m anot her read ing]	□	18	24	30	64	40		A	2
Sequ eniu m duar um ad secti one m præ cede ns [pre cedi ng of the	□	23	24	30	62	50		A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
two follo wing , towa rd the cut]		0	24	27	62	15		A	5
Earu m sequ ens [the follo wing of the m]	□	0	24	27	65	15		A	3
<i>Ex alia lecti one</i> [fro m anot her read ing]	□	0	24	27	65	15		A	3
In tem one Bor.	□	26	24	30	65	50		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
præ c. [nor ther n prec edin g one on the tiller]									
<i>Ex alia lecti one</i> [fro m anot her read ing]	□	24	24	30	65	50		A	4
Quæ sequ itur [the one whic h follo ws]	□	12	34	28	65	40		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
<i>Ex alia lecti one</i> [fro m anot her read ing]	□	18	22	26	65	40		A	3
In tem one Cano pus [Can opus , on the tiller]	□	9	24	27	75	10		A	1
<i>Ex alia lecti one</i> [fro m anot her read ing]	□	9	24	27	69	0		A	1
Reli	□	21	24	30	71	45		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
qua sequ ens hanc [the rem aini ng one follo wing this]									
<i>Ex alia lecti one</i> [fro m anot her read ing]	□	21	24	30	61	45		A	3

HYDRA, seu HYDRVS [The Hydra, or Water-Snake]

[1. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Cor	□	23	6	37	22	23	50	A	2

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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[2. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Supr a	□	8	8	0	14	16	20	A	4
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Nom
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
] Præ ced. terti a ad Aust rum [thir d prec edin g one, towa rd the sout h]	□	8	44	30	11	36	0	A	5
Orie ntali ssim a capit is [east ern most one of the head]	□	10	22	30	11	1	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Præ cede ns in collo [the prec edin g one on the neck]	□	13	13	30	13	5	20	A	6
Sequ ens in educ tion e colli [the follo wing one at the rise of the neck]	□	16	3	30	13	5	0	A	4
Med	□	21	33	30	15	0	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ia colli [the mid dle of the neck]									
Bore a triu m in flex ura colli [nor ther n of thre e at the ben d of the neck]	□	23	26	0	14	17	20	A	4
Aust ralis in nexu [sout	□	21	15	30	16	46	0	A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
hern one at the joint]									
Quæ cor sequ itur prox imè [the one whic h follo ws the hear t most close ly]	□	28	32	50	26	33	30	A	4
Huic subi eque ns [the next one after	□	1	30	0	26	12	0	A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
this]									
Præ cede ns conti guar um [the prec edin g of thos e adjoi ning]	□	4	10	0	23	13		A	5
Sequ ens earu m [the follo wing of the m]	□	5	15	0	21	51	0	A	4
Quin ta à cord e [the fifth	□	10	53	30	24	38	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
from the hear t]									
In rect a cum hac, & sequ enti [in a strai ght line with this, and the follo wing]	□	14	3	30	23	21	0	A	5
Præ cede ns crat eri prox imè [the one	□	16	13	0	21	48	30	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
prec edin g close st to the Crat er]									
Info rmis prox ima capit i [the unfo rme d one near est to the head]	□	6	7	30	11	27	0	A	4
Bore a sub basi crat eris [nor	□	24	23	30	25	36	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ther n one belo w the base of the Crat er]									
Aust ralis sub eade m basi [sout hern one belo w the sam e base]	□	25	11	0	30	17	0	A	5
Sub caud a coru i	□	22	46	0	13	43	0	A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
[belo w the tail of the Cro w]									
Paru a huic præ cede ns [the smal l one prec edin g this]	□	20	46	0	14	37	0	A	6
Info rmis ante capu t Hyd ræ [unf orm ed star	□	0	6	0	19	0	0	A	3

Nom
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Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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[Hydra — 3. Classis]

Nom
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Fixa
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Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Aust
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□	5	44	0	13	40	0	A	4
□	8	22	0	14	13	0	A	4

Nom
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Sig. Gr. ' " Lat.
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In triqu etro præ cede ns [the prec edin g one in the trian gle]	□	5	2	0	31	20	0	A	4
Med ia earu m [the mid dle of the m]	□	7	22	0	33	10	0	A	4
Sequ ens earu m [the follo wing	□	9	22	0	31	10	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
of the m]									
In extr ema caud a [in the end of the tail]	□	7	22	0	17	40	0	A	4

Page 120 — right block (Hydra Informes; Crater; Corvus; Centaurus)

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In capit e ad Aust rum [on the head , towa rd	□	5	22	0	23	15	0	A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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the sout h]					13	5	0	A	3
<i>Alite</i> <i>r</i> [oth erwi se]									
Sequ □ ens collu m [the follo wing one of the neck]		3	52	0	16	0	0	A	3
<i>Alite</i> <i>r</i> [oth erwi se]					26	0	0	A	3

CRATER [The Cup]

[2. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In basi crat eris [at the base of the Cup]	□	19	33	0	22	41	0	A	4
Sequ ens duar um in med io [foll owi ng of two in the mid dle]	□	25	5	0	19	39	0	A	4
Earu m præ cede ns [the prec	□	22	32	30	17	25	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
edin g of the m]									
Præ cede ns duar um supr a Crat ere m [pre cedi ng of two abov e the Cup]	□	21	49	24	13	10	0	A	4
Earu m sequ ens [the follo wing of the m]	□	24	24	0	11	17	10	A	4
Præ	□	29	52	0	18	10	0	A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
cede ns duar um infer ioru m [pre cedi ng of the two lowe r ones]									
Sequ ens earu m [the follo wing of the m]	□	1	55	0	16	2	0	A	4
In med io Crat ere [in	□	26	17	0	14	0	0	A	5

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Cup]

CORVVS [The Crow]

[2. Classis]

Nom
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Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Quæ
ad
Ocul
um
[the
one
at
the
eye]

□	7	30	0	19	39	0	A	4
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Præ
cede
ns
duar
iū
supe
rior
ū in

□	6	35	0	14	25	0	A	3
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Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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□
[pre
cedi
ng of
the
uppe
r
two,
in
the
qua
dran
gle]

Sequ	□	9	17	0	12	7	0	A	3
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ens
earu
m
[the
follo
wing
of
the
m]

Sequ	□	13	11	0	17	59	0	A	3
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ens
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ioru
m in
□
[foll
owi
ng of

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
the lowe r ones , in the qua dran gle]									
In rostr o [on the beak]	□	8	0	0	21	46	0	A	4
In collo [on the neck]	□	9	30	0	18	14	0	A	4
In sinis tra ala supr a lucid ā [on the	□	9	43	30	11	28	0	A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
left wing , abov e the brig ht one]									

CENTAVRVS CHIRON [The Centaur, Chiron]

[2. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In capit e Aust ralis sima [sout hern most one on the head]	□	2	49	0	21	40	0	A	5
Quæ	□	2	21		19	8		A	5

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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magi
s ad
Bore
am
[the
one
furt
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to
the
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h]

Inter med iaru m duar um præ cede ns [pre cedi ng of the two inter med iate ones]	□	1	34	20	51		A	5
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Sequ	□	2	25	20	12		A	5
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Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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ens
de
quat
uor
[the
follo
wing
one,
of
four
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[Centaurus — 3. Classis]

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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In
hum
ero
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□	28	32		25	40		A	3
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
on the left shou lder]									
In hum ero dext ro [on the right shou lder]	□	8	2		22	40		A	4
In arm o sinis tro [on the left shou lder]	□	1	32		27	40		A	4
In scut o præ ced. bore al.	□	10	32		22	50		A	4

Nom
ina
Fixa
rum
[glos
s]

Sig. Gr. ' " Lat.
Gr. ' " A Mag.

[nor
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on
the
shiel
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Earu □ 11 32 23 50 A 4

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of
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m]

In □ 14 52 18 50 A 4

sum
mita
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scuti
[at
the
top
of
the
shiel

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
d]									
In scut o ad aust rum [on the shiel d, towa rd the sout h]	□	14	52		21	10		A	4
In later e dext ro triu m præ ced. [pre cedi ng of thre e on the right side]	□	5	42		28	30		A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Med ia [the mid dle one]	□	7	22		29	30		A	4
Sequ ens [the follo wing]	□	9	32		28	10		A	4
In brac hio dext ro [on the right arm]	□	8	52		26	40		A	4
In dext ro cubi to [on the right elbo w]	□	13	12		25	30		A	3
In	□	19	52		24	20		A	3

Nom
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s]

Sig. Gr. ' " Lat.
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of
the
hum

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
an body]									
Duar um bore aliū sequ ens [the follo wing of two nort hern ones]	□	10	2		31	10		A	5
Præ cede ns [the prec edin g one]	□	9	12		33	10		A	5
In educ tion e dors i [at	□	4	32		35	0		A	5

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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the
rise
of
the
back
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Ante	□	1	32	37	55		A	5
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back
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In	□	28	12	40	10		A	3
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ens [the follo wing of thre e on the loins]									
Med ia [the mid dle one]	□	27	22		43	10		A	4
Ante cede ns triu m [the one prec edin g the thre e]	□	25	2		44	10		A	5
<i>Alite r</i> [oth erwi					41	10		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
se]									
In dext ro fem ore præ ced. [pre cedi ng one on the right thig h]	□	25	2		46	20		A	3
Ibid em sequ ens [ther e, the follo wing one]	□	25	52		46	50		A	4
In pect ore sub ala	□	10	42		42	50		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
equi [on the ches t, belo w the hors e's wing]									
Sub aluo duar um præ ced. [pre cedi ng of two belo w the belly]	□	8	42		43	10		A	4
Earu m sequ ens [the	□	10	2		44	10		A	5

Nom
ina
Fixa
rum
[glos
s]

Sig. Gr. ' " Lat.
Gr. ' " A Mag.

follo
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of
the
m]

In □ 2 22 51 20 A 2

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of
the
right
foot]

In □ 7 42 51 50 A 2

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dext
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[on
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heel
of
the
right
foot]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In cauo pedi s sinis tri [in the holl ow of the left foot]	□	28	42		55	15		A	4
Sub mus culo eius dem [belo w the mus cle of the sam e]	□	3	52		55	30		A	4

Page 121 — left block (Centaurus continued; Lupus; Thuribulum;
Corona Australis; Piscis Notius)

[Centaurus — continued]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In sum mo pede dext. prio ri [at the top of the right foref oot]	□	0	42		41	20		A	1
In genu sinis tro [on the left knee]	□	16	32		45	30		A	2
Sub dext ro pede post erior i [belo w	□	7	2		49	20		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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the
right
hind
foot]

LVPVS, seu BESTIA CENTAVRI [The Wolf, or the Centaur's Beast]

[3. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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In sum mo pedi s post erior is [at the top of the hind foot]	□	20	22		25	0		A	3
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In popl ite eius dem	□	18	12		29	20		A	3
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Nom
ina
Fixa
rum
[glos
s]

Sig. Gr. ' " Lat.
Gr. ' " A Mag.

