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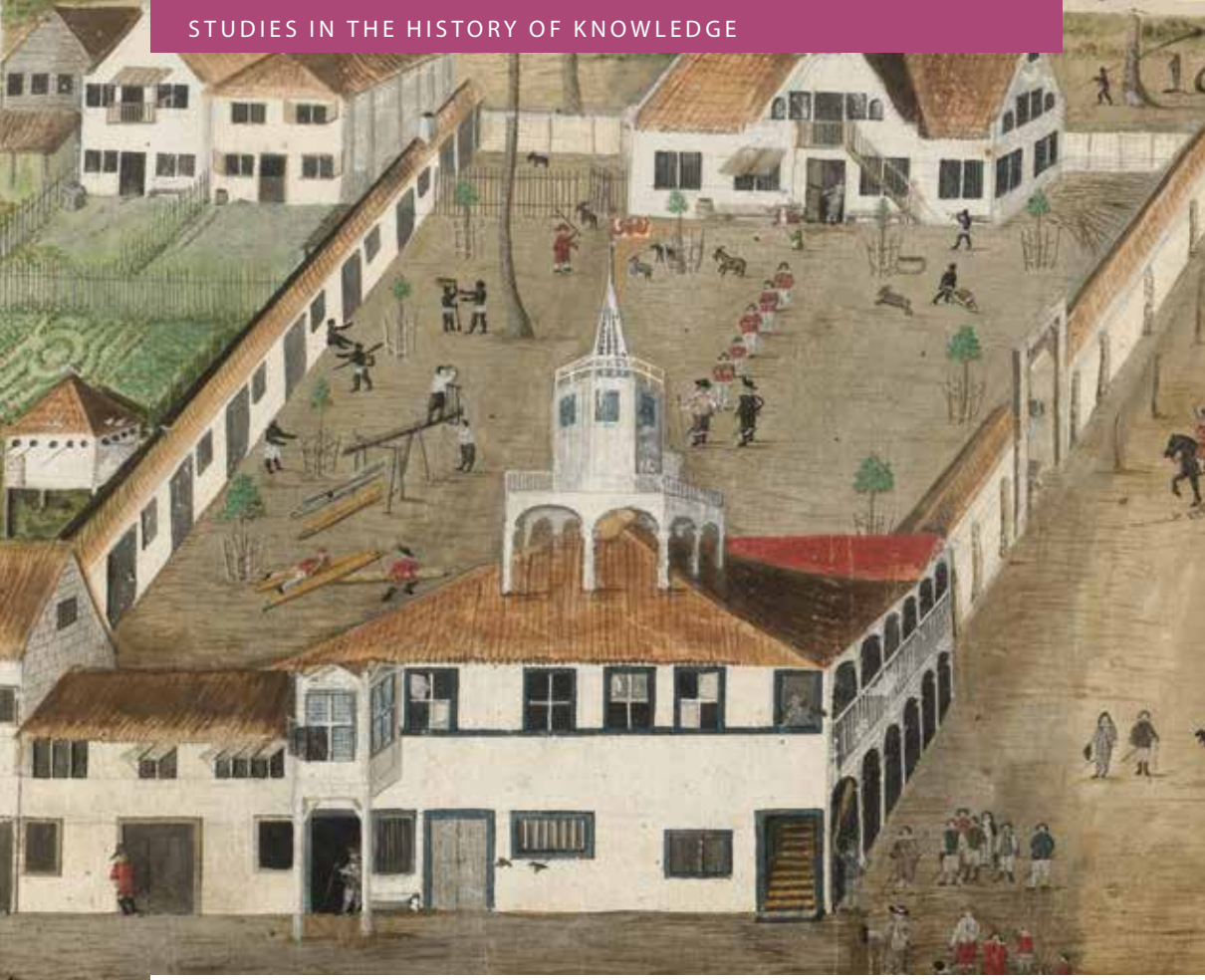

Huib J. Zuidervaart & Oscar T. Matsuura

Astronomer, Cartographer and Naturalist of the New World

The Life and Scholarly Achievements of Georg Marggrafe (1610-1643) in Colonial Dutch Brazil

Amsterdam University Press

VOLUME 2

Transcription and English Translation of His Astronomical Observations

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This book highlights the scientific achievements of the astronomer, cartographer and naturalist Georg Marggrafe (1601-1643).
It consists of two volumes:
Vol. 1. Discusses his biography and legacy. (ISBN 978 94 6372 218 6)
Vol. 2. Presents his previously unpublished astronomical observations, collected in colonial Dutch Brazil between 1638 and 1643. This volume contains the earliest known series of observations of the Southern Hemisphere, collected by scientific instruments made according to the European standards of the time.

Cover illustration: Former Portuguese house at Antonio Vaz. First residence of the Dutch governor-general Johan Maurits von Nassau-Siegen, depicted in 1639 by Zacharias Wagener. On top of the house stands the observatory constructed onbehalf of Georg Marggrafe. (Thierbuch, Ca 226, fol. 107. Kupferstich-Kabinett, Staatliche Kunstsammlungen Dresden, Photo: Herbert Boswank.

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PART V

PROGYMNASTICA ASTRONOMICA AMERICANA

(Title coined by Georg Marggrafe
for the intended publication of
his astronomical observations)

TRANSCRIPTION AND ENGLISH TRANSLATION OF MARGGRAFE'S ASTRONOMICAL OBSERVATIONS, MADE IN COLONIAL DUTCH BRAZIL IN THE YEARS 1638–1643

Introduction

Georg Marggrafe made important scholarly contributions to three scholarly fields: cartography, natural history and astronomy. However, his death, in 1643, prevented him from personally finalizing and publishing his results. That's why his written legacy was split into three parts at the time. Marggrafe's maps were given to the cartographic publisher Johannes Blaeu, who published these maps as four careful engravings in Caspar Barlaeus's *Rerum per octennium in Brasilia* (1647) and combined them into a large wall map the same year. About the two other fields, natural history and astronomy, Marggrafe's personal Maecenas, Johan Maurits von Nassau-Siegen, the former governor of Dutch Brazil, reported the following in one of his letters:

> [Marggrafe's] manuscripts and drawings concerning the natural history of Brasil, with the description and dimensions of this country have been given by us to Mr. de Laet, and the manuscripts relating to the astronomical observations, to Professor Gool, *in order that its content be studied at our cost, and compiled to be published* [our italics], as has partly been done.[1]

The WIC director Johannes de Laet indeed published Marggrafe's 'Historiae Rerum Naturalium Brasiliae' in 1648, as part of the elaborately illustrated folio edition *Historia Naturalis Brasiliae*. But 'Professor Gool', or Jacob Golius, never fulfilled the task imposed on him. That is to say, Golius never took the last step. Under his supervision an edited manuscript was compiled from the then available original observation books of Georg Marggrafe, a manuscript which was press-ready in the mid–1650s. This editing may have been done by Marggrafe's former roommate, the mathematician and astronomer Samuel Kechel ab Hollensteijn, who also constructed a *Planisphaerium* of the southern

1 Johan Maurits von Nassau-Siegen to the curators of Leiden University, 19 March 1655. University Library Leiden, ASF 290: "De Schriften ende teijckeningen, betreffende de natuijrlicke historie van Brasil, ende de beschrijvinge ende afmetinge der voors. Landen, sijn door ons gegeven aen den heere de Laet, Ende de Schriften, aengaende de Astronomische Observatien, aen den heere Professor Gool, ten eijnde deselve saecken op onse Costen ondersoecht, ende bij een gebracht, mochten in 't licht gegeven worden, soo als ten deele is geschied".

stars, based on Marggrafe's observations. In 1655 it was said that Kechel would be compensated by publisher Elsevier for his services.[2]

However, a publication was not realized, firstly due to Golius's remarkable intention to present the Brazilian observations in one volume together with 'other astronomical observations transmitted to him from Arabia'.[3] But the fierce quarrel that erupted in 1656 between Golius and Marggrafe's younger brother Christian over Georg's legacy certainly will not have contributed to Golius' zeal either. When in 1668, a year after Golius's death, this astronomical text from Persia finally saw the light, no one knew that originally Marggrafe's observations would be included. From Golius's estate, the press-ready manuscript came into the possession of Melchisédech Thévenot and surfaced again in Paris, at the auction of his library in 1694. The further history of this manuscript and its two copies, made at the request of the astronomer Joseph-Nicolas de L'isle, is elaborately outlined in our Volume 1, Chapter 6.

In this Volume 2, we present a transcription (with an English translation) of the best-preserved De l'Isle copy, made from the original – now lost – press-ready manuscript from Leiden. With this, the third part of Marggrafe's scholarly legacy finally will be available for other scholars, just as his Maecenas, Johan Maurits von Nassau-Siegen, had intended.

The Paris manuscript: a note about the transcription

The following concerns the text of the early eighteenth-century manuscript B 4–5 in the archives of the *Observatoire de Paris,* entitled 'Observations faites au Brésil'. This manuscript, which is bound in contemporary green coloured vellum, contains a set of 114 handwritten small folio pages. The document has been marked with three different ink stamps, bearing the texts 'Observatoire de Paris'; 'Depot des Cartes et Journaux de la Marine', and 'Observatoire Imperial'. In the inside of the book can be read: 'No 76 Dix neuf pieces cottées'.

The transcription of this manuscript is made by Oscar Matsuura, according to the principle that its content is leading. Therefore, no diplomatic method of transcription was followed (maintaining the original format, punctuation, spelling etc.), but rather the so-called critical-normal or judicial method. This means that the transcript is made as accurately as possible, maintaining its abbreviations and astronomical symbols, but with

2 Willem Piso to Jacob Gool, 12 May 1655. University Library Leiden, ASF 290: "De observatien van Markgraef sijn mijn behandigt, alsmede UEd. aengename schrijvens. welke ik Elsevier comunicerende, tot antwoort bequam, dat ik uit sijn neam wilde UE notificeren dat hij UE brief mede ontvangen hadde, en sich in alle billikheit soude laten vinden tot beloning van de moeite van doctor Kechel: niet alleen vant geen [hij] geschreven heeft, maar ook van 't afteijkenen vant Planispherium …".

3 Christian Marggrafe to Johannes Hevelius, 20 July 1652: 'Fratris mei Georgij observationes Astronomicas iam demu[m] vidi. Sunt Theoriae novae Planetarum, praecipue Mercurij, qui eo in loco, quo vixit, melius quam apud nos conspici potuit. Edentur brevi a clariss. Golio una cum alijs observationibus Astronomicus ex Arabia transmissis'. Observatoire de Paris, Hevelius correspondence.

a capitalization of names (of places and persons). Sound values are also corrected: 'U' as in 'uocant' is replaced by 'V" in 'vocant', etc.; Roman numerals in the text are translated into Arabic. In running text, the sentences are also displayed consecutively. However, the pagination of the manuscript has been maintained. The number between square brackets refers to the page number of the manuscript.

In Leiden, the archive *Erfgoed Leiden en Omstreken* (*ELO*) still preserves some of Marggrafe's original notes concerning his astronomical observations in Brazil.[4] These authentic manuscripts were evidently used to compile the edited, but lost, press-ready Leiden manuscript, of which the Paris manuscript is a neat copy. Especially important is a notebook in Marggrafe's own hand (ELO, North no. 53), containing his Brazilian observations from 15 September 1639 (when Marggrafe started to observe from the newly built observatory) until 19 June 1640. Marggrafe used this notebook to collect his draft notes of the observations. Two examples of such draft notes, hastily written down in pencil, have survived, which confirms that Marggrafe followed this procedure.[5] The last entry in this small notebook is written halfway down a page, while the Paris manuscript continues at that date without interruption, presenting the observations made on the following day.

The Paris manuscript is the most elaborate of all surviving observation registers. A second – but unfortunately incomplete – copy in the same hand is preserved in the *Biblioteca Nacional de Portugal* in Lisbon (*fig. 1*).[6] A comparison between the Paris and Lisbon manuscripts shows how carefully the Paris scribe has worked. Apart from the page format and page numbering, there is no textual difference between these two manuscripts. This means that we can be reasonably sure that the Paris manuscript is an almost verbatim copy of the lost 'original' press-ready Leiden manuscript, which evidently was compiled from material now mostly lost. Therefore, we have chosen to use the Paris copy of Marggrafe's observations as the basis for this text edition. However, all observations in the Paris manuscript were checked against data and text in the still available Leiden notebook and other Leiden draft sheets of paper, as well as the seventeenth-century extract compiled by Ismael Boulliau.[7] Whenever corrections or additions are made in the transcription, for example when an obvious copying error was made, this is stated in the footnotes.

Not included in this text edition are several loose drawings of the Recife observatory, its instruments and various calculations from Brazil, preserved in the Leiden archive. These are discussed in Volume 1, Chapters 8 and 9. Leiden documents relating to Marggrafe's

4 Marggrafe's digitized autographs in the Leiden archive were acquired by Oscar Matsuura on CD-Rom in 2006. Today the collection can be consulted via the website of the library of Erfgoed Leiden (ELO): https://www.erfgoedleiden.nl/collecties/bibliotheek, shelfmark LB 7000–1.

5 ELO, North no. 54 (draft observations of 24 December 1639) and North no. 59 (draft observations of 18– 21 December 1639).

6 Biblioteca Nacional de Portugal, Mss 6, n. 37. This Lisbon manuscript contains two library stamps. One that has been used since 1796 by the *Real Biblioteca Pública* (Royal Public Library), which was based on the collections of the *Biblioteca da Real Mesa Censória* (Royal Board of Censorship). This stamp was replaced in 1836, when the name was changed into *Biblioteca National*. A second stamp was applied after 1922. See for the ink stamps: *Do terreiro do Paço ao Campo Grande. 200 Anos da Biblioteca Nacional* (Liboa: BN, 1997), 164.

7 OdP, manuscript B12–13.

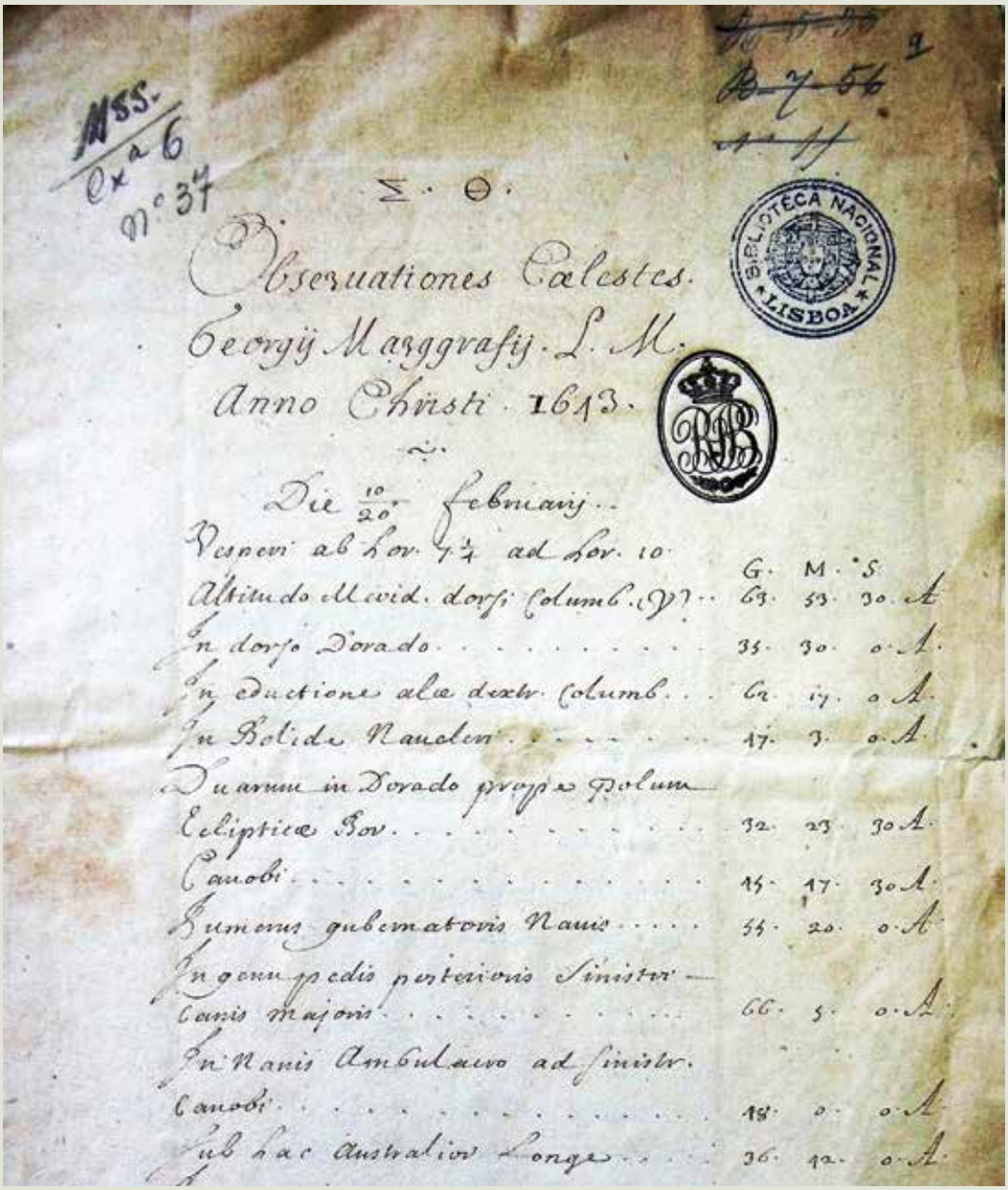


FIG. 1 Top page of the manuscript *Observationes Coelestes Georgij Marggrafij L.M.* of the year 1643, preserved in the Biblioteca Nacional de Portugal (Lisbon) with two library stamps, one introduced in 1796 by the Real Biblioteca Pública (Royal Public Library), the other after 1836, when the name was changed into Biblioteca National. (Photo by the authors).

astronomical observations in Brazil are the following, put in chronological order (first column the date, last column the numbers put in pencil on the documents by John D. North in 1979):

25 and 26 December 1638	North no. 41
15 to 21 September 1639	North no. 53, fol. 2r
18 September 1639	North no. 26vs
21 to 23 September 1639	North no. 53, fol. 2vs–3r
24 September to 14 October 1639	North no. 53, fol. 3vs–4r
28 September 1639	North no. 37
28 September 1639	North no. 51
15 October to 17 December 1639	North no. 53, fol. 4vs–5r
17 to 20 December 1639	North no. 53, fol. 5vs–6r
18 to 21 December 1639	North no. 59vs
19 December 1639	North no. 59r
20 to 24 December 1639	North no. 53, fol. 6vs–7r
18 and 21 December 1639	North no. 54, fol. 1vs–2r
24 December 1639	North no. 54, fol. 1r
24 December 1639	North no. 54, fol. 2vs–3r
24 December 1639 to 19 January 1640	North no. 53, fol. 7vs–8r
28 June 1640	North no. 32, 79
25 September to 4 October 1640	North no. 37
12 November 1640	North no. 6
7 to 15 October 1642	North no. 61
20 November 1642	North no. 49, fol. 1–2r
22 November 1642	North no. 49, fol. 2vs

A note about the English translation

The English translation (by both authors) aims at a correct understanding of the text, sometimes deviating from a translation that is too literal. Occasionally, it was typographically necessary to interrupt a line when it actually continues. In that case, this is indicated at the end of such a line with three dots (…), which also appear at the beginning of the next line. Abbreviated portions of text in the manuscript have been completed in the translation between square brackets [ ].

The identification of the observed celestial bodies has been performed by the astronomer Oscar Matsuura. In this task (completed in 2004), he was assisted by Andre Luiz da Silva, while he was an intern at the Planetário do Ibirapuera with a scientific initiation grant sponsored by the company Omnislux. Of great help in identifying the stars observed was the *SkyMap Pro 11 Software for Astronomers*, which gave the possibility of reproducing

and checking all astronomical observations.[8] Most observations were made at Marggrafe's observatory, for which current location we used the geographical coordinates 8° 3' 51" South and 34° 52' 37" West, applying as additional parameters an altitude of 10 meters and an average temperature of 25° C.

Marggrafe called several bright stars with names by which they are still known today. These are Arcturus (α Bootis), Fomahant Aquarii (Fomalhaut or α Piscis Austrini), El Karnar (Achernar or α Eridani), Canobus (Canopus or α Carinae), Capella (α Aurigae), Sirius (α Canis Majoris), Rigel Orionis (β Orionis), Spica Virginis (α Virginis), Procyon (α Canis Minoris) and Aldebaran (α Tauri). But other stars – constituting the majority – had to be identified by the personal description provided by Marggrafe, since the current designations did not exist in his time. To complicate matters further, the same star was often described in different ways. For example, the star we know today as η_2 Hydri is called by Marggrafe σ of the Water Snake, or '*the first star of the quintet*' of that asterism.[9] He used a sequential position, the beginning and end of which is often not clear, because it is not known which stars he has – or has not – included.

For identifying the stars, it was therefore crucial to follow the chronological sequence of the meridian passages, despite the relatively frequent occurrence of reversing the order of adjacent meridian transits. The identifications made in this way were those that seemed most plausible. They are all listed in the footnotes of the translation, together with the date of earliest sighting. Stars mentioned on the same page of the translated manuscript are not repeated in those notes.

Astronomical and other symbols used by Marggrafe in his manuscripts

measurements

①	Rhineland *voet* (foot) = 0.314 m.
②	Rhineland *duim* (thumb or inch) = $^1/_{12}$ foot = 2.62 cm.
lb	*Libra* (pound).
G	*Gradus* (degree, °).
M	Minute (') = $^1/_{60}$ degree.
S	Second (") = $^1/_{60}$ minute.
∂	Occasionally used symbol for degree (°).

8 Chris Marriott, *SkyMap Pro 11 Software for Astronomers*. Provided by the Thompson Partnership, Devon, England.

9 In current astronomy the Greek letter σ is no longer in use.

THE SOLAR SYSTEM

☉	The Sun
☾	The Moon (rising)
☽	The Moon (waning)
☿	Mercury
♀	Venus
♁	Earth
♂	Mars
♃	Jupiter
♄	Saturn

THE CONSTELLATIONS

Zodiac symbols are sometimes used to represent points on the ecliptic, with each symbol representing the "first point" of each sign. So Aries is the spring equinox, Cancer ♋ is the summer solstice, etc.

	In Latin	*In English*	
♈	Aries	Ram	
♉	Taurus	Bull	[*not used by M.*]
♊	Gemini	Twins	
♋	Cancer	Crab	
♌	Leo	Lion	
♍	Virgo	Maiden	
♎	Libra	Scales	[*not used by M.*]
♏	Scorpio	Scorpion	
♐	Sagittarius	Archer	
♑	Capricorn	Sea Goat	
♒	Aquarius	Water Carrier	
♓	Pisces	Fishes	[*not used by M.*]

Letters of the Greek alphabet were used to represent successive stars in a constellation.

OTHER

△	Upward triangle.
≙	Upward isosceles triangle.
∇	Downward triangle.
χ	Versus (towards).
o	Perpendicular to …
☌	Conjunction

TRANSCRIPTION

The Latin text of Marggrafe's astronomical observations in Dutch Brazil.

[1]

Observatorij nostri astronomici et instrumentorum quae fabre fieri curavi munificentia Illustri. et Excellentissimi herois I. Mauritij Comitis Nassovij Brevis Descriptio. In nova civitate Mauritia in Insula Antonij Vaaz quae est in Brasilia Americae Australis regione.[1]

Super aedibus Illustrissimi herois Mauritij Nassovij Gubernatoris Brasiliae etc., theatrum extrui curavimus figurae quadratae cujus quod libet latus est pedum Rhenolandicorum viginti. Patet ex eo prospectus in mare et terram circumjacentem amplissimus. Ex aedibus autem interius per gradus 43 commodissimus est ascensus in theatrum. In medio theatri extruximus domum sexangularem, et sex laterum, quod libet latus 6 ped.

[2]

Rhenolandicorum latum. Domus altitudo est 13 pedum, ejus tabulatum inferius (ubi instrumenta posita sunt) distat a tabulato theatri in altitudine quinque pedibus, ita ut subter id camera clausa et obscura sit per speculationibus et praxi optica. Camera a[2] superior domus, ubi observationes astronomicae maximam partem peraguntur altitudinem habet octo pedes Rhenolandicorum in uno a latere versus quarum per januam ingressus patet ascendendo 10 gradus. In reliquis quinque lateribus sunt quinque fenestrae vitreae amplae, et super his 5 fenestrae vitreis, ut et super janua, latera camerae superius ad $1\frac{1}{3}$ ①[3] altitudem[4] possunt pandi; superius hac camera alio tabulato tegitur sexangulari, quod circum circa per sex januas triangulares versus meridiem et septentrionem quidem 4 ① longas, in reliquis plagis 2½ ① longas, et tam amplas ut est quod libet latus et area domus aperiri potest, et januae quidem sex superiores aperiuntur sursum elevando, sex inferiores seu laterales deorsum

---

1 With ink stamps: 'Observatoire de Paris'; 'Depot des cartes et journaux de la marine' and 'Observatoire Imperial'. At the foot of the page, left: '76 78, A.'

2 A superfluous word.

3 The symbol ① used in the Paris manuscript stands for the unit of length, the Rhineland *foot*.

4 It should be *altitudinem*.

[3]

remittendo, ut ita amplissimus pateat prospectus in omnem plagam, omnes que altitudines non verticales et verticales instrumentis capi possint. Super domo adhuc 4 ① altum ambulacrum est, cujus sustentacula levia facillimum tolli possunt; medio autem illius pyramidalis structura lignea est, cui vexillum ex cupro decoratum, quod insignia comitum Nassoviae continet impositum est. Interius autem in camera superiori in medio erectus est ad trabem quadratam firmam (cujus trabis quodlibet latus 6½ ②[5] est que longum 6 ① ped. 9 ② circum agitur in trabe substrata 10 ② longa, superius in trabe tabulati 5 ② crassa) quadrans ex ligno firmissimo, quod *Pao Sancto* Lusitani vocant, fabricatus cujus altitudo est 5 pedum Rhenolandicorum, est que ad fabres in scrupula prima[6] et 30" divisus, ut ita levi negotio ¼ unius minuti eo observari poterit, habetque pinnacidia Thyconica[7] cum cylindro. Cylinder autem longus est (inquantum

[4]

prominet) 4¾ ② ferelatus seu crassus, seu in diametro 2½ ②. Regula seu lineale longitudinem habet instrumenti et latitudinem 3¾ ②.

Dioptra duas rimas parallelas sibi ipsis et cylindri extremitatibus lateribus parallelas habet, distantes invicem 2½ ②, longas 3 ②. His rimis parallelis ad angulos rectos interius sunt rimae perpendiculares factae breves pro diametro solis exactius capiendo in altitudine ☉. Tota autem dioptra 4 & ¾ ② longa, et totalata 3¾ ②. Quadrantem hunc ambit circulus azimuthalis 10 pedes Rhenolandicos in diametro habens; est que quadrantis columna ejus centrum, ex qua gnomon tendit in ambitum circuli, ut monstret quod gradus et minuta azimuthi observatio det. Circulus autem azimuthalis in singula minuta prima divisus est ut 30 scrupula secunda[8] in eo etiam notari poterint.

Incumbit autem circulus azimuthalis 12 columnis in altit. 1½ ① a tabulato camera. Quadrantis autem inferior extremitas a contignatione camerae elevata est 2½ ①.

[5]

Superior a summitate camerae distat ½ ① potestque quadrans trabi quadratae ad fixus per quadrata duo ferramenta commodissime circum agi.

Curavi etiam perficere sextantem itidem (ut quadrans) 5 ① Rhenolandii altum, atque eodem modo divisum aeq. regula, pinnacidijs et cylindro instructum pro distantijs mensurandis, qui in peculiari camerae adservatur sub gradibus ubi in majorem cameram adscensus est; huic inferiori latere 4 ferramenta minimum digitum crassa per cochleas inserta sunt, versus partem acuminatam seu centralem duo quaelibet 4 ① longa, versus rotundam itidem duo, quaelibet 3 ① longa; ut ita sextans firmari possit super basi sua. Nam in trabis basi in lateribus, multae foramina sunt, quibus per claves ferramenta applicantur,

---

5 The symbol ② used in the Paris manuscript stands for *digitus* (in Dutch *duim* or in English *inch*), which stands for 1/12 of a *foot*, measuring 2,62 cm.

6 *Scrupulum primum* = minute (').

7 It should be *pinacidium tychonicum*. This is an ingenious sighting tube conceived by Tycho Brahe. See vol. 1, fig. 92a.

8 *Scrupulum secundum*: second (").

ibique firmantur. Haec ferramenta altera extremitate regulis ferreis firmantur, quia eorum usus non est necessarius.

Alium paruum sextantem etiam habeo,

[6]

cujus altitudo 2[9] ② seu 1 ① & 8 ② Rhenolandicorum atque in singula bina scrupula divisum, cylindro et etiam pinnacidijs cum rimulis et dioptris exornatum ad observationes geodaeticas peragendas et in itinere etiam ad astronomicam itidem usurpandum.

Habeo et globos coelestes et terrestres quatuor diversae magnitudinis cum Uranometria Bayeri qui semper in observatorio usui sunt.

Teneo arenaria duo clepsidrae vice fungentes, tubum[10] praeterea habeo insignem 7 ① Rhenolandicos longum.

Libellam etiam construxi ex metallo quae pendet 2 lb[11] 9 ¾ unc.[12] (seu 41 ¾ unc) et tornata est, figurae cylindraceae, quae adpensa est chordae 29 ② Rhenoland. longae seu 2 ① 5 ②, ut sit mensurae temporis, et γνοχθημερω[13] observando.