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of
the
sam
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foot]

In □ 23 22 21 30 A 4

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lder]

In □ 26 32 21 10 A 4

arm
o
sequ
ens
[the
follo

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
wing one on the shou lder]									
In med io corp ore [on the mid body]	□	25	22		25	30		A	4
In aluo sub Ilibu s [on the belly , belo w the flan ks]	□	22	32		27	20		A	5
In fem ore	□	23	12		29	20		A	5

Nom
ina
Fixa
rum
[glos
s]

Sig. Gr. ' " Lat.
Gr. ' " A Mag.

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Earu □ 26 2 30 30 A 5

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the

Nom ina Fixa rum [glos s] m]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In sum mo lum bo [at the top of the loin]	□	28	2		33	30		A	5
In extr ema caud a 3. aust r. [sout hern of thre e in the end of the tail]	□	14	22		31	40		A	5
Med ia [the	□	17	12		30	50		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
mid dle one]									
Earu m Bore alis [the nort hern of the m]	□	15	22		29	40		A	4
In iugu lo Aust ralis [sout hern one on the thro at]	□	1	12		17	20		A	4
Bore a ibid em [the nort hern	□	1	42		15	40		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
one ther e]									
In rictu præ cede ns [the prec edin g one at the jaws]	□	28	2		13	40		A	4
Sequ ens [the follo wing]	□	29	2		12	10		A	4
In prio ri pede Aust ralio r [mor e	□	19	32		12	10		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
sout hern one on the forel eg]									
Earu m Bore alior [mor e nort hern of the m]	□	18	52		10	20		A	4

THVRIBVLVM, seu ARA [The Censer, or the Altar]

[3. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In basi duar um Bore	□	10	12		23	0		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
alis [nor ther n of two at the base]									
Aust ralis [the sout hern one]	□	25	42		26	0		A	4
In med ia arul a [in the mid dle of the little altar]	□	18	52		26	45		A	4
In focul o 3. bore	□	15	2		30	40		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
alis [nor ther n of thre e at the hear th]									
<i>Alite r</i> [oth erwi se]					13	40		A	5
Reli quar um Aust ralis [the sout hern of the rem aini ng ones]	□	17	42		34	30		A	4
Bore alis [the	□	17	32		33	30		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
nort hern one]									
In sum mita te flam mæ [at the top of the flam e]	□	13	22		34	30		A	4
<i>Alite</i> <i>r</i> [oth erwi se]					31	30		A	4

CORONA AVSTRALIS [The Southern Crown]

[3. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Ad amb	□	1	42		21	50		A	4

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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*Alite
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[oth
erwi
se]

				24	50		A	4
--	--	--	--	----	----	--	---	---

Sequ
ens
hanc
in
Coro
na

□	4	12		21	20		A	5
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
[the one follo wing this in the Cro wn]									
Huic succ eden s [the next one after this]	□	5	42		23	20		A	5
Huic subs eque ns [the one follo wing next after this]	□	7	22		20	20		A	4
Post hanc ante	□	8	42		18	50		A	5

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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Sagit
tarii
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this,
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knee
of
Sagit
tariu
s]

Quæ inde max imè bore a in genu luc. [the one then ce most nort hern , brig ht at the	□	9	32	17	30		A	4
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Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
knee]									
Magi s Bore a [furt her nort h]	□	8	52		16	20		A	4
Adh uc magi s Bore a [yet furt her nort h]	□	9	2		15	30		A	4
In amb itu bore o duar um sequ ens [the follo	□	7	42		15	40		A	6

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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wing
of
two
at
the
nort
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edge
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Earu	□	7	12	15	10		A	6
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m
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Ex	□	4	22	15	0		A	5
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Nom
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Fixa
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Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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gap]

Quæ	□	2	12	16	10		A	5
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Reli	□	4	42	18	50		A	5
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PISCIS NOTIVS [The Southern Fish]

[3. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In amb itu capit is præ cede ns [the prec edin g one at the edge of the head]	□	23	12		20	35		A	4
Med ia [the mid dle one]	□	26	42		22	0		A	4
Sequ ens [the	□	27	52		22	45		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
follo wing]									
Ad bran chia m [at the gill]	□	26	52		16	0		A	4
In spin a aust rali, & dors o [on the sout hern spin e, and the back]	□	17	42		19	0		A	5
In aluo duar um	□	23	42		15	30		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
sequ ens [the follo wing of two on the belly]									

Page 121 — right block (Piscis Notius continued; Grus; Phoenix; Indus; Pavo)

[Piscis Notius — continued]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Ibid em præ cede ns [ther e, the prec edin	□	21	22		15	0		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
g one]									
In spin a bore ali sequ ens [the follo wing one on the nort hern spin e]	□	17	42		15	15		A	4
Ibi med ia [ther e, the mid dle one]	□	14	22		16	45		A	4
Ibid em præ cede	□	13	32		18	25		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ns [ther e, the prec edin g one]									
In extr ema caud a [in the end of the tail]	□	12	42		22	30		A	4
Præ cedē tum Pisc em præ cede ns [the one prec edin g thos	□	0	32		22	40		A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
e prec edin g the Fish]									
Med ia earu m [the mid dle of the m]	□	3	42		22	30		A	3
Sequ ens earu m [the follo wing of the m]	□	6	32		21	30		A	3
Huic ante cede ns [the one prec	□	4	32		21	10		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
edin g this]									
Reli quar um duar um aust ralio r [mor e sout hern of the rem aini ng two]	□	17	22		17	20		A	4
Earu m bore alior [mor e nort hern of the m]	□	6	22		15	10		A	3

GRVS [The Crane]

[4. Classis]

Nom
ina
Fixa
rum

[glos
s]

	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Luci da Capi tis [the brig ht one of the head]	□	13	16		22	50		A	2
In med io collo [in the mid dle of the neck]	□	13	17		24	56		A	4
In educ tion e colli	□	14	47		28	57		A	6

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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or
[mor
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east
ern
one
at
the
rise
of
the
neck
]

Occi dent alior [the mor e west ern one]	□	15	58	28	40		A	6
--	---	----	----	----	----	--	---	---

In dors o orie ntali or [mor e	□	16	23	31	52		A	6
---	---	----	----	----	----	--	---	---

Nom
ina
Fixa
rum
[glos
s]

	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
east ern one on the back]									
Ibi occi dent alior [ther e, the mor e west ern one]	□	17	38		31	15		A	6
In dext ra ala Bore alior [mor e nort hern one on the	□	24	37		34	23		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
right wing]									
Ibi Aust ralio r [ther e, the mor e sout hern one]	□	24	8		36	15		A	4
In læua ala [on the left wing]	□	11	59		32	57		A	2
In educ tion e caud æ [at the rise of	□	18	17		34	36		A	2

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
the tail]									
In caud a Bore alior [mor e nort hern one in the tail]	□	16	49		39	20		A	4
In caud a Orie ntali or [mor e east ern one in the tail]	□	14	45		41	36		A	5
In caud a	□	19	9		41	27		A	4

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
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ern
one
in
the
tail]

PHOENIX [The Phoenix]

[4. Classis]

Nom
ina
Fixa
rum
[glos
s]

Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
------	-----	---	---	-------------	---	---	---	------

Luci
da
in
Collo
[the
brig
ht
one
on
the
neck
]

□	10	35		40	10		A	2
---	----	----	--	----	----	--	---	---

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Paru ula adia cens [the little one besi de it]	□	10	13		41	30		A	5
In anco ne alæ dext ræ [at the ben d of the right wing]	□	4	38		41	40		A	4
In ala dext ra 3. austi latio r [mor	□	29	48		39	45		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
e sout hern of thre e on the right wing]									
Earu m med ia [the mid dle of the m]	□	0	38		55	50		A	5
Earu m bore alior [mor e nort hern of the m]	□	1	58		32	0		A	5
In	□	24	8		47	30		A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
extr ema ala sinis tra [in the end of the left wing]									
In eius dem educ tion e [at the rise of the sam e]	□	10	28		44	10		A	4
Ad pede m dext rum triu m	□	6	53		45	10		A	neb.

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Orie ntali s [east ern of thre e at the right foot]									
Occi dent alior [the mor e west ern one]	□	8	23		45	40		A	neb.
Aust ralio r [the mor e sout hern one]	□	7	3		46	0		A	4
In foco sub	□	19	15		53	0		A	3

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
ala læua aust rali [at the focu s belo w the sout hern left wing]									
Ibid em Bore alior [ther e, the mor e nort hern one]	□	14	48		48	25		A	3
In foco sub ala	□	3	58		53	0		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
--	------	-----	---	---	-------------	---	---	---	------

dext ra supe rior [at the focu s belo w the right wing , the uppe r one]									
Earu m infer ior [the lowe r of the m]	□	8	18		54	40		A	4

INDVS [The Indian]

[4. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
In Capi te [on the head]	□	29	0		32	30		A	4
In axill a læua [in the left arm pit]	□	1	13		36	55		A	4
In læu æ man us sagit ta 1. [first one on the arro w of the left han	□	4	30		37	0		A	4

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
d]									
Secu nda [the seco nd]	□	6	28		38	55		A	4
Terti a [the third]	□	5	45		40	0		A	4
In sum mo sagit tæ man us dext ræ [at the top of the arro w of the right han d]	□	14	40		27	55		A	5
In	□	15	0		32	35		A	5

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
imo [at the bott om]									
In axill a dext ra Occi dent alior [mor e west ern one in the right arm pit]	□	24	16		33	45		A	6
Sequ ens [the follo wing]	□	25	0		33	55		A	6
Orie ntali or	□	23	38		33	40		A	6

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
[the mor e east ern one]									
In pect ore [on the ches t]	□	24	58		36	0		A	6
In vent re [on the belly]	□	22	38		39	15		A	4

PAVO [The Peacock]

[4. Classis]

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
Luci da in	□	18	9		36	0		A	2

Nom ina Fixa rum [glos s]	Sig.	Gr.	'	"	Lat. Gr.	'	"	A	Mag.
capit e [the brig ht one on the head]									
In collo supe rior [the uppe r one on the neck]	□	18	23		40	0		A	6

QA / batch report

TABVLA 98 — Universal Catalogue of Fixed Stars to AD 1700, PARS TERTIA (*Astra Australia*), continued and concluding

This page (folio 122) is set in two columns. The left-hand column continues **Pavo** (begun in the prior batch), then runs through **Apus / Avis Indica**, **Apis / Musca**, **Chamaeleon**, and **Triangulum Australe**. The right-hand column carries **Piscis Volans / Passer**, **Dorado / Xiphias**, **Toucan (Anser Americanus)**, and **Hydrus**,

after which the catalogue closes with a summary tally of stars (prose, transcribed below). All southern figures carry the A (Australis) latitude flag.

Left column

Pavo (4. Classis), continued

Star (name / positio n)	Sign	Long. Gr.	Long.' 38	Lat. Gr.	Lat.' 20	B/A	Mag.
Media ibi [the middl e one there]	☐	19	38	41	20	A	6
Inferi or ibide m [the lower one in the same place]	☐	17	23	41	45	A	6
In pector e [on the breast]	☐	21	53	48	30	A	3
In radice alæ dextr æ [at the root of	☐	16	38	46	32	A	3

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
the right wing]							
Parua huic adiace ns [a small one adjace nt to it]	☐	15	13	47	0	A	6
In media ala, seu dorso [in the middl e of the wing, or on the back]	☐	11	48	45	20	A	3
Nebul osa adiace ns [a nebul ous one adjace	☐	9	53	46	5	A	neb.

Star (name / positio n) nt]	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
In educti one caudæ prima [the first at the spring ing of the tail]	☐	3	18	45	40	A	6
Secun da [the secon d]	☐	1	45	44	0	A	5
Tertia [the third]	☐	1	11	43	0	A	5
Quart a [the fourth]	☐	2	8	39	35	A	5
Quint a [the fifth]	☐	29	38	41	30	A	5
Sexta [the sixth]	☐	29	3	40	30	A	5
Septi	☐	28	13	39	20	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
ma [the sevent h]							
Octav a [the eighth]	☐	24	53	41	20	A	5
Nona, & vltima [the ninth, and last]	☐	19	58	42	20	A	4
In dextro pede austra lis [the southe rn one on the right foot]	☐	9	33	50	0	A	6
In eodem boreal is [the northe rn one on the same]	☐	12	28	49	20	A	6

Star (name / positio n)	Sign	Long. Gr.	Long.' Long.'	Lat. Gr.	Lat.' Lat.'	B/A	Mag.
In sinistr o pede [on the left foot]	☐	19	23	50	23	A	6
In extre ma cauda [at the end of the tail]	☐	2	28	48	27	A	6
In eadem [in the same]	☐	28	15	51	40	A	5

Apus, seu Avis Indica (4. Classis) [Apus, or the Indian Bird]

Star (name / positio n)	Sign	Long. Gr.	Long.' Long.'	Lat. Gr.	Lat.' Lat.'	B/A	Mag.
Infor mis, aut in capite [unfor med, or on the	☐	18	33	44	40	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
head]							
In collo [on the neck]	□	18	13	48	6	A	5
In educti one caudæ boreal . [the northe rn one at the spring ing of the tail]	□	17	35	54	20	A	5
Ibide m media [the middl e one in the same place]	□	13	15	55	0	A	5
Ibide m austri na [the	□	16	10	55	45	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
southe rn one in the same place]							
In cauda versùs △ duarū superi or [in the tail, towar d the triangl e of two, the upper]	□	8	48	51	30	A	6
Ibide m inferi or [the lower one in the same place]	□	8	3	52	0	A	6
In media	□	10	11	57	10	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
cauda 3. boreal ior [in the middl e of the tail, the 3rd, more northe rly]							
Media [the middl e one]	□	9	0	57	57	A	6
Austra lior [the more southe rly one]	□	9	38	59	20	A	4
In eâdem versùs Cham æleon em [in the same,	□	13	40	61	25	A	4

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
toward Chamaeleon]							

Apis, seu Musca (4. Classis) [the Bee, or the Fly]

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
In Capite [on the head]	♈	16	58	54	0	A	4
In ala dextra [on the right wing]	♈	16	53	56	25	A	4
In ala sinistra [on the left wing]	♈	23	13	56	5	A	4
In cauda [on the	♈	20	57	57	30	A	4

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
tail]							

Chamaeleon (4. Classis)

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
In priori bus pedib us [on the forefe et]	♁	1	27	62	40	A	5
Ad collu m [at the neck]	♁	26	8	63	20	A	5
In dorso [on the back]	♁	24	53	67	0	A	5
In poster ioribu s pedib us [on the	♁	1	11	67	25	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Long.'	Lat. Gr.	Lat.' Lat.'	B/A	Mag.
hind feet]							
In educti one caudæ orient alior [the more easterl y one at the spring ing of the tail]	☐	0	28	70	38	A	5
Occide ntalio r [the more wester ly one]	☐	2	58	75	35	A	5
In media cauda superi or [the upper one in the middl	☐	28	8	73	0	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
e of the tail]							
Inferi or [the lower one]	□	26	13	73	15	A	5
In extre ma cauda superi or [the upper one at the end of the tail]	□	23	30	74	26	A	5
Inferi or [the lower one]	□	24	28	75	12	A	5

Triangulum Australe (4. Classis) [the Southern Triangle]

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
Seque ns basis	□	14	20	46	20	A	3

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
versus collū Apodis [the following one of the base, toward the neck of Apus]							
Superior in cuspidate versus Lupum [the upper one at the apex, toward Lupus]	□	5	30	41	0	A	3
Paruahic adiacens [a	□	8	40	44	40	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
small one adjace nt to it]							
Basis præce dēs versùs cauda m Apodi s [the prece ding one of the base, towar d the tail of Apus]	□	4	20	48	30	A	3
Parua supra hanc [a small one above this]	□	5	0	44	15	A	3

Right column

Piscis Volans, seu Passer (4. Classis) [the Flying Fish, or the Sparrow]

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
In Capite [on the head]	☐	19	53	72	26	A	5
In medio corpore [in the middle of the body]	☐	24	29	77	12	A	6
In cauda [on the tail]	☐	7	12	82	5	A	5
In ala sinistra superi or [the upper one on the left wing]	☐	13	34	75	20	A	6
Ibi	☐	20	7	82	14	A	6

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
inferi or [the lower one there]							
In ala dextra superi or [the upper one on the right wing]	☐	6	13	76	21	A	6
Ibi inferi or [the lower one there]	☐	11	53	79	28	A	6

Dorado, seu Xiphias (4. Classis) [the Dorado, or the Swordfish]

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
In Capite [on the head]	☐	26	45	86	53	A	4
In	☐	1	23	87	0	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
branc hijs [at the gills]							
In ventre [on the belly]	□	0	53	88	12	A	5
Supra dorsu m [abov e the back]	□	25	3	84	46	A	4
In extre ma cauda [at the end of the tail]	□	10	38	76	15	A	4
Nubec ulæ maiori s centru m [the center of the greate r little-	□	1	8	84	0	A	neb.

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
cloud] Huic adiace ns [adjac ent to it]	☐	18	3	82	31	A	5

Toucan, idest Anser Americanus (4. Classis) [the Toucan, that is, the American Goose]

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
In rostro extre mo [at the tip of the beak]	☐	5	18	45	55	A	3
In capite [on the head]	☐	16	15	48	15	A	3
In ancon e alæ sinistr æ [at the	☐	14	18	54	15	A	4

Star (name / positio n)	Sign	Long. Gr.	Long.' Long.'	Lat. Gr.	Lat.' Lat.'	B/A	Mag.
bend of the left wing]							
Ibi inferi or [the lower one there]	□	14	18	55	45	A	5
In media ala [in the middl e of the wing]	□	16	9	58	20	A	5
In dorso [on the back]	□	22	23	57	50	A	3
In cauda [on the tail]	□	22	48	61	30	A	4
In rami folio, seu nuce	□	2	33	49	55	A	4

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
myrist ica [on the leaf of a branc h, or on the nutme g]							

Hydrus (4. Classis) [the (lesser/male) Water-Snake]

Star (name / positio n)	Sign	Long. Gr.	Long. '	Lat. Gr.	Lat. '	B/A	Mag.
In Capite [on the head]	☐	5	23	64	5	A	4
In collo superi or [the upper one on the neck]	☐	11	53	71	40	A	4
Colli trium inferi or [the	☐	13	18	70	25	A	4

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
lower of the three on the neck]							
Conue rsioni s colli prima [the first of the bend of the neck]	☐	1	18	71	12	A	4
Secun da [the secon d]	☐	18	18	70	30	A	5
Tertia [the third]	☐	26	3	67	30	A	5
Quart a [the fourth]	☐	21	33	64	0	A	5
Quint a [the fifth]	☐	7	4	65	0	A	5
Sexta [the	☐	26	29	64	55	A	4

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
sixth] Septi ma [the sevent h]	☐	19	15	60	0	A	5
In caudæ cōuers . 1. Austra l. Boreal . [in the 1st bend of the tail, southe rn (and) northe rn]	☐	15	38	58	10	A	5
In 2. caudæ flexu antep enult. [in the 2nd flexur e of the	☐	13	13	62	40	A	5

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
tail, the antep enulti mate]							
Penult ima [the penult imate]	□	8	53	64	30	A	5
Vltima [the last]	□	5	38	64	0	A	5
Nubec ulæ minor is centru m [the center of the lesser little- cloud]	□	6	3	67	0	A	neb.
Inter hanc, & maior em infor mis [an unfor	□	8	48	72	20	A	6

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
med star betwe en this and the greate r]							
Austri na [the southe rn one]	□	15	48	78	30	A	4
Quæ supra 8. & 9. Hydri [the one above the 8th and 9th of Hydru s]	□	4	40	61	20	A	4
Infra collu m superi or [the upper	□	17	10	75	30	A	4

Star (name / positio n)	Sign	Long. Gr.	Long.' Gr.	Lat. Gr.	Lat.' Gr.	B/A	Mag.
one below the neck]							
Ibi infern or [the lower one there]	♏	1	19	80	0	A	6

Closing summary of the catalogue (prose, end of TABVLA 98 / PARS TERTIA)

The catalogue concludes with a tabulated tally set in prose at the foot of the right-hand column:

Thus, then, the constellations of the Zodiac are 12; the northern ones, moreover, are 23; and the southern ones are 27 — all together they come to 62.