In inferiori obscura camera, quae intra per rotunda foramina etiam luce illustrari potest, basis est facta protubo imponendo ad observationes deliquiorum solis, macularum solis, et aliarum rerum. Basis illa constat primo ligno

[7]

4½ ① alto, 4 ② lato & 1½ ② crasso quod erectum statui potest; nam inferiore transversale lignum habet, cui incumbit, hac transversim (per crucem) multae foramina habet, et in medio cavitatem ubi inseritur regula 9 ① longa, quae hinc inde agi potest, et altior ac humilior statui. Regula 3 ② lata, 1 ② plus crassa et supra hanc orbis, cujus diameter 1 ① inseritur, qui et circum agi et demitti ac abtolli potest.

In regula interstitio 1½, 3, 3 & 1½ ① perpendicularia corpora erecta sunt 8 ② alta, quibus tubus imponitur et superius clauduntur. Altera extremitas regulae foramini seu fenestrae incumbit. Extra domum in theatro stant aliquae bases pro impendendis instrumentis tempore observationum. Una quidem ex solida trabe, et inferius cruciformis pede gravi 5 ① alta, cui globus pedalis impositus est, qui in sua matrice circum agi potest; habet que globus eminentiam quadratam 2 ② latam & 2 ½ altam cui imponitur major sextans pro distantijs syderum[14] di-

[8]

metiendis.

Alia basis ligno perpendiculari 2 ① alto, cui superius incumbit lignum excavatum 5 ① longum, quod per cochleam movetur. Super perpendiculari et per semicirculum

---

9 This is obviously an error of the copyist. It should be 20 instead of 2.

10 *Tubus astronomicus* = telescope.

11 'lb', fully spelled out as *libra* (pound).

12 Uncia = ounce (unit of weight equal to 1/12 pound). The Amsterdam pound was 494,09 grams and corresponded to 16 ounces. So an ounce would be 30.9 grams.

13 It could be νυχθημερον, which means a full period of a day including the day and the night.

14 It should be *siderum*.

transeuntes utrimque firmaturi, cui imponitur tubus opticus qui 7 ① longitudinem habet, ut fixae et planetae exactius rimari et collustrari, ac congressus Lunae cum fixis aut planetis exacte adnotari possint. Tota haec basis qua utor, imponitur cancellis theatri, nam inferius rotundam aciem habet quae foramini immititur et circum agi pro libitu potest.

Alia basis est 2½ ① alta, perpendiculari trabecula quam etiam imponi priori modo potest cancellis theatri, et sextans minor ei adpendi pro altit. eo sumendis.

In quolibet angulo theatri exterius sciatericum[15] delineavi, ut ita diversi mode semper tempus ex umbra ☉ possit adnotari.

Intra tectum domus autem S. Excittae.[16]

[9]

.....[17] Infra theatrum horologium magnum ferreum est, quod campanae pulsu omnibus incolis nostrae civitatis tempus indicat.

Habeo etiam pro basi sextantis minoris, quando peregro, habeo malleum more Polonico figuratum, ex solido ferro, novem fere ② longum, postica et superiori parte cum eminentia quadrata 1 ② longa, alta, et crassa ut sextans horizontaliter imponi possit, pro distantijs mensurandis, et perpendiculariter adpendi, ad altitudines capiendas. Hic malleus baculo applicatus est 4 ½ ① longo, ex solido ligno, quod *Pao Santo* vocant et inferius longam aciem habet, ut firmiter terrae inseri possit.

Dein libellam triangularem (vulgo *Waeterpass*) normam rectangulam, regulas tres ex ligno solido factas habeo ad directionem instrumentorum necessarias. Tabulam item ex lapide fissili, lucernas duas, scamnum triplex seu tres gradus habens ad

[10]

quadrantem adscendendum, aliud scamnum sub quadrante magno verticalibus altitudinibus sumendis necessarium aliaq.

Observationes aliquot sine instrumentis habitae a me in insula Antonij Vaaz in Brasilia anteq[18] instrumenta perfecta fuerunt et observatorium extructum.

A.C.[19] 1638 die $\frac{9}{19}$ Septemb.[20] vesperi hora 6 ½ distabat ☿ a Spica ♍ advisum tantum quantum tunc distabat ♂ a sinistro hum.[21] ♐ (secundum Bayer, σ) erat autem ☿ occidentalior et borealior Spica ♍.

15 It should be *sciotherum*.

16 A misread for *Excellentiam*. See North, 'Markgraf' (1979), 407, note 63.

17 It seems that the 18th century French copyist could not read the original manuscript here and has therefore left a blank space.

18 *Antequam*.

19 *Anno Christi*.

20 Expressing the date in the Old Style (Julian calendar) above and in the New Style (Gregorian calendar) below.

21 *Humero*.

Sequenti die $\frac{10}{20}$ Sept. vesperi h. 6½ circiter ☿ adhuc occidentalior et borealior Spica ♍ distare videbatur ab ea in distantia quae est inter cor ♍[22] et antecedentem id ad ortum quae apud

[11]

Bayerum est τ ([23] distat cord. ♏ et anteced. 2 σ ad Austrum est ex calculo 29 distantiam a ☿ et Spica ex calculo invenio ad hanc horam 1° 10' dubito fixae uniq. loco exacto.

Sequenti die $\frac{11}{22}$ [24] Sept. vesperi h. 6 ½ circiter Mercurius transiverat Spicam Virginis et distare videbatur ab ea tantum quantum heri, et orientalior in tantum in quantum heri occidentalior.

A.C. 1639 die $\frac{8}{18}$ Maij vesperi ♂ ♀ et ☿ faciebant △ isoscelum[25] ad sursum, cujus basis erant ♂ et ☿. ☿ occidebat et paulo post ♀ & 1' temp. post ♀ occasum oriebatur ☾ (fere plena) supremo suo margine. ♃ hac vespera umbras faciebat, et radiabat in fluvio Rio Bibiribi vocato, ipsa stans in orientali coeli plaga ♀ et umbras circumscribebat corporibus et radijs ejus videbatur in fluvio vulgo Rio Capibarini[26] vocato.

Altero die post d. $\frac{10}{20}$ Maij vesperi ♃ et ♀ umbras circumscribebant corporibus. Die sequenti nimirum die

[12]

$\frac{11}{21}$ Maij vesperi h. 7 ♀ erat orientalior et borealior ♂ ac et in distantia dimidia duarum australium in ense Orionis seu distantia aequali aut minimum majori mediae caudae Ursae Majoris et aequitis super incidentis. ♃ et ♀ umbras circumscribebant corporibus absente Luna.

Maculae nigrae instar deficientis Lunae in via lactea non dantur in caelo austrino ubi falso scribit Joseph a Costa L. 1. hist. Ind. c. 2. sed dantur paulis quaedam quae instar reliqui coeli nigriore videntur, quia carent luce illa et stellulis quibus Galaxia reliqua abundat. Sunt autem tria vel quatuor praecipua talia spatia minus luminosa.

Nubeculae Magellani carent stellis advisum, constant eadem materia quam Via Lactea.

~. ~.~.~.~.~.~.~. ~.~.~

[13]

Observatio Eclipsis Lunae totalis quam habui die $\frac{10}{20}$ decembris Vesperi Anno 1638 in Insula Antonij-Vaaz Brasiliae ejusque Civitate Mauritia**.**

Vespera dicti diej et anni initium sumebat Eclipsis lunae, quamvis autem observatorium et instrumenta nondum perfecta erant, ut privato observationem instituere potuissem (finem enim structurae domum imposuimus mense septembris anni sequentis 1639) tamen quadrante pedali erecto phasum tempora diligenter adnotavi. Quando igitur luna

22 The symbol in the Paris manuscript is of Virgo, but should be Scorpion (♏), so the star should be Antares.

23 This parenthesis was not closed in the manuscript.

24 It should be $\frac{11}{21}$.

25 It should be *isoscelem.*

26 ‘Rio Capibarini’ is a later addition; the original word has been scratched out and replaced.

in limbo orientali deficere incipiebat, erat altitudo procyonis in orientali plaga 33° 30'
quum medietas ☾ advisum observata videbatur procyon altit. Or. 42° 20'.

[14]

In principio totalis observationis altit. Procyon Orient. erat 50° 10'.

NB. quae [ ] his inclusi non perexactis vendito quam lubricus sit ea observandi modus at praecipuis phasis diligenter sunt observatae.

In fine totalis observationis altit. cord. ♌ in Ortu erat 33° 30'.
Quum disci[27] lumen recuperasset ☽ alt. Cordis ♌ erat 37° 30'.
Quum dimidiata apparebat ☽ altit. Cord. ♌ erat 41° 30'.
In fine omnimode Eclipsis Alt. cord. ♌ erat 48° 00'.
Erat coelum tempore Eclips. serenissimum.[28]

De colore ☾ Eclipsatae notandum ☾ usque dum in umbram totalem immergeretur ab initio nimirum Eclipsis omnimode ad initium totalis observationis talem colorem habebat qualem solet recens ρ nova[29] hic habere.

Postquam autem tota in umbra terrae esset immersa versus Ortum crassior erat umbra reliqua parte clarior in communi autem totae

[15]

☾ rubebat, et quia prunae colorem habebat. Circa medium Eclipsis in medio disci umbra erat spissior circa limbum autem circum circa rubebat magis, dilucior[30] que apparebat postquam itaque tenderet versus principium emersionis discipans[31] versus occasum crassior erat quam quae vergebat versus Ortum et flava claritas pendebat[32] verum lumen, donec ipsum eximia claritate itqu[33] incipiebat recipere et ab eo tempore usque ad finem omnimode Eclipsis pars obscurata, habebat eundem colorem quem habuerat ab initio ad totalem obtenebrationem usque. Nunquam luminis pars bifidum faciebat lunam seu secundum lineam rectam secabat, sed semper corniculata fuit obscura, et ultimo obtusa.

Die $\frac{15}{25}$ Junij eodem anno 1638 calculus Eclipsis ☾ totalem hic in Brasilia conspiciendum indicabat. At pluebat tota nocte cum vento valido et semel tantum lunam emicantem ex nubibus videbam ad $\frac{1}{3}$ circiter adhuc obscuratam

[16]

erat autem eo tempore quo calculus indicabat illam emersuram paulatim ex umbra terrae nimirum in initium emersionis et finem omnimodae Eclipsis.

---

27 'disci' written in other ink.

28 A description of the eclipse with the recorded times is present in the Leiden manuscripts (*ELO*, North no. 11r), as well as some calculations in North no. 10r, 10vs and 11vs).

29 'ρ *nova*' written in other ink. A symbol like this in the original manuscript might mean lunar phase.

30 It should be *dilutior*.

31 It should be *dissipans*.

32 'P endebat' written in different ink.

33 It may be *itaque*.

~. ~.~.~.~.~.~.~. ~.~.~

Observationes Astronomicae Georgij Margraphij
Anno C.[34] MDCXXXIX

		G.	M.	S.[35]	
Die $\frac{5}{15}$ Septemb. h. 6 $\frac{3}{4}$ p.m.					
In altitudine Arcturi occident. 2 /[36]					
temp. post		18°	59'	00"	South[123]
Altitudo ☿ occident.		10°	49'	30"	
Azimuth ejus ab occid. aequinoct.	versus merid.	07°	30'	00"	
H. 7 Urb.[37]					
Altitudo Arcturi Occid.		17°	19'	2	/temp.
post.					
Altitudo ☿ Occid.		08°	49'	00"	
Azimuth ejus ab occas. χ[38] Merid.		08°	09'	00"	
Iterum					
In altitud. Spica ♍ occident.		07°	22'	30"	
et 1 / tempore post					
Altitudo ☿ Occid.		06°	29'	45"	
Azimuth		08°	20'	00"	

[17]

Stabat ☿ et Spica ♍ in eodem verticali, Spica ♍ superior et ☿ inferior.

	G.°	M.'	S."	
Die $\frac{6}{16}$ Septemb.				
Altitudo ☉ Merid.	79	09		in Sept.
Vesperi h. 6 $\frac{1}{2}$ [39] alt. merid. sup. alae Cygni	37	31	45	in Sept.
h. 6 $\frac{3}{4}$ alt. Arcturi occid.	19	46	00	
1 $\frac{1}{2}$ / temp. post ☿ altitudo	12	44	30	
Azimuth ab occas. ♃[40] Austrum	08	20	00	

☿ erat australior et orientalior Spica in eadem distantia circiter qua heri.

Die $\frac{7}{17}$ Septemb.

34 *Anno Christi.* Beginning of the Leiden manuscript (*ELO*, North no. 53).

35 *G. M. S.*: degree, minute and second of arc.

36 /: minute of time.

37 Urb.: *Urbica.*

38 χ is the symbol for *versus.*

39 The words *Vesperi h. 6* $\frac{1}{2}$ does not appear in the Leiden manuscript (*ELO*, North no. 53, fol. 2r).

40 In the manuscript ♃ is the symbol that stands for Jupiter, but it should be χ, the symbol for *versus.* (see 15 September 1639).

Altitudo ☉ Merid.	79	37	30	in Sept.[41]
[42]				
Die 18 Septemb.				
Altitudo ☉ Merid. in Septentr.	79	55	15	
Vesperi[43] Altit. Mer. Lucid. Lyrae in Septentr.	43	20	30	
H. 6 $\frac{3}{4}$ altit. Arcturi Occid.	16	20	30	
2 / temp. post ☿ altitudo	10	59	00	
Azimuth Occid. ad Aus	09	36	00	
⌈Altit. Mer. Cauda Vult.	68	20	00	B[44]
| Mediae 3 in ala Cygni	30	49	30	B
⌊				
| Suprem. alae Cygni	37	31	30	B
⌊ Lucida Vulturis	73	41	30	B
Die 19 Septemb.				
Altitudo ☉ Merid.	80	20	00	B

[18]

Vesperi ob nubes cucurrentes[45] ☿ observare non potui.				
Altitudo Merid. Lucidae Lyrae	43	20	45	
⌈Caudae Vulturis	68	20	0'	⌉
| Med. 3 in Alae Cygni	30	45	30'	|
| Sup. Alae Cygni	37	31	30'	⌋B
| Pectoris Cygni	42	43	30'	|
⌊ Cauda Cygni	37	46	30'	⌋
Die 20 Septemb.				
Altit. ☉ Merid.	80	43	20	B
Vesperi ob nubes currentes ☿ observare non potui. Eodem Vesp. ab h. 9 ad 15				
Altit. Mer. capitis gruis (γ)	59	7	30	A[46]
Alae dextrae sin Bayer gruis (η)	49	29	30	A
Die 20 Septemb.[47]				
Altitudo Merid. Extrem. Rostri Toucan (α)	36	13	20	A
In Eductione Caud. gruis (θ)	49	33	0	A
In Cauda gruis 3 Borialior (χ)	45	3	0	A
Fomahant ♒	66	38	0	A

41 *79º 32' 30"* in the Leiden manuscript (*ELO*, North no. 53, fol. 2r). According to calculation, this value is closer to the correct one, so it is adopted in the translation..

42 At this place the Leiden manuscript has *Vesperi impeditus*.

43 'Vesperi' written with a different hand in the left margin.

44 B for *Boreal*.

45 It shoud be *currentes*.

46 A stands for *Austral*.

47 Unnecessary repetition of the date.

In hydro quae in coluro Aequi (ι)	18	55	30	A
(1' temp. post Culm. lucid. colli phoen.)				
Austr. Caud. Ceti	78	14	0	A
El Karnar	39	12	0	A
Caput hydri (α)	34	58	0	A
Die 21 Septemb.				
Altitudo ⊙ Merid.	81	7	45	B

[19]

Vesperi h. 6 $\frac{3}{4}$ horolog.	G.	M.	S.	
In Occid. altit. Arcturi	16	45	0	
Pulsib. libellae 140 post altit. ☿	14	13	0	
Azimuth ab occasu χ merid.	10	40	0	
Mox item altit. ☿	13	5	0	
Azimuth	11	10	0	
& 140 puls. post altit. Arcturi occid.	14	46	30	
Item in altit. Merid. Caudae Vult. erat				
Altitudo ☿ Occid.	11	34	30	
Azimuth ab occas. ad Austrum	15	31	0[48]	
Altitud. M. M. fixarum quas hac nocte accepi secundum ordinem prout Meridianum ingreditur[49],				
Altit. Merid.				
θ in Pavone	24	30	0	⎫
η in Pavone	31	16	30	⎪
α in Pavone	40	30	0	⎪
ς in Pavone	30	51	40	⎪
κ in Indo	38	32	40	⎪
κ (μ *ML*) Hydri	19	20	0	⎪
ε in Pavone	31	20	30	⎬A
Caput gruis (α [50])	59	8	0	⎪
η gruis	49	37	0	⎪
χ[51] in Toucan	36	14	30	⎪
θ in grue	49	32	30	⎪
χ in grue	45	4	50	⎪
Fomahant ♒	66	39	0	⎭

48 *11° 31'* in the Leiden manuscript (*ELO*, North no. 53, fol. 2vs). According to calculation, this value is closer to the correct one, so it is adopted in the translation. .

49 In the Leiden manuscript follows: 'sub hora 7 et 14 nocte'.

50 In the previous page the same star had the correct Greek letter γ.

51 α in the Leiden manuscript (*ELO*, North no. 53, fol. 2vs). Apparently the Greek letter χ of the scribe of the Paris manuscripts has to be understand as α.

	°	'	"	
μ in Grue	43	33	40	⎫
Sub hydro clara	14	50	0	⎬A
β Toucan	38	5	30	⎭
Inferior in anteriore parte alae Toucan (debet ce[52] ε in Bayero τθ transpositae, ε dt ce[53] major, d minor.)[54]				
‖	30	43	30	⎫
| hydro[55]	18	53	30	⎪
Med. alae Toucan (ς)	31	18	0	⎪A
Caput (α)	53	56	0	⎬
Ultim. alae Toucan (η)	33	19	30	⎪
O C.[56] Australi	78	14	0	⎭

Hora 14 coelum obduxerunt nubes. ε.[57]
El Karnar cum cap. hydri observare non potui.

Die $\frac{12}{22}$ Septemb.

Altitudo Solis Merid.	81	30	20	B
Vesperi h. 6 $\frac{1}{2}$				
In Altit. Arcturi occid.	16	54	30	
123 pulsib. post alt. ☿ Occid.	15	16	30	
Azimuth ab occasu ψ[58]	10	58	0	Merid.
Iterum altit. Arcturi occid.	15	32	0	
& 144 puls. post alt. ☿ occid.	13	46	0	
Azimuth ☿ ab occas. in Austrum	11	20	0	
Iterum in Altit. Merid. Lucid. Vult. et azimuth ☿ 10.47 erat ejus altit. (☿)	12	13	0	

Peractis hisce observationibus horolog.

52 There is a horizontal line above the word in the Paris manuscript.
53 With a double horizontal line above the word in the Paris manuscript.
54 The sentence in parenthesis is clearer in the Leiden manuscript (*ELO*, North no. 53, fol. 2vs): *debet* ε *esse, sed in Bayero Atlante transpositae* ε *debet major esse,* δ *minor*
55 In the Leiden manuscript is added: *in coluro aeqn.*
56 *CC Australior* in the Leiden manuscript.
57 According to the Leiden manuscript this symbol means *ideo* (therefore).
58 Symbol for *Ad Austrum.*

[21]

Sonabat septimam. Hinc nubibus obducebatur coelum, antea clarissimum. Circa 9 vespertinam iterum inclarescebat ergo ab h. 9 $\frac{1}{2}$ ad 4. matut.

Ita ut ordine sequitur

	G.	M.	S.
Altitudo Merid. gruis[59]	59	8	40
β gruis	56	52	40
η gruis	49	23	30[60]
χ[61] in Toucan	36	15	30
γ in Toucan	31	32	30
ε gruis	52	50	0
ν hydri	15	0	0
θ gruis	49	29	30[62]
χ gruis	44	59	30
fomahant ♒	66	38	0
μ gruis	43	32	0
Sub hydro	14	51	0
β Toucan	38	5	0
ζ phoenicis	58	20	0
ε phoenicis	53	38	0
δ phoenicis	50	46	30
ε Toucan	30	40	0
ι hydri	18	54	0
ζ Toucan	31	18	0
α phoenicis	53	50	0
β phoenicis	52	27	0
η Toucan	33	14	0
CC A	78	12	30
El Karnar	39	9	15[63]
χ Eridani	41	51	0[64]

59 α *gruis* in the Leiden manuscript (*ELO*, North no. 53, fol. 2vs).

60 *49 29 30* in the Leiden manuscript, but the value in the Paris manuscript is closer to the correct one.

61 α in the Leiden manuscript. Apparently the Greek letter χ of the scribe of the Paris manuscripts has to be understand as α.

62 *49 31 30* in the Leiden manuscript, but the value in the Paris manuscript is closer to the correct one.

63 An illegible word in parenthesis in the Paris manuscript can be decipherd as 'ter' (meaning three times observed) in the Leiden manuscript.

64 *44 51 0* in the Leiden manuscript. This value is closer to the correct one.

[22]

		G.	M.	S.
Caput hydri		34	56	0
Omnes in Austro[65]				
In Sept.	⌈altit. merid. cap. Medusae	42	19	40
	⌊altit. merid. luc. lat. persei	33	18	0
Die 23 Septemb.				
Meridiae[66] nubilum				
Vesperi h. 6 $\frac{3}{4}$ Urb. in altit. Arcturi occid.		15	29	30
75 pulsib. post ☿ altit.		14	43	0
Azimuth ab occid. ad merid.		11	14	0
& 70 pulsus post Arcturi alt. occid.		14	47	30
		Paulopost		
Altitudo Arcturi Occid.		13	18	0
& 91 pulsib. post altit. ☿		12	25	30
Azimuth ab occas. vers. Austr.		11	24	0
& 60 pulsib. post altit. Arcturi		12	39	0
Item $\frac{1}{2}$ ere post altit. ☿		8	11	0
Azimuth ab occas. χ[67] Austr.		12	30	0
& pulsib. 221[68] alt. Luc. coron. Bor. in Occid.		23	41	0
Altit. M. M. fixarum Australium sumptarum in A[69] ab h.7 ad 14 prout ordine sequuntur.				
Altit. Merid. θ in pavone		24	27	30
η in pavone		31	18	0
χ[70] pavonis		40	28	0
ζ pavonis		30	50	0
κ Indi		38	30	0

[23]

	G.	M.	S.
κ hydri[71]	19	19	0
ε pavone	31	20	0
ħ Alt. Merid. A.	79[72]		

65 Referring to the stars observed hitherto.
66 It should be *meridie*.
67 Symbol meaning *versus*. See 15 September 1639.
68 Here the Paris manuscript missed the word *post* that appears in the Leiden manuscript (*ELO*, North no. 53, fol. 3r).
69 *A = Austrum*.
70 α in the Leiden manuscript.
71 μ hydri in the Leiden manuscript (*ELO*, North no. 53, fol. 3r).
72 *79° 53′30″* in the Leiden manuscript. This value is adopted in the translation.

I[73](sic!) piscis Notij	63	30	0	
Caput gruis	59	9	0	
η gruis	49	34	0	
χ[74]Toucan	36	15	30	
γ Toucan	31	32	30	
ν hydri	15	2	0	
θ gruis	49	30	0	
χ gruis	45	16	0[75]	
fomahant ♒	66	37	30	
μ gruis	43	35	0	
Sub hydro	14	52	0	
β Toucan	38	5	0	
ζ phonin[76]	58	23	30	
ε phoenic.	53	39	0	
δ phoenic.	50	47	0	
Sub δ phoenic. δ extat in globo	46	6	30	
Nubilum protempus hinc.				
ζ Toucan	31	17	30	
α phoenicis	53	57	0	
β phoenic.	52	23	0[77]	
η Toucan	33	16	30	
A. C. Ceti	78	10	0	
Hinc Nubilum fact.				
Die 24 Septemb.				
Altitudo ⊙ Merid.	82	16	15	B

[24]

Vesperi h. 6 $\frac{3}{4}$

	G.	M.	S.
In Occid. Altit. Arcturi	15	30	0
104 pulsib. post altit. ☿	15	21	30
Et azimuth ☿ ab occas. χ merid.	13	15	0
Iterum non multum post in altit. Arctur.	13	15	0[78]
& 84 puls. post γ[79] altit. ☿	13	43	0

73 Should be *ι*.

74 α in the Leiden manuscript.

75 This line has been crossed out in the Leiden manuscript.

76 *Phoenicis* in the Leiden manuscript.

77 *52° 33′ 0″* in the Leiden manuscript (*ELO*, North no. 53, fol. 3vs). According to calculation, this value is closer to the correct one, so it is adopted in the translation.

78 *13° 55′* in the Leiden manuscript (*ELO*, North no. 53, fol. 3vs). According to the calculation, this value is closer to the correct one, so it is adopted in the translation.

79 A meaningless symbol that does not exist in the Leiden manuscript. It is ignored in the translation.

Azimuth ☿ occid. in Merid.	12	16	0	
& 94 puls. post alt. Arctur. occid.	13	15	0	
Iterum altit. Arcturi	12	7	0	
& 97[80] puls. post alt. ☿	11	40	0	
Azimuth	12	5	0	
Et postea altit. Arcturi	11	19	0	
Die 25 Septemb.				
Altitudo ☉ Merid.[81]	82	40	0	
Vesperi h. 6 $\frac{1}{2}$ horolog.				
In altit. Arcturi Occid.	14	47	0	
106 pulsib. post alt. ☿	15	12	0	
Azimuth ☿ ab occas. χ merid.	12	29	0	
& 44 puls. post alt. Arcturi	13	55	30	
paulo post altit. Arcturi occid.	12	47	0	
& altit. ☿	13	11	30	
Azimuth ab occas. ad merid.	12	48	0	
Dehinc alt. Arcturi occid.	12	3	30	
Altit. M. δ in dracone quae est borea □				
Secunda[82]				
Flexurae	14	50	0	B
Sup. alae Cygni	37	31	30	B

[25]

	G.	M.	S.	
Pectoris Cygni	42	46	15	B
Caudae Cygni	37	48	30	B
H. 10 Vesperi				
Altit. Merid. χ[83] Toucan	36	14	0	A
γ Toucan	31	31	30	A
θ gruis	49	30	0	A
fomahant ♒	66	38	0	A
Hinc nubibus obductum coelum				
Die 26 Septemb.				
Altitudo ☉ Merid.	83	30[84]	20	B
Vesperi ob nubes currentes ☿ observare non potui.				

80 *79* pulses in the Leiden manuscript. This value is adopted in the translation.
81 *Sept.* is added in the Leiden manuscript.
82 *Secundae* in the Leiden manuscript.
83 α in the Leiden manuscript (*ELO*, North no. 53, fol. 3vs). Apparently the Greek letter χ of the scribe of the Paris manuscripts has to be understand as α.
84 *83 3 20* in the Leiden manuscript. This value is adopted in the translation because it is closer to the calculated one.

Die $\frac{17}{22}$ Septemb.

Altitudo ☉ Merid.	83	26	30	B

Vespera et nox nubila

Die $\frac{18}{28}$ Septemb.

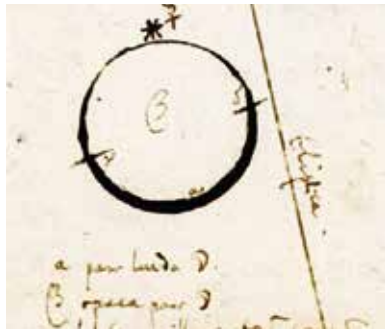
Merid. nubil.
Vesperi post horam 6 horolog. quadrante
circiter post, ☿ primum ex claritate
crepusculi conspicuus, proxime supra
☾ fulcatam stabat inclinans non nihil
in austrum quia et ecliptica in austrum
inclinabat superius, statim autem
Immergebatur ☿ in ☾, nimirum in
superiorem et Orientalem marginem
obscurae ☾ (prout oculis meis vidi et

[26]

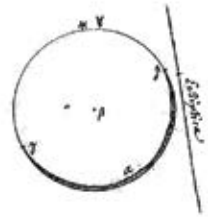
	G.	M.	S.
tubo optico) hoc est ☾ sulcata tegebat			
☿ quod spectaculum mihi fuit jucundissimum.			
Intercedebant autem inter tempus immersionis			
☿ in ☾ et Occid.			
Altitudinem Lucid. Coronae Boreae	22	24	0[85]
Puls. libella mea	10	46	
Postea in tempus comprobarem sumpsi			
íterum altitudinem Lucidae Coronae			
Boreae in Occid.	23	48	0
Et eandem paulopost	23	0	0
Inter has duas altitudines autem inter-			
cedebant pulsus 216.			
Quando altit. Luc. Coron. Bor. in Occ.	21	52	0
Nondum emergerat ☿ ex ☾ sonabat			
tunc horologium septimam, hinc nubibus			
obducebatur caelum occidentale. [86]			

85 *24° 24′ 0″* in the Leiden manuscript. This value is adopted as consistent with the set of observations.

86 Before the next drawing, the Leiden manuscript (*ELO*, North no. 53, fol. 4r) has more than 20 lines of *Calculus* exploring the above observations for estimating the time of the occultation of Mercury by the Moon (6:15:30 PM). Time intervals between two subsequent observations were measured counting the oscillations of a pendulum. The period of the pendulum was estimated by ascribing somehow, the solar time apparently for some observations.



[Mss Leiden]



[Mss Paris]

	Die $\frac{19}{29}$ Septemb.				
Altitudo ☉ Merid.		84	12	30	B
	Die 30 Septemb.				
Altitudo ☉ Merid.		84	37	0	B

[27]

		G.	M.	S.	
	Die 1 et 2 Octob. Nubil.				
	Die 3 Octob.				
Altitudo ☉ Merid.		85	47	20	B
	Die 4 Octobr.				
Altitudo ☉ Merid.		86	10	30	B
	Die 5 Octob.				
Altitudo ☉ Merid.		86	34	20	B
	Die 6 et 7 Nubilum				
	Die 8 Octob.				
Altitudo ☉ Merid.		87	43	30	B
	Die 9 Octob.				
Altitudo ☉ Merid.		88	6	30	B
	Die[87] 11, 12 Octob. inconstans coelum				
	Die $\frac{3}{13}$ Octob.				
Altitudo ☉ Merid.		89	37	30	B

Die $\frac{2}{12}$ Octob. vesperi h. 7 ♀ distabat
circiter 18' a Corde ♏ ipsa occidentalior.