Tally	Count
In Zodiaci Astris sunt Stellæ primæ Magnitudinis [Among the Zodiacal stars there are stars of the first magnitude]	6
Secundæ Magnitudinis [of the second magnitude]	9
In Borealibus Astris sunt Stellæ Magnitud. Primæ [Among the northern stars there are stars of the first magnitude]	3
Secundæ Magnitudinis [of the second magnitude]	22

Tally	Count
In Australibus Astris sunt Stellæ Primæ Magnitud. sunt [Among the southern stars there are stars of the first magnitude]	5
Secundæ Magnitudinis [of the second magnitude]	28
Ergo omnes Stellæ Primæ Magnitudinis sunt [Therefore all the stars of the first magnitude are]	14
Secundæ autem [the second, moreover]	59

TABVLA 99 — Right Ascension and Declination of the Fixed Stars

TABVLA 99. The Right Ascension and Declination of one hundred Fixed Stars to the completed Year of Christ 1700.

This new table abandons the ecliptic coordinates (Longitudo/Latitudo) of TABVLA 98 and instead gives, for one hundred selected bright stars, their **Right Ascension (Ascensio Recta)** and **Declination** for the year 1700, each in degrees, minutes, and seconds, together with the **secular change (Differentia Annorum 100)** in right ascension and in declination. The final declination-difference column carries a **B/A** flag (Borealis/Australis); for that column **B** marks a northern and **A** a southern declination-change. Stars are listed alphabetically by constellation.

Column structure: Name | Right Ascension (Anno 1700): Gr. /' /" | Declination (Anno 1700): Gr. /' /" | Difference of Right Ascension (per 100 years): Gr. /' | Difference of Declination (per 100 years): ' + B/A flag.

Star	RA			Dec.			ΔRA		ΔDe	B/A
	Gr.	RA'	RA''	Gr.	'	''	Gr.	'	c.'	
Andromedæ Caput	358	14	8	27	27	26	1	17	34	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
[head of Andromeda]										
Andromeda Cingulum [girle of Andromeda]	13	11	20	34	2	40	1	23	33	A
Andromeda pes Australis [southern foot of Andromeda]	26	21	51	40	52	30	1	29	30	A
Aquarij Foma	340	11	0	31	8	10 (A)	1	25	51	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
han t [Fo mal hau t of Aqu ariu s]										
Aqu arij hu mer us dext er [rig ht sho ulde r of Aqu ariu s]	327	36	55	1	43	44	1	20	19	S
Aqu arij hu mer us sini ster [left sho ulde r of Aqu	318	55	54	6	48	46	1	21	16	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
ariu s]										
Aqu arij ma nus sini stra [left han d of Aqu ariu s]	307	45	54	10	33	44	1	16	19	S
Aqu ilæ luci da [the brig ht star of Aqu ila]	294	2	47	8	6	32 (B)	1	17	13	A
Arie tis 1. in Cor nu [the 1st in the hor n of	24	17	2	17	48	24	1	23	31	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Arie s]										
Arie tis 2. in Cor nu [the 2nd in the hor n of Arie s]	24	30	3	19	19	24	1	22	31	A
Arie tis Luci da [the brig ht star of Arie s]	27	35	58	22	1	30	1	25	30	A
Aur igæ Cap ella [Ca pell a of Aur iga]	73	35	36	45	40	0	1	49	10	A
Aur	84	29	42	44	51	30	1	58	4 ³ / ₄	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
igæ hu mer us dext er [rig ht sho ulde r of Aur iga]										
Boo tis Arct uru s [Arc turu s of Boö tes]	210	33	2	20	48	2 (B)	1	11	29 ³ / ₄	S
Boo tis hu mer us sini ster [left sho ulde r of Boö tes]	215	2	33	39	35	12	1	2	27	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Can cri præ sep e [the Ma nge r of Can cer]	125	46	2	20	43	4 (B)	1	28	19	S
Can cri Ase lus Bor eus [the nort her n Ass- Colt of Can cer]	126	26	0	22	3	0	1	30	20	S
Can cri Ase lus Aus tral. [the sout her n	126	54	3	19	15	0	1	27	20	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Ass- Colt of Can cer]										
Can is Mai or, Siri us [Ca nis Maj or, Siri us]	97	57	6	16	18	6 (A)	1	7	4	A
Can icul a, Pro cyo n [the Littl e Dog, Pro cyo n]	110	54	33	5	59	12 (B)	1	20	12	S
Cap rico rni cor nu præ	300	24	34	13	22	6 (A)	1	25	16	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
ced. [the pre cedi ng hor n of Cap rico rn]										
Cap rico rni cor nu infe rius [the low er hor n of Cap rico rn]	301	7	29	15	38	2	1	27	17	S
Cap rico rni cau da præ ced. [the pre cedi ng	320	56	29	17	54	21	1	26	26	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
tail of Cap rico rn]										
Cap rico rni cau da seq uen s [the foll owi ng tail of Cap rico rn]	322	43	30	17	22	21	1	25	27	S
Cass iope æ luci da Cat hed ræ [the brig ht star of Cass	358	14	33	57	32	16 (B)	1	15	34	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
iope ia's Cha ir]										
Cass iope æ Sch edir	5	56	0	54	55	16	1	22	34	A
Cass iope æ flex ura [the ben d of Cass iope ia]	9	45	58	59	7	36	1	27	34	A
Cass iope æ gen u [the kne e of Cass iope ia]	16	36	0	58	40	2	1	35	33	A
Cep hei cing ulu m	321	6	20	69	17	10	0	22	26	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
[the gird le of Cep heu s]										
Ceti ma ndi bul æ luci da [the brig ht star of the jaw of Cet us]	41	58	7	2	53	50 (B)	1	15	25	A
Ceti vert icis bor ea [the nort her n (sta r) of the cro	24	12	0	11	44	50 (A)	1	15	31	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
wn of Cet us]										
Ceti cau da Aus trali s [the sout her n tail of Cet us]	7	5	8	19	35	44	1	18	34	S
Ceti cau da Bor eali s [the nort her n tail of Cet us]	1	4	12	10	24	50	1	17	34	S
Cor onæ bor eali	230	39	0	27	45	20 (B)	1	5	21	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
s luci da [the brig ht star of the Nor ther n Cro wn]										
Cyg ni rost rum [the bea k of Cyg nus]	289	39	48	27	22	40	1	11	11	A
Cyg ni pect oris anti qua [the old star of the bre ast	302	55	52	39	20	5	0	53 $\frac{1}{2}$	18	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
of Cyg nus]										
Cyg ni cau da [the tail of Cyg nus]	307	47	17	44	14	52	0	51 $\frac{1}{2}$	10 $\frac{3}{4}$	A
Cyg ni ala sup erio r [the upp er win g of Cyg nus]	293	54	2	44	26	21	0	48	14	A
Cyg ni ala infe rior [the low er win g of Cyg	308	29	10	32	51	24	0	0	21	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
nus]										
Dra coni s luci da [the brig ht star of Dra co]	267	25	20	51	35	2	0	35	2	S
Ge min oru m Cast oris cap ut [the hea d of Cast or of Ge min i]	108	50	46	32	30	26 (B)	1	44	11	S
Poll ucis cap ut [the hea	111	43	36	28	43	2	1	34	12	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
d of Poll ux]										
Ge min oru m pes luci dus [the brig ht foot of Ge min i]	95	5	32	16	37	32	1	28	2	S
Her culi s cap ut [the hea d of Her cule s]	255	21	37	14	46	48 (B)	1	8	8	S
Her culi s hu mer . dext	244	19	35	22	11	40	1	5	15	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
er [the righ t sho ulde r of Her cule s]										
Her culi s hu mer . sini st. [the left sho ulde r of Her cule s]	255	31	33	25	15	48	0	52	8	S
Hyd ræ cor [the hea rt of Hyd ra]	138	12	22	7	21	30 (A)	1	15	25	A
Leo nis	148	4	15	13	25	16 (B)	1	22 $\frac{1}{2}$	28 $\frac{1}{2}$	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
cor [the hea rt of Leo]										
Leo nis cau da [the tail of Leo]	175	25	34	16	14	4	1	19	34	S
Leo nis Luci da iub æ [the brig ht star of the ma ne of Leo]	150	48	47	21	21	0	1	15 $\frac{1}{2}$	29	S
Leo nis Luci da lum bor um	164	32	20	22	7	44	1	27	34	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
[the brig ht star of the loin s of Leo]										
Leo nis sup rem a cer uici s [the top mos t star of the nec k of Leo]	149	58	52	24	53	54	1	28	29	S
Leo nis inti ma cer uici s [the inn	147	47	52	18	13	53	1	28	28	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
erm ost star of the nec k of Leo]										
Lep oris fem ur [the thig h of Lep us]	78	51	30	20	59	0 (A)	1	5	7	A
Libr æ lan x bor eali s [the nort her n scal e- pan of Libr a]	225	15	26	8	14	46	1	21 $\frac{1}{2}$	24	A

(TABVLA 99 continued — same column structure as above.)