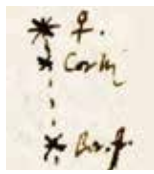
87 *10, 11 and 12* in the Leiden manuscript (*ELO*, North no. 53, fol. 4r).

Die $\frac{3}{13}$ octob. h. 7 preterierat[88] ♀ Cor ♏ distans ab eo 30' circiter, stabatque in recta linea Borealiori Cordis ♏ a Corde ♏ vel minimum vergente Corde ♏ magis in Austrum hoc modo. Patet hinc Orientalioribus ♀ transijsse proxime Cor ♏ parum borealior

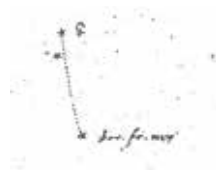
[28]

	G.	M.	S.	

conjunctionem que fuisse h.16. Die 12 Octob. respectu mei loci in Anton. Vaaz Brasiliae Insul. quum diurnus ♀ sit 48[89] calculus Rudolphinorum 10' borealiorem statuit ♀ Corde ♏ tempore conjunctionis.



[Mss Leiden]



[Mss Paris]

[Mss Boulliau]

Die 14 Octob.				
Altitudo ⊙ Merid. in vertice	90	0	0	
Vel si manis 89° 59' 50" in austro 10" ultra verticem accurate tum est observatio 90.0.0 quousque in duobus locis meridiani sumpta convergo instrumento semel versus semptentrionem, semel versus austrum.				
Die $\frac{5}{15}$ Octob.				
Altitudo ⊙ Merid.	89	37	15	
Die 16 Octob.				
Altitudo ⊙ Merid.	89	14	20	A
Die 17 Octob.				
Altitudo ⊙ Merid.	88	51	30	A

88 It should be *praeterierat.*

89 *48′* in the Leiden manuscript (*ELO*, North no. 53, fol. 4r).

[29]

	G.	M.	S.	
Die 18 Octob.				
Altitudo ☉ Merid.	88	29	15	A
Die 19 Octob.				
Altitudo ☉ Merid.	88	7	20	A
Die $\frac{10}{20}$ Octob.				
Altitudo ☉ Merid.	87	46	20	A
Die 21 Octob.				
Altitudo ☉ Merid.	87	25	15	A

Die 24[90] Octob. abfui in agro

Die 23 Octob.				
Altitudo ☉ Merid.	86	42	40	A

Die 24 Octob.Inconstans

Die 25 Octob.				
Altitudo ☉ Merid.	86	0	30	A

Die 26, 27 Nubilum

Die 28 Octob.				
Altitudo ☉ Merid.	84	59	30	A

Vesperi h. 7 $\frac{1}{2}$

Luna adhuc Occidentalior paulo erat
♃, et ad diametrum suam[91] (ad summum)
australior videbatur transitura ♃,
sed antequam visa ♂ ingrueret
nubibus obducebatur Occidens, occident.[92]
melius observare potuerunt.

[30]

	G.	M.	S.	

Die 29 Octob. Inconstans

Die 30 Octob.				
Altitudo ☉ Merid.	84	20	0	A

Seq. Inconstans.

Die 2 Novemb.				
Altitudo ☉ Merid.	83	20	50	A
Die 3 Novemb.				
Altitudo ☉ Merid.	83	2	20	A

Die 4 et sequent. absens fui, et ob pluviam
Inconstans fuit

Die 10 Novemb.				
Altitudo ☉ Merid.	81	0	0	A

90 *22* in the Leiden manuscript (*ELO*, North no. 53, fil. 4vs).
91 It should be *suum*.
92 *occidentaliores* in the Leiden manuscript.

Die 11 et 12. Inconstans.				
Die $\frac{3}{12}$ Novemb.				
Altitudo ⊙ Merid.	80	10	0	A
Die 14 Inconstans.				
Die 15 Novemb.				
Altitudo ⊙ Merid.	79	39	0	A
Die 16 et 17 Inconstans.				
Die 18 Novemb.				
Altitudo ⊙ Merid.	78	53	30	A
Seqq. Inconstans.				
Die 26 Novemb.				
Altitudo ⊙ Merid.	77	11	10	A

[31]

	G.	M.	S.	
Vesperi ab h.7 ad 10 $\frac{1}{2}$				
♀ appropinquans Occasu heliaco vespertino, hisce diebus apparebat cornicula[93] per tubum.				
Altitudo Merid. caput Androm.	54	39	40	B
Extrema Alae Pegasi	68	32	30	B
Altitudo Merid. ζ Toucan	31	18	0	A
ι Hydri	18	58	30	A
η Toucan	33	16	30	A
ε Phoenicis[94]	38	47	0	A
λ Phoenicis	49	36	0	A
ν Phoenicis	41	6	0	A
Supra μ Phoenicis non extans in globo	53	3	0	A
μ Phoenicis	47	20	0	A
El Karnar	39	10	0	A bis[95]
Secunda Fluvij	44	52	30	A
Caput Hydri	34	⌈ 56	0	A
		⌊ 55	~~30~~	A[96]
Tertia Fluvij	45	2	30	A
4ta. fluvij	48	54	0[97]	
Non est 4. glob. non habet 4 fluvij[98]	42	⌈ 13	30	A
		⌊ 13	0	A

93 *corniculata* in the Leiden manuscript (*ELO*, North no. 53, fol. 4vs).
94 ξ Phoenicis in the Leiden manuscript.
95 El Karnar maybe observed twice.
96 *55′ 30″* in the Leiden manuscript (*ELO*, North no. 53, fol. 5r).
97 This line from the Leiden manuscript was skipped in the Paris manuscript.
98 The Leiden manuscript describes this star as *Cap. Medusae (in Sept.)*.

Hinc nubilum factum coelum antea
clarissimum.

Die 27 Novemb.				
Altitudo ⊙ Merid.	77	0	0	A
Die 28 Novemb.				
Altitudo ⊙ Merid.	76	49	40	A
Die 29 Novemb.				
Altitudo ⊙ Merid.	76	39	40	A

[32]

	G.	M.	S.	
Seqq. turbid.				
Die $\frac{2}{12}$ Decemb.				
Altitudo ⊙ Merid.	75	4	40	A
Die 13 Decemb.				
Altitudo ⊙ Merid.	75	0	30	A
Die 14 Inconstans.				
Die 15 Decemb.				
Altitudo ⊙ Merid.	74	54	30	A
Die 16 Decemb.				
Altitudo ⊙ Merid.	74	51	40	A
Vesperi ab h.7 a dio[99].				
Altitudo Merid. λ Phoenic. [100]	49	38	0	A
ν Phoenic.	41	5	30	A
	glob. non habet[101]			
(2.[102] Supra μ Phoenic.	53	4	0	A
(1. In Hydro η	27	29	0	A
μ Phoenic.	47	20	0	A
El Karnar	39	9	50	A
χ Eridani S. 2da (mihi 3)	44	51	30	A
Die $\frac{6}{16}$ Decemb.[103]				
Altitudo Merid. Cap. Hydri	34	54	0	A
φ Eridani S. tertia	45	5	30	A
In Hydro S. tertia	27	56	30	A
κ Eridani S. quarta	48	55	30	A
ι Eridani S. quinta	53	48	0	A
In Erid. (mihi 7$^{dt\ ec}$)	56	49	30	A
	glob. non habet			

99 *ad 10* in the Leiden manuscript (*ELO*, North no. 53, fol. 5r).
100 Unclear additional words like *et foco*.
101 In the Leiden manuscript this note belongs to the following observation.
102 (*2*) means that this star crossed the meridian before the following star marked with (*1*).
103 Repeated date.

[33]

	G.	M.	S.	
Supra hunc[104] longe	⌈ 64	18	30	A
	⌊ glob. non habet			
In Hydro quarta conv. colli 2a	28	27	0	A
Sexta Eridani (m. 8)	56	30	0	A
Viges. Eridani (4[105])	73	10	0	A
Sub hac Orientalior	⌈ 67	47	0	A
	⌊ glob. non habet			
Octava fluvij mihi putata	53	46	0	A
Sed est in fl. non extat in globo.				
Die $\frac{7}{17}$ Decemb.				
Altitudo ☉ Merid.	74	49	20	A
Vesperi ab h. 6 $\frac{3}{14}$ ad 12 Noct.				
Altitudo Merid. λ Phoenic.	49	37	20	A
ν Phoenic.	41	6	30	A
η Hydri	27	29	30	A
Supra μ Phoenic.	53	5	0	A
μ Phoenic.	47	19	30	A
El Karnar[106]	39	9	50	A
χ Eridiani	44	51	0	A
σ Hydri mihi prima quoq. [107]	28	50	0	A
Caput Hydri	34 ⌈	55	0	
	⌊	54	30	A[108]
φ Eridani	45 ⌈	4	30	A[109]
	⌊	5	0	A
(2.[110] Quarta Fluvij	48	57	0	A bis
(1. In Hydro S. tertia	27	59	0	A
ι Eridani[111]	53	47	0	A
In Erid. (caret glob.	56	50	0	A

104 It should be *hanc*.
105 τ in the Leiden manuscript (*ELO*, North no. 53, fol. 5r).
106 Inserted at the left in the margin: *Culminat proxime Ante crus. Cassiop.*
107 Inserted at the left in the margin: *Statim culminat Caput Hydri* .
108 This value is closer to the calculated one.
109 *Ibidem.*
110 In this case, according to calculation, the order between (*1*) and (*2*) should not be exchanged.
111 Inserted at the left in the margin: *Et statim culminat.*

[34]

	G.	M.	S.	
Supra hanc	64	17		A
Quarta Hidri[112]	28	29	0	A
6 Fluvij (θ)	56	29	30	A
Viges. Eridan.	73	11	0	A
Quinta quoque in Hydro	29	5	0	A
Sub 20 Erid. Orientalior[113]	67	47	0	A
In Eridiano[114] (globus caret)	53	46	0	A
Inferior Colli Hydri S. prima 3 in Hydr. et Nub. Major S. dorado	34	20	0	A
In Eridiano[115], Glob. non habet	56	44	0	A
Secunda 3 in Hydr. & n. [116]	34	0	0	
Occid. Δ fl. S. 7ª Eridan. globi	59	46	0	A
Austr. Δ Eridan.	59	30	0	A
Bor. Δ Eridan.	[117]			
S. 3 trium in Hydro et informis in circulo Antarctico	32	20	0	A
Inform. in duas nubes Orient.	22	58	30	A
Alt. Merid. Aldebar.	65	⌈ 59	0	B
		⌊ 59	30	B
Capellae	36	⌈ 9	0	B
		⌊ 9	30	B
Rigel Orionis	89	30	⌈ 20	A
			⌊ 30	A
Die $\frac{8}{18}$ Decemb.				
Altitudo ⊙ Merid.	74	47	30	A
Vesperi h. 7				
In Altit. Occid. Caput Androm.	51	28	30	
Ejus Azimuth a Sept. vers. Occcas.	22	45	0	
Crepusculum finebatur verspertinum				

[35]

	G.	M.	S.
Succedebant inter hanc observationem altit. Cap. Androm. usque ad mediat. Coeli η hydri pulsus libellae meae 873. 273 puls. in hanc et culminationem			

112 It should be *Hydri*.
113 Inserted at the left in the margin: *glob. caret.*
114 It should be *Eridano*.
115 It should be *Eridano*.
116 Inserted at the left in the margin: *glob. non habet.*
117 Meridian elevation not recorded.

Sup. μ phoenic. A.
211 puls.
M. μ phoenicis in Merid. A
431 puls.
M. El Karnar A.
387 puls.
M. Crus Cassiop. B
299 p.
M. Secunda fluvij mihi A ejus
altit. M. 42° 56' 0" A
495 p.
M. χ fluvij A.
298 p.
M. ι quinq. in hydro A.
66 p.
M. Caput hydri A
188 p.

Altit. Occid. Cap. Androm.	44	10	0	

[118]

Azimuth ejus a Sept. in Occas.	38	40	0	

252 p.

Alt. Occid. Cap. Androm.	42	46	0	
Azimuth ejus	39	56	0	

Die $\frac{9}{19}$ Decembr.

Altitudo ⊙ Merid.	74	45	40	A

[36]

	G.	M.	S.	
Vesperi h.7				
Altitudo Cap. Androm. Occid.	51	20	0	
Azimuth ejus a Sept. in occas.	23	17	0	

finis tunc crepusculi verspertini
735 puls.
η hydri mediat coeli A.
238 p.
M. Sup. μ phoenic. A 219 p.
M. μ phoenic. A.

---

118 After this entry, the French copyist (or the earlier editor) has forgotten to copy the next lines, which are present in the Leiden manuscript (*ELO*, North no. 53, fol. 5vs). These lines are added in the translation:
Azimuth ejus a Sept. in Occ. 38 1 0
283 p.
Cap. Androm. alt. occ. 43 27 0 et

457 p.
M. El Karnar A.
490 p.

M. Crus Cassiop. B. alt. ejus Merid.	19	54	30	B

797
M. χ fluvii A.
240 p.
M. I quinq. in hydr. A
148
M. Cap. hydri
229

Altitudo Occ. Cap. Androm.	44	20	0	&

[119]

Azimuth ejus a Merid. in Ortum	36	9	0	

353 p.

Caput Androm. Altit. Occ.	42	40	0	&
Azimuth ejus a Sept. in Occas.	39	52	0	

252 p.

Canobi altit. Orient.	22	37	0	&
Azimuth ejus a Merid. in Ortum[120]	35	53	0	

[37]

	G.	M.	S.	
Eadem Vespera				
Altitudo Merid. Cap. Medusae	42	14	30	B
Lucid. plejad.	58	20	0	B[121]
Informis in Cir. Antarct.	32	20	0	A
Informis in 2 Nubei Orient.	22	57	15	A
Die $\frac{10}{20}$ Decemb.				
Altitudo ⊙ Merid.	74	44	30	A
Vesperi ab h.7.				
Altitudo Occid. Cap. Androm.		50	00	&
Azimuth ejus a Sept. in Occid.	27	10	0	

Tunc finis Crepusculi.

---

119 The following lines in the Leiden manuscript (*ELO*, North no. 53, fol. 6r) were skipped in the Paris manuscript, but added in the translation:
Azimuth ejus a Sept. in Occ. *37 41 0*
307 puls.
Canobi alt. Or. *21 20 0 &*

120 Here Boulliau's copy (OdP, B12–13) interrupts the observations until August 1640.

121 The Paris manuscript as well as the Leiden manuscript (*ELO* , North no. 53, fol. 6r) have 58° 20' 0" B. In another Leiden manuscript (*ELO*, North no. 59recto) the value is 58° 50' 0". Compared to the calculated value, the first value has an error exceedingly greater than the usual error. In addition, the observation journal North no. 53 seems to be copied from the sketchier North no. 59. So the latter value was adopted in the translation.

307 puls.				
M. Supra μ phoenicis A				
159 p.				
M. μ phoenicis A				
327 p.				
M. El Karnar A				
599 p.				
M. Crus Cassiop. B. Alt. ejus Merid.	19	54	0	B
743 p.				
M. χ fluvij A				
136 p.				
M. Cap. hydri A				
136 p.				
Altitudo Cap. Androm. Occ.	45	5	0	&
Azimuth ejus a Sept. in occ.	36	3	0	

[38]

	G.	M.	S.	
426 p.				
Canobi Alt. Or.	21	4	30	&
Azimuth ejus a merid. in Ortum	36	10	0	
616 p.				
Caput Androm. Altit. occ.	42	35	30	
Azimuth ejus a Sept. in occ.	40	15	0	
Eadem vespera us. ad h. 12 $\frac{1}{2}$				
Altit. Merid. dextri humeri persej	29	45	20	B
Capitis Medusae	42	16	0	B
Lucid. Lat. persej	33	14	30	B
Inform. 2 in Nub. Orient.	22	57	0	A
In fl. et dorado (glob. caret)	55	6	0	A
Alia in fluu. et dorado (glob. caret)	45	73	30	A[122, 123]
Extrem. Caudae Dorado	42	30	30	A
Capellae	36	11	30	B
Rigel Orionis	89	34	0	A
Mediet Nubei[124] Majoris	29	15	0	A
In dorso Dorado	35	32	0	A
Canobi	45	48	30	A
Die $\frac{11}{21}$ Decemb.				
Altitudo ⊙ Merid.	74	44	10	A

122 *45 53 30* in the Leiden manuscript (*ELO*, North no. 53, fol. 6vs). This value is used in the translation.

123 In the Paris manuscript, the following line from the Leiden manuscript was skipped. This line is added in the translation: *Inform. ad lat. occ. Dorad. 34 51 0 A*

124 Declension dubious.

Vesperi ab h. 9 $\frac{1}{2}$ ad 13 Noct.

Altitudo Merid. 2 Occid. in Erid.	⌈Super.	63	32	30	A
	⌊Infer.	63	20	0	A
Inform. ad Latus occid. Dorad.		34	50	30	A
Inform. hac longa[125] Superior[126]		52	2	0	A
2 Orient. Erid. inferior		60	53	30	A[127]

[39]

	G.	M.	S.	
Extrema Caudae Dorado	42	27	30	A
In fl. et Columbae (glob. caret)	55	41	0	A
In Columb. et fl. longe superior binis[128]				
Nebulosis	62	13	0	A
⌈ Infra his 2 Nebulas ad Ortum paulo[129]	40	18	0	A
⌊ Extra Columbam versus Occid.	62	57	0	A
Proxima Sup. Nubei Major	30	40	0	A
Extrema alae dextrae Columbae	62	28	0	A
In dorso Columbae	63	55	30	A
In dorso dorado	35	30	30	A
In bolide Naucleri	47	6	0	A
In eductione alae dextrae Columbae	62	20	0	A
In eductione Colli Columbae	62	55	0	A
2 in Dorado Sup. Bor.	32	25	30	A
Sub bolide Naucleri [130]	42	0	0	A
Australissima in Ramo Columbae	55	22	30	A
Capitis Columbae	61	1	0	A
Sub Canobo ad dextrum[131]	43	21	30	A
Trium superior in Ramo Columbae austr.	63	12	0	A
Extrem. ped. dextr. post. Canis Major	68	16	30	A
3 Superior in Ramo Columbae media	64	58	30	A
3 Superior in Ramo Columb. Borealis	65	53	0	A
Canobi	45	49	30	A

Nota. Canobi magnitudo et color
ac splendor cum Sirij conveniant proxime

125 It should be *longe*.
126 Inserted at the left in the margin: *glob. caret.*
127 *66 53 30* in the Leiden manuscript. This value, which is closer to the calculated one, is used in the translation.
128 Inserted at the left in the margin: *glob. caret.*
129 Inserted at the left in the margin, before the accolade: *glob. caret.*
130 Inserted at the left in the margin: *glob. non habet.*
131 Inserted at the left in the margin: *glob. non habet.*

El Karnar aequalis in hisce Rigel Orionis

[40]

	G.	M.	S.	
ergo Canobus magnitud. & splendor superat El Karnar in quantum Rigel superatur a Sirio.[132]				
Die $\frac{12}{22}$ Decemb.				
Altitudo ⊙ Merid.	74	44	20	A
Circa occasum ⊙ et post erat serenissimum (uti et hac et antecedentib. diebus) eratque rubeo[133] vespertina insignis.[134]				
Vidi autem lucem diej paene tunc fugatam et verum finem crepusculi vespertini quia[135] Lucida Vulturis duo[136] ab occasu distaret et in medio coelo essent 20 grad. aequatoris[137] a o ♈ Numeratus.				
Finito crepusculo nubibus obducebatur totum coelum initio facto ab oriente.				
Die 23 pluvium. Nubilum coelum.				
Die $\frac{14}{24}$ Decemb.				
Altitudo ⊙ Merid.	74	44	45	A
Vesperi a 7 ad 8 $\frac{1}{2}$ h.				
Altitudo occid. Cap. Androm.	46	13	0	
Azimuth ejus a Septent. in occ. 270 puls.	34	53	0	

[41]

	G.	M.	S.
M. I. quique[138] Hydri A. 164 p.			

132 The words '*in quantum Rigel superatur a Sirio*' ['Insofar as Rigel is surpassed by Sirius'] are *not* included in the Leiden manuscript (ELO, North no. no. 53, fol. 6vs). However, these words do appear in the Boulliau copy (OdP, B12–13), which proves that he used the same source as the later made De l'Isle copy.

133 *Rubedo* in the Leiden manuscript (*ELO*, ibidem).

134 At this point two lines from the Leiden manuscript are omitted in the Paris manuscript, probably because they are hardly readable (also for us).

135 *Quum* in the Leiden manuscript.

136 *2°* in the Leiden manuscript

137 Not *aequatoris* but *angularis* according to the Leiden manuscript.

138 *1ª quinque* in the Leiden manuscript (*ELO*, North no. no. 53, fol. 7r).

M. Cap. Hydri A. NB [139] Cap. Hydri
2' circiter temp. culminat. Orientalis[140]
duarum parvatarum Sup. a 2da fl.
Seu Sup. 2 min[141]
1096 p.
φ Eridani A.
50 p.
Secunda [quique][142] Hidri A.
505 p.
Tertia [quousque][143] Hidri A.
47
Quarta fl. globi. A.
135
Clara longe supra 4 fl. ejus altit.
M. 62° 48' 0"A.

NB Sunt 3 instar △ isopleur. ejus
haec est Occid.
672 p.
I.[144] Erid. s quinta A.
24 p.
6 Erid. globo non extat A.
227 p.
Quarta S[145] in Hydro cum hac culminat
paruula 6 magnit. in hanc et fluu.
est q ejus altit. Merid. 42 7 0
296 p.

[42]

	G.	M.	S.	
Occid Δ Sup. fluvij 6. A				
43 p.				
Seq. hanc Australior ejus Alt. Mer.	61	0	0	A
488 p.				
6. Erid. glob. mihi 8 seu lucida A.				
126 p.				
Alt. Occid. luc. ped. Austral. androm.	40	11	0	

139 Here appears the word *ante* in the Leiden manuscript, where the NB stands in the margin.
140 *orientalior* in the Leiden manuscript.
141 Here the Leiden manuscript has the addition: *2 mihi 3.*
142 *quinque* added from the Leiden manuscript.
143 *Ibidem.*
144 Sic!
145 *5* in the Leiden manuscript, instead of *S.*

Et ejus azimuth a septent. in occid.	30	30	0	
152 p.				
Alt. Occid. luc. ped. Austral. Androm.	39	53	30	
Azimuth	31	0	0	
Ab h. 9 ad h. 13				
Alt. M 11. Eridiani mihi [146]	56	42	0	A
Occ. Δ fluvij (7 globi)	59	44	0	A
17. Erid. globi	73	50	0	A
Australis Δ Erid. (8. globi)	59	25	30	A
Bor. Δ fluu. (9 fl. globi)	60	50	0	A
15. Erid. globi	72	30	0	A
14. Erid. globi	73	10	0	A
Inform. in 2. Nubes Or.	22	57	30	A
Ex duabus lucid. Or. quae sunt sub e	glob. non habet			
duobus occ. in fluvis Rio Indi[147]	55	0	0	A
2. occid. in fl. superior (10 Erid. globi)	63	31	30	A
Inter fl. et Dorado	45	50	0	A
2. occid. in fl. infer. (11 Erid. globi)	63	18	30	A
Ad latus Occid. Dorado	34	38	30	A[148]

[43]

	G.	M.	S.	
Informis super hac longe superior	52	27	30	A
2. Orient. super (13 fl. globi)	67	68	30	A[149]
2. Orient. fl. infer. (12 fl. globi)	66	51	30	A
Alt. Merid. extrem. Caudae Dorado	42	25	0	A
Super hac informis Or. in ∇	55	40	0	A

[Mss Leiden]

[Mss Paris]

Extra Columba Occid.	62	10	0	A
Infra 2. Nebulos. ad Ortum	40	16	30	A
Rigel Orionis	89	31	0	A
Proxime Sup. Nub. Major.	30	41	0	A

146 The following data are also written (in pencil) as a draft on a single piece of paper among the Leiden manuscripts (North no 54. See also North no. 53, fol. 7vs–8r).

147 *Rio Indi* does not appear in the Leiden manuscript (*ELO*, North no. no. 53, fol. 7 recto), but instead a small triangle ∇ with four stars is drawn, identical to the figure on the next page.

148 *34 48 30* in the Leiden manuscript. This value is used in the translation.

149 *67° 68′ 38″* in the Leiden manuscript (*ELO*, North no. no. 53, fol. 7r). This value is used in the translation. It is also closer to the calculated one.

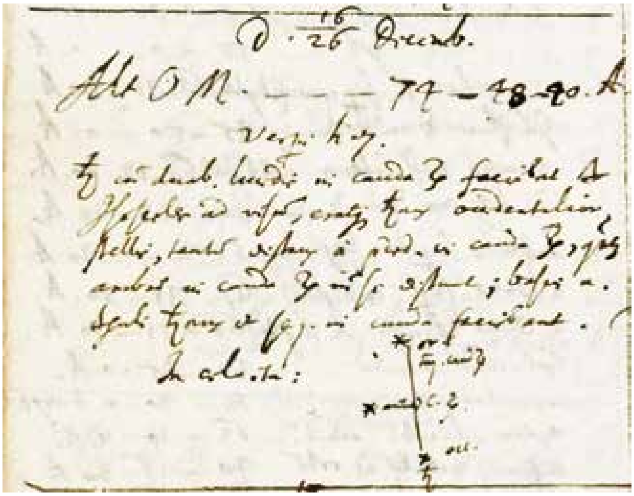
Extr. Alae dextr. Columb.	62	29	0	A
In Dorso Columbae	63	55	0	A
In dorso Dorado	35	46	30	A[150]
In extrem. alae sinist. Columb.	65	46	30	A
In educt. alae dextrae Columb.	62	18	30	A
In bolide Naucleri	47	4	30	A
In eductione alae sinistrae Columb.	64	20	0	A
In eductione Colli Columb.	62	55	0	A
Superior 2 in ventre Dorado	32	20	30	A
Inferior	31	16	0	A
Caput Columbae	61	0	0	A
Sub Canobi ad dextr.[151]	43	21	0	A
3. Sup. in Ramo Columb. Austr.	63	10	0	A
Extrem. ped. dext. post Canis Major.	68	14	30	A
Media 3. Super in Ramo Columbae	64	56	30	A
Borealior 3. in Ramo Columbae	65	51	0	A
Canobi	45	48	30	A

[44]

	G.	M.	S.	
Die $\frac{15}{25}$ Decemb.				
Altitudo ☉ Merid.	74	46	20	A
Die $\frac{16}{26}$ Decemb.				
Altitudo ☉ Merid.	74	48	40	A

Vesperi h.7
♄ cum duabus lucidis in cauda ♑ faciebat Δ isosceles ad visum erat que ♄ occidentalior stellis tantum distans a precedent[152] in cauda ♑ quantum ambae in cauda inter se distant basini autem trianguli ♄ et seq. in cauda faciebant.[153]

150 *35° 30′ 0″* in the Leiden manuscript. This value is used in the translation. It is also closer to the calculated one.
151 Inserted at the left in the margin: *glob. non habet.*
152 It should be *precedent.* with the abbreviation dot.
153 The figure from the Leiden manuscript (*ELO*, North no. 53, fol. 7vs) differs slightly from the one in the Paris manuscript.

[Mss Leiden] *[Mss Paris]*

Die $\frac{17}{27}$ Decemb.

Altitudo ⊙ Merid.	74	51	0	A

Die 28, 29 et 30. Inconstans coelum
fuit, et ego etiam absens fui in campis.

Die $\frac{21}{31}$ Decemb.

Altitiudo ⊙ Merid.	75	6	0	A

Nox Inconstans.

~.

[45]

Sequitur annus 1640
Et in eo Observationes
Coelestes Georgij
Marggrafij Die 1[a]
Januarij Greg. A. C.
1640

	G.	M.	S.	
Altitudo ⊙ Meridiana	75	10	15	A

Seqq. Inconstans Coelum.
Die 6 Januarij

Altitudo ⊙ Merid.	75	41	30	A

Die 7 Januarij

Altitudo ⊙ Merid	75	50	0	A

Die 8 Januarij

Altitudo ⊙ Merid.	75	58	30	A

Die 9 Januarij

Altitudo ⊙ Merid.	76	70	0	A[154]

Reliquo mensis ut et februarij[155], ut
plurimum serenitate carvimus, et ego
aliquoties peregre abfui. Mense Martii
die $\frac{8}{18}$ nocte sequent. domus nostra

[46]

G. M. S.

ubi habitamus, sponte sua totaliter
corruit, nobis omnibus dormientibus.
Sed singulari Dei ope omnes septem
numero vivi servati sumus, hinc inde
tamen in membris laesi, supellex
mea damnum inde passa, arculis
íncludenda fuit, usquedum aede
Redintegrata quod trimestri spatio
post demum[156] factam; Interea temporis
coactus fui feriari ab operibus
mathematicis; accedente[157] etiam semiluxatione
axillae sinistrae, quae me inutilem
ad aliquid peragendum effecit et
ultra duos menses detinuit.

Die $\frac{1}{11}$ Junij

Altitudo ⊙ Merid.	58	41	0	B

Die 12 et 13 pluit.

Die 14 Junij

Altitudo ⊙ Merid.	58	30	50	B

Die 15 Junij

Altitudo ⊙ Merid.	58	28	30	B

Die 16 Junij

Altitudo ⊙ Merid.	58	26	40	B

Die 17 Junij. Nubilum.