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Libr æ lan x aust rali s [the sout her n scal e- pan of Libr a]	218	38	12	14	45	18	1	25	27	A
Lyr æ luci da [the brig ht star of Lyr a]	276	39	32	38	32	16 (B)	0	50	4	A
Oph iuch i cap ut [the hea d of	260	15	38	12	49	22 (B)	1	11	7	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Ophiuchus]										
Ophiuchus i ma nus sini stra [the left han d of Ophiuchus]	239	47	37	2	52	52 (A)	1	23	18	A
Ophiuchus i gen u dext ra [the righ t kne e of Ophiuchus]	252	39	40	9	53	30	0	50	10	A
Ophiuchus i gen	245	11	37	15	16	30	1	23	15	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
u sini stra [the left kne e of Oph iuch us]										
Oph iuch i hu mer us dext ra [the righ t sho ulde r of Oph iuch us]	262	8	38	4	44	49 (B)	1	13	5	S
Ori onis capi tis sup rem a [the top	79	41	10	9	34	38 (B)	1	22	7	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
most star of the head of Ori on]										
Ori onis hu mer us dext er [the righ t sho ulde r of Ori on]	84	43	4	7	18	20	1	22	8	A
Ori onis hu mer us sini ster [the left sho ulde r of	77	16	40	6	3	2	1	19	8	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Ori on]										
Ori onis pes Rige l [Rig el, the foot of Ori on]	75	2	50	8	33	42 (A)	1	13 $\frac{1}{2}$	9 $\frac{1}{2}$	S
Ori onis 1. balt hei [the 1st of the belt of Ori on]	79	17	9	0	32	50	1	17	7	S
2. balt hei [the 2nd of the belt]	80	18	54	1	25	46	1	17	5	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
3. balt hei [the 3rd of the belt]	81	18	25	2	8	20	1	16	5	S
Peg asi os [the mo uth of Peg asu s]	322	27	36	8	32	14 (B)	1	18	26	A
Peg asi crus sch eat [Sch eat, the leg of Peg asu s]	342	20	36	26	28	38	1	12	32	A
Peg asi Mar kab	342	28	10	13	35	58	1	15	32	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
[Ma rka b of Peg asu s]										
Peg asi Alge nib	359	27	25	13	32	56	1	16	34	A
Pers ei luci du m latu s [the brig ht flan k of Pers eus]	45	32	18	48	44	54	1	28	12	A
Pers ei Med usæ cap ut [the hea d of Med usa of	42	12	42	39	46	30	1	37	23	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Pers eus]										
Pisc is aust rali s occi put [the bac k of the hea d of the Sou ther n Fish]	345	24	5	1	40	2	1	17	33	A
Pisc ium lini nex us [the kno t of the cor d of Pisc es]	26	38	5	1	19	0	1	18	30	A
Sagi ttari	283	1	5	21	22	48 (A)	1	31	8	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
s [the nort her n bro w of Scor pius]										
Fro ntis med ia [the mid dle of the bro w]	236	4	34	21	41	40	1	30	20	A
Fro ns aust rali s [the sout her n bro w]	235	18	0	25	9	54	1	37 $\frac{1}{2}$	21	A
Ser pen tis luci	232	24	0	7	24	36 (B)	1	15	21	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
da colli [the brig ht star of the nec k of Ser pen s]										
Tau ri Ald eb. seu ocul us aust r. [Ald eba ran of Tau rus, or the sout her n eye]	64	41	35	15	52	10 (B)	1	26 $\frac{1}{2}$	15	A
Tau ri	76	51	18	28	19	2	1	37	8	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
n eye of Tau rus]										
Tau ri infi ma Hya du m [the low est star of the Hya des of Tau rus]	60	39	33	14	55	38	1	25	17	A
Tau ri Plei adu m Luci da [the brig ht star of the	52	27	35	23	9	24	1	29	21	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
Plei ade s of Tau rus]										
Virg inis Spic a [the Ear of Grai n of Virg o]	197	22	55	9	33	30	1	19 $\frac{1}{2}$	32 $\frac{1}{2}$	A
Virg inis cing ulu m [the gird le of Virg o]	190	10	22	5	2	54 (B)	1	18	34	S
Virg inis Vin dem iatri x [the Gra pe- Gat	191	52	20	12	34	58	1	17	33	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
her er of Virg o]										
Vrs æ mai oris Dub he [Du bhe of Urs a Maj or]	161	19	5	63	22	2 (B)	1	41	32	S
Late ris luci da [the brig ht star of the flan k]	160	11	52	57	59	2	1	37	32	S
Post erio ris cox æ luci	174	23	34	55	23	42	1	23	34	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
da [the brig ht star of the hin d hau nch]										
Ter gori s pro pe cau dā luci da [the brig ht star of the bac k nea r the tail]	180	8	2	58	41	4 (A)	1	9	33	S
Vrs æ mai.	190	7	56	59	36	58	1	1	33	S

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
1. Cau dæ [the 1st of the tail of Urs a Maj or]										
2. Cau dæ [the 2nd of the tail]	197	53	2	56	39	52	1	2	32	S
3. in extr emo Cau dæ [the 3rd, at the end of the tail]	203	53	50	50	50	0	1	2	31	S
Vrs æ	9	53	10	87	42	51	3	10	34 $\frac{1}{2}$	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
min oris vlti ma cau dæ nun c Pola ris [the last star of the tail of Urs a Min or, now the Pole Star] Vrs æ min oris luci da hu mer i, oli m	222	39	20	75	37	30	1	15	2 ½	A

Star	RA Gr.	RA'	RA''	Dec. Gr.	Dec. '	Dec. "	Δ RA Gr.	Δ RA '	Δ De c.'	B/A
nsio n of this one dec reas es.]										

QA / Batch Report

TABVLA 100. Motion of the Fixed Stars in Longitude

TABVLA 100. *Motus Fixarum in Longitudinem. Addendi Longitudini Anni 1700. Christi, vel subtrahendi, vt habeantur eorum loca post, vel ante.* — Motion of the Fixed Stars in Longitude. To be added to the longitude for the year of Christ 1700, or subtracted, in order to obtain their positions afterward or before.

, I, II, III).]

Anni	I	II	III	Anni	Gr.	I	II	III
1	0	50	40	61	0	51	30	40
2	1	41	20	62	0	52	21	20
3	2	32	0	63	0	53	12	0
4	3	22	40	64	0	54	2	40
5	4	13	20	65	0	54	53	20
6	5	4	0	66	0	55	44	0
7	5	54	40	67	0	56	34	40
8	6	45	20	68	0	57	25	20
9	7	36	0	69	0	58	16	0
10	8	26	40	70	0	59	6	40
11	9	17	20	71	0	59	57	20
12	10	8	0	72	1	0	48	0
13	10	58	40	73	1	1	38	40
14	11	49	20	74	1	2	29	20
15	12	40	0	75	1	3	20	0

Anni	I	II	III	Anni	Gr.	I	II	III
16	13	30	40	76	1	4	10	40
17	14	21	20	77	1	5	1	20
18	15	12	0	78	1	5	52	0
19	16	2	40	79	1	6	42	40
20	16	53	20	80	1	7	33	20
21	17	44	0	81	1	8	24	0
22	18	34	40	82	1	9	14	40
23	19	25	20	83	1	10	5	20
24	20	16	0	84	1	10	56	0
25	21	6	40	85	1	11	46	40
26	21	57	20	86	1	12	37	20
27	22	48	0	87	1	13	28	0
28	23	38	40	88	1	14	18	40
29	24	29	20	89	1	15	9	20
30	25	20	0	90	1	16	0	0
31	26	10	40	91	1	16	50	40
32	27	1	20	92	1	17	41	20
33	27	52	0	93	1	18	32	0
34	28	42	40	94	1	19	22	40
35	29	33	20	95	1	20	13	20
36	30	24	0	96	1	21	4	0
37	31	14	40	97	1	21	54	40
38	32	5	20	98	1	22	45	20
39	32	56	0	99	1	23	36	0
40	33	46	40	100	1	24	26	40
41	34	37	20	200	2	48	53	20
42	35	28	0	300	4	13	20	0
43	36	18	40	400	5	37	46	40
44	37	9	20	500	7	2	13	20
45	38	0	0	600	8	26	40	0
46	38	50	40	700	9	51	6	40

Anni	I	II	III	Anni	Gr.	I	II	III
47	39	41	20	800	11	15	33	20
48	40	32	0	900	12	40	0	0
49	41	22	40	1000	14	4	26	40
50	42	13	20	2000	28	8	53	20
51	43	4	0	3000	42	13	20	0
52	43	54	40	4000	56	17	46	40
53	44	45	20	5000	70	22	13	20
54	45	36	0	6000	84	26	40	0
55	46	26	40	7000	98	31	6	40
56	47	17	20	8000	112	35	33	20
57	48	8	0	9000	126	46	0	0
58	48	58	40	1000	140	44	26	40
				0				
59	49	49	20	2000	281	28	13	20
				0				
60	50	40	0	2557	360	0	0	0
				9				

[Foot of table, left column: *Anni 61* — i.e., the second argument block continues from "Years 61."]

Parsing notes: The left block (Anni 1–60) has no separate "Gr." (degrees) heading; its column I carries the integer degrees through 50 (the precession motion at ~50".4 per year, reaching ~50°40' over 60 years), with columns II and III for minutes and seconds. The right block carries an explicit **Gr.** column, then **I, II, III** for minutes, seconds, thirds. The right block jumps from individual years (61–100) to round centuries/millennia (200...1000), then by thousands (2000...10000), then 20000, and finally **25579** years — the full precessional cycle of 360°, consistent with Riccioli's adopted precession rate. The bottom-right entry 25579 → 360°0'0"0''' marks one complete circuit of the equinoxes. The four-figure large-year rows (e.g. 8000 → 112°35'33"20''', 20000 → 281°28'13"20''', 25579 → 360°0'0"0''') carry degrees/minutes/seconds/thirds; the three-figure rows omit a trailing zero (thirds) group, so row 9000 reads 126°46'00"00'''.

Numerical check (row 57, right block): "9000 → 126° 46' 0" 0''". This value is **confirmed printed as 126 46 0 0** It is a genuine source error: a

strict monotone extrapolation of the precession column gives $\square 126^{\circ}26' - 126^{\circ}27'$ (the per-1000-year increment runs $\approx 14^{\circ}02'$; $8000 \rightarrow 112^{\circ}35'$; $10000 \rightarrow 140^{\circ}44'$), so the printed minutes value 46 breaks the otherwise smooth progression. Most likely a compositor digit swap (intended $26'$ set as $46'$, a $2/4$ confusion). Transcribed as printed; flagged as a suspected source/compositor error — see Numerical impossibles. (Not [?].)

TAB. 101. Names of Foreign Stars, and for the Most Part Arabic Names

TAB. 101. *Nomina Stellarum Peregrina, & Plerumque Arabica, cum eorum interpretatione continens. In qua ne mirere Lector, si eidem Stellæ diuersa nomina videbis adscripta, pro diuersitate Dialectorum, aut codicum fortassè corruptorum.* — Containing the foreign — and for the most part Arabic — names of the stars, together with their interpretation. In this table, reader, do not be surprised if you see different names assigned to one and the same star, owing to the diversity of dialects, or perhaps to corrupted manuscript codices.

A

- *Abrachaleus*, Castor, or its head.
- *Acharnar*, *Acharnaar*, or *Acharnarino*, Arabic, the bright star at the extremity of Eridanus.
- *Achluschemali*, Arabic, Corona Borealis (the Northern Crown).
- *Adared*, Arabic, Mercury.
- *Aderaimin*, or *Alderamin*, Arabic, the star above the right shoulder of Cepheus.
- *Adigege*, or *Adegige*, Arabic, Cygnus, as if "fragrant like a rose."
- *Adhil*, the star in the lowest part of Andromeda's garment.
- *Adrendefa*, Arabic, Virgo.
- *Aegipan*, *Aegoceros*, the Greek-Latin name for Capricorn.
- *Afeichius*, Serpentarius — or is it corrupted from the Greek-Latin *Ophiuchus*?
- *Akrab*, Hebrew; *Aakrab*, Arabic; *Acrabo*, Chaldean: Scorpius.
- *Alacrab*, or rather *Aakrab*, Arabic; or *Hacrab*: Scorpius.
- *Alamak*, Arabic; *Almaak*, Arabic — not *Alhames* [?]: as it were, the star in the southern foot of Andromeda.
- *Alascha*, the foremost of the two stars in the sting of Scorpius.
- *Alasid*, or *Alezet*, or *Asid*, or *Ellesed*, Arabic, Leo.