154 *76º 7′ 0″ A* in the Leiden manuscript (*ELO*, North no. 53, fol. 7vs). In the Paris manuscript is added in pencil in a different hand: *10′ putative*.
155 *Februario* in the Leiden manuscript.
156 *domum* in the Leiden manuscript (*ELO*, North no. no. 53, fol. 7vs).
157 It should be *accidente*.

[47]

	G.	M.	S.	
Die 18 Junij.				
Altitudo ⊙ Merid.	58	24	40	B
Die $\frac{9}{19}$ Junij.				
Altitudo ⊙ Merid.	58	23	40	B[157a]
Die $\frac{10}{20}$ Junij.				
Ab h. 9 $\frac{1}{2}$ fere Ante Merid.				
1. Altitudo ⊙ Ante Merid.	40	22	30	
Azimuth ejus a Sept. in Ort.	48	50	0	
2. Altitudo ⊙	42	31	0	
Azimuth ut ante	46	43	0	
3. Altitudo ⊙	46	5	30	
Azimuth	42	33	30	
4. Altitudo ⊙	47	22	30	
Azimuth	40	42	0	
5. Altitudo ⊙	48	7	30	
Azimuth	39	35	0	
6. Altitudo ⊙ Ante Meridiem	49	0	0	
Azimuth a Sept. in Ortum	38	10	0	
7. Altitudo ⊙	53	21	0	
Azimuth	29	5	0	
Erat h. 10 $\frac{3}{4}$ Solarij				
8. Altitudo ⊙ Merid.	58	23	30	
Azimuth	0	0	0	
9. Altitudo ⊙ post Meridiem	58	12	0	
Azim. a Sept. in Occas.	7	47	0	

[48]

	G.	M.	S.
10. Altitudo ⊙	57	30	0
Azimuth	14	40	0
11. Altitudo ⊙	56	0	0
Azimuth	22	34	0
12. Altitudo ⊙	49	15	30
Azimuth	39	35	0
13. Altitudo ⊙	48	7	30
Azimuth	41	37	0
14. Altitudo ⊙	47	41	0
Azimuth a Septent. in Occas.	42	21	0
Erat h. 2. Solarij			
Per Gnomonis umbram etiam antecedentia			

157a End of the Leiden manuscript (*ELO* North no. 53].

Observavi erecto stylo partic.
4000, ergo in Observat. anteced.
1. Longitudo Umbrae erat particul. 4660
(qualium Gnomon 4000)

Angulus inter 1 et 2 obseru. umbrae	2°	15'	
2. Longitudo Umbrae partic. 4324.			
Angulus	4	0	
4[158]...p...3650			
Angulus	1	15	
5. ...p...3554			
Angulus	1	30	
6....p...3448			
Angulus	9	0	
7....p...2950			

[49]

Angulus	29	0	
8. ...p...2437			
Angulus	8	0	
9. ...p...2455			
Angulus	6	45	
10. ...p...2522			
Angulus	7	6	
11 ...p...2671			
Angulus	77[159]	15	
12. ...p...3415			
Angulus	2	0	
13. ...p...3552			
Angulus	0	45	
14. ... p...3610			

Die $\frac{11}{21}$ Junij.
Ab h. 9 $\frac{1}{4}$ circiter Ante Merid.

1. Altitudo ⊙ Ante Merid.	39°	15'	0"
Azimuth a Septent. in Ortum	49	40	0
2. Altitudo ⊙	40	22	30
Azimuth	48	49	0
3. Altitudo ⊙	41	12	0
Azimuth	48	0	0
4. Altitudo ⊙	42	31	0
Azimuth	46	42	0
5. Altitudo ⊙	46	0	0
Azimuth	42	41	0

158 Sic! The item *3* is missing.
159 Shoud be *17* instead of *77*.

[50]

	G.	M.	S.	
6. Altitudo ⊙	49	40	0	
Azimuth	37	0	0	
7. Altitudo ⊙	51	59	0	
Azimuth	32	22	0	
8. Altitudo ⊙ Merid.	58	23	30	B
Azimuth	0	0	0	
2° in azim. a Septent. in Occ. adhuc				
eadem q[160] Merid. altit. ⊙)				
9. Altitudo ⊙ post Merid.	58	4	0	
Azimuth a Sept. in occas.	43	41	0[161]	
Erat circiter 2 h. solarij.				
Gnomon partic. 4000 debet in				
observationibus praecedent.				
1. Longitudo Umbrae p. 4851				
Angulus	1°	0'		
2. ...p...4661				
Angulus	1	0		
3. ...p...4530				
Angulus	1	15		
4. ...p...4325				
Angulus	4	0		
5. ...p...3830				
Angulus	5	30		
6. ...p...3366				
Angulus	4	30		
7. ...p...3100				
Angulus	32	30		

[51]

8...p..2438			
Angulus	9°	45'	
9...p...2469			
Angulus	31	15	
10 ...p...3510			
Angulus	2	30	
11 ...p...3730			
NB. Anguli exactiores exhibentur in			
Circulo Azimuthali.			

Die 22 Junij pluit.

160 In the Paris manuscript there is a tilde mark above the q, so the word *quam* is meant.
161 Sic!

Die $\frac{13}{23}$ Junij.

Altitudo ☉ Merid.	58	25	0	B

Die $\frac{14}{24}$ Junij.

Altitudo ☉ Merid.	58	26	20	B

Vesperi Coelo serenissimo Observavi
quando finiretur crepusculum Vespertinum;
Vidi autem ejus finem, fugato poenitus[162]
illo rubore lato, quum Cord. ♏ Altit.

Orient. esset	41	36	0	

Diebus seqq. Coelum incommodum.
Die $\frac{18}{28}$ Junij Coelo serenissimo.
H.10 Antemeridiana, erecto instrumento
meo optico, per foramen cujus diameter
10 particularum; accepi diametrum

[52]

Radij[163] ☉ ejusmodi particularum; aliquoties
73, aliquoties 74 distantia autem
foraminis a Radio adumbrato erat
p. 7340, observatio repetita post merid.
eadem dedit. Hoc dico majorem non
comparuisse diametrum Radij, quam 74 p.
et minime fuisse 73 p.

Altitudo ☉ Merid.	58°	36'	0"	B

Seqq. turbidum coelum.
Die $\frac{5}{28}$ Julij.

Altitudo ☉ Merid.	60	26	30	B

Die 16 Julij pluit.
Die $\frac{}{17}$ Julij

Altitudo ☉ Merid.	60	47	0	B

Seqq. pluviosum.
Die $\frac{13}{23}$ Julij.

Altitudo ☉ Merid.	61	55	30	B

Die $\frac{14}{24}$ Julij.

Altitudo ☉ Merid.	62	8	20	B

Die 25 Julij pluit.

Die $\frac{16}{26}$ Julij.

Altitudo ☉ Merid.	62	34	40	B

162 Sic!

163 The expression *diameter of the radius* sounds oddly and is repeated few lines later. But in this case *radius* means the luminous projection of the Sun.

Die $\frac{17}{27}$ Julij.

Altitudo ☉ Merid.	62	49	40	B

[53]

	G.	M.	S.	
Seqq. dies nubili pluviosi				
Kalend. Augusti				
Altitudo ☉ Merid.	64	1	40	B
Die 2 Augusti				
Altitudo ☉ Merid.	64	17	0	B
Seqq. nub. pluviosi.				
Die 7 Augusti				
Altitudo ☉ Merid.	65	40	0	B
Vesperi die 7 Augusti h. 6 $\frac{1}{2}$				
In Altitud. Occid. Arcturi [164]	51	20	0	
Ejus azimuth a Septent. in Occ.	41	17	0	
330 puls. post. Altit. ☿ Occid.	6	7	0	
Azimuth a Septent. in Occas.	77	42	0	
245 puls. post iterum ☿ altit.	4	59	30	
Azimuth a Septent. in Occas.	78	0	0	
343 pulsus post altit. Arcturi occ.	48	59	0	
Azimuth ejus a Septent. in Occ.	44	28	0	
Ulterius ad h. 9 usque verspertinam				
Altitudo Merid. Or. Anguli Austr. (β [165])	29	53	30	A
In turib.	49	51	0	A
In turib.	42	49	30	A
Una Cauda ♏ (ε)	64	32	0	A
2ª Cauda ♏ (μ)	60	47	0	A
3ª Cauda ♏ (ζ)	55	25	30	A

[54]

	G.	M.	S.	
Duarum in turib. Inferior	42	10	0	A
Superior	43	0	0	A
quae Sub. Superiore 2mo. in turib.	37	49	30	A
In turib. Supra duas	48	39	0	A
Vltim. Cauda ♏	61	10	0	A
Penultim. Cauda ♏	61	20	0	A
Sexta Caud. ♏	55	26	30	A
Occidentalissim. pavon. (χ)	33	40	0	A
Quarta a fine Cauda ♏	59	21	0	A

164 Here Boulliau's copy resumes, having omitted all observations since 21 December 1639.
165 Not β but α Trianguli Australis.

Quinta a fine Cauda ♏	58	12	30	A
Post Caud. ♏ in ♐	61	16	0	A
In Cauda pavon. (μ)	34	30	0	A
In turib.	48	6	30	A
Una Arcus ♐ (γ)	67	46	30	A
Arcus ♐	61	18	0	A
♃ Meridiana altitudo	74	31	30	A
& 127 pulsus post				
Quae Orientalior prima Arcus ♐ (δ)	68	10	0	A
Arcus ♐ (ε)	63	36	30	A
Sub Corona ∇ occ.	52	3	0	A
————∇ austr.	48	56	0	A
————∇ Or.	52	3	0	A
In Arcu ♐ (λ)	72	30	0	A
In pavoni (ν)	35	39	0	A
In pavoni (ι)	30	32	30	A
Die 8 Augusti				
Altitudo ⊙ Merid.	65	77	30	B[166]

[55]

	G.	M.	S.	
Vesperi ob nubes ☿ Observare non potuit.				
Altitud. Merid. p[167] Cor. ♏ ad Boream	73	23	30	A
Cordis ♏	72	29	30	A
Seq. Cor. ♏ ad austrum	70	40	0	A
Or. △ Austrini	29	51	0	A
Hinc nubes Iterum Serenum.				
Altitudo Merid. prima cauda ♏	64	31	0	A
Secunda Cauda ♏	60	45	30	A
Hinc nubes per noctem.				
Die 9 Augusti.				
Altitudo ⊙ Merid.	66	14	30	B
Die 10 Augusti.				
Altitudo ⊙ Merid.	66	32	0	B
Parvo Sextante itidem	66	32	0	B
Vespera multae nubes demum ijs dispersis. H. 6 $\frac{1}{2}$				
Altitudo ☿ occ.	8	21	0	
Azim. a Septent. in Occ.	79	38		
215 puls. post.				
Altitudo Occ. Luc. Coronae Bor.	52	26	0	&

166 Value of minutes obviously wrong.
167 With an abbreviation mark above.

Azimuth a Septent. in occ.	16	10	0	
117 puls. post.				
☿ Altit.	7	6	0	
Azimuth	79	40		
& 225 puls. post				

[56]

	G.	M.	S.	
Altitudo Occ. Luc. Coronae Bor.	52	7	0	
Azimuth	16	30		
Iterum Impeditum a nubibus per tempus				
Hinc clarum.				
Altitudo Merid. 3ª Caud. ♏ (μ)	55	24	0	A
Duarum in turib. inferior	42	7	0	A
Superior	43	0	0	A
In turib. sub tres duabus	37	49	0	A
Supra hic duabus	48	36	0	A
Ultima Caudae ♏	61	6	0	A
Penultima Caudae ♏	61	20	0	A
Statim hac culminat paruula				
sub Cauda ♏				
Nubes Iterum.				
Occidentalissim. pavonis (λ) est sub ea				
quae in turib. sub duabus cum altit.				
merid.	37 49; 33 36.0[168]			
Quarta a fine Caudae ♏	59	18	30	A
Quinta a fine Caudae ♏	58	18	0	A
Extra Caudam ♏	61	11	0	A
Nubecula Splendens hac Superior in				
ejus locum nebulosum Bayerus posuit	63	25	0	A
In Cauda pavonis (μ)	34	30	0	A
In turibulo	48	4	30	A
Hinc Nubilum				

Die $\frac{1}{11}$ Augusti pluit.

Die $\frac{2}{12}$ Augusti.

[57]

	G.	M	S.	
Vesperi dimidia 7 Inclarescebat.				
Altitudo Merid. Cord. ♏	72	29	30	A
Seq. Cord. ♏ ad Austr.	70	39	30	A
Iterum nubilum.				

168 Sic! But *37 49* before the semicolon is the meridian elevation quoted few lines above.

Die $\frac{3}{13}$ Augusti.

Altitudo ☉ Merid.		67	25	40	B

Die $\frac{6}{16}$ Augusti.

Altitudo ☉ Merid.		68	21	0	B

Nox Nubilosa.

Die $\frac{7}{17}$ Aug.

Alt. ☉ Mer.		68	40	30	

Nox nebulosa.

Die 18 Augusti.

Altitudo ☉ Merid.		69	0	15	B

Nox nubilosa.

Die $\frac{9}{19}$ Augusti.

Altitudo ☉ Merid.		69	20	0	B

Nox Nubilosa.

Die $\frac{10}{20}$ Augusti.

Altitudo ☉ Merid.		69	40	0	B

Vesperi post 6

☿ ob nubes observare non potui

Altitud. Merid. 3. Caud. Sco (ζ)		55	24	30	A
Duo in turib. inferior		42	10	0	A
Superior		43	0	0	A
Quae Sub. Super 2^{mum} In turib.		37	49	30	A
Quae Supra duas in turib.		48	39	30	A
Ultima Caudae ♏		61	10	0	A
Penultima Caudae ♏		61	21	30	A

[58]

		G.	M.	S.	
Sexta Caud. ♏		55	24	0	A[169]
		33	37	30	A
Quarta a fine Caud. ♏		59	20	0	A
Quinta a fine Caud. ♏		58	10	30	A

Hinc nubilum.

Biduum pluviosum.

Die $\frac{13}{23}$ Augusti.

Altitudo ☉ Merid.		70	40	20	B

Nox pluv.

Die $\frac{14}{24}$ Augusti Merid.

Nubilum pluvies.

Vesperi post 6. h.

Altitudo Spica ♍ occ.		38	20	0	&
Azimuth ab occas. in Merid.		6	0	0	

169 The next observed celestial body has not been recorded.

138 puls. post.			
Altitudo ☿ occ.	17	29	0
Azimuth	88	20	
a Sept. in Occas.			
140 puls.			
Altitudo Spic. ♍ occ.	36	58	0
Azimuth ab occid. in Merid.	5	55	0
135 puls.			
Altitudo ☿	16	26	30
Azimuth a Septent. in occas.	88	12	0
141 puls.			

[59]

	G.	M.	S.
Altitudo Spic. ♍	35	54	0
Azimuth	6	7	0
128 p.			
Altitudo ☿	15	20	0
Azimuth	88	36	0
128 p.			
Altitudo Spicae ♍	34	51	0
Azimuth	6	6	0
234 p.			
Altitudo ☿	14	2	0
Azimuth	88	43	0
137 p.			
Altitudo Spicae ♍	33	25	30
Azimuth	6	20	0

Postea

Quae Supra duas in turib. in Merid.
252 puls. post.
Ultima Caudae ♏ in Merid.
160 p.
Penultima Caud. ♏ Culminat.
138 p.
Sexta Caud. ♏
389 p.
Quarta Caudae ♏ a fine
286 p.
Quinta a fine Caudae ♏
255 p.

[60]

	G.	M.	S.	
Extra Caud. ♏				
155 p.				
Occ. Altit. Arcturi	31	26		
Azimuth ejus a Sept. in Occ.	59	35		
Altit. Merid. quae in Sinistr. Herculis draconis	35	41	0	B
Altitudo Mer. duo Lucid. in Cap. draconis sequentis	30	20	30	B
Postea h. 7 $\frac{1}{2}$ circiter.				
Altitudo Occ. Arcturi	25	37	0	
Azimuth a Septent. in Occas.	62	25	0	
118 p. post.				
♃ Altitud. Merid.	74	32	30	A
353 p.				
Altitudo Arcturi Occid.	24	1	0	
Azimuth	62	51	0	
Altitudo Merid. Lucid. Lyrae	43	22	30	B
ab h. 11 $\frac{1}{2}$ ad h. 13[170].				
Altitudo occ. Caud. Vult.	39	6	30	
Azimuth a Septent. in occas.	65	51	0	
182 p.				
Altitude Merid. ♄	83	48	0	A
897 p.				
Altitudo Merid. ♂	79	49	0	A
385 p.				
Altitudo Occ. Caud. Vulturis	33	53	0	
Azimuth ejus	68	6	0	

[61]

	G.	M.	S.	
260 p.				
Altitudo Merid. θ in grue				
959 p.				
Altitudo Merid. fomahant ♒	66	34	0	A
Die $\frac{15}{25}$ Augusti.				
Merid. nubes.				
Vesperi post 6 $\frac{1}{4}$ h.				
In altitud. Occ. Spic. ♍	37	28	0	

170 This time reckoning suggests that the hours of the day start at noon and goes up to 24 h at the next noon. But the new date would start at midnight.

Azimuth ab Occid. in Merid.	5	38	0	
118 p. post.				
Altitudo ☿ Occid.	18	9	0	
Azimuth ejus a Septent. in Occ.	88	31	0	
123 p.				
Altitudo Spic. ♍	36	33	0	
Azimuth ejus	5	38	0	
142 p.				
Altitudo ☿ Occ.	17	10	0	
Azimuth	88	37	0	
121 p.				
Altitudo Spicae ♍	35	30	0	
Azimuth	6	1	0	
189 p.				
Altitudo ☿	16	0	0	
Azimuth	88	48	0	
104				
Altitudo Spicae ♍	34	21	0	

[62]

	G.	M.	S.	
Azimuth	6	2	30	
hor. 7 $\frac{1}{2}$				
Altitudo Arcturi Occid.	26	36	30	
Azimuth a Septent. in Occ.	61	58	0	
163 p.				
Altitudo ♃ Merid.	74	32	0	A
377 p.				
Altitudo Arcturi Occid.	24	39	0	
Azimuth	62	21	0	
hor. 8.				
Altitudo Merid. Lucid. Lyrae	43	23	30	B
Circa et post Med. Noct. Nubilum.				
Die $\frac{16}{26}$ Augusti h. 6 $\frac{1}{4}$ vesperi.				
Altitudo Spicae ♍ occ.	36	22	30	
Azimuth ab occas. in Merid.	5	55	0	
126 p.				
☿ Altitudo Occ.	18	10	30	
Azimuth a Septent. in Occ.	89	13	0	
283 p.				
☿ altitudo Occ.	17	4	30	
Azimuth	89	23	0	
378 p.				
Spica ♍ Altitudo Occ.	33	20	0	

Azimuth	6	9	0	
440 p.				

[63]

	G.	M.	S.	
Quae Supra duas in turib. in Merid...				
171 p.				
Ultima in Cauda ♏ in Merid.				
183 p.				
Penultima Caudae ♏ in Merid.				
89 p.				
Sexta Caudae ♏				
424 p.				
Quarta Caudae ♏				
316 p.				
Quinta Caudae ♏				
192 p.				
Post Caudam ♏				
101 p.				
Altitudo Spicae ♍ occid.	26	6	0	
Azimuth ab occ. in Merid.	6	45	0	
Post hor. 7 $\frac{1}{4}$ Altitudo Arcturi Occid.	26	51	0	
Azimuth a Septent. in occ.	61	28	0	
218 p. post.				
♃ altitudo Merid.	74	32	0	A
270 p.				
Altitudo Arcturi Occid.	25	7	30	
Azimuth	62	22	0	
Altitudo Merid. Lucid. Lyrae	43	24	0	B

hor. 11 $\frac{1}{2}$

[64]

	G.	M.	S.	
Altitudo Occ. Caud. Vult.	41	2	0	
Azimuth a Septent. in occ.	64	42	0	
637 p.				
♄ Altitudo Merid.	83	47	30	A
825 p.				
♂ altitudo Merid.	79	41	30	A
943 p.				
Altitudo Occid. Caudae Vult.	32	30	0	
Azimuth		68	43	0

Die 27. Nub. pluit.

Die $\frac{18}{28}$ Augusti.

Merid. Nubes.

Vesperi h. 6 $\frac{1}{4}$

Altitudo Occ. ☿	17	24	0
Azimuth ab Occid. in Merid.	0	38	0
158 p.			
Altitudo Spicae ♍ occ.	32	24	0
Azimuth ab Occ. in Merid.	6	15	0
128 p.			
Altitudo ☿	16	21	0
Azimuth	0	46	0
97 p.			
Altitudo Spicae ♍ Occid.	31	32	0
Azimuth	6	18	0
86 p.			

[65]

	G.	M.	S.
Altitudo ☿	15	38	30
Azimuth	0	58	0
554 p.			
Altitudo Spicae ♍ occid.	29	0	30
Azimuth	6	35	0
113 p.			
Altitudo ☿	13	0	0
Azimuth	1	21	30
130 p.			
Altitudo Spicae ♍	28	8	30
Azimuth	6	42	0
108 p.			
Altitudo ☿	12	6	30
Azimuth	1	34	0
113 p.			
Altitudo Spicae ♍ occ.	27	19	0
Azimuth	6	45	0
h. 7 $\frac{1}{2}$			
Altitudo Occ. Arcturi	27	28	0
Azimuth a Septent. in occas.	61	32	0
349 p.			
♃ Altitudo Merid.	74	32	0
299 p.			
Altitudo Arcturi Occ.	25	13	0
Azimuth	62	22	0

Circa Med. Noctis Nubilum factum.

Die $\frac{19}{29}$Augusti pluit.

[66]

	G.	M.	S.
Die $\frac{20}{30}$Augusti.			
Vesperi ab h. 6 $\frac{1}{4}$ usque ad 8 h.			
Altitudo Occ. ☿	17	50	0
Azimuth ab occid. in Merid.	1	47	0
117 p. post.			
Altitudo Occ. Spicae ♍	31	1	0
Azimuth ab occid. in Merid.	6	28	0
74 p.			
☿ Altitudo	17	0	0
Azimuth	2	2	0
92 p.			
Spicae ♍ Altitudo	30	14	30
Azimuth	6	37	0
119 p.			
☿ Altitudo	16	10	0
Azimuth	2	10	0
105 p.			
Altitudo Spicae ♍	29	21	0
Azimuth	6	41	0
88 p.			
☿ Altitudo	15	27	0
Azimuth	2	14	30
113 p.			
Altitudo Spicae ♍	28	36	30
Azimuth	6	42	0
88 p.			

[67]

	G.	M.	S.
☿ Altitudo	14	45	0
Azimuth	2	21	30
120 p.			
Altitudo Spicae ♍	27	47	30
Azimuth	6	43	0
80 p.			
☿ Altitudo	13	51	30
Azimuth	2	24	0
106 p.			
Spicae ♍ Altitudo	27	3	30
Azimuth	6	45	0
116 p.			
☿ Altitudo	13	5	0
Azimuth	2	27	0
89 p.			

Spicae ♍ Altitudo	26	18	0	
Azimuth	6	47	0	
105 p.				
☿ Altitudo	12	20	30	
Azimuth	2	36	0	
105 p.				
Altitudo Arcturi Occid.	31	5	0	
Azimuth a Septent. in Occas.	59	43	0	
122 p.				
☿ Altitudo	11	27	30	
Azimuth	2	45	0	
216 p.				

[68]

	G.	M.	S.	
Arcturi Altitudo Occ.	30	0	0	
Azimuth	60	24	30	
557 p.				
Arcturi Altitudo occ.	28	6	0	
Azimuth	61	7	0	
536 p.				
♃ Altitudo Merid.	74	31	0	
281 p.				
Altitudo Arcturi occid.	25	20	0	
Azimuth a Septent. in occ.	62	20	0	
1957 p.				
Altitudo Merid. Lucid. Lyrae	43	23	30	
♄ et ♂ non observavi ob viciniam Lunae plenae				
Die $\frac{21}{31}$ Augusti.				
Altitudo ☉ Merid.	73	30	0	B
Die 1 Septemb. Vesp. h. 6 $\frac{1}{4}$				
Altitudo Occ. Spicae ♍	27	34	0	
Azimuth ab occ. in Merid.	6	47	0	
138 p.				
☿ Altitudo Occid.	15	19	0	
Azimuth ab occ. in Merid.	3	25	0	
135 p.				
Altitudo Spicae ♍	26	30	30	
Azimuth	6	49	0	
124 p.				

[69]

	G.	M.	S.
☿ Altitudo	14	20	0
Azimuth	3	31	30
123 p.			
Spicae ♍ Altitudo	25	32	0
Azimuth	6	52	0
130 p.			
☿ Altitudo	13	20	0
Azimuth	3	38	0
119 p.			
Spicae ♍ Altitudo	24	34	30
Azimuth	6	57	0
Paulo post ♃ observavi hoc modo.			
Altitudo Arcturi Occid.	26	36	0
Azimuth a Septent. in Occas.	61	55	0
171 p.			
♃ Altitudo Merid.	74	31	0
382 p.			
Altitudo Arcturi Occid.	24	48	0
Azimuth	62	38	30
Die 2 Septemb.			
Altitudo ☉ Merid.	74	13	15
Vesperi h. 6 $\frac{1}{4}$			
Altitudo Spicae ♍ occid.	27	28	30
Azimuth ab occid. in Merid.	6	35	0
112 p.			
Altitudo ☿ Occid.	6	10	0[171]

[70]

	G.	M.	S.
Azimuth ab Occid. in Merid.	3	33	30
112 p.			
Altitudo Spicae ♍	26	35	0
Azimuth	6	39	0
119 p.			
☿ Altitudo	15	18	30
Azimuth	3	41	30
117 p.			
Spicae ♍ Altitudo	25	42	0
Azimuth	6	43	0
138 p.			

171 Considering the following observations of Mercury the elevation should rather be 16° 10' 0" . This value is adopted for the translation.

☿ Altitudo	14	19	30
Azimuth	3	47	0
121 p.			
Arcturi Altitudo Occ.	30	26	0
Azimuth a Septent. in Occ.	60	2	0
116 p.			
☿ Altitudo Occid.	13	19	30
Azimuth	3	51	0
109 p.			
Arcturi Altitudo Occid.	29	42	30
Azimuth	60	20	30
119 p.			
☿ Altitudo	12	30	0
Azimuth	4	7	0
96 p.			
Arcturi Altitudo Occid.	28	57	0
Azimuth	0	41	0

[71]

G. M. S.

Lustravi etiam hac vespera ☿ quam primum videri potuit, propter crepusculum tubo utens, et quia ille in elongatione maxima, apparebat clarissime bifidus et quod fere minus, lucens quam dimidiam partem. ☿ autem scintillat instar fixae, in quanta etiam sit Altitudine ab horizonte conspicuus. ♃ no observavi quia nubilum factum.

Die 3, 4 et 5. Inconstans coelum.
Die 6 Septemb. Merid. Nubes.

Vesperi h. 6 $\frac{1}{4}$			
Altitudo Arcturi Occid.	29	46	0
Azimuth a Septent. in Occas.	60	12	0
163 p.			
☿ Altitudo	15	25	0
Azimuth ab Occas. in Merid.	5	13	0
109 p.			
Altitudo Arcturi Occ.	28	51	0
Azimuth	61	0	0
148 p.			
☿ Altitudo	14	31	0
Azimuth	5	22	0
113 p.			

Spicae ♍ Altitudo Occ.	21	51	0
Azimuth ab Occ. in Merid.	7	8	0
110 p.			

[72]

	G.	M.	S.
☿ Altitudo	13	39	0
Azimuth	5	38	0
137 p.			
Spicae ♍ Altitudo	21	0	0
Azimuth	7	22	30
105 p.			
☿ Altitudo Occid.	12	47	30
Azimuth	5	47	30
149 p.			
Arcturi Altitudo Occid.	26	17	0
Azimuth	61	50	0
146 p.			
Spicae ♍ Altitudo Occid.	19	30	0
Azimuth	7	14	0

♂ Jam Acronychus ac Perigeus in ♒ Insignis Magnitudine fulget, et magnitudine paululum Superat ♃ Colore ab eo diversissimus ♂ enim rubet instar prunea ♃ clara Luce fulget.

Die 7 Septemb. Merid. Nubes.
Vesperi h. 6 $\frac{1}{4}$

Altitudo Spicae ♍ Occid.	20	10	0
Azimuth ab Occas. in Merid.	6	42	30
110 p.			
☿ Altitudo	12	31	0
Azimuth ab Occas. in Merid.	5	57	0
125 p.			

[73]

	G.	M.	S.
Spicae ♍ Altitudo Occid.	19	10	0
Azimuth	7	4	0
86 p.			
☿ Altitudo	11	39	0
Azimuth	6	13	0
75 p.			
Spicae ♍ Altitudo	18	33	30

Azimuth	7	12	30	
Et eo momento.				
♃ Altitudo Meridiana	74	30	0	A

Antequam has observationes ☿ et ♃
Instituerem, Tubo accurate lustravi ☿
Statim postquam emergeret ex crepusculo,
diu que lustravi et apparuit mihi
clarissime sulcat. lucidam partem
Ortum versus S. Superius, partem
opacam Occasum versus seu inferius,
id est ☿ Cornutus, more ♀, Cornua
dirigebat in Occidentem quod in ☾
fieri Solet quando Occidentalis est.

[Mss Paris]

[Mss Boulliau]

Reliquum Noctis Nubilum.

Die 8 et 9. Turbidum, pluv. Coelum.
Die 10 Septemb.

Altitudo ☉ Merid.	77	17	0	B

[74]

	G.	M.	S.	

Vesperi ab Amicis Impeditus fui:
Noctu Nubes.
Die 11 et 12. Nubes pluv.
Die $\frac{4}{14}$ Sept. Merid. Nubilum
Vesperi h. 6 $\frac{1}{4}$

In Crepusculo quando nondum apparerent				
fixae ♃ mediabat coelum. Et ♃				
Altitudo Merid.	74	30	0	A
Postea quam primum apparebat ☿				
Lustravi cum perspicillo et apparuit				
Corniculatum.				
Deinde				
Altitudo ☿ occid.	9	22	0	
Azimuth ab Occ. in Merid.	8	33	0	
103 p.				
Spicae ♍ Altitudo Occid.	13	36	0	

Azimuth ab Occas. in Merid.	8	10	0	
123 p. post.				
Arcturi Altitudo Occ.	20	5	0	
Azimuth a Septent. in Occas.	64	36	0	
136 p.				
Altitudo ☿	7	51	0	
Azimuth	8	52	0	
120 p.				
Altitudo Spicae ♍ Occid.	12	7	30	
Azimuth	8	37	0	
104 p.				

[75]

	G.	M.	S.	
Altitudo Arcturi Occid.	18	50	0	
Azimuth	64	55	0	
105 p.				
Altitudo ☿	6	36	30	
Azimuth	9	1	0	
123 p.				
Spicae ♍ Altitudo	10	51	0	
Azimuth	8	32	0	
153 p.				
Altitudo Arcturi	17	31	0	
Azimuth	65	18	0	
Postea has fixarum Altitudines Austr. Sumpsi.				
Altitudo Merid. ♃ in ♐	67	45	0	A
| γ quq. in Cor. A. Secunda a sumo	59	40	0	A
NB Intercedunt | τ in ♐	69	55	0	A
aliquae fixae ⎨ Orientalis Cap. ♐	76	30	0	A
omnes non | Duarum proximor[172] sibi sub pedibus				
sumpsi | ♐ Superior (non extat in globo	53	3	0	
| Quae Supra has duas Orient.	56	50	0	A
	glo.caret			

Die 15 et 16. Inconst. nub.

172 It should be *proximarum.*

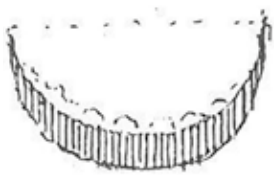
Die 17 Septemb. Merid. nubilum.

Vespera clara quidem, sed propter
versus horizontem Occidentalem quae
tardius discussae, ☿ observare non potui.

Hora 10 Vesperi, Ante.

[76]

	G.	M.	S.	
Altitudo Merid. 11 Hydri seu λ	19	9	0	
In pisse[173] Notio (ι)	63	25	0	A
In pisse[174] Notio (θ)	65	32	0	A
Capit gruis (α)	59	4	0	A
in laeva manus[175] Indi Sagitt. 2 (δ)				
duarum Superior Supra Rostrum Toucan	41	28	0	A
Inferior i.e. ejusdem Saggit. 3 (ε)	39	53	0	A
Altitudo Occid. Caud. Vult.	41	41	0	
Azimuth ejus a Septent. in Occas.	64	18	0	
399 p. post				
Altitudo Merid. ♄	83	20	0	A
48 p.				
Altitudo Merid. ♂	79	43	0	A
528 p.				
Altitudo Occid. Caud. Vult.	38	1	0	
Azimuth	66	23	0	
Iterum				
Altitudo Merid. extrem. Rostri Toucan (α)	36	10	0	A
Col.[176] Toucan (γ)	31	29	0	A
Die $\frac{8}{18}$ Septemb.				
Altitudo Meridiana ⊙	80	20	40	B



[Mss Paris]

Vesperi clarum coelum,
Sed quia nubes oblong-
atrae[177], circa occidentem
collectae, et vix 1 $\frac{1}{2}$ hora post occasum
⊙ discussae ☿ nec videre nec observare

173 It should be *pisce.*
174 It should be *pisce.*
175 It should be *manu.*
176 *Collum.*
177 It should be *oblongatae.*

[77]

	G.	M.	S.	
Instrumentis potui.				
♃ Altitudo Merid.	74	29	30	B
Hora 10 Vesp. ad 12 fine.				
Altitudo Merid. 11 Hydrae (λ)	19	5	0	A
Caput Gruis (α)	59	4	30	A
Altitudo Occid. Caud. Vultur.	41	30	0	
Azimuth a Septent. in Occas.	64	30	0	
210 p.				
Ea quae ad clunes ♒ in Merid. (1)				
173 p.				
♄ altitudo Merid.	83	18	30	A
56 p.				
♂ Altitudo Merid.	79	47	30	A
572 p.				
Altitudo Occid. Caud. Vultur.	32	50	0	
Azimuth	66	31	0	
103 p.				
Altitudo Occid. Caud. Vult.	37	28	30[178]	
Azimuth	66	40	0	
Altit. Merid. in Cauda gruis trium bor. (λ) 44	58	30	A	
Fomahant ♒	66	33	30	A
Sub hydro (quae non in globo)	14	51	0	A
Die $\frac{9}{19}$ Septembris.				
Altitudo ☉ Merid.	80	44	20	B
Vesperi				
♃ et ♂ visibiles erant, ipso momento				

[78]

	G.	M.	S.	
occasus Solis, non item ♄ quamvis ♂				
Vicinus: Sed post $\frac{1}{4}$ horae denuo poterat				
videri, paulo post occasum ☉ erat.				
Altitudo Meridiana ♃	74	29	30	A
1307 p.				
Altitudo Occid. Arcturi	20	28	30	
Azimuth a Septent. in Occas.	64	18	0	
345 p.				
Altitudo Arcturi Occid.	19	17	30	
Azimuth	64	50	0	
1256 p.				
Spicae ♍ Altitudo Occid.	7	15	0	

178 Note that this western elevation is higher than the previous one.

Azimuth ab Occas. in Merid.	8	58	0	
189 p.				
Arcturi Altitudo Occid.	14	5	0	
Azimuth a Septent. in Occas.	66	20	0	

Coelum autem Serenissimum erat ubique et Rubedo vespertina in Occid. ☿ tamen videre nunquam potui, quamvis diligentissime diuque eum quaesiverim. Et Spicae ♍ quae 4 aut 5 grad. jam altior eo Supra horizontem aegre tandem emergebat videnda ☿ plane non.
Causam coniscio in aërem minus illuminatum a luce crepusculi, et rubedinam vespertinam: accessit luna quae corniculata

[79]

	G.	M.	S.	

et in ✳[179] ☉ in Occidente extabat, cujus lumen etiam adjumento fuit,[180] Et ☿ ℞[181] gradus etiam ipsae causam praebere potuit aliqualem.

Hora 10 Vesperi (paulo ante)

Altitudo Occid. Caudae Vultur.	42	11	0	
Azimuth a Septent. in Occ.	64	12	0	
279 p.				
Stella ad clunes ♒ in Meridiano...				
263 p.				
Altitudo Merid. ♄	83	17	30	A
46 p.				
Altitudo Merid. ♂	79	54	0	A
724 p.				
Altitudo Occid. Caud. Vult.	37	34	0	
Azimuth	66	24	0	
127.				
Altitudo Occid. Caud. Vult.	37	8	0	

179 In astrology, ✳ is the symbol for the sextile, or the situation in which the lines of sight of two celestial bodies, viewed from the center of the earth, make an angle of 60 degrees with each other. On this day, 19 September 1640, the Sun and the Moon were approximately in this situation.

180 Sic!

181 In medieval times the symbol ℞ was an abbreviation of the late Latin instruction 'recipere', meaning 'receive'. It was the first word of a medical prescription. In astronomy 'Mercurius recipere' refers to the retrograde movement of the planet.

Azimuth	66	48	0	
Die $\frac{10}{20}$ Septemb.				
Altitudo ☉ Merid.	81	8	0	B
Vesperi coelo Serenissimo observavi quando finiretur Crepusculum. Jam autem Rubedo illa vespertina disparuerat quando in Occidentali plaga erat				
Altitudo Cordis ♏	45	48	0	

[80]

	G.	M.	S.	
Vt autem dicam de Rubedine Vespertina Coelo Serenissimo occulta ☉ infra horizontem merso (praeclare videri potest, & ☉ tunc sine Radijs apparet) paulo post aurej ex flavo coloris se diffundit color Arcuatum in Occidente ad 5.6 vel 7. grad. altitudinem in Medio post semi horam circiter hic color Rubicans q. fit seu flamm. fumo pauco mixtus, et hunc colorem retinet donec sensim dispareat durante hoc Crepusculo, stella in ejus ambitu Consistens videri non potest. Ideo etiam ☿ hac die et Anteced. nunquam videre potui existentem in ejus Ambitu. Spic. ♍ vero vidi quia altior et extra ejus arcum, quodque descensu suo Sequebatur disparitionem crepusculi, Nam a Superiore parte accurato disparere incipit Rubedo illa, inferior pars, ultimo euanescit.				
Vesperi h. 10.				
Altitudo Caudae Vultur. Occid.	40	26	0	
Azimuth a Septent. in Occas.	65	21	0	
105 p.				
Altitudo Merid. ♄	83	15	30	A
36 p.				

[81]

	G.	M.	S.	
Altitudo Merid. ♂	79	58	30	A
589 p.				
Altitudo Occid. Caud. Vultur.	37	36	30	

Azimuth		66	42	0	
63 p.					
Altitudo Occid. Caud. Vultur.		37	20	0	
Azimuth		66	50	0	
	Die $\frac{11}{21}$ Septemb.				
Altitudo ⊙ Merid.		81	31	30	B
	Die $\frac{12}{22}$ Septemb.				
Altitudo ⊙ Merid.		81	55	0	B

Et eodem Meridie
Stilus erectus particularum 4000
Longitudo Umbrae - 587 partic. ejusmodi.
Circa Occasum ⊙ observatorio expectans
tempus culminationis lunae futurae,
Circa h. 6. 22' eaque in prima quadratura
et primis gradibus ♑ existente, ac Nonag.
cum Merid. coincidente in differentia
36' circiter, et post Occasum ⊙ totum

Coelum nubibus obducebatur, ut desiderio
meo satisfacere minime possem.

	Die $\frac{13}{23}$ Septemb.				
Altitudo ⊙ Merid.		82	18	0	B
Vesperi h. 9 $\frac{3}{4}$ fere					
Altitudo Occid. Caudae Vulturis		41	10	0	

[82]

	G.	M.	S.	
Azimuth a Septent. in Occas.	64	50	0	
216 p.				
Altitudo Merid. ♄	83	10	0	A
149 p.				
Altitudo Merid. ♂	80	11	30	A
547 p.				
Altitudo Occid. Caud. Vultur.	37	52	0	
Azimuth	66	28	0	
256 p.				
Altitudo Occid. Caud. Vult.	36	59	0	
Azimuth	67	8	0	

Hora 10 $\frac{1}{2}$ vidi tres Satellites ♃ in Occid-
entali plaga, existentes unum Supra,
duas infra cum H. M.[182] Intervallo à ♃
1 $\frac{1}{2}$ 1. 5 circiter.

182 *H.M.*: maybe abbreviation for *Hic Monstrato* referring to the figure.

[Mss Paris]

Die 24 Sept. Nubilum.
Die $\frac{15}{25}$ Septemb.

Altitudo ⊙ Merid.	83	4	20	B
Vesperi h. 9 $\frac{3}{4}$ post.				
Altitudo Occid. Caud. Vulturis	40	53	30	
Azimuth a Septent. in Occas.	64	43	0	
158 p.				

[83]	G.	M.	S.	
Altitudo Merid. ♄	83	9	0	A
171 p.				
Altitudo Merid. ♂	80	24	30	A
516 p.				
Altitudo Occid. Caud. Vult.	37	59	0	
Azimuth	66	38	0	
211 p.				
Altitudo Occid. Lucid. Lyrae	21	10	0	
Azimuth a Septent. in Occas.	43	33	0	
Die $\frac{16}{26}$ Septemb.				
Altitudo ⊙ Merid.	83	27	40	B
Vesperi h. 9 $\frac{3}{4}$				
Altitudo Caud. Vult. Occid.	41	51	0	
Azimuth a Septent. in Occas.	64	15	0	
397 p.				
Altitudo Merid. ♄	83	9	0	A
157 p.				
Altitudo Merid. ♂	80	30	0	A
596 p.				
Altitudo Occid. Caud. Vult.	37	44	30	
Azimuth	66	32	0	
120 p.				
Altitudo Occid. Lucid. Lyrae	21	13	30	
Azimuth a Septent. in Occas.	43	29	30	

Sequens pluviosum ✳[183]

183 Apparently a meaningless symbol.

[84]

	G.	M.	S.	
Die $\frac{20}{30}$ Septemb.				
Altitudo ☉ Merid.	84	59	30	B
Nox Nubila				
Die 1ª. Octobris				
Altitudo ☉ Merid.	85	22	0	B
Die 2. Octob.				
Altitudo ☉ Merid.	85	45	0	B
Vesperi h. 8 $\frac{3}{4}$				
Altitudo Occid. Caud. Vultur.	41	58	30	
Azimuth a Septent. in Occas.	64	11	0	
346 p.				
Altitudo Merid. ♄	83	5	0	A
485 p.				
Altitudo Merid. ♂	81	14	0	A
566 p.				
Altitudo Occid. Lucid. Lyrae	20	59	0	
Azimuth a Septent. in Occid.	43	31	30	
237 p.				
Altitudo Occ. Caud. Vultur.	36	9	0	
Azimuth a Septent. in Occas.	67	8	0	
119 p.				
Altitudo Occid. Caud. Vultur.	35	41	30	
Azimuth	67	31	0	
Die 3. Octob.				
Altitudo ☉ Merid.	86	9	0	B

[85]

	G.	M.	S.	
Nox Sequens nubila, pluviosa, Ventosa.				
Die 4 Octobris				
Altitudo ☉ Merid.	86	32	0	B
Biduum Inconstans.				
Die 7. Octob.				
Mane ab h. 4 ad 7. Man. ☿ videri non potuit quamvis Sereno Coelo. Crepusculum matutinum videri incipiebat quum humerum rubescens Orionis distabat à Meridiano in Occidentem 2. grad.				
Hor. 5 $\frac{1}{4}$ Circiter				
Altitudo Orient. Jubae ♌	22	25	0	
Azimuth ab Ortu in Septent.	27	36	0	

271 p.				
Altitudo Orient. Jubae ♌	23	35	0	
Azimuth ab Ortu in Septent.	28	8	0	
280 p.				
Sequens in ped. praeced. ♊ 1 Anteced.				
Seu Calx ♊ in Meridiano				
810 p.				
Lucida pedis ♊ in Merid.				
118 p.				
Altitudo Centri Lunae bissectae Merid.	61	38	30	B

[86]

	G.	M.	S.	
(Erat ☾ Bissecta et 90 Coincidebat fere				
cum Meridiano, ☾ autem tantum 37' circiter				
distabat tempore culminationis a				
Nonagesimo in Ortu ex Calculo.)				
1634 p.				
Centrum ☉ visum In horizonte Ortiuo,				
In azimutho[184] ab Ortu in Austrum	5	42	0	
1469 p.				
Altitudo ☉ Orientalis	5	46	30	
Azimuth ab Ortu in Austrum	4	39	0	
826 p.				
Altitudo ☉ Orientalis	9	7	30	
Azimuth ab Ortu in Austrum	4	4	0	
Altitudo ☉ Merid.	87	42	0	B
Die 8 Octobris				
Altitudo ☉ Merid.	88	4	40	B
Die 9 Octob.				
Altitudo ☉ Merid.	88	27	0	B
Vesperi ab h. 8 usque ad 9 $\frac{1}{4}$				
Altitudo Merid. Sequentis Caudae ♑	80	21	30	A
312 p.				
Altitudo Occid. Caud. Vultur.	44	22	0	
Azimuth a Septent. in Occas.	62	42	0	
383 p.				
Altitudo Occid. Caud. Vultur.	48	4	0[185]	

184 Sic.

185 Western elevation higher than the previous one, so it is obviously wrong. Possibly it should be *43° 4′ 0″*.

		G.	M.	S.	
Azimuth		63	22	0	
543 p.					
Altitudo Merid. ♄		83	0	0	A
730 p.					
Altitudo Merid. ♂		82	9	30	A
566 p.					
Altitudo Caud. Vult. Occid.		35	49	0	
Azimuth a Septent. in Occas.		67	14	0	
105 p.					
Altitudo Occid. Caud. Vultur.		35	30	0	
Azimuth		67	29	0	
	Die 10 Octob.				
Meridie nubilum					
Vesperi ab h. 8					
Altitudo Merid. Seq. Caudae ♑		80	22	30	A
914 p.					
η Gruis in Merid.					
266 p.					
Altitudo Occid. Lucid. Lyrae		24	9	0	
Azimuth a Septent. in Occas.[186]					
106 p.					
Altitudo Merid. ♄		82	59	30	A
796 p.					
Altitudo Merid. ♂		82	18	0	A
384 p.					
Altitudo Occid. Caud. Vultur.		36	22	0	
Azimuth a Septent. in Occas.		67	6	0	

		G.	M.	S.	
128 p.					
Altitudo Occid. Lucid. Lyrae		20	19	0	
Azimuth		43	59	0	
133 p.					
Altitudo Occid. Caud. Vultur.		35	30	30	
Azimuth		67	21	0	
	Die $\frac{1}{11}$ Octob.				
	Mane ab h. 4.				

In vigilans ☿, Nunquam tamen mihi
Comparaviteadem causa quam veluti
die $\frac{9}{19}$ Septemb. hujus anni. Quamvis

186 Sic! Azimuth missing.

enim jam in maximam elongationem perigea est ☿: tamen vix Oritur ante Initium Crepusculi, et usque dum 4:5. aut 6 grad. altitudinem acquirit, mera fere dies est, ut cerni non poterit ab ejus claritate; Nam Crepuscula matutina brevi diem efficiunt, ut longo tempore Ante Ortum Solis merum diem habeamus. Accedebat etiam Luna corniculata in Orientali plaga.

Quando altitudo Merid. Syrij esset Merus erat dies quum tamen dimidia hora post demum ☉ Ortus fuerit, ut ex hac observatione judicare poteris.	81	50	0	A

[89]

	G.	M.	S.	
Altitudo ☉ Meridiana	89	12	0	B
Die 12 Nub. pluit.				
Die $\frac{3}{13}$ Octob.				
Altitudo ☉ Merid.	89	56	30	B
Nox Nubila				
Die $\frac{4}{14}$ Octob.				
Altitudo ☉ Merid.	89	33	40	A
Vesperi ab h. 8. ad. 9.				
Altitudo Occid. Caud. Vultur.	42	39	0	
Azimuth a Septent. in Occas.	63	40	0	
423 p.				
Altitudo Merid. ♄	82	58	0	A
429 p.				
Altitudo Occid. Lucid. Lyrae	22	50	0	
Azimuth a Septent. in Occas.	41	57	0	
715 p.				
Altitudo Merid. ♂	82	56	30	A
500 p				
Altitudo Occid. Caud. Vulturis	35	11	30	
Azimuth	67	24	0	
170 p.				
Altitudo Occid. Caud. Vultur.	34	36	0	
Azimuth a Septent. in Occas.	67	53	0	
159 p.				
Altitudo Occid. Lucid. Lyrae	18	49	0	
Azimuth	45	38	0	

[90]

	G.	M.	S.	
Vltima medietas noctis nubila, pluit.				
Die $\frac{5}{15}$ Octob.				
Altitudo ⊙ Merid.	89	11	0	A
Nox Nubila				
Die $\frac{6}{16}$ Octob.				
Altitudo ⊙ Merid.	88	49	30	A
Die $\frac{7}{17}$ Octob.				
Altitudo ⊙ Merid.	88	27	30	A
Integrum fere Mensem peregri abfui Chorographiae et Topographiae Causa:				
Die $\frac{3}{13}$ Novemb.				
Coelum pro noto haud erat Serenum ad Observationem ⊙ Eclipsis quae accidebat, attamen Initium et finem rite observatam.				
Hor. igitur 10 $\frac{1}{2}$ horolog. paulo plus in Altit. ⊙ Orient.	67	12	0	
Initium hic erat Mauriciae[187].				
Hor. 1 $\frac{1}{2}$ fere post merid. in alt. ⊙ occ.	67	26	0	
Desinebat Eclipsis ⊙ Mauriciae.				
Altitudo ⊙ Meridiana Obscurati:	79	51	0	A
Et eo Momento observatio maxima proxime Crepusculi Vespertini initium videbatur. Caelum Obtusum. Inclinatio				

[91]

[Mss Paris]

	G.	M.	S.
in Meridiem talis circiter, exacte observare nubes Invidebant. Digiti obscurati 10.			
Incaepit Eclipsis ab Occidente Superius,			

187 *Mauritiae* before.

desijt ab Oriente inferius Sectiones omnes
Curvae.
Raptim Observavi quum Cornua deorsum
inclinabant.
Altitudo ⊙ Occid. 79 14 0
Et quum 6. digit lumen Recuperasse
videbantur, erat Altitudo ⊙ Occid. 77 38 0
Pag. Seq. vide observationem hujus
Eclipsis Nauclerorum

Die $\frac{4}{14}$ Novemb.

Altitudo ⊙ Merid. 79 35 40 A

Die 15 Novemb.

Altitudo ⊙ Merid. 79 20 20 A

Biduum pluvice.

Die 18 Novemb.

Altitudo ⊙ Merid. 78 37 0 A

Die $\frac{9}{19}$ Novemb.

Altitudo ⊙ Merid. 78 23 30 A

Die 20 Novemb.

Altitudo ⊙ Merid. 78 10 0 A

Septiduum Nubilum, pluvium mixtum.

[92]

G. M. S.

Die 28. Novemb.

Altitudo ⊙ Merid. 76 37 30 A

Die 29. Novemb.

Altitudo ⊙ Merid. 76 27 0 A

Die 30. Nubilum

Die 1ª Decembris.

Altitudo ⊙ Merid. 76 8 30 A

Seqq. Septimanis peregre iterum abfui.

Die $\frac{10}{20}$ Decemb.

Altitudo ⊙ Merid. 74 39 40 A

Die 21. Decemb.

Altitudo ⊙ Merid. 74 39 30 A

Die 22. Decemb.

Altitudo ⊙ Merid. 74 40 0 A

Seqq. Obtusum Coelum.

Die 28. Decemb.

Altitudo ⊙ Merid. 74 53 30 A

Die 29. Decemb.

Altitudo ⊙ Merid. 74 57 30 A

Die 30. Decemb.

Altitudo ⊙ Merid.	75	2	0	A
Die 31. Decemb.				
Altitudo ⊙ Merid.	75	6	20	A

~.

[93]

Observationes
Eclipsis Solis

$\frac{3}{13}$ Novemb. 1640. ~
Aliquot Nauclerorum.
Sub latitudine Australi 20° 5' remotus a terra seu littore Brasiliae 23 milliaribus observavit Initium hor. 11 ante Meridiem finem h. 1.15'. post merid. et digitos observatos 8 seu $\frac{2}{3}$ Coelo sereno, vento N.N.[188] Navarchus (LEENDERT RIEIJSEN HARTOCHS[189]) Inde ponam longitudinem loci observationis 346 gr. 20'. min. ~

~.~

Sequitur annus C. 1641
Et in eo Observationes
coelestes Georgij Marggrafij.

Die 1.2. et 3. Januarij, nubilum enim pluit.

188 *N.N.W.* according to to the original letter.

189 The original Dutch letter is preserved among the Leiden manuscripts (*ELO*, North no. 1). It reads: *Int Jaer onses heeren 1640 | Item, op Den 13 november de klock 11 ueeren twee | begonnen | De keliptie inde sonne ende hij weerden twee derde paertten | veer duijstert ende het duerde tot de kloock 1 ueeren ende ¼ ueers | twee ende wij hadden op des vrijdach de hoeckes van 20 graeden en | 5 menutes ende wij hadden leeijnten 346 grades ende 28 menuten | besuiden de kijmme ende wij waeren buiten de wech 23 millen ende wij | hadden moeij ronde schin weer en den wint weer noort noort dewest | Schijper LEENDERT REIJNSEN VERHOCHEN*. According to the signature of the original letter, the correct name of the skipper was 'VERHOCHEN'.

[94]

	G.	M.	S.	
Die 4. Jan. 1641. Stilo Gregor.				
Altitudo ☉ Meridiana	75	29	30	A
Die 5. Januarij.				
Altitudo ☉ Meridiana	75	36	30	A
Die 6. Januarij.				
Altitudo ☉ Merid.	75	44	0	A
Die 7. Jan. Nubilum.				
Die 8. Januarij.				
Altitudo ☉ Merid.	75	59	30	A
Die 9. Januarij.				
Altitudo ☉ Merid.	76	8	0	A
Die 10. Januarij.				
Altitudo ☉ Merid.	76	17	0	A

Vesperi Coelo Serenissimo observavi quamdiu aliquas litteras Vulgariter Scriptas posset. Sub die post occasum ☉, nulla adhibita candela, tam diu autem perfecte legere potui, usque[190] dum Mirach S. Cingulum Andromedae haberet altitud. Occid. 41 1 0
Et Azimuth ejus a Sept. in Occas. 29 21 0
☉ Occidit hodie hora 6.12'
Altitudo Merid. Capitis Medusae 2 20 0

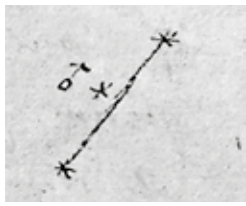
[95]

	G.	M.	S.	
Quia Coelum Serenissimum, observavi et durationem Crepusculi vespertini. Vidi Autem Rubedinem illam poenitus fugatam et Jam jam verum finem Crepusculi, quando Lucid. Latus Persej culminaret in Altitudine	33	19	30	B
Notandum autem Crepuscula hic paulo longiora esse sole versante in Australioribus signis, Breviora in Borealissimis, ubi ex observationibus Collectis etiam patebit.				
Hora 8 vesperi ♂ medius videbatur Inter medium et sequentem lini ♓.				

190 Beginning of the surviving part of the (incomplete preserved) manuscript in Lisbon.

Non tamen in recta linea, sed paulum
a linea recta australior sic[191]

[Mss Paris]



[Mss Lisbon]

Die $\frac{1}{11}$ Januarij.

Altitudo ☉ Merid.	76	26	40	A

Die12.Inconstans.

Die 13 Januarij.

Altitudo ☉ Merid.	76	48	30	A

Die 14 Januarij

Altitudo ☉ Merid.	76	59	30	A

[96]

	G.	M.	S.	

Die $\frac{5}{15}$ Januarij.

Altitudo ☉ Merid.	77	10	30	A

Die16 Januarij.

Altitudo ☉ Merid.	77	21	30	A

Die 17 Januarij.

Altitudo ☉ Merid.	77	33	30	A

Die 18 Januarij.

Altitudo ☉ Merid.	77	46	0	A

Vesperi h. 6 $\frac{1}{2}$ Tubo meo insidiatus
sum ♂ ♄ ♀: dicto ergo tempore
♀ distabat a ♄ $\frac{2}{3}$ diametri mei tubi,
erat que ♀ adhuc tantum Occidentalior
1. hora post. Iam proximior erat ♀
♄. et postea Ambo Occidebant.
Occidentaliores observare poterunt
Veram ♂. Quantum ad Latitudinem
Videbatur ♀ aut Strincturam ♄

191 'sic' added by the copyist?

aut eum quam proxime praeterituram
versus Austrum.
Calculus meus ex Rudolphinis prae-
dixit ♀ transituram ad Austrum 1'
minuto Australiorem ♄, nudis oculis
adspiciore[192] ♀ et ♄. ♀ eximie radiabat
et ad dextram altior paululum stabat

[97]

	G.	M.	S.	
♄ a Radijs ejus fere tactum ad visum				
et ipse egre videndus ab ♀.				
Praedixi hanc ☌ ♄ ♀ optime obser-				
uandam esse in Nova Hispania et vera				
dixi utinam nobis fortuna fuisset?				
Die 19. Januarij.				
Altitudo ☉ Meridiana	77	59	0	A
Vesperi h. 7 ♀ praeterierat ♄, exis-				
tens Orientalior, videbitur que distan-				
tia ♀ a ♄ eadem quae est Inter Austra-				
lem et Borealem in praecedenti cornu ♈				
[193]in Bayero γ et β).				
Triduum Inconstans.				
Die 23. Januarij.				
Altitudo ☉ Merid.	78	52	0	A
Biduum Nubilum.				
Die 26 Januarij.				
Altidudo ☉ Merid.	79	38	0	A
Triduum Nubile.				
Die 30 Januarij.				
Altitudo ☉ Merid.	80	43	0	A
Die 31 Januarij.				
Altitudo ☉ Merid.	81	0	0	A
Seqq. Turbidum.				

[98]

	G.	M.	S.	
Die 7. februarij.				
Altitudo ☉ Merid.	83	6	30	A
Die 9 februarij peregre profectus sum,				
et novem menses continuos abfui				
Geographiae causa. Mense Novembris				

192 Sic! It may be *adspiciuntur*.
193 An opening parenthesis is missing here.

rediens, Mensem Mauritiae consumpsi.
Sed maximam partem etiam in vicinis
Locis Geographiae causa absens.
Mense decembris die 10 peregre
profectus sum in Borealem Brasiliae
ab hinc partem chorographiae
et historiae naturalis causa, Interea
ab Operibus Astronomicis feriavi
Coactus fui. In posterum tamen Deo
vita et valetudine concedente redux
Continua opera, etiam quae restant
in hac parte Omnia peragam.

Anno Christi 1642.
Die $\frac{6}{16}$ Iunij. ex hoc itinere
mense decembris Anni praeteriti
Inchoato Redij

~.~

[99]

G. M. S.

Σ × Θ ×[194]

Observationes Caelestes
Georgij Marggrafij.
Anno Christi 1642.