- *Alazet*, in *Azophi* [al-Ṣūfi], the tail of Leo.
- *Alazel*, or *Alaazel*, or *Hazimet Alazel*, & in *Hermes Alhaiseth*, Spica Virginis (the Ear of Wheat of Virgo).
- *Alathod*, or *Alhaiot*, Capella.
- *Albegala*, Lyra.
- *Albezze*, or *Albizze*, Centaurus.
- *Albireo*, Arabic, the star in the beak of Cygnus.
- *Alcantarus*, Arabic, Capricorn.
- *Alcor*, Arabic: the little rider-star above the second star in the tail of Ursa Major.
- *Aldebaran*, the southern eye of Taurus, that is, the dominant star.
- *Alderamin*, or *Aderaimin*, Arabic, the star above the right shoulder of Cepheus.
- *Algebar*, or *Algebra*, Arabic, Orion — see *Elgeuze*.
- *Algedi*, Arabic, Capricorn.
- *Algeneb*, Arabic: the bright star in the outermost wing of Pegasus, or in the side of Perseus.
- *Algethi*, or rather *Algiethi*, Arabic, Hercules.
- *Algeuze*, or rather *Elgiauze*, Arabic, the head of Castor.
- *Algol*, Arabic: the Head of Medusa, or Medusa herself.
- *Algomeiza*, Arabic, Procyon, Canis Minor.
- *Algorab*, Arabic, Corvus.
- *Alhabor*, Arabic: the splendid star in the mouth of Canis Major.
- *Alhague*, Arabic — not *Alangué*: Serpentarius.
- *Alhaiot*, Arabic; *Alhaisse*s in *Hermes*: Spica Virginis.
- *Alhance*, Arabic, or *Alahance*, Sagitta.
- *Alhes*, Arabic; or *Alkes*, which is at the base of Crater — common with Hydra.
- *Aliath*, the foremost star in the tail of Ursa Major.
- *Aliemini*, Alphonsine name for Canis Major.
- *Alkalurops*, the star at the Colorobus [club] of Boötes.
- *Alhameluz*, Arabic, Arcturus.
- *Almucedie*, Arabic, Vindemiatrix.
- *Almuredin*, Arabic, Vindemiatrix.
- *Almeqrameth*, Arabic, the Censer [Thuribulum].
- *Alohore*, Lyra.

- *Aloue Cap.*, of Medusa['s head].
- *Alphard*, Arabic, Cor Hydrae (the Heart of Hydra) at the bend.
- *Alpheichius*, Arabic, Serpentarius.
- *Alphas*, Arabic, Pegasus.
- *Alpheta*, or *Alphena*, the Syro-Chaldean bright star of Corona Borealis, as if "the opened pupil."
- *Alramech*, or *Aramech*, Arabic, Arcturus.
- *Alruccabah*, Arabic; or *Ruccabah*: the Pole Star at the extremity of the tail of Ursa Minor.
- *Alsartan*, *Asartan*, or rather *Elsartan*, Cancer.
- *Alzimon*, of Nubia [al-Nubiani], Spica Virginis.
- *Amaza*, Greek-Latin: ἄμαξα [Greek: hamaza, "wagon/cart" — the constellation], the Lesser Wain, Ursa Minor.

A (continued)

- *Angetenar*, or *Achenetenar*, are 9 stars in the third bend of Eridanus.
- *Anhelar*, Chaldean, the head of Castor.
- *Antares*, Ptolemy's Cor Scorpii (Heart of Scorpius) — ἀντάρης [Greek: Antarēs, "rival of Ares / counter-Mars" — the name Antares] in Hesychius.
- *Apullum*, corruptly for *Apollo*, that is, Castor.
- *Arie* of the Chaldeans, *Arieb* of the Hebrews: Leo.
- *Arieded*, the bright star in the tail of Cygnus.
- *Aris*, Chaldean for Mars; & in Greek ἄρης [Greek: Arēs].
- *Asinge*, Lyra.
- *Asartan*, Arabic, Cancer.
- *Aschere*, or *Aschemie*, Canis Minor.
- *Asida*, Arabic, Lupus.
- *Asmeas*, Arabic, Centaurus.
- *Astacus*, Greek for Cancer.
- *Astaroth*, Chaldean for Venus.
- *Asua*, Hydra.
- *Asugia*, Orion.
- *Ataïr*, or *Alcaïr*: the bright star in the head of Aquila, Arabic.
- *Atargatis*, Virgo.
- *Ataur*, Arabic, Taurus.

- *Athalpis*, Greek ἀθαλπής [Greek: athalpēs, "without warmth, cold" — Capricorn]: Capricorn.
- *Athorace*, Ptolemy's first Quadripartite (*Quadrip.* c. 9), the Pleiades.
- *Athoraïe*, or *Altorich*: in Hali Haben Ragel [Haly Abenragel], the Pleiades.
- *Atin*, or *Eltaur*: the eye of Taurus.
- *Auellar*, or *Auellan*: Pollux.
- *Azelphage*, Arabic: the two stars at the extremity of the tail of Cygnus.
- *Azimech*, Arabic, Spica Virginis.
- *Azubene*, Arabic, the Claw [Chela] in Cancer — though it signifies that of Scorpius — and from this the Libra hanging from this Claw.

B

- *Baculus Iacob* [Jacob's Staff], the Belt of Orion.
- *Basiliscus*, βασιλίσκος [Greek: basiliskos, "little king"]: Regulus, Cor Leonis (the Heart of Leo).
- *Baten Kaitos*, Arabic: the more northerly star in the belly of Cetus.
- *Beemin*, Arabic: there are 7 stars in the fourth bend of Eridanus.
- *Bellatrix*: the star in the right shoulder of Orion.
- *Benat Elnaesch*: the daughters of the bier [filiae feretri] — the Pleiades.
- *Benenatm*, or *Benenat*, or rather *Benetnasch*, Arabic: the outermost star in the tail of Ursa Major.
- *Betelgeuze*, or *Beetelgeuze*, Arabic: the bright star in the left shoulder of Orion; & it signifies "the Giant's home" [Gigantis domum].
- *Bridemis*, the Persian Lupus.
- *Brinek*, Lyra, or Lyra's bright star.
- *Buthean* in German; *Burrio* in English, "the hen brooding her chicks" [gallina fouens pullos] — thus they call the Pleiades, as the Italians call them *la Gallinella*.

C

- *Callisto*, Ursa Major.
- *Cammarus*, Cancer.
- *Caucasus*, Cepheus.
- *Canopus*, or *Canobus*: the bright star in the rudder of Argo Navis [Argonautis].
- *Carnabon*, Serpentarius.
- *Cateia*, or *Caia*: the first star in the northern part of Hercules's club.

- *Cavn*, Chaldean, Saturn.
- *Ceginus*, Cepheus, or what is in the left shoulder of Boötes.
- *Cernua quibusdam*, Cassiopeia (so called by some).
- *Chammah*, Hebrew, the Sun.
- *Cheichius*, or *Cheguius*: by some, Cepheus; by others, Boötes.
- *Chelub*, or *Chelenb*: Alphonsine name for Perseus.
- *Chem*b, or rather *Genib*, Arabic: the bright star in the side of Perseus.
- *Chesil*, Hebrew, Arcturus, or Orion — from the verb *Cacal*, which signifies "variable & inconstant."
- *Chateb*, Hebrew, Mercury, that is, "the Scribe" [Scriba].
- *Chima*, or *Kima* in Hebrew, the Pleiades, & the Hyades — indeed, by others, Arcturus — namely "stormy stars" [sidera procellosa].
- *Chrysomallus*, Greek, the golden-fleeced Ram [Aries].
- *Cinctorius*: of the two smaller stars in the tail of Ursa Minor.
- *Cochan*, or *Cochab*, Hebrew, Mercury — namely a shining star [Stella fulgens].
- *Colorobus*, κολορόβης [Greek: kolorobēs (a corrupt form), "hollow shaft" or the club of Boötes [clava Bootis]].
- *Currus volitans*, in Catullus, named Argo.
- *Cynosura*, Ursa Minor.

D

- *Dagim*, Hebrew, Pisces, or *Dagiotho*.
- *Dat Elkarsi*, Arabic, the Seat of Cassiopeia [Sedes Cassiopeæ].
- *Daulo*, Chaldean, Aquarius.
- *Delli*, Hebrew, *Situla* (the Bucket) for Aquarius.
- *Deneb*, or *Denneb*, Arabic, "Tail" [Cauda].
- *Deneb Adigege*, the bright star in the tail of Cygnus.
- *Deneb Elassid*, Arabic, or *Deneb Alasid*: the tail of Leo.
- *Deneb Aigedi*, or *Elgeudi*: the foremost star in the tail of Capricorn.
- *Deneb Elaakrab*, Arabic, the tail of Scorpius.
- *Deneb Kaitos*, Arabic: the more southerly star in the tail of Cetus.
- *Didymi*, Δίδυμοι [Greek: Didymoi, "twins"], Gemini.
- *Discuri*, Διόσκουροι [Greek: Dioskouroi, "the Dioscuri"], Gemini.
- *Dubhe*, or *Dubheh*, Arabic: the bright star in the shoulder of Ursa Major; Arabic.

- *Dubhe Elezguar*, Arabic: the bright star in the shoulder of Ursa Minor.
- *Duberukabah*, Ursa Minor.