Die $\frac{4}{14}$ Aprilis vesperi in Castello
Ceulen, ad fluv. Potij î[195]: qui vulgo
Rio grande vocatur Ostium sito,
observavi instrumento meo, quod
Sextans erat initium Eclipsis ☾,
quando altitudo Procyonis seu Antica-
nis esset in Occidentali plaga coeli 31°.31'.0".
paulo post nubibus obducebatur coelum,
antea serenissimum. Imberque cadebat
et Lunam non videbam Amplius, usque
dum ultra 10 digit. esset observata.
Hinc enim serenitas exquisita redijt
et ego observavi principium totalis
observationis ☾ quando Altitudo Cordis
♏ Orientalis esset 32°.24'.0". postea
coelum iterum nubibus tectum fuit.
Antetempus principij emersionis ☾

194 Abbreviation of Σὺν Θεω, meaning ‘With God’, or ‘With Gods help’.
195 Sic!

[100]

ex totali umbra terrae coelum inclarescebat denuo, lunaque diu antequam veri luminis aliquid reciperet, falsa luce clarescebat. Tempus initij emersionis ex totali umbra invidere mihi nubes. De hinc coelum serenissimum usque ad omnimodum finem Eclipseos, quam observavi quando altitudo sinistri humeri ♐ esset in Orientali plaga 35°.18'.0". Incipiebat Eclipsis ab Ortu inferius, Recuperatio prima Luminis itidem erat ab Ortu; desinebat omnimoda Eclipsis ab Occasu.
Hanc Eclipsim etiam observavit Nauarchus JACOB ABRAHAMSEN, ad fluv. Ipanaema ostium in Capitania Ciara sub latitudine australi 4°.50'. Initium autem Eclipsis se observasse seribit vesperi h. 9.30'. finem h. 13.15'. Durationem totalis morae in umbra terrae ponit 1 $\frac{1}{4}$ horis.

Die 3. Octob. Greg.

	G.	M.	S.	
Altitudo ⊙ Merid. B	85	74	40[196]	

Die 7. Octob. Styl. Greg.

Vesperi circa 11. horam initium sumebat

[101]

	G.	M.	S.	
hic Mauritiae Eclipsis ☾, et 151.puls. [197]				
post initium erat ejus altitudo Orientalis ♂	48	43	30	
Coelum erat clarum sed multae nubes currentes, qua de causa non potui Stellam eligere quam volui.				
Tempore Eclipsis altitudo centri ☾				
Meridiana	76	14	30	B
214 p. post altit. Orient. Aldebar.	35	39	0	
Initium totalis observationis quo minus observarem Invidere nubes uti				

196 This value is clearly wrong. A plausible correction is *86° 4′ 40″*.

197 A draft of this observation of the eclipse of 7 October 1642 is also written on a single sheet of paper among the Leiden documents (North no. 61).

et emersionem ex totali umbra. Tempore totalis Eclipseos ☾ parum Conspicua, Ante emersionem totalem diu Lumine parum Splendebat pars obscurata autem in conspicua erat quando ☾ Incipiebat recuperare Lumen. Initium observationis ab ortu, emersionis itidem ab ortu. Post finem Omnimodae Eclipsis 2 minuta temporis erat altitudo occidentalis occipitis piscis Australis 16 50 0

Nota. ♂ ad Initium Eclipsis longitudo est 6.8[198]. Lat. Meridionalis descendens 1°.56'. proinde ascensio recta ♂

[102]

	G.	M.	S.	
34°.20'. et declinatio 11°.45' Borea. Aldebaran ascensio recta 63°.53', et declinatio 15.44. Borea. Occipitis piscis Australis ascensio recta 344°.4'. Et declinatio 1°.21'. Borea.				
Die $\frac{5}{15}$ Octob.				
Altitudo ⊙ Merid.	89	23	0	A
Die 2. Novembris.				
Vesperi h. 6 $\frac{1}{2}$ circiter				
Altitudo Occ. Cor.♏	14	32	30	
Azimuth ejus ab Occid. in Merid . 264 . puls. post.	25	52	0	
Altitudo Occid. ☿	5	10	0	
Azimuth ab Occid. in Merid. 152 p. p.	21	53	30	
Altitudo Occid. Cordis ♏	13	3	0	
Azimuth Occid. in Merid.	25	55	0	
Die 7. Novemb. Greg.				
Vesperi hor. 6 $\frac{1}{2}$ circiter				
Altitudo Occid. Cord. ♏	9	34	0	
Azimuth ab Occid. in Merid. 166 p. p.	25	50	0	
Altitudo Occid. ☿	7	32	30	
Azimuth ejus ab Occid. in Merid. 93 p. p.	23	50	0	

198 Or *6′ 8″*.

[103]

	G.	M.	S.
Altitudo Occid. Cordis ♏	8	35	30
Azimuth	26	23	0
130 p. p.			
Altitudo Occid. ☿	6	37	30
Azimuth	23	52	0
129 p. p.			
Altitudo Occid. Cordis ♏	7	44	30
Azimuth	26	12	0
127 p. p.			
Altitudo Occid. ☿	5	49	0
Azimuth	23	52	0
157 p. p.			
Altitudo Occid. Cord. ♏	6	50	0
Azimuth	26	26	0
117 p. p.			
Altitudo Occid. ☿	4	53	30
Azimuth	23	56	0
129 p. p.			
Altitudo Occid. Cord. ♏	5	58	30
Azimuth	26	34	0
Die 8 Novemb. Vesperi h. 6 $\frac{1}{2}$			
Altitudo ☿ Occid.	10	41	30
Azimuth ab Occid. in Merid.	23	52	0
198 p. p.			
Altitudo Occid. Lucid. Lyrae	25	10	0

[104]

	G.	M.	S.
Azimuth a Septent. in Occid.	41	22	0
230 p. p.			
Altitudo ☿ Occid.	9	10	0
Azimuth	23	54	0
397 p. p.			
Altitudo Lucid. Lyrae Occid.	23	42	30
Azimuth	42	33	0

Cor ♏ videbam aequalis fere *[one illegible word]*
paulo majoris altitudinis ab horizonte
cum ☿, sed australius longe: Invide-
bant nubes supervenientes, quo minus
cum ☿ conferrem.

Die 9. Novemb. Gregor.

Vesperi hor 6 $\frac{1}{2}$ ad 7.			
Altitudo ☿ Occid.	11	35	0
Azimuth ab Occas. in Merid.	23	52	0
134 p. p.			
Altitudo Occid. Lucid. Lyrae	24	59	0
Azimuth a Septent. in Occas.	41	35	0
120 p. p.			
Altitudo ☿ Occid.	10	37	0
Azimuth	23	53	0
158 p. p.			
Altitudo Occid. Lucid. Lyrae	24	15	30
Azimuth	42	9	0

[105]

	G.	M.	S.
202 p. p.			
Altitudo Occid. ☿	9	19	0
Azimuth	23	58	0
179 p. p.			
Altitudo Occid. ☿	8	48	0
Azimuth	74	3	0[199]
188 p. p.			
Altitudo Occid. Cordis ♏	6	54	30
Azimuth ab Occid. in Merid.	26	22	0
149 p. p.			
Altitudo ☿	7	40	30
Azimuth	24	13	0
215 p. p.			
Altitudo Occid. Lucid. Lyrae	21	53	0
Azimuth a Septent. in Occas.	43	40	0

Die $\frac{10}{20}$ Novemb.

Vesperi hor. 6 $\frac{1}{2}$ ad hor. 7 $\frac{1}{4}$			
Altitudo Merid. fomahant ♒	66	40	0
189 p. p.			
Altitudo ☿ Occid.	12	3	30
Azimuth ab Occid. in Austrum	25	33	0
272 p. p.			
Altitudo Occid. Caud. Cygni	29	43	0
Azimuth a Sept. in Occas.	27	20	0
166 p. p.			

199 Sic, but according to calculation a plausible value should be *24° 3′ 0″*.

[106]

		G.	M.	S.	
Altitudo Merid. ♃		88	38	0	A
235 p. p.					
Altitudo ☿ Occid.		9	40	0	
Azimuth		25	45	0	
153 p. p.					
Altitudo Occid. Caud. Cygni		28	43	0	
Azimuth		28	40	0	
139 p. p.					
Altitudo ☿ Occid.		8	40	0	
Azimuth		25	51	0	
170 p. p.					
Altitudo Occid. Caud. Cygni		28	8	0	
Azimuth a Septent. in Occas.		29	27	0	
NB. quamprimum ☿ videbatur in crepusculo vespertino, Tubo cum accurate lustravi, et apparuit Cornut.					
Eadem vespera ab h. 9 $\frac{1}{2}$ ad 11 $\frac{1}{2}$ h.					
Altitudo Meridiana El Karnar		39	13	30	A
Sequens El Karnar in fluvio		42	58	0	A
Duarum quae Supra 3. Eridiani occidentalior		50	10	0	A
3 Eridiani		44	52	30	A
	Duarum quae Supra 3.				
Haec 30" temporis	Erid. Orientalior	49	8	0	A
culminabat post 3.	Conversionis Colli				
Eridiani.	Hydri tertia	28	50	0	A
	Caput Hydri	34	56	0	A
Tertia Eridiani		45	0	30	A
Quarta Eridiani		48	56	0	A
In Hydro tertia d. quinque		28	0	0	A

[107]

	G.	M.	S.	
Quinta Eridani	53	49	0	A
In Erid. (quae 7 esse debet) glob. caret	56	50	0	A
Supra hanc Longe	64	17	30	A
Altitudo Merid. Convers. Colli Hydri 2ª	28	29	0	A
Sexta Eridani	56	31	0	A
Convers. Colli Hydri prima	29	7	0	A
Superior Colli Hydri seu secunda	32	47	0	A
Longe supra hanc mox culminans	37	9	0	A
(Duas omisi hic.)				
Sub 20. Erid. Orient.	67	48	30	

Die $\frac{11}{21}$ Novembris.

Vesperi ab hor 6 $\frac{1}{2}$ ad hor. 10.				
Altitudo Merid. fomahant ♒	66	40	0	A
150 p. p.				
Altitudo ☿ Occid.	31	1	30[200]	
Azimuth ab Occid. in Merid.	25	50	0	
157 p. p.				
Altitudo Lucid. Vult. Occid.	40	23	0	
Azimuth a Septent. in Occid.	73	18	0	
122 p. p.				
Altitudo ☿ Occid.	12	2	0	
Azimuth	25	51	0	
131 p. p.				
Altitudo Lucid. Vult. Occid.	39	24	0	
Azimuth	73	55	0	

[108]

	G.	M.	S.	
122 p. p.				
Altitudo ☿ Occid.	1	9	0	
Azimuth	25	53	0	
128 p. p.				
Altitudo Lucid. Vult. Occid.	38	33	30	
Azimuth	74	2	0	
☿ lustravi in Crepusculo et apparuit fulcatus more ♀				
Altitudo Merid. in eductione Rostri Toucan (β)	38	6	0	A
Quae in linea Recta fere inter fomah. et ζ phoenicis	53	44	0	A[201]
In phoenic. alae dextr. 3. bor (ζ)	58	24	0	A
In eadem ala trium media (ε)	53	41	0	A
In eadem ala trium Austral. (δ)	50	49	0	A
Sub δ phoenic. (glob. non habet)	46	6	30	A
Supra phoenic. (glob. non)	68	9	0	A
In eductione alae sinistr. Toucan super (δ)	31	59	0	A

200 Sic! According to a Leiden manuscript, dated at the beginning 20 November 1640 (*ELO*, North no. 49), this must be *13° 1′ 30″*, which indeed is a more plausible value. This value is used in the translation.

201 Sic! According to a Leiden manuscript, dated at the beginning 20 November 1640 (*ELO*, North no. 49), this must be *63° 44′ 0″*, which indeed is a more plausible value. This value is used in the translation.

In ejusdem alae eductione Inferior				
5 (culminat mox post δ)	30	39	30	A
Seu trium prima et Occid. ζ				
Alae dextrae phoenicis (ν)	43	30	30	A
In phoenice quod ejus Rostrum dici				
potest (glob. non habet)	50	34	30	A
In Media Ala (ζ)	31	20	0	A

[109]

	G.	M.	S.	
Conversionis colli hydri | Sexta (ι)	19	1	0	A
| Quinta (θ)	24	13	0	A
Lucida Colli phoenicis (α)	54	2	30	A
parvula ejusdem (β)	52	36	0	A
In dorso Toucan (η)	33	19	0	A
Ad dextr. ped. phoenicis trium Austral.				
(κ)	47	31	0	A
In eductione alae sinist. phoenic. (η)	50	11	0	A
In foco sub ped. dext. phoenicis duarum				
superior	38	50	0	A
In phoenice (glob. non habet)	45	16	30	A
Supra phoenicem (glob. non habet)	66	55	0	A
In foco sub ala sinistra phoenicis				
duarum borealior (λ)	49	39	0	A
In foco sub pede dextro phoenicis				
duarum inferior (ν)	41	8	0	A
Super λ phoenic. (glob. non habet)	50	50	0	A
Conversio h. colli hydri quarta (η)	27	29	0	A
Supra μ phoenicis glob. non habet	53	6	0	A
In foco sub ala sinist. phoenicis duarum				
australior (μ)	47	19	0	A
El Karnar	39	13	0	A

Die $\frac{12}{22}$ Novemb.

Vesperi altit. Merid. fomahant ♒	66	39	30	A
171 p. p.				
Altitudo ☿ Occid.	13	37	0	

[110]

	G.	M.	S.
Azimuth ab Occid. in Merid.	25	39	0
210 p. p.			
Altitudo Lucid. Vult. Occid.	39	51	0

Azimuth a Septent. ad Occas.	73	20	0	
182 p. p.				
Altitudo ☿ Occid.	12	19	0	
Azimuth	25	42	0	
180 p. p.				
Altitudo Occid. Lucid. Vultur.	38	24	0	
Azimuth	74	10	0	
138 p. p.				
Altitudo ☿ Occid.	11	15	0	
Azimuth	25	50	0	
131 p. p.				
Altitudo Lucid. Vult. Occid.	37	30	0	
Azimuth	74	12	0	
157 p. p.				
Altitudo ☿ Occid.	10	8	30	
Azimuth	25	56	0	
154 p. p.				
Altitudo Occid. Lucid. Vult.	36	21	0	
Azimuth	74	56	0	
☿ fulcatus cornua in Occidentem dirigebat, seu inferius.[202]				
Die $\frac{10}{20}$ Decemb.				
Altitudo ⊙ Merid.	74	40	0	M[203]

[111]

	G.	M.	S.	
Σ × Θ ×[204]				
Observationes Coelestes Georgij Marggrafij L.M.[205] Anno Christi 1643				
Die $\frac{10}{20}$ februarij.				
Vesperi ab hor. 7 $\frac{1}{4}$ ad 10 hor.				
Altitudo Merid. dorsi Columbae (γ)	63	53	30	A
In dorso dorado	35	30	0	A
In eductione alae dextr. Columbae	62	17	0	A
In Bolide Naucleri	47	3	0	A
Duarum in Dorado prope polum				

202 This is the last observation copied by Boullieu in the manuscript in the Observatoire de Paris, B12– 13.

203 *M* for meridional was used instead of *A* for austral.

204 Abbreviation of *Σὺν Θεω* that means 'With God', or 'With Gods help'.

205 *L.M.*: abbreviation for *Liebstadio-Misnici.*

Eclipticae Bor.	32	23	30	A
Canobi	45	47	30	A
Humerus gubernatoris Navis	55	20	0	A
In genu pedis posterioris Sinistri Canis majoris	66	5	0	A
In Navis Ambulacro ad Sinist. Canobi	48	0	0	A
Sub hac Australior Longe	36	42	0	A
in extremitate caudae piscis volantis	28	21	0	A
In extremitate ala[206] dextrae piscis volantis	30	59	0	A
Sup. Clipeo Navis Longe (λ)	55	37	0	A
Extrema alae sinistrae piscis volantis	26	30	0	A
In Navi Supra duobus Nebulosis	46	11	0	A

[112]

	G.	M.	S.	
Die 10 Martii Gregor.				
Vesperi ab hor. 8 ad hor. 10 $\frac{1}{2}$				
Altitudo Merid. in extrem. alae destr. piscis volantis quae in Navi (θ)	58	32	0	A
Quae Super Nebulosis junctae[207]	46	14	0	A
Extrema alae Sinistr. piscis volantis	26	31	0	A
In Navi (δ)	59	12	0	A
Nebulosae junctae[208]	38	35	0	A
In Navi (ζ)	51	59	0	A
In ventre piscis volantis	30	42	0	A
Ad Sinistrum nebulosarum (μ)	39	53	30	A
Prima alae sinist. piscis volantis	27	57	0	A
Prima alae dextrae piscis volantis	33	19	0	A
Ultima Caudae Chamelonis	22	32	0	A
Duarum in Navi Occidentalior	46	35	0	A
In Navi	39	46	0	A
In Navi	44	52	0	A
Penultima Caudae Chamelonis	22	0	0	A
In Navi	38	59	0	A
In Navi	52	31	0	A
In Navi	56	13	0	A
Antepenultimam Caudae Chamelonis	20	40	0	A
Caput piscis volantis	35	15	0	A[209]
In Naui duarum Occidentalior	40	41	0	A
Quae Sub hac	37	23	0	A

206 It should be *alae.*
207 Inserted at the left in the margin: *glob. caret.*
208 Inserted at the left in the margin: *glob. caret.*
209 Sic!

Duarum Orientalior	40	25	0	A

[113]

	G.	M.	S.	
In Navi	30	1	0	A
Quae Supra duabus Antedictis	44	44	0	A
In Navi	59	17	0	A
In Navi	42	48	0	A
In Navi duabus Orientalior	40	36	0	A
In Navi	37	20	0	A
In Navi	34	50	0	A
In Navi	45	20	0	A

Dehinc peregre abij Geographiae
et Historiae Naturalis causa, Redij 2.
Aprilis.

Eclipsis Lunae partialis

Die 4. Aprilis Gregor. Mane coelum Serenum erat, Nubes currentes, ventus terrestris, hora 4 $\frac{1}{2}$ nondum Initium Eclipseos, postea nubes obducebant Occidentem, quominus ☾ videri posset. Emergebat ☾ ex Nubibus altitudinem habens 4. grad. Occidentalem, in claritate Crepusculi deficiens $\frac{1}{4}$ ab Austro, seu ad sinistrum mihi. Iterum disparebat, amplius non conspicua, ante occasum suum, tantum de hac Eclipsi observare nubes concesserunt.

[114]

	G.	M.	S.	
Die 21 Junij Serenissimum.				
Altitudo ☉ Merid.	58	23	30	B
Die 22 Junij.				
Altitudo ☉ Meridiana	58	23	30	B

÷

Finis Observationum
Georgij Marggrafij.~[210]

210 End of both the Lisbon and Paris manuscripts.

TRANSLATION: THE ENGLISH TEXT OF MARGGRAFE'S ASTRONOMICAL OBSERVATIONS IN DUTCH BRAZIL

[1]

Short description of our astronomical observatory and of the instruments

of whose skilful construction I took care through the generosity of the most illustrious and distinguished hero, count Johan Maurits van Nassau, in the new town of Mauritia, in the island of Antonio Vaz, which is in Brazil, in the southern region of America.

We supervised the erection, on top of the house of the most illustrious hero [Johan] Maurits van Nassau, the Governor of Brazil, etc., of a square platform, the sides of which measured 20 Rhineland feet.[1] From there a very wide view is offered over the sea and the land around it. Climbing this platform is done from the interior of the house through 43 very comfortable steps. In the center of the platform, we erected a hexagonal turret with six sides, each with a width of six …

[2]

Rhineland feet.[2] The height of the turret is 13 feet.[3] Its floorboard (where the instruments are placed) stands 5 feet[4] above the floor of the platform, so that there is an enclosed and dark room underneath for observations and optical experiments.

The upper chamber of the turret, where most of the astronomical observations are carried out, has a height of 8 Rhineland feet[5] and on one side, after climbing 10 steps, one finds the entrance door. In the five remaining sides there are large windows with glass, and above these five windows, as well as above the door, the sides of the room reach $1\frac{1}{3}$ Rhineland feet up to the ceiling;[6] the upper part of this room is covered with another hexagonal floor, and is surrounded by six triangular shutters, four feet wide to the south and the north , and 2.5 feet wide on the remaining sides, and wide enough to open the turret on either side.[7] The six upper shutters can be opened by lifting them up, and the six bottom or side shutters …

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1 1 Rhineland foot = 0.314 meter. So, 20 Rhineland feet is 6.3 meter.
2 6 Rhineland feet is 1.9 meter. For designs for the observatory, see vol. 1, fig. 88 and *ELO*, North nos. 69a, 70r and 70 vs.
3 13 Rhineland feet = 4.1 meter.
4 5 Rhineland feet = 1.6 meter.
5 8 Rhineland feet = 2.5 meter.
6 $1\frac{1}{3}$ Rhineland feet = 0.42 meter.
7 4 Rhineland feet = 1.26 meter ; 2½ Rhineland feet = 0.79 meter.

[3]

by folding them down, so that a wide view is accessible in all directions and all vertical and non-vertical elevations required for the instruments.

Above the turret there is an ambulacrum still four feet high, which light handrail can be easily removed, and in the middle of that pyramid is a wooden structure, decorated with a copper vane, holding the insignia of the Count of Nassau. Inside, in the middle of the upper room, the quadrant was installed, securely attached to a square beam (with each side 6.5 inches wide and 6 feet and 9 inches long), which can pivot on a 10-inch long and 5-inch wide supporting beam adjacent to the upper floor.[8] This quadrant, 5 Rhineland feet high, is made out of a sturdy wood that the Portuguese call *Pau Santo*.[9] The workmen divided the graded circle to within one and a half arc minutes, so that it would be possible to observe a quarter of an arc minute in normal use. The quadrant also has a Tychonic sight with a cylinder. The cylinder itself (while …

[4]

protruding) measures approximately 4¾ inches; [it is] not quite wide or thick, but 2½ inches in diameter. A ruler has the length of the instrument and is 3¾ inches wide.

The *dioptra* [or astronomical sighting tube] has two slits parallel to each other and parallel to the sides at the extremities of the cylinder, mutually separated 2½ inches, with a length of 3 inches.[10] Inside these parallel and at right angle slits there are perpendicular slits made short for grasping exactly the [apparent] diameter of the Sun, when taking its elevation. The entire *dioptra* is 4¾ inches long, and its full width is 3¾ inches. An azimuthal circle 10 Rhineland feet in diameter encircles the quadrant; the pillar of the quadrant is in the center [of the azimuthal circle], from which a pointer stretches over the circuit of the [azimuthal] circle, in order to show how much degrees and minutes the observation of the azimuth provides.

The azimuthal circle is divided into minutes, so that 30" can be recorded. This azimuthal circle rests on 12 columns, 1½ feet above the floor of the room. The lower end of the quadrant is 2½ feet above this floor.

[5]

Its upper part is ½ a foot away from the top of the room. The quadrant is attached to a square frame of beams that can be easily turned by means of two square iron tools.

I took care also of building a sextant[11] in the same way (as the quadrant), 5 Rhineland feet high, and divided in the same way and equipped with a similar ruler, a Tychonic sight and a cylinder for measuring [angular] distances. This [instrument] is kept in a special place under the ladder, whereby one goes up to the larger room. To this lower side [of the sextant] 4 small finger thick tools were inserted by means of screw thread, tapered towards

---

8 Drawings related to the 5-foot quadrant were found in the Leiden manuscripts.See vol. 1, fig. 90 and 91b (*ELO*, North no. 71vs).

9 *Pau Santo* , literally '*Holy Wood';* scientifically *Zollernia paraensis.*

10 Related drawings were found among the Leiden manuscripts. See vol. 1, fig. 92b (*ELO,* North no. 73r and 73vs).

11 For a drawing of the sextant, see vol. 1, fig. 94 (*ELO*, North no. 71r).

the central line, each 4 feet long, and likewise two toward the sphere [of a ball joint], each 3 feet long; so that the sextant may stand firm upon his pedestal.[12] In the side of the pedestal there are many holes in which iron plugs can be inserted and secured. These plugs are blocked at their ends by iron pins [inserted into holes], so that they do not need to be secured [in some other way]. I have also another small sextant, …

[6]

the height of which is 20 Rhineland inches, or 1 foot and 8 inches, divided into 2 arc minutes. [This instrument] is [also] equipped with a cylinder and a Tychonic sight with narrow slits and sighting tubes, for conducting geodetic observations and also [for astronomical use] during the expeditions.

I also have four celestial and terrestrial globes of different sizes, with Bayer's *Uranometria*, which are always used in the observatory. Further, there are two hourglasses, which act as *clepsydra*. And I have an outstanding telescope, [with a tube] seven feet long.

To measure the time while observing during the *nychthemeron* [night], I constructed on a lathe a cylindrical plumb bob of metal, weighing 2 pounds and 9 ounces (or 41 ¾ ounces). It is suspended from a rope, 2 foot 5 inch, or 29 inch long.

In the lower dark room, which can be illuminated inside by light through the circular apertures, a support has been made for adjusting the *tubus* [telescope] to observe solar eclipses, sunspots etc. This support consists of a principal beam …

[7]

4½ feet high, 4 inches wide and 1½ inch thick, that can stand up; for the lower part has a transverse beam, on which it leans; it has many transversal (or crossed) holes[13] and in the middle of the cavity a 9 feet long ruler can be inserted, which can be operated on either side, and set higher or lower. The ruler is three inches wide and more than one inch thick and above it a circular frame, one foot in diameter, is inserted that can be turned, lowered or removed. On the ruler, at intervals of [respectively] 1½, 3, 3 and 1½ feet, vertical holders are raised, 8 inches high, upon which the *tubus* [telescope] can be placed, the upper part of which is covered.[14] The other end of the ruler leans on the aperture or window.

Outside the building, on the platform there are some pedestals for placing the instruments during the observations. One [is made] of solid timber, 5 feet high, with a sturdy cross shaped foot below, on which a sphere [with a diameter] of one foot is set,[15] that can move around in its casing; this sphere has a square protuberance, two inches wide and 2½ [inches] high, upon which the great sextant can be set for …

12 For a sketch of the pedestal of the sextant, see also vol. 1, fig. 94 and below, manuscript page 7.

13 For displacing the *telescope* laterally.

14 For a sketch of this device, see *ELO*, North no. 72vs.

15 The sphere of a ball joint.

[8]

measuring stellar [angular] distances. On the top part of another vertical pedestal of two feet high, a hollow gutter with a length of five feet is attached, which can be moved by screws.[16] A semicircle is attached to both ends of the vertical stand to stabilize the 7-foot telescope [in the gutter], so that the fixed [stars] and the planets can be accurately examined and viewed, and the Moon's encounter with the fixed [stars] and the planets may be recorded exactly. When I use this pedestal, the whole is attached to the balustrade of the platform, having below a round point that can be inserted into a hole and may be turned with ease.

Another 2½ feet high pedestal, with a small vertical rod, can also be attached to the balustrade of the platform, just like the previous one. The small sextant can be hung on this stand for the measurement of elevations. In each corner of the *Theatre* [platform], I outlined a sundial, so that in different ways the time always may be recorded from the shadow of the Sun.[17] However, under the roof of the house of His Excellency, …[*sentence not finished*].[18]

[9]

Below the platform there is a large iron clock that by the stroke of the bell announces the time to all inhabitants of our city.

When I travel, I also have for the smaller sextant a Polish-style hammer-shaped pedestal, made of solid iron, about 9 inches long, with a cuboid protrusion, one inch long, high and thick in the rear and upper part, so that the sextant can be placed horizontally for measuring [azimuthal] distances, and suspended vertically for measuring elevations.[19] This hammer is attached to a stick, 4 ½ feet long, made of sturdy wood called *Pao Santo*, the lower part of which is long and tapered, so that it can be pinned steadfastly into the ground. Further, I have a triangular level (commonly called *Waterpass*), a carpenter's square, three rulers made of a solid wood, all needed for orienting the instruments. Also, a slate board, two lanterns, a three-legged stool with three steps for …

[10]

climbing up to the quadrant,[20] another bench beneath the large quadrant, required for getting the elevations, and other necessary items.

16 For the placing of a telescope.

17 A possible drawing of the sundial's *gnomon* or staff can be found in *ELO*, North no. 72r. See vol. 1, fig. 96.

18 This is probably the result of a transcribing error by the French copyist.

19 A partial drawing is present in the Leiden manuscripts (*ELO*, North no. 72r). See vol. 1, fig. 96.

20 Its aligning sight.

[1638]

Some observations performed by myself without instruments on the Island of Antonio Vaz, before the instruments were finished and the observatory was built.

On 19 September 1638, at 6:30 PM, seen [with the naked eye], Mercury stood as far from Spica of Virgo[21], as Mars was then from the Archer's left shoulder (σ according to Bayer).[22] But Mercury was more to the west and to the north than Spica. On the following day, 20 September, at about 6:30 PM, Mercury was still more westward and northward than Spica. She was seen standing apart from that star by a distance [comparable to the interval] between the Heart of Scorpion[23] and the star preceding it in the east, which according to …

[11]

… Bayer is τ [Scorpii][24]. (The distance of the Heart of Scorpion and the preceding star $2\,\widehat{C}$[25] to the south is according to my calculation for this time 1° 10', or 29 times the distance between Mercury and Spica[26]. But I am not sure of the precise location of a single fixed star). On the following day, 21 September [1638], about 6:30 PM, Mercury passed Spica of Virgo and seemed to be as far from it as yesterday, and more easterly in so far as yesterday was more westerly.

In the evening of 18 May 1639, Mars, Venus and Mercury formed an upward isosceles triangle, whose base was formed by Mars and Mercury. Mercury was setting and Venus shortly afterwards, and a minute (in time) later the (almost full) Moon rose with its upper edge. This evening Jupiter (itself standing in the eastern region of the sky) did cast shadows and shined on the river named Rio Beberibe, while Venus (whose brightness was seen on the river called Rio Capibaribe) did cast shadows circumscribing the bodies. After the next day, on the evening of 20 May [1639], Jupiter and Venus [also] cast shadows circumscribing the bodies. On the following day, evidently the day of …

[12]

… 21 May [1639], at 7 PM, Venus was more eastward and more northward than Mars, and also at half distance between the two southern stars of the Orion's sword[27], or at an equivalent or small distance of the brighter star in the middle of the tail of the Great Bear[28]

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21 **Spica**, or α Virginis, with an apparent visual magnitude of 0.97, is the brightest object in the constellation of Virgo and one of the 20 brightest stars in the night sky. *First observation.*

22 σ Sagittarii. *First observation.*

23 **Antares**, or α Scorpii, with an apparent visual magnitude of +0.6 down to +1.6, is the brightest star in the constellation of Scorpius. On average it is the 15th-brightest star in the night sky. *First observation.*

24 τ Scorpii. *First observation.*

25 Maybe the symbol for *degree* (°).

26 Spica, or α Virginis. First observed 19 September 1638.

27 These stars might be δ and ε Orionis.

28 ε Ursae Majoris. *First observation.*

to the star almost falling upon it[29]. Jupiter and Venus [again] cast shadows circumscribing the bodies in the absence of the Moon.

Black spots, like the eclipsed Moon in the Milky Way do not appear in the eastern sky, as José de Acosta wrongly states in the second Chapter of the first book of his *Historia Natural y Moral de las Indias.*[30] But there are a few [regions] that seem blacker than the rest of the sky, because they lack that light of the stars with which the rest of the galaxy abounds. But there are a few [regions] that appear blacker than the rest of the sky, because they lack the light from the stars that the rest of the galaxy is so richly supplied with. However, there are [only] three or four of such less luminous regions. The Magellanic Clouds lack the [naked eye] visible stars. They consist of the same substance as the Milky Way.

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[13]

Observations I made of the total Lunar Eclipse in the evening of 20 December 1638 on the Island of Antonio Vaz in Brazil and in its town, Mauritia.

In the evening of the aforesaid date and year, the beginning of the eclipse of the Moon took place.[31] And although the observatory and the instruments were not yet finished, so that I was deprived of being able to set up the observation privately (the structure on the house [of the Governor] would only be ready in September of the next year 1639), we recorded carefully the time of the critical moments with the installed one-foot quadrant. When then the Moon started to fade out in the eastern border, the elevation of Procyon[32] in the eastern region was 33° 30'
and when half of the Moon was observed, …
… Procyon was seen at the eastern elevation of 42° 20'.

29 78 Ursae Majoris. *First observation.*

30 Marggrafe refers here to José de Acosta, *Historia natural y moral de las Indias, en que se tratan las cosas notables del cielo, y elementos, metales, plantas, y animales dellas: y los ritos y cerimonias, leyes y gouierno, y guerras de los Indios* (Sevilla: Juan de León, 1590). In his account of his observations of the southern sky in Peru, Acosta mentions dark spots like the eclipsed Moon participating of the daily motion of the sky as the Milky Way, that he did not have seen in the northern skies.

31 According to SkyMap, this eclipse was entirely visible from Recife.

32 **Procyon**, or α Canis Minoris, with an apparent visual magnitude of 0.34, is the brightest star in the constellation of Canis Minor (‘the small dog’) and the eighth-brightest star in the night sky. *First observation.*

[14]

In the beginning of the observation of the total [eclipse], …
… the eastern elevation of Procyon was 50° 10'.
Note that [ ][33] included here is meant to indicate that these values are not completely accurate. Because the method of observing is slippery. But the most important moments have been carefully observed. At the end of the observation of the total [eclipse] the eastern elevation of the Heart of the Lion[34] was 33° 30'.
When the light of the lunar disc was recovered, …
… the elevation of the Heart of the Lion was 37° 30'.
When the Moon was seen halved, the elevation of the Heart of the Lion was 41° 30'.
At the end of any sign of eclipse the elevation of the Heart of the Lion was 48° 00'.
During the eclipse the sky was mostly clear. As for the colour of the eclipsed Moon, it should be noted that, until it was plunged into total shadow, from the beginning to the total eclipse, the Moon had the same colour as a recent New Moon here.[35] However, after the whole [Moon] was immersed in the shadow of the Earth, the shadow was darker towards the east, while the remaining part was brighter. But in general the whole …

[15]

… Moon appeared red and had even the colour of a plum. About halfway through the eclipse, the shadow in the center of the disk was thicker, but around the rim [of the Moon] it was redder, and as [the eclipse] progressed toward the beginning of the resurrection, it appeared more diluted; [the darkened part] that disappeared to the west was coarser than the part that bent to the east. Then came a golden brightness like a real light, because [the Moon] itself took on an extraordinary brightness and from then on the eclipsed part until the end of the eclipse had the same colour that it had from the beginning until the total obscuration. At no point did the illuminated part cause the Moon to split into two halves, or cut through a straight line, but always the dark part was crescent-shaped and ultimately obtuse.

Calculations have shown that a total lunar eclipse could be observed in Brazil on 25 June of the same year 1638. [36] But then it rained all night, with strong winds, and only once did I see the Moon shining through the clouds, obscured to about a third.

[16]

But it was then already the time predicted by the calculation when the Moon would gradually emerge from the shadow of the Earth, that is, near the end of the eclipse.

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33 The bracket might symbolize the values of the elevation.

34 **Regulus**, or α Leonis, with an apparent visual magnitude of 1,4, is the brightest object in the constellation Leo, and the 22nd brightest star in the sky. *First observation.*

35 The previous New Moon was on 5 December 1638.

36 The eclipse was indeed total, but partially visible from Recife in the dawn of 25/26 June 1638. When leaving the umbra, the Moon had already set.

Astronomical observations of Georg Marggrafe in the year 1639[37]

	°	'	"
On 15 September at 6:45 PM,			
when 2 minutes later the western elevation of Arcturus[38] was	18	59	00
the western elevation of Mercury was	10	49	30
and its azimuth from west to south was	07	30	00
7 o'clock, city time,			
when 2 minutes later the western elevation of Arcturus was	17	19	00
the western elevation of Mercury was	08	49	00
and its azimuth from west to south was	08	09	00
Repetition: when the western elevation of Spica of Virgo was	07	22	30
and 1 minute later the western elevation of Mercury was	06	29	45
and azimuth [from west to south]	08	20	00

[17]

Mercury and Spica of Virgo[39] stood in the same vertical [circle], Spica of Virgo higher and Mercury lower.

16 September [1639]

Meridian elevation of the Sun	79	09	north
At 6:30 PM, the meridian elevation of the upper star …			
… of the wing of the Swan[40]	37	31	45 north
At 6:45 PM, the western elevation of Arcturus[41]	19	46	00
1.5 minute later, Mercury's elevation	12	44	30
Azimuth from west to south	08	20	00

Mercury was further south and east than Spica, at about the same distance [from this star] as yesterday.

17 September [1639]

Meridian elevation of the Sun	79	32	30 north

18 September [1639]

Meridian elevation of the Sun in the north	79	55	15

In the evening, meridian elevation in the north …

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37 Here Marggrafe starts to report his observations with the 5 feet quadrant on the newly finished observatory. The observations recorded from this date, until 19 June 1640, are also noted down in the Leiden manuscript, ELO, North no. 53. The notes copied by Boulliau (Observatoire de Paris, B12– 13) also start here.

38 **Arcturus**, or α Bootis, with an apparent visual magnitude of -0,05, is the brightest star in the constellation of Boötes, the fourth-brightest in the night sky, and the brightest in the northern celestial hemisphere. *First observation.*

39 Spica, or α Virginis. First observed 19 September 1638.

40 The star should be STF 2579 in the Swan, but its meridian transit occurred more than one hour after the last recorded observation of the night. On the other hand, there was no other candidate star crossing the meridian around 6 h 30 m of the local solar time.

41 Arcturus, or α Bootis. First observed 15 September 1639.

… of the bright star of the Lyre[42]	43	20	30	
At 6:45 [PM], the western elevation of Arcturus	16	20	30	
2 minutes later, Mercury elevation	10	59	00	
Azimuth from west to south	09	36	00	
⎡Meridian elevation of the tail of the Eagle[43]	68	20	00	N
⎢[Meridian elevation] of the star in the middle of three …				
⎬ … in the wing of the Swan	30	49	30	N
⎢[Meridian elevation] of the star of the tip of Swan's wing[44]	37	31	30	N
⎣[Meridian elevation] of the bright star of the Eagle[45]	73	41	30	N

19 September [1639]

Meridian elevation of the Sun	80	20	00	N

[18]

In the evening, because of clouds moving swiftly I could not observe Mercury.

Meridian elevation of the bright star of Lyre[46]	43	20	45	
⎡Tail of the Eagle[47]	68	20	00⎤	
⎢Star in the middle of the three stars in the [right] wing of the Swan[48]	30	45	30⎢	
⎬Upper star of the wing of the Swan[49]	37	31	30 ⎬	north
⎢Star of the breast of the Swan[50]	42	43	30⎢	
⎣Star of the tail of the Swan[51]	37	46	30⎦	

20 September [1639]

Meridian elevation of the Sun	80	43	20	north
In the evening because of clouds moving swiftly, I could not observe Mercury.				
In the same evening from 9 PM to 3 AM:				
Meridian elevation of the head of the Crane[52] (γ)	59	7	30	south

42 **Vega**, or α Lyrae, with an apparent visual magnitude of 0.026, is the brightest star in the constellation of Lyra, and the fifth-brightest star in the night sky. *First observation.*

43 ζ Aquilae. *First observation.*

44 STF 2579. First observed 16 September 1639.

45 **Altair**, or α Aquilae, with an apparent visual magnitude of 0.76, is the brightest star in the constellation of Aquila (Eagle) and the twelfth-brightest star in the night sky. *First observation.* According to our calculation, this star crossed the meridian 33 s before the previous star.

46 Vega, or α Lyrae. First observed 18 September 1639.

47 ζ Aquilae. First observed 18 September 1639.

48 ι Cygni. *First observation.*

49 STF 2579. First observed 16 September 1639.

50 γ Cygni. *First observation.*

51 **Deneb**, or α Cygni, with an average apparent visual magnitude of 1,25, is the brightest star in the constellation of Cygnus ('the Swan'), and the 19th brightest star in the night sky. Deneb is one of the vertices of the asterism known as the Summer Triangle and the Head of the Northern Cross. *First observation.*

52 γ Gruis. *First observation.*

[Meridian elevation] of the right wing (left for Bayer) of the Crane[53]	49	29	30 south
Meridian elevation of the end of the beak of the Toucan[54]	36	13	20 south
[Meridian elevation] of the star where the tail of the Crane comes from.[55]	49	33	0 south
[Meridian elevation] of the star more to the north among the three in the tail of the Crane[56] (χ)	45	3	0 south
Fomalhaut of the Water Carrier[57]	66	38	0 south
[Meridian elevation] of the star of the Water Snake … … in the equinoctial colure[58]	18	55	30 south
(1 minute after the culmination of the bright star of the neck of Phoenix[59])			
[Meridian elevation] of the southernmost star of the tail of the Whale[60]	78	14	0 south
[Meridian elevation] of Achernar[61]	39	12	0 south
[Meridian elevation] of the head of the Water Snake[62]	34	58	0 south

21 September [1639]

Meridian elevation of the Sun	81	7	45 north

[19]

In the evening at 6:45 PM. Western elevation of Arcturus[63]	16	45	0
After 140 oscillations of the pendulum, the elevation of Mercury	14	13	0
Azimuth from west to south	10	40	0
Soon again the elevation of Mercury [was]	13	5	0

53 **Alnair**, or α Gruis. One of the brightest stars in the sky, with a visual magnitude of 1.7, this star is one of the fifty-eight stars selected for celestial navigation. *First observation.*

54 α Tucanae. *First observation.* Tucana (the Toucan) is not a prominent constellation, as all of its stars are third magnitude or fainter.

55 β Gruis. *First observation.*

56 ε Gruis. *First observation.*

57 **Fomalhaut**, or α Piscis Austrini, with an apparent visual magnitude of 1,16, is the brightest star in the southern constellation of Piscis Austrinus, the 'Southern Fish', and one of the brightest stars in the sky. *First observation.* See however, vol. 1, page 254.

58 β Hydri. *First observation.* Brightest star in the constellation of Hydrus, also the closest reasonably bright star to the south celestial pole. Hydrus ('Water Snake') is a small constellation in the deep southern sky, one of twelve constellations created by Petrus Plancius at the end of the sixteenth century.

59 **Ankaa**, or α Phoenicis, with an apparant visual magnitude of 2.38, is the brightest star in the constellation of Phoenix. *First observation.*

60 β Ceti. *First observation.*

61 **Achernar**, or α Eridani, with an apparent visual magnitude of 0.40-0.46,is the brightest star in the constellation of 'the river' Eridanus, and the ninth-brightest in the night sky. *First observation.*

62 '**Head of Hydras**', or α Hydri, with an apparent visual magnitude of 2.90, is the second (!) brightest star in the southern circumpolar constellation of Hydrus ('the Water Snake'). *First observation* . Alpha Hydri should not be confused with α Hydrae, in the constellation Hydra, a vast constellation on the celestial equator.

63 Arcturus, or α Bootis. First observed 15 September 1639.

[and its] azimuth [from west to south]	11	10	0	
And after 140 oscillations of the pendulum, …				
… the western elevation of Arcturus [was]	14	46	30	
Likewise when the tail of the Eagle[64] was crossing the meridian, …				
… the western elevation of Mercury [was]	11	34	30	
… [and its] azimuth from west to south	11	31	0	
Meridian elevation of the stars I caught this night [in my telescope], in the order they crossed the meridian. Between 7 and 14 hours in the night.				
Meridian elevation: θ of the Peacock[65]	24	30	0	⎫
η of the Peacock[66]	31	16	30	⎪
α of the Peacock[67]	40	30	0	⎪
ζ of the Peacock[68]	30	51	40	⎪
κ of the Indian[69]	38	32	40	⎪
κ of the Water Snake[70]	19	20	0	⎪
ε of the Peacock[71]	31	20	30	⎭
south				
Head of the Crane (α)[72]	59	8	0	⎫
η of the Crane[73]	49	37	0	⎪
α of the Toucan[74]	36	14	30	⎪
θ of the Crane[75]	49	32	30	⎪
χ of the Crane[76]	45	4	50	⎪
Fomalhaut[77] of the Water Carrier	66	39	0	⎭

64 ζ Aquilae. First observed 18 September 1639.
65 ε Pavonis. *First observation.*
66 δ Pavonis. *First observation*
67 **Peacock**, or α Pavonis. Binary star in the southern constellation of Pavo ('peacock'), near the border with the constellation Telescopium, with na apparent magnitude of 1.94. *First observation.*
68 β Pavonis. *First observation.*
69 β Indi. *First observation.*
70 ν Octantis. *First observation.*
71 γ Pavonis. *First observation.* According to our calculation, this star crossed the meridian 2 m 38 s before the previous star.
72 γ Gruis. First observed 20 September 1639.
73 Alnair, or α Gruis. First observed 20 September 1639.
74 α Tucanae. First observed 20 September 1639.
75 β Gruis. First observed 20 September 1639.
76 ε Gruis. First observed 20 September 1639.
77 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.

μ of the Crane[78]	43	33	40	⎫
Bright star below the Water Snake[79]	14	50	0	⎬ south
β of the Toucan[80]	38	5	30	⎭

Lower star in the foremost part of the Toucan's wing[81] (should be ε, but transposing to the Bayer's atlas ε should be brighter and δ less)

|| 30	43	30		⎫
| (or ι) of the Water Snake[82]	18	53	30	⎪
The star in the middle of Toucan's wing (ζ)[83]	31	18	0	⎬ south
Head of Phoenix (α)[84]	53	56	0	⎪
The last star of the Toucan's wing (η)[85]	33	19	30	⎪
The southernmost star of the tail of the Whale[86]	78	14	0	⎭

At 2 AM the clouds covered the sky and I could not observe Achernar[87] with the head of the Water Snake[88].

22 September [1639]

Meridian elevation of the Sun	81	30	20	south
At 6:30 PM. Western elevation of Arcturus[89]	16	54	30	
After 123 oscillations of the pendulum the western elevation of Mercury	15	16	30	
Azimuth from west to south	10	58	0	
Again the western elevation of Arcturus	15	32	0	
And after 144 oscillations of the pendulum the western elevation of Mercury	13	46	0	
Azimuth of Mercury from west to south	11	20	0	
Again when the bright star of the Eagle[90] was crossing the meridian, … … the azimuth of Mercury [from west to south] was	10	47		

78 ζ Gruis. *First observation.*

79 β Octantis. *First observation.* According to our calculation, this star crossed the meridian before the four preceding stars and 35 m 7 s before the previous one.

80 γ Tucanae. *First observation.*

81 ε Tucanae. *First observation.*

82 β Hydri. First observed 20 September 1639.

83 ζ Tucanae. *First observation.* According to our calculation, this star crossed the meridian 4 m 50 s before the previous star.

84 Ankaa, or α Phoenicis. First observed 20 September 1639.

85 β_1 Tucanae. *First observation.*

86 β Ceti. First observed 20 September 1639.

87 Achernar, or α Eridani. First observed 20 September 1639.

88 α Hydri. First observed 20 September 1639.

89 Arcturus, or α Bootis. First observed 15 September 1639.

90 The bright star of the Eagle should be Altair, or α Aquilae (First observed 18 September 1639). But its meridian passage occurred after this series of observations was interrupted at 7 PM. Moreover, the elevation of Mercury was incompatibly low (1° 19' 21"). So the star should be ζ Aquilae, described before as the Tail of the Eagle. (First observed 18 September 1639).

… and its elevation 12 13 0

Once finished these observations the clock …

[21]

… struck 7 PM. Henceforth the clouds covered the sky which earlier was very clear. Around 9 PM it became clear again, then from 9:30 PM to 4 AM, I mader the following observations:

Meridian elevation of α of the Crane[91]	59	08	40
β of the Crane[92]	56	52	40
η of the Crane[93]	49	23	30
α of the Toucan[94]	36	15	30
γ of the Toucan[95]	31	32	30
ε of the Crane[96]	52	50	00
ν of the Water Snake[97]	15	00	00
θ of the Crane[98]	49	29	30
χ of the Crane[99]	44	59	30
Fomalhaut of the Water Carrier[100]	66	38	00
μ of the Crane[101]	43	32	00
Below the Water Snake[102]	14	51	00
β of the Toucan[103]	38	05	00
ζ of the Phoenix[104]	58	20	00
ε of the Phoenix[105]	53	38	00
δ of the Phoenix[106]	50	46	30
ε of the Toucan[107]	30	40	00
ι of the Water Snake[108]	18	54	00
ζ of the Toucan[109]	31	18	00

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91 γ Gruis. First observed 20 September 1639.

92 λ Gruis. *First observation.*

93 Alnair, or α Gruis. First observed 20 September 1639.

94 α Tucanae. First observed 20 September 1639.

95 δ Tucanae. *First observation.*

96 δ_1 Gruis. *First observation.*

97 β Octantis. First observed 21 September 1639. This star crossed the meridian 3 m 26 s before the previous star.

98 β Gruis. First observed 20 September 1639.

99 ε Gruis. First observed 20 September 1639.

100 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.

101 ζ Gruis. First observed 21 September 1639.

102 β Octantis. First observed 21 September 1639.

103 γ Tucanae. First observed 21 September 1639.

104 β Sculptoris. *First observation.*

105 ι Phoenicis. *First observation.*

106 HR 8959 in the Phoenix.

107 ε Tucanae. First observed 21 September 1639.

108 β Hydri. First observed 20 September 1639.

109 ζ Tucanae. First observed 21 September 1639. This star crossed the meridian 4 m 50 s before the previous star.

α of the Phoenix[110]	53	50	00
β of the Phoenix[111]	52	27	00
η of the Toucan[112]	33	14	00
CC A[113]	78	12	30
Achernar[114]	39	09	15
χ of the River[115] (Eridanus)	44	51	00

[22]

Head of the Water Snake[116]	34	56	0
All in southern sky[117]			
In the northern sky ⌈ meridian elevation of Medusa's head[118]	42	19	40
⌊ meridian elevation of the bright star …			
… in the rib of Perseus[119]	33	18	0

23 September [1639]

Clouded at noon. At 6:45 PM the western elevation of Arcturus[120]	15	29	30
and after 75 oscillations of the pendulum the elevation of Mercury was	14	43	0
and its azimuth from west to the meridian [south]	11	14	0
and after 70 oscillations of the pendulum, …			
… the western elevation of Arcturus was	14	47	30
A little later the western elevation of Arcturus was	13	18	0
and after 91 oscillations of the pendulum, the elevation of Mercury was	12	25	30
and its azimuth from west towards south was	11	24	0
and after 60 oscillations of the pendulum the elevation of Arcturus was	12	39	0
Likewise about an half [121] later, the elevation of Mercury was	8	11	0
and its azimuth from west towards south was	12	30	0

110 Ankaa, or α Phoenicis. First observed 20 September 1639.

111 κ Phoenicis. *First observation.*

112 β_1 Tucanae. First observed 21 September 1639.

113 β Ceti. First observed 20 September 1639. *CC A* stands for *Caudae Ceti Australior.*

114 Achernar, or α Eridani. First observed 20 September 1639.

115 χ Eridani. *First observation.*

116 α Hydri. First observed 22 September 1639.

117 Referring to the stars observed hitherto.

118 **Algol**, or β Persei, known also as the Demon Star, is a bright multiple star in the constellation of Perseus and one of the first non-nova variable stars to be discovered. Algol's apparant visual magnitude is usually near-constant at 2.1, but regularly dips to 3.4 every 2.86 days during roughly 10-hour-long partial eclipses. *First observation.*

119 **Mirfak**, or α Persei, with an apparent visual magnitude of 1.81, is the brightest star in the northern constellation of Perseus, outshining the constellation's best-known star, Algol. *First observation.*

120 Arcturus, or α Bootis. First observed 15 September 1639.

121 The unit of time,(minute or hour), is not given. According our calculations, the time lapse was about 15 minutes.

and after 221 oscillations of the pendulum the western elevation …			
… of the bright star of the Northern Crown[122] was	23	41	0
Meridian elevations of fixed southern [stars], taken up in the southern sky from 7 PM to 2 AM, follow in the right order.			
Meridian altitude of θ in the Peacock[123]	24	27	30
η in the Peacock[124]	31	18	0
α of the Peacock[125]	40	28	0
ζ of the Peacock[126]	30	50	0
κ of the Indian[127]	38	30	0
[23]			
κ of the Water Snake[128]	19	19	0
ε in the Peacock[129]	31	20	00
Meridian southern altitude of Saturn	79	53	30
ι of the southern Fish[130]	63	30	0
Head of the Crane[131]	59	9	0
η of the Crane[132]	49	34	0
α of the Toucan[133]	36	15	30
γ of the Toucan[134]	31	32	30
ν of the Water Snake[135]	15	2	0
θ of the Crane[136]	49	30	0
χ of the Crane[137]	45	16	0
Fomalhaut of the Water Carrier[138]	66	37	30
μ of the Crane[139]	43	35	0

122 **Alphecca**, or α Coronae Borealis, with an average apparent visual magnitude of 2.24, is an eclipsing binary star in the constellation of Corona Borealis. *First observation.*

123 ε Pavonis. First observed 21 September 1639.

124 δ Pavonis. First observed 21 September 1639.

125 Peacock, or α Pavonis. First observed 21 September 1639.

126 β Pavonis. First observed 21 September 1639.

127 β Indi. First observed 21 September 1639.

128 ν Octantis. First observed 21 September 1639.

129 γ Pavonis. First observed 21 September 1639. This star crossed the meridian 2 m 37 s before the previous star.

130 ι Piscis Austrini. *First observation.*

131 γ Gruis. First observed 20 September 1639.

132 Alnair, or α Gruis. First observed 20 September 1639.

133 α Tucanae. First observed 20 September 1639.

134 δ Tucanae. First observed 22 September 1639.

135 β Octantis. First observed 21 September 1639.

136 β Gruis. First observed 20 September 1639.

137 ε Gruis. First observed 20 September 1639.

138 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.

139 ζ Gruis. First observed 21 September 1639.

Below the Water Snake[140]	14	52	0
β of the Toucan[141]	38	5	0
ζ of the Phoenix[142]	58	23	30
ε of the Phoenix[143]	53	39	0
δ of the Phoenix[144]	50	47	0
Star below δ of the Phoenix[145] (δ recorded on the globe)	46	6	30
Cloudy henceforth.			
ζ of the Toucan[146]	31	17	30
α of the Phoenix[147]	53	57	0
β of the Phoenix[148]	52	33	0
η of the Toucan[149]	33	16	30
Australior Caudae Ceti[150]	78	10	0
From now on the sky became cloudy			

24 September [1639]

Meridian elevation of the Sun	82	16	15 north

[24]

6:45 PM. Western elevation of Arcturus[151]	15	30	0
After 104 oscillations of the pendulum the elevation of Mercury was	15	21	30
and the azimuth of Mercury from west to the meridian [south] was	13	15	0
Again not much later when the elevation of Arcturus was	13	55	0
after 84 oscillations of the pendulum the elevation of Mercury was	13	43	0
Western azimuth of Mercury to the [southern] meridian	12	16	0
and after 94 oscillations of the pendulum …			
… the western elevation of Arcturus was	13	15	0
Again the elevation of Arcturus	12	7	0
and after 79 oscillations of the pendulum the elevation of Mercury was	11	40	0
Azimuth [from west to south]	12	5	0
And later the elevation of Arcturus was	11	19	0

140 No candidate star was found below the Water Snake (Hydrus) crossing the meridian around the given elevation between the meridian transit of the previous and the subsequent star.
141 γ Tucanae. First observed 21 September 1639.
142 β Sculptoris. First observed 22 September 1639.
143 ι Phoenicis. First observed 22 September 1639.
144 TYC 8456-967-1 in the Phoenix. *First observation.*
145 σ Phoenicis. *First observation.* Absent in Houtman's catalogue. See Knobel, 'On Frederick de Houtman's catalogue of the southern stars' (1917); Verbunt & Van Gent, 'Early star catalogues of the southern sky' (2011).
146 ζ Tucanae. First observed 21 September 1639.
147 Ankaa, or α Phoenicis. First observed 20 September 1639.
148 κ Phoenicis. First observed 22 September 1639.
149 β_1 Tucanae. First observed 21 September 1639.
150 β Ceti. First observed 20 September 1639.
151 Arcturus, or α Bootis. First observed 15 September 1639.

25 September [1639]

Meridian elevation of the Sun [to the north]	82	40	0
6:30 PM on the watch, when the western elevation of Arcturus was	14	47	0
after 106 oscillations of the pendulum, the elevation of Mercury was	15	12	0
The azimuth of Mercury from west to [south] in the meridian	12	29	0
and after 44 oscillations of the pendulum, the elevation of Arcturus was	13	55	30
and a little later the western elevation of Arcturus was	12	47	0
and the elevation of Mercury was	13	11	30
and the azimuth from west to [south] in the meridian	12	48	0
After that, the western elevation of Arcturus was	12	3	30
The meridian elevation of δ of the Dragon[152], which is to the north of the head of the Dragon[153], and is the second of the bend	14	50	0 north
Upper [star] in the [right] wing of the Swan[154]	37	31	30 north

[25]

[Meridian elevation] of the breast of the Swan[155]	42	46	15 north
[Meridian elevation] of the tail of the Swan[156]	37	48	30 north
10 PM. Meridian elevation of α of the Toucan[157]	36	14	0 south
γ of the Toucan[158]	31	31	30 south
θ of the Crane[159]	49	30	0 south
Fomalhaut of the Water Carrier[160]	66	38	0 south

Henceforth the sky was covered by clouds

26 September [1639]

Meridian elevation of the Sun	83	3	20 north

In the evening because of moving clouds, I could not observe Mercury.

27 September [1639]

Meridian altitude of the Sun	83	26	30 north

Evening and night cloudy

152 δ Draconis. *First observation.*
153 The stars of the head of the Dragon are β Draconis, γ Draconis, ξ Draconis and ν_2 Draconis.
154 STF 2579. First observed 16 September 1639.
155 γ Cygni. First observed 19 September 1639.
156 Deneb, or α Cygni. First observed 19 September 1639.
157 α Tucanae. First observed 20 September 1639.
158 δ Tucanae. First observed 22 September 1639.
159 β Gruis. First observed 20 September 1639.
160 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.

28 September

Cloudy at noon. In the evening after about 6:15 PM, Mercury was the first to become visible in the brightness of the twilight; she was near and above the thin crescent of the New Moon, inclined somewhat to the south, because the upper part of the ecliptic was also inclined [to the south]. But Mercury would immediately plunge in the Moon, and without doubt in the upper and eastern edge of the dark part of the Moon (exactly as I observed with my eyes …

[26]

… and with the telescope). That is, the furrowed Moon hided Mercury, a view that was very pleasant for me. Between the instant of the immersion of Mercury in the Moon the western elevation of the bright star of the Northern Crown[161] was 24 24 0

[Number of] oscillations of my pendulum 1046.