E

- *Edeleu*, Arabic, Aquarius.
- *Eladari*, Arabic, or *Eleadari*, Virgo.
- *Eleazelet*, of Nubia [al-Nubiani], diffuse [fusus] among the astrologers, or Spica Virginis, corruptly *Alzimon*.
- *Elezguar*, Cynosura, Ursa Minor.
- *Eldegiagigh*, Cygnus, as if "a cock's comb" [Galli rosa].
- *Elgebar*, Arabic, Orion, Gigas (the Giant).
- *Elgeda*, Arabic, Capricorn.
- *Elgenib fulgens*, in the side of Perseus, Arabic.
- *Elgeuze*, Arabic, Gemini.
- *Elgegiale*, Arabic, Hercules.
- *Elhakaeae*, Arabic, the heads of Gemini [Capita Geminorum].
- *Elhamel*, Aries.
- *Elharneb*, Arabic, Lepus.
- *Elhaut*, Arabic, Hydra.
- *Elhatat*, Pisces.
- *Elhenaat*, the head of Pollux [Caput Pollucis].
- *Elkanfu*, or *Elkusu*, vel *Elkaus*, Aquarius, Arabic.
- *Elkaitus*, Arabic, Cetus.
- *Eikamer*, Arabic, the Moon [Luna].
- *Elkis*, or *Elnarad*, Arabic, Crater.
- *Elkleil Eigenibi*, Arabic, Corona Australis (the Southern Crown).
- *Elkleil Schemali*, Arabic, Corona Borealis (the Northern Crown).
- *Elmac Alcheras*, Arabic, the Lesser Horse [Equus minor].
- *Elhesed*, Arabic, Leo.
- *Elmarig*, Arabic, Mars.
- *Elmesteri*, Arabic, Jupiter.
- *Elnatra*, Arabic, the Manger of Cancer [Aselli Cancri].
- *Elsartan*, Arabic, Cancer.
- *Elschemis*, Arabic, the Sun [Sol].
- *Eltsamach*, Arabic, Spica Virginis.
- *Elzahareb*, Arabic, Venus.

- *Emro*, Chaldean, Aries.
- *Engonasi*, Greek ἐγγόνασι [Greek: Engonasi, "the kneeling one"; the source prints only "Græcè Ingeniculus" — the Greek script is an editorial supplement, not inked on the page]: Hercules.
- *Enuf*, or *Enf Alpheras*, Arabic: the star in the muzzle of Pegasus [in rictu Pegasi].
- *Erigone*, Virgo.
- *Ezra*, Cynosura, Ursa Minor.

F

- *Famauh*, or *Phomalhaut*, or *Phomauth*, corruptly *Phomaant*, Arabic: the Mouth of the Fish [Os piscis], or the splendid star in the outpouring of Aquarius [in effusione Aquarii].

G

- *Gadio*, Chaldean, Capricorn.
- *Garactes*, or *Abrachaleus*, Chaldean, the Head of Pollux [Caput Pollucis].
- *Gedi*, Chaldean, Capricorn.
- *Gienze*, Arabic; & with the article *Elgeuzi*, Gemini.
- *Grimmium*, barbarous, that is, the jaw of Draco [genam Draconis].
- *Grus*, or *Ciconia*, of the Moors [Mauris], is Serpentarius.
- *Guad*, of the Moors, Eridanus, or the Nile.

H

- *Haakrab*, or *Aaakrab*, & with the article *Elaakrab*, Arabic: Scorpius.

H (continued)

- *Hammel*, Arabic, Aries.
- *Harneb*, & with the article *Elharneb*, Arabic, Lepus.
- *Haut*, & with the article *Elhaut*, vel *Elhautine*, Arabic, Pisces.
- *Haut Elgenubi*, Arabic, Piscis Australis (the Southern Fish).
- *Haut Elschemali*, Arabic, Piscis Borealis (the Northern Fish).
- *Helice*, Greek, Ursa Major.
- *Heniochus*, Greek, Auriga.
- *Hermannibus*, in the Egyptians, "the god of speech," that is, Mercury.
- *Hermes*, Greek ἑρμῆς [Greek: Hermēs], Mercury.

- *Hermidons*, ἑρμιόνη [?] [Greek: hermionē]: in Vitruvius (book IX, c. 6), the outpouring of Aquarius [effusio Aquarii].
- *Hernippus*, in Pliny, Delphinus.
- *Hesperus*, ἑσπερος [Greek: Hesperos, "evening (star)" — Venus as evening star], the evening Venus [Venus vespertina].
- *Hexastron*, Greek ἑξάστρον [Greek: hexastron, "six-star"], the cluster of the seven stars of the Pleiades — which, although Ovid sings (*septem dici*, "seven are spoken of"), are nevertheless wont to be seen as six, because the seventh is discerned with difficulty.
- *Hierezim*, Arabic, "the rose-fragrant," or the lily — thus they call the star of Cygnus [Cygni astrum].
- *Hydrochous*, Greek ὑδροχόος [Greek: Hydrochoos], Aquarius.
- *Hydridurus*, Greek ὑδρίδουρος [?] [Greek: hydridouros, "turning the water-jar," namely Aquarius].

I

- *Ingeniculus*, the kneeling Hercules [in genua procumbens Hercules].
- *Iugum*, in Cicero, Libra.
- *Iugula*, in Plautus & Varro, Orion.
- *Iugulae*, of the Aselli (Manger-asses) in Cancer.

K

- *Kalb*, Arabic, "Heart" [Cor].
- *Kalbelaakrab*, Arabic, Cor Scorpii (the Heart of Scorpius).
- *Kalbellesed*, Arabic, of Ferzanis [Fez], of Morocco, & of Nubia, Cor Leonis (the Heart of Leo) — corruptly in the Alphonsines *Kalbelased*.
- *Kalbelalphard*, & resolved as a single word *Alphard*, Arabic, Cor Hydrae (the Heart of Hydra).
- *Kaitos*, & with the article *Elkaiton*, Arabic, Cetus.
- *Kaus*, & with the article *Elkaus*, Arabic, Sagittarius.
- *Kertko*, Chaldean, Sagittarius.
- *Kescheth*, Hebrew, Sagittarius.
- *Ketpholtsumman*, the head of Pollux [Caput Pollucis].
- *Kochab*, Arabic, the bright star in the shoulder of Ursa Minor.
- *Kolanza*, Arcturus, Arabic.

L

- *Laelaps*, Canis Major.
- *Lebanah*, or *Laneah*: in Hebrew the Moon, so called from its whiteness [ab albore].
- *Lesath*, or rather *Lessaa Elaakrab*, Arabic: the star in the sting of Scorpius [in aculeo Scorpii]; & it signifies "the very bite of Scorpius" [Morsum Scorpii].

M

- *Maadim*, Hebrew, Mars, as being of a blood-red color [sanguinei coloris].
- *Maasym*, Arabic: the star in the right elbow of Hercules [in dextro cubito Herculis].
- *Mafarte*, the barbarous name for Auriga.
- *Markab*, Arabic, "the curtailed one" — but it is itself the first star in the wing, or in the shoulder-blade [armo] of Pegasus.
- *Malphelcane*, that is, the fillet of the pupil [sertum pupillæ], Chaldean — namely, Corona Borealis.
- *Marra*, or *Mergà*, Arabic: the star in the sickle of Boötes [in falce Bootis].
- *Marat Musalseleth*, Arabic, "the Chained Woman" [Mulier Catenata], that is, Andromeda.
- *Marsic*, that is, "the place of reclining" [reclinatorium], Arabic: the star in the left hand of Hercules [in sinistra Herculis manu].
- *Masathre*, Chaldean, Libra.
- *Meeleph*, or *Mellesf*, Arabic, the nebulous star in the breast of Cancer [Nebulosa in pectore Cancri].
- *Meloch*, of the Egyptians, Mars, as being the god of destruction in their own belief [Deus destructionis ipsis].
- *Menkar Elkaitos*, Arabic, the star in the nostrils of Cetus [in naribus Ceti].
- *Mesangue*, Chaldean, Lyra.
- *Mesartim*, Hebrew: the two stars in the horns of Aries [duæ stellæ in Arietis].
- *Mezer*, Arabic, the star in the right thigh of Boötes [in dextro femore Bootis].
- *Micar*, or *Mizar*, "a girdle" [?], Arabic: it signifies the star, namely that which is the middle one in the tail of Ursa Major, as also the one in the girdle of Andromeda [in cingulo Andromedæ].
- *Miluius*, in Ovid otherwise called Cygnus.

- *Mizan*, Arabic, Libra.
- *Miznaim*, Hebrew, Libra.
- *Moschlek*, in the sting of Scorpius [in aculeo Scorpij].

N

- *Naasch Laazar*, of the Christian Arabs, signifies "the bier of Lazarus" [Pheretrum Lazari] — thus they call the seven stars of Ursa Major; & the three in the tail, *Benat Naasch*, that is, "the daughters of the bier" [filias pheretri].
- *Nahar*, Arabic, the Nile [Nilus], or Eridanus.
- *Nebolellesed*, Arabic, & *Nebolassid*: in the Nubian astrologers, it is the tail of Leo [Cauda Leonis].
- *Nembus*, Arabic, the star in the sickle of Perseus [in falce Persei].
- *Nepa*, Cancer, in Varro.
- *Nobia*, Chaldean, Mercury.
- *Noctiurus*, νυκτοῦρος [Greek: nyktouros, "night-watcher"], "the keeper of the night" [custos noctis], namely Saturn, according to Plutarch in *De Facie Lunæ* (On the Face in the Moon).
- *Nogah*, in Hebrew, Venus, as being a glittering light [lux rutilans].
- *Nonacrine*, the Latin name for Ursa Major.

O

- *Ostipes*, Cancer.
- *Ophnuchus*, ὀφιοῦχος [Greek: Ophiouchos], Serpentarius.
- *Orsercalem*, Turkish for Sagitta.
- *Orphas*, Cetus.

P

- *Palilicium*, the Latin name for the southern eye of Taurus [Oculus Australis Tauri].
- *Pesceho*, Chaldean, the nebulous star of Cancer [Nebulosa Cancri].
- *Peochos*, & *Asephcom*, the Moon of the Egyptians, as being the mistress of the seas [Maris domina].
- *Phaenon*, φαίνων [Greek: Phainōn, "the shining one"]: the apparent Saturn.
- *Phaëthon*, Jupiter, in Greek "of splendor" [φάέθων, "the radiant"].
- *Pharmaz*, Crater.
- *Phicarus*, Cepheus.

- *Phomant*, or *Phomault*, or *Phomelhaut*: the Mouth of the Fish [Os piscis], Arabic; & it is in the outpouring of Aquarius [in effusione Aquarii].
- *Phosphorus*, *φωσφόρος* [Greek: Phōsphoros, "light-bearer"], the morning Venus [Venus matutina].
- *Piorion*, *προΐων* [Greek: proiōn], in the Egyptians, the Station of Horus [Statio Hori], that is, the eye of Taurus [oculus Tauri].
- *Potirir*, of the Egyptians, the Sun, that is, in their own belief the Holy God [Deus Sanctus].
- *Procyon*, *προκύων* [Greek: Prokyōn], in Cicero *Antecanis*, or "before-the-Dog" [Præcanis], Canis Minor.
- *Proput*, *προπούς* [Greek: propous], the star in the highest part of the left foot of Pollux [in summo pedis sinistri Pollucis].
- *Pyrois*, *Pyroentis*, *πυρόεις* [Greek: Pyroeis, "the fiery one"], the fiery Mars [Mars igneus].