Afterwards I took up to confirm the elevation …

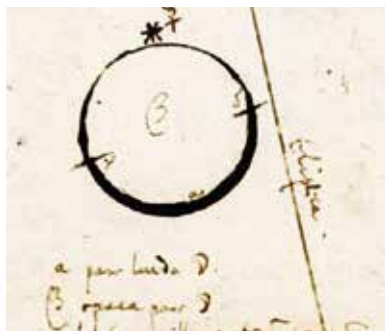
… of the bright star of the Northern Crown 23 48 0

and once again a little later the western elevation …

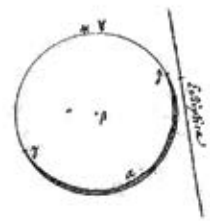
… of the bright star of the Northern Crown 23 0 0

But 216 oscillations of the pendulum intervened between these two elevations. When the western elevation of the bright star of the Northern Crown was 21 52 0

Mercury had not yet emerged from behind the Moon, then the clock chimed 7 o'clock and henceforth clouds covered the western sky.[162]



[Mss Leiden]



[Mss Paris]

29 September

Meridian elevation of the Sun 84 12 30 north

30 September

Meridian elevation of the Sun 84 37 0 north

161 Alphecca, or α Coronae Borealis. First observed 23 September 1639.

162 The inserted figures are from the Leiden manuscript (ELO, North no. 53, fol. 4r) and the Paris manuscript.

[27]

On 1 and 2 October [1639]. Cloudy

On 3 October [1639]

Meridian elevation of the Sun	85	47	20 north

On 4 October [1639]

Meridian elevation of the Sun	86	10	30 north

On 5 October [1639]

Meridian elevation of the Sun	86	34	20 north

On 6 and 7 [Octover [1639]. Cloudy

On 8 October [1639]

Meridian elevation of the Sun	87	43	30 north

On 9 October [1639]

Meridian elevation of the Sun	88	6	30 north

On 10, 11 and 12 October [1639]. Fickle weather.

13 October [1639]

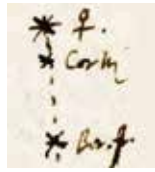
Meridian elevation of the Sun	89	37	30 north

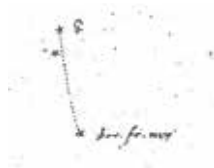
On 12 October,[163] at 7 PM, Venus stood apart about 18' westwards of the Heart of Scorpion[164]. On 13 October at 7 PM, Venus had passed the Heart of Scorpion at a distance of about 30', and stood in a straight line with the [star in the] north of the Heart of Scorpio[165] and the Heart of Scorpion; or at least she approached the Heart of Scorpion more to the south in this way. Then it is clear that Venus headed eastwards, closer to the Heart of Scorpion, slightly more northerly …

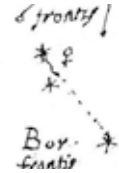
[28]

… than the conjunction that would occur on 12 October, at 4 AM[166], calculated for my place on the Brazilian Island Antoni Vaz. Since the daily motion of Venus is 48', I calculated from the Rudolphine [tables] that Venus was 10' south of the Heart of Scorpion at the time of the conjunction.

163 Notice, this observation recedes back one day.
164 α Scorpii or Antares. First observed 20 September 1638.
165 σ Scorpii. *First observation.*
166 It should be 13 October 1639, 4 PM.







[Mss Leiden] *[Mss Paris]* *[Mss Boulliau]*

On 14 October [1639]

Meridian elevation of the Sun at the vertex 90 0 0[167]

If on the [next] morning in the south, 10" beyond the vertex, [an angle of] 89° 59' 50" [is measured], then an observation of 90° 0' 0" is accurate, as long as the meridian [elevation] is recorded twice, [namely] by pointing the instrument north once and then south.

On 15 October [1639]

Meridian elevation of the Sun 89 37 15

On 16 October [1639]

Meridian elevation of the Sun 89 14 20 south

On 17 October [1639]

Meridian elevation of the Sun 88 51 30 south

[29]

On 18 October [1639]

Meridian elevation of the Sun 88 29 15 south

On 19 October [1639]

Meridian elevation of the Sun 88 7 20 south

On 20 October [1639]

Meridian elevation of the Sun 87 46 20 south

On 21 October [1639]

Meridian elevation of the Sun 87 25 15 south

On 22 October [1639] I went away to the field.

167 According to our calculation, the meridian elevation of the Sun was 89° 51' 04" south.

On 23 October [1639]

Meridian elevation of the Sun 86 42 40 south

On 24 October [1639]. Unstable weather.

On 25 October [1639]

Meridian elevation of the Sun 86 0 30 south

On 26 and 27 October. Cloudy.

On 28 October [1639]

Meridian elevation of the Sun 84 59 30 s outh

7:30 PM. Hitherto, the Moon was a little west of Jupiter, and Jupiter was envisioned to cross [the Moon] at its more southerly intersection, but before the impending attack of the conjunction could be observed, the western sky [was] covered with clouds. People who live further west may have perceived [the conjunction] better.

[30]

On 29 October [1639]. Unstable weather.

On 30 October [1639]

Meridian elevation of the Sun 84 20 0 south

Following days. Fickle weather.

On 2 November [1639]

Meridian elevation of the Sun 83 20 50 south

On 3 November [1639]

Meridian elevation of the Sun 83 2 20 south

On 4 November [1639] and following days
I was away, and because of rain. The weather was fickle.

On 10 November [1639]

Meridian elevation of the Sun 81 0 0 south

On 11 and 12 November. Fickle weather.

On 13 November [1639]

Meridian elevation of the Sun 80 10 0 south

On 14 November. Fickle weather.

On 15 November [1639]

Meridian elevation of the Sun 79 39 0 south

On 16 and 17 November. Fickle weather.

On 18 November [1639]

Meridian elevation of the Sun	78	53	30 south

Following days. Fickle weather.

On 26 November [1639]

Meridian elevation of the Sun	77	11	10 south

[31]

From 7 PM to 10:30 PM. Venus nearing the heliacal setting in the evening, appeared horned these days through the telescope.

Meridian elevation of the head of Andromeda[168]	54	39	40 north
Star in the extremity of the wing of Pegasus[169]	68	32	30 north
Meridian elevation of ξ of the Toucan[170]	31	18	0 south
ι of the Water Snake[171]	18	58	30 south
η of the Toucan[172]	33	16	30 south
ξ of the Phoenix[173]	38	47	0 south
λ of the Phoenix[174]	49	36	0 south
ν of the Phoenix[175]	41	6	0 south
Above μ of the Phoenix[176] not displayed on the globe	53	3	0 south
μ of the Phoenix[177]	47	20	0 south
Achernar[178]	39	10	0 south
The second star of the River (Eridanus)[179]	44	52	30 south
Head of the Water Snake[180]	34	⌈ 56	0 south
		⌊ 55	30 south[181]
The third star of the River (Eridanus)[182]	45	2	30 south

168 **Andromeda**, (also) Alpheratz, or α Andromedae, with an overall apparent visual magnitude 2.06, of is the brightest star in the constellation of Andromeda. *First observation.*
169 **Algenib**, or γ Pegasi. *First observation.*
170 ζ Tucanae. First observed 21 September 1639.
171 β Hydri. First observed 20 September 1639.
172 β_1 Tucanae. First observed 21 September 1639.
173 η Phoenicis. *First observation.*
174 β Phoenicis. *First observation.*
175 ζ Phoenicis. *First observation.*
176 γ Phoenicis. *First observation. Not in the globe* suggests a non-Ptolemaic star.
177 δ Phoenicis. *First observation.*
178 Achernar, or α Eridani. First observed 20 September 1639.
179 χ Eridani. First observed 22 September 1639.
180 α Hydri. First observed 22 September 1639.
181 This value is closer to the calculated one.
182 φ Eridani. *First observation.*

The fourth star of the River[183]	48	54	0 south
The globe does not show the fourth of the River.			
The head of Medusa[184]	42	13	30 south
		13	0 south

Henceforth, the previously very clear sky turned cloudy

On 27 November [1639]

Meridian elevation of the Sun	77	00	0" south

On 28 November [1639]

Meridian elevation of the Sun	76	49	40 south

On 29 November [1639]

Meridian elevation of the Sun	76	39	40 south

[32]

Following days stormy

On 12 December [1639]

Meridian elevation of the Sun	75	4	40 south

On 13 December [1639]

Meridian elevation of the Sun	75	0	30 south

On 14 December. Fickle weather

On 15 December [1639]

Meridian elevation of the Sun	74	54	30 south

On 16 December [1639]

Meridian elevation of the Sun	74	51	40 south
From 7 PM to 10 PM. Meridian elevation of λ of the Phoenix[185]	49	38	0 south
ν of the Phoenix[186]	41	5	30 south
η of the Water Snake[187]	27	29	0 south
The star above μ of the Phoenix[188]			
	53	4	0 south
	not on the globe		
μ of the Phoenix[189]	47	20	0 south

183 κ Eridani. *First observation. Not in the globe* suggests a non-Ptolemaic star.
184 Algol, or β Persei. First observed 22 September 1639.
185 β Phoenicis. First observed 26 November1639.
186 ζ Phoenicis. First observed 26 November1639.
187 κ Tucanae. *First observation.*
188 γ Phoenicis. First observed 26 November1639. *Not in the globe* suggests a non-Ptolemeic star.
189 δ Phoenicis. First observed 26 November1639.

Achernar[190]	39	9	50 south
χ of the River[191], the second star (third for me)	44	51	30 south
Meridian elevation of the Head of the Water Snake[192]	34	54	0 south
φ of the River[193], the third star	45	5	30 south
The third star of the Water Snake[194]	27	56	30 south
κ of the River[195], the fourth star	48	55	30 south
ι of the River[196], the fifth star	53	48	0 south
In the River (for me the 7th star)[197]			
	⌈ 56	49	30 south
	⌊not on the globe		

[33]

Far above this star[198] (not on the globe)	64	18	30 south
The fourth star of the Water Snake[199] (second after the twist of the neck)	28	27	0 south
The sixth star of the River[200] (for me the 8th)	56	30	0 south
The 20th of the River (τ)[201]	73	10	0 south
Below that star and more to the east[202] (not on the globe)	67	47	0 south
Star reckoned by myself as 8th of the River[203]	53	46	0 south

If this star is in the River, it is not displayed on the globe.

17 December [1639]

Meridian elevation of the Sun	74	49	20 south
From 6:45 PM to midnight. Meridian elevation of λ of the Phoenix[204]	49	37	20 south
ν of the Phoenix[205]	41	6	30 south
η of the Water Snake[206]	27	29	30 south
Above μ of the Phoenix[207]	53	5	0 south

190 Achernar, or α Eridani. First observed 20 September 1639.
191 χ Eridani. First observed 22 September 1639.
192 α Hydri. First observed 22 September 1639.
193 φ Eridani. First observed 26 November1639.
194 δ Hydri. *First observation.*
195 κ Eridani. First observed 26 November1639. According to our calculation, this star crossed the meridian 1 m 49 s before the previous star.
196 TYC 7558-987-1 in the River Eridanus. *First observation.*
197 ι Eridani. *First observation. Not in the globe* suggests a non-Ptolemeic star.
198 β Fornacis. *First observation. Not in the globe* suggests a non-Ptolemeic star.
199 ε Hydri. *First observation.*
200 θ_1 Eridani. *First observation.*
201 τ_3 Eridani. *First observation.*
202 α Fornacis. *First observation.* Absent in Houtman's catalogue.
203 TYC 7567-1183-1 in the River Eridanus. *First observation.* Absent in Houtman's catalogue.
204 β Phoenicis. First observed 26 November1639.
205 ζ Phoenicis. First observed 26 November1639.
206 κ Tucanae. First observed 16 December 1639.
207 γ Phoenicis. First observed 26 November1639.

μ of the Phoenix[208]	47	19	30 south
Achernar [209]	39	9	50 south
χ of the River[210]	44	51	0 south
σ of the Water Snake[211] (for me the first [second] also) [212]	28	50	0 south
Head of the Water Snake[213]	34	⌈55	0
		⌊54	30 south
φ of the River[214]	45	⌈ 4	30 south
		⌊ 5	0 south
The fourth star of the River[215]	48	57	0 south
The third star of the Water Snake[216]	27	59	0 south
ι of the River[217]	53	47	0 south
In the River (not displayed on the globe)[218]	56	50	0 south

[34]

Above this star[219]	64	17	00 south
Fourth star of the Water Snake[220]	28	29	00 south
6th of the River (θ)[221]	56	29	30 south
The twentieth star of the River[222]	73	11	00 south
Also the fifth star of the Water Snake[223]	29	05	00 south
Below the 20th star of the River and more to the east[224]	67	47	00 south
Star in the River (not not displayed on the globe)[225]	53	46	00 south

Beneath[226] the first[227] of the three stars in the neck of the Water Snake …

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208 δ Phoenicis. First observed 26 November1639.
209 Achernar, or α Eridani. Inserted in the left margin: *About the same time the leg of ε Cassiopeia culminates.*
210 χ Eridani. First observed 22 September 1639.
211 η_2 Hydri. *First observation.*
212 Inserted in the left margin: *Immediately the head of the Water Snake culminates .*
213 α Hydri. First observed 20 September 1639.
214 φ Eridani. First observed 26 November1639.
215 κ Eridani. observed twice. First observed 26 November1639.
216 δ Hydri. First observed 16 December 1639.
217 TYC 7558-987-1. First observed 16 December 1639. Inserted in the left margin: *And immediately reached culmination.*
218 ι Eridani. First observed 16 December 1639. Absent in Houtman's catalogue.
219 β Fornacis. First observed 16 December 1639.
220 ε Hydri. First observed 16 December 1639.
221 θ_1 Eridani. First observed 16 December 1639.
222 τ_3 Eridani. First observed 16 December 1639.
223 ζ Hydri. *First observation.* This star crossed the meridian 6 m 11 s before the previous star.
224 α Fornacis. First observed 16 December 1639.
225 TYC 7567-1183-1. First observed 16 December 1639. *Absent in the globe* suggests a non-Ptolemaic star.
226 'Beneath' refers to the southern Celestial Pole, not the elevation from the horizon.
227 ζ Hydri ? (was earlier the fifth star of the Water Snake).

… and the Large Cloud[228] of Dorado constellation[229]	34	20	0 south
Star in the River, the globe does not show[230]	56	44	00 south
The second of the three stars in the Water Snake and n.[231]	34	00	00 south
Western star of the Δ[232] of the River, 7th of the Eridanus on the globe	59	46	00 south
Southern star of the Δ of the River	59	30	00 south
Northern star of the Δ of the River, third star of the trio in the Water Snake[233] and the shapeless Large Cloud in the Antarctic Circle[234]	32	20	00 south
[Star[235]] east of the 2 shapeless clouds	22	58	30 south
Meridian elevation of Aldebaran[236]	65	59	00 north
		59	30 north[237]
[Meridian elevation of] Capella[238]	36	9	00 north
		9	30 north[239]
[Meridian elevation of] Rigel[240] of the Orion	89	30	20 south[241]
			30 south

18 December [1639]

Meridian elevation of the Sun	74	47	30 south
At 7 PM. Head of Andromeda[242] in the western elevation of	51	28	30
Its azimuth from north to west	22	45	0
The evening twilight was ending.			

228 Large Magellanic Cloud.

229 ξ_2 Reticuli. Dorado is the constellation of Dolphin fish.

230 TYC 7572-1748-1 in the River Eridanus. *First observation*. Absent in Houtman's catalogue.

231 κ Reticuli. *Absent in the globe* suggests a non-Ptolemaic star. According to our calculation, this star crossed the meridian 54 s before the previous star. 'n.' might mean *nubes* (referring to the Magellanic Clouds)

232 Triangle formed by the following stars in the River Eridanus: TYC 7034-1311-1; 7570-1585-1 and 7035-1374-1.

233 β Reticuli. *First observation*.

234 Large Magellanic Cloud.

235 γ Hydri. *First observation*.

236 **Aldebaran**, or α Tauri. *First observation*.

237 This value is closer to the calculated one.

238 **Capella**, or α Aurigae, with an apparent visual magnitude of 0.08, is the brightest star in the northern constellation of Auriga, and the sixth-brightest star in the night sky. Its name means 'little goat' in Latin. *First observation*.

239 This value is closer to the calculated one.

240 **Rigel**, or β Orionis. *First observation*.

241 This value is closer to the calculated one.

242 Andromeda, or α Andromedae. First observed 26 November1639.

[35]

From the observation of the elevation of the head of Andromeda[243] until the meridian transit of η of the Water Snake[244] it lasted 873 oscillations of my pendulum. 273 oscillations between this observation and the southern culmination of the star above μ of the Phoenix[245].

211 oscillations of the pendulum:

Southern meridian transit of μ of the Phoenix[246]

431 oscillations of the pendulum:

Southern meridian transit of Achernar[247]

387 oscillations of the pendulum:

Northern meridian transit of the leg of Cassiopeia[248]

299 oscillations of the pendulum:

Southern meridian transit of the second star for me of the River[249];

its elevation	22°	56'	0" south

495 oscillations of the pendulum:

Southern meridian transit of χ of the River[250]

298 oscillations of the pendulum:

Southern meridian transit of the first star of the quintet of the Water Snake[251]

66 oscillations of the pendulum:

Southern meridian transit of the head of the Water Snake[252]

188 oscillations of the pendulum:

Western elevation of the head of Andromeda[253]	44	10	0
Its azimuth from north to west	38	1	0

283 oscillations of the pendulum:

Western elevation of the head of Andromeda	43	27	0
Its azimuth from north to west	38	40	0

252 oscillations of the pendulum:

Western elevation of the head of Andromeda	42	46	0
Its azimuth	39	56	0

19 December [1639]

Meridian elevation of the Sun	74	45	40 south

243 Andromeda, or α Andromedae. First observed 26 November1639.
244 κ Tucanae. First observed 16 December 1639.
245 γ Phoenicis. First observed 26 November1639.
246 δ Phoenicis. First observed 26 November1639.
247 Achernar, or α Eridani. First observed 20 September 1639.
248 ε Cassiopeiae. See observations 17 December 1639, 6:45 PM.
249 TYC 8475-1390-1 in the River Eridanus. *First observation.*
250 χ Eridani. First observed 22 September 1639.
251 η_2 Hydri. First observed 17 December 1639.
252 α Hydri. First observed 22 September 1639.
253 Andromeda, or α Andromedae. First observed 26 November1639.

[36]

At 7 PM. Western elevation of the Head of Andromeda[254]	51	20	0	
Its azimuth from the north to the west	23	17	0	
Then the end of the evening twilight.				
735 oscillations of the pendulum:				
η of the Water Snake[255] reaches the celestial southern meridian				
238 oscillations of the pendulum:				
Meridian transit of the star above μ of the Phoenix[256]				
219 oscillations of the pendulum:				
Southern meridian transit of μ of the Phoenix[257]				
457 oscillations of the pendulum:				
Southern meridian transit of Achernar[258]				
490 oscillations of the pendulum:				
Northern meridian transit of the Cassiopeia's leg[259].				
Its meridian elevation	19	54	30 north	
797 [oscillations of the pendulum]:				
Southern meridian transit of χ of the River[260]				
240 oscillations of the pendulum:				
Southern meridian transit of the first star of the quintet of the Water Snake[261]				
148 [oscillations of the pendulum]:				
Meridian transit of the head of the Water Snake[262]				
229 oscillations of the pendulum]:				
Western elevation of the head of Andromeda	44	20	0	and
its azimuth from north to west	37	41	0	
307 oscillations of the pendulum:				
Eastern elevation of Canopus[263]	21	20	0	
Its azimuth from south to east	36	9	0	
353 oscillations of the pendulum:				
Western elevation of the head of Andromeda	42	40	0"	&
its azimuth from north to west	39	52	0	
252 oscillations of the pendulum:				
Eastern elevation of Canopus	22	37	0"	&
Its azimuth from south to east	35	53	0	

254 Andromeda, or α Andromedae. First observed 26 November1639.
255 κ Tucanae. First observed 16 December 1639.
256 γ Phoenicis. First observed 26 November1639.
257 δ Phoenicis. First observed 26 November1639.
258 Achernar, or α Eridani. First observed 20 September 1639.
259 ε Cassiopeiae. See observations 17 December 1639, 6:45 PM.
260 χ Eridani. First observed 22 September 1639.
261 η_2 Hydri. First observed 17 December 1639.
262 α Hydri. First observed 22 September 1639.
263 **Canopus**, or α Carinae, with an apparent visual magnitude of -0.74, is the brightest star in the southern constellation of Carina and the second-brightest star in the night sky. *First observation*. Canopus was a luxury city at the coast of ancient Egypt.

[37]

In the same evening the Meridian elevation of Medusa's head[264] [was]	42	14	30	north
Of the bright star of Pleiades[265]	58	50	0	north
Of the shapeless object in the Antarctic Circle[266]	32	20	0	south
Of the [star] east of the 2 shapeless nebulae[267]	22	57	15	south

On 20 December [1639]

Meridian elevation of the Sun	74	44	30	south
From 7 PM. Western elevation of the Head of Andromeda[268]		50	00	&
its azimuth from north to west	27	10	0	

Then the twilight ended.
307 oscillations of the pendulum:
Southern meridian transit of the star above μ of the Phoenix[269]
159 oscillations of the pendulum:
Southern meridian transit of μ of the Phoenix[270]
327 oscillations of the pendulum:
Southern meridian transit of Achernar[271]
599 oscillations of the pendulum:
Northern meridian transit of the leg of Cassiopeia[272].

Its meridian elevation	19	54	0	north

743 oscillations of the pendulum:
Southern meridian transit of χ of the River[273]
136 oscillations of the pendulum:
Southern meridian transit of the head of the Water Snake[274]
136 oscillations of the pendulum:

Western elevation of the head of Andromeda[275]	45	5	0	&
its azimuth from north to west	36	3	0	

264 Algol or β Persei. First observed 22 September 1639.
265 η Tauri or Alcyone.
266 β Reticuli. First observed 17 December 1639.
267 γ Hydri. First observed 17 December 1639. The nebulae are the Magellanic Clouds.
268 Andromeda, or α Andromedae. First observed 26 November1639.
269 γ Phoenicis. First observed 26 November1639.
270 δ Phoenicis. First observed 26 November1639.
271 Achernar, or α Eridani. First observed 20 September 1639.
272 ε Cassiopeiae. See observations 17 December 1639, 6:45 PM.
273 χ Eridani. First observed 22 September 1639.
274 α Hydri. First observed 22 September 1639.
275 Andromeda, or α Andromedae. First observed 26 November1639. According to our calculation, this star was at this elevation 2 m 14 s before the previous star was crossing the meridian.

[38]

426 oscillations of the pendulum:				
Eastern elevation of Canopus[276]	21	4	30	&
its azimuth from south to east	36	10	0	
616 oscillations of the pendulum:				
Western elevation of the Head of Andromeda[277]	42	35	30	
Its azimuth from north to west	40	15	0	
In the same evening until 0:30 AM.				
Meridian elevation of the right shoulder of Perseus[278]	29	45	20	north
of the Head of Medusa[279]	42	16	0	north
of the bright star in the rib of Perseus[280]	33	14	30	north
of the star eastern of the 2 shapeless clouds[281]	22	57	0	south
of the star in the River and Dorado[282] (not on the globe)	55	6	0	south
Another star in the River and Dorado[283] (not on the globe)	45	53	30	south
[Star] of the shapeless [body] at the western side of Dorado[284]	34	51	0	south
[Meridian elevation] of the end of Dorado's Tail[285]	42	30	30	south
of Capella[286]	36	11	0	north
of Rigel of Orion[287]	89	34	0	south
[Star] that divides the Large Cloud[288] in the middle[289]	29	15	0	south
[Star] in the back of Dorado[290]	35	32	0	south
[Meridian elevation] of Canopus[291]	45	48	30	south

276 Canopus, or α Carinae. First observed 19 December 1639.
277 Andromeda, or α Andromedae. First observed 26 November1639.
278 γ Persei. *First observation.*
279 Algol, or β Persei. First observed 22 September 1639.
280 Mirfak, or α Persei. First observed 22 September 1639.
281 γ Hydri. First observed 17 December 1639. The shapeless clouds are the Magellanic Clouds.
282 α Horologii. *First observation.* Absent in Houtman's catalogue.
283 γ Doradus. *First observation.* Absent in Houtman's catalogue.
284 **α Reticuli** is the brightest star in the southern circumpolar constellation of Reticulum. It has an apparent visual magnitude of 3.3. *First observation.* The Shapeless body of Dorado refers to the Large Magellanic Cloud.
285 **α Doradus** is the brightest star in the southern constellation of Dorado ('the dolphinfish'). It consists of a binary star system with an apparent visual magnitude that varies between 3.26 and 3.30, making this start one of the brightest binary stars. *First observation.*
286 Capella, or α Aurigae. First observed 17 December 1639.
287 β Orionis. First observed 17 December 1639.
288 The Large Magellanic Cloud.
289 Possibly the brightest star in the region, TYC 9162-504-1 in Dorado, with magnitude 6.02.
290 β Doradus. *First observation.*
291 Canopus, or α Carinae. First observed 19 December 1639.

On 21 December [1639]

Meridian elevation of the Sun	74	44	10 south
From 9:30 PM to 1 AM.			
Meridian elevation of the stars of the western pair of the River ⌈upper[292]	63	32	30 south
⌊lower[293]	63	20	0 south
[Star] of the shapeless [object][294] at the western side of Dorado[295]	34	50	30 south
[Meridian elevation] of the star far above this shapeless [object][296]	52	2	0 south
[Meridian elevation] of the lower star of the eastern pair of the River[297]	66	53	30 south

[39]

[Star] at the end of Dorado's Tail[298]	42	27	30 south
[Star] in the River and of the Dove (not on the globe)[299]	55	41	0 south
In the Dove and the River far and above the two clouds[300]	62	13	0 south
Below the two clouds[301] and			
⌈a little to the east[302]	40	18	0 south
⌊Out of Dove constellation towards west[303]	62	57	0 south
[Star] near and above the Large Cloud[304]	30	40	0 south
[Star] in the end of the right wing of the Dove[305]	62	28	0 south
[Star] in the back of the Dove[306]	63	55	30 south
[Star] in the back of Dorado[307]	35	30	30 south
[Star] in the Swift Ship of the Skipper[308] [Jason]	47	6	0 south

292 41 Eridani. *First observation.*
293 43 Eridani. *First observation.*
294 Large Magellanic Cloud.
295 α Reticuli. 'western' Should be 'eastern'. First observed 20 December 1639. According to our calculation, this star crossed the meridian 34 s before the previous star.
296 δ Caeli in the Chisel. *First observation.* Inserted in the left margin: *does not exist in the globe*, which suggests a non-Ptolemeic star.
297 υ_2 Eridani. *First observation.*
298 α Doradus. First observed 20 December 1639.
299 α Caeli. *First observation.* Absent in Houtman's catalogue.
300 γ Caeli. *First observation* Inserted in the left margin: *not in the globe.* Absent in Houtman's catalogue.
301 The Magellanic Clouds.
302 ξ Doradus. *First observation.* Inserted at the left in the margin, before the accolade: *Not in the globe*, which remark suggests a non-Ptolemeic star. 'Large cloud' refers to the Magellanic Cloud.
303 o Columbae. *First observation.*
304 θ Doradus. *First observation.*
305 ε Columbae. *First observation.*
306 **Phact**, or α Columbae, is a the brightest star in the southern constellation of Columba, with an apparent visual magnitude of 2.6. *First observation.*
307 β Doradus. First observed 20 December 1639.
308 β Pictoris. *First observation.* The swift ship = Argo Navis.

[Star] where the right wing of the Dove comes from.[309]	62	20	0 south
[Star] where the neck of the Dove comes from.[310]	62	55	0 south
Of the two stars in Dorado, the upper or northern one.[311]	32	25	30 south
[Star] below Argo Navis of the Skipper.[312]	42	0	0 south
The southernmost [star] of the branch of the Dove.[313]	55	22	30 south
[Star] of the Head of the Dove.[314]	61	1	0 south
[Star] below Canopus to the right.[315]	43	21	30 south
Of the upper triplet [of stars] of the Branch of the Dove, …			
… that one in the south.[316]	63	12	0 south
[Star] of the end of the right and rear foot of the Great Dog.[317]	68	16	30 south
Of the three [stars] in the upper part of the Branch of the Dove, …			
… that one in the middle.[318]	64	58	30 south
From the upper triplet [of stars] in the Branch of the Dove, …			
…that one in the north.[319]	65	53	0 south
[Meridian elevation] of Canopus[320]	45	49	30 south

Remark. The brightness and colour besides the splendour of Canopus agrees closely with those of Sirius[321]. Achernar[322] is equal in these aspects to Rigel[323] in Orion, …

[40]

… therefore Canopus[324] surpasses Achernar[325] in brightness and splendour, while Rigel[326] is surpassed by Sirius.[327]

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309 β Columbae. *First observation*. According to our calculation, this star crossed the meridian 30 s before the previous one.

310 γ Columbae. *First observation*.

311 δ Doradus. *First observation*. According to our calculation, this star crossed the meridian 35 s before the previous one. The other star of the pair is ε Doradus.

312 γ Pictoris. This star crossed the meridian 53 s before the two previous ones. Inserted in the left margin: *Not in the globe*, which suggests a non-Ptolemeic star.

313 η Columbae. *First observation*.

314 θ Columbae. *First observation*.

315 δ Pictoris. *First observation*. Inserted in the left margin: *not in the globe*. Canopus = α Carinae.

316 κ Columbae. The other stars are δ Columbae and λ Canis Majoris. *First observations*

317 ζ Canis Majoris. *First observation*.

318 δ Columbae. See two footnotes above.

319 λ Canis Majoris. *Ibidem*.

320 Canopus, or α Carinae. First observed 19 December 1639.

321 **Sirius**, or α Canis Majoris, with an apparent visual magnitude of -1.46, is the brightest star in the night sky, almost twice as bright as Canopus, the next brightest star. *First observation*.

322 Achernar, or α Eridani. First observed 20 September 1639.

323 β Orionis. First