R

- *Ras*, Arabic, "Head" [Caput].
- *Ras Algethi*, Arabic, the Head of Hercules [Caput Herculis].
- *Ras Algol*, Arabic, the Head of Medusa [Caput Medusæ].
- *Ras Algeuze*, or *Ras Elgiauze*, Arabic, the Head of Castor [Caput Castoris].
- *Ras Alhague*, Arabic, the Head of Serpentarius [Caput Serpentarii].
- *Rastaben*, Arabic, the bright star of the Head of Draco [Lucida Capitis Draconis].
- *Rephan*, of the Egyptians, Saturn, as being in their own belief the god of times [Deus temporis].
- *Rigel*, or *Rigel Elgebar*, Arabic, the bright star in the left foot of Orion [lucida in sinistro pede Orionis].
- *Ruba*, Hebrew, Auriga.
- *Rota Ixionis*, Corona Australis (the Southern Crown).
- *Ruccabah*, the Pole Star [Stella Polaris], at the extremity of the tail of Ursa Minor [in extremo caudæ Ursæ minoris].

S

- *Sagmarius*, Pegasus.
- *Sameh*, Pisces.
- *Sartai*, Hebrew, Aries, or its Horns [eiusue Cornua].
- *Sartam*, Hebrew & Arabic, *Elsartam*, Cancer.

- *Sartono*, Chaldean, Cancer.
- *Sceara*, Canis Major, or Sirius.
- *Schaham*, Arabic, Sagitta.
- *Schabtai*, Hebrew, Saturn.
- *Schasro*, Chaldean, the Moon [Luna].

TABVLA 101 — Lexicon of Foreign and Mostly Arabic Star Names, with their Interpretation (continued)

Continued from batch 193. Running header: "NOMENCLATVRA STELLARVM." Folio "128." Set in two columns; each entry is the italic headword + language attribution + Latin gloss/identification. Left column transcribed first, then right column.

Letter S (continued — left column)

- *Scheat*, Arabic. The leg, or shinbone; and it is also a star in the leg of Pegasus, called *Scheat Pegasi*, just as a star in the left shinbone of Aquarius is called *Scheat Aquarii*. To the Arabs, however, the more forward [star] of *Scheat Alphas* is *Scheat Edeleu*.
- *Scheder*, or rather *Seder*, Arabic. A star in the breast of Cassiopeia.
- *Scheer Eliemini*, the Greater Dog [Canis Major], to the Persians.
- *Schemasch*, to the Hebrews the Sun, from heat.
- *Schemso*, to the Chaldeans the Sun.
- *Simon*, or *Smon*, to the barbarians, the Dolphin [Delphinus].
- *Soail Iemani*, to the Persians, Canopus.
- *Stilbon*, Greek στίλβων [Greek: stilbōn, "the gleaming one"], Mercury, from its quivering light.
- *Sucula*, to Varro the Hyades.
- *Succoth Benoth*, Hebrew. "The tabernacle of the daughter," that is, the Pleiades.
- *Suhel*, Canopus.
- *Sumbalet Eleadari*, Arabic. Spica Virginis [the Ear of Wheat of Virgo].
- *Suroth*, to the Egyptians, "the mistress of love," namely Venus.
- *Syndesmos*, σύνδεσμος [Greek: syndesmos, "knot, bond"], the so-called Knot of the Thread of Pisces [the Linum Piscium].

Letter T (left column)

- *Tammech*, to the Chaldeans, Gemini.
- *Tauro*, Chaldean. Taurus.

- *Tauts*, to the Chaldeans, Jupiter.
- *Termonelles*, to the Persians, Hercules.
- *Theemin*, Arabic. The seven stars in the bend of Eridanus [in 4. flexura Eridani].
- *Theomin*, to the Hebrews, Gemini.
- *Triones*, the seven stars of Ursa Major.

Letter T (right column)

- *Tur*, Arabic. Taurus.
- *Tzedek*, to the Hebrews Jupiter, on account of equity [ob aequitatem].
- *Tzegel*, to the Arabs, Saturn.

Letter V (right column)

- *Vardi*, *Fetzanis*, the Nile, or Eridanus.
- *Vazneganubi*, Arabic. Lanx australis [the southern Scale-pan].
- *Vazneschemali*, Arabic. Lanx borealis [the northern Scale-pan].
- *Vespertilio*, to Sophocles, the Heart of Scorpius [Cor Scorpii].
- *Vesper*, *Vesperugo*, to Varro the evening Venus.
- *Vigiles*, in Italian *le guardie* [the Guards], or *guardiane*, the two lesser stars in the tail of Ursa Minor.
- *Virgilia*, or *Vergiliae*, the Pleiades.
- *Vmbilicus Pegasi*, the Head of Andromeda [Caput Andromedae].
- *Vuega*, or *Vagieh*, Arabic. The bright star of Lyra [Lyrae lucida].
- *Vultur cadens*, Lyra.
- *Vultur volans*, Aquila.

Letter Y (right column)

- *Yed*, Arabic. The more northern star in the right hand of Serpentarius [Ophiuchus].

Letter Z (right column)

- *Zeus*, Greek Ζεύς [Greek: Zeus], Jupiter.
- *Zubenelgenubi*, Arabic. Lanx australis [the southern Scale-pan], or *Vaznegunubi*.
- *Zubeneschemali*, or *Vazneschemali*, Lanx borealis [the northern Scale-pan].

FINIS

[End of TABVLA 101 and end of the Tabulae novalmagesticae*. The closing rubric* FINIS is centered below the lexicon.]

ERRATA. In Prolegomenis. CORRIGE.

[Errata for the Prolegomena. Three columns of locators — Page, Column, Line — followed by the printed (wrong) reading and the corrected reading. Transcribed as a pipe-table preserving the structure.]

Pag.	Col.	Lin.	[Printed — wrong]	[CORRIGE — correct]
II	1	29	sphæricam	sphæram
II	2	11	sub firmamento	supra firmament um
IV	2	13	percurret	percurreret
IV	2	42	Spicæ	Spica
IV	2	45	Antrogradi	Antrogradi
V	2	47	Comas	Comes
VI	1	11	qui &	qui ea
VII	1	65	mediæ distantiæ	medias distantias
VIII	1	43	Videri	Viden
IX	2	45	retentosq;	retentaque
39	1	6	Labouera	Lalouera
69	1	50	Sideris	Siderei
70	2	70	melius	meliores
78	1	76	eius	eiusque

Parsing notes: The first block uses Roman page numerals (II–IX), the second block Arabic (39, 69, 70, 78). At IV/2/45 the "wrong" and "correct" forms both read *Antrogradi* as printed — likely a compositor slip in the errata itself (the intended correction is presumably from *Atrogradi* to *Antrogradi*, the left-column form reading *Atrogradi*); see anomaly (a). Both columns are headed identically; the left

under *ERRATA* gives the erroneous reading, the right under *CORRIGE* the correction.

ERRATA. *In Tabulis.* CORRIGE.

[*Errata for the Tables. A single Page-number column, then the printed (wrong) reading and the corrected reading. These are chiefly place-name and observatory-station corrections.*]

Pag.	[Printed — wrong]	[CORRIGE — correct]
9	Alba Iulia Transilvani	Alba Iulia Transilvaniae
10	Cluia <i>Clives</i>	Cluia <i>Cleuer</i>
10	Dauentria. <i>Deunter</i>	Dauentria. <i>Deunter</i>
10	Faentia. <i>Faenza</i> 0 1 56 ad. 44 33 15	44 23 15
10	Hildesemium Saxoniae. <i>Hildesem</i>	Hildesemium Saxoniae. <i>Hildesheim</i>
11	Iuliacum Giuliech. & <i>Ginliers</i>	Iuliacum <i>Giulicch</i> , & <i>Ginliers</i>
11	Lemouices. <i>Lemoges</i>	Lemouices. <i>Limoges</i>
11	Leouardia Frisiæ. <i>Leuuayden</i>	Leouardia Frisiæ. <i>Leuarden</i>
11	Lipsia Misniæ. <i>Lipsi</i> , & <i>Leipsig</i>	Lipsia Misniæ. <i>Lipsia</i> , & <i>Lipsig</i>
11	Maiorica <i>Mallorca</i>	Maiorica <i>Mallorca</i>
11	Matisco. <i>Mascon</i>	Matisco. <i>Mascon</i>
11	Mussipons, seu Mosæpons. <i>Portamuson</i>	Mussipons, seu Mosæpons. <i>Pontamuson</i>
11	Oenipontum 47 10 0	Oenipontum 47 15 0
11	Promontorium Sacrum.	Promontorium Sacrum.
11	Rhemiorum. <i>Rems</i>	Rhemiorum, <i>Rems</i>
11	Sabala Galliæ. <i>Sable</i>	Sabulæ Galliæ. <i>Sable</i>
12	Santonas. <i>Santogne</i>	Santones. <i>Santogne</i>

Pag.	[Printed — wrong]	[CORRIGE — correct]
13	Triuer. <i>Trier</i>	Treuri. <i>Trier</i>
13	Tuder. <i>Todin</i>	Tuder. <i>Todi</i>
13	Valentiane.	Valentinæ.

Parsing notes: Single Page column (Arabic). Many rows pair a Latinized place name with its vernacular form (italic). Page locator "12" applies to *Santonas*; "13" to *Triuer*, *Tuder*, *Valentiane* (page-number values inferred from their printed position in the column, which is partly faint at the gutter — see Readability). Several rows show identical "wrong"/"correct" entries (*Dauentria/Deuenter*, *Maiorica/Mallorca*, *Matisco/Mascon*, *Promontorium Sacrum*) where the correction is a subtle accent/letter change not fully resolvable at this resolution; transcribed as best read. The *Fauentia* and *Oenipontum* rows correct tabulated coordinate values: *Fauentia* latitude 44 33 15 → 44 23 15 (a minutes correction); *Oenipontum* 47 10 0 → 47 15 0.

These two leaves carry no printed text. They are binding matter at the very end of the volume, following the bibliographically complete work (FINIS and both errata blocks closed pp. 581–582 were blank endpapers).

** ** — [blank endpaper]. A blank rear flyleaf (laid paper, visible chain-lines). No printed text, manuscript annotation, library stamp, or shelfmark.

** ** — [back pastedown / inside back cover]. The inner face of the rear board, covered in mottled/marbled tan leather. No printed text, label, bookplate, or shelfmark visible.

No imprimatur, approbatio, colophon, signature register, booklist, or dedication tail appears on either leaf. The work is complete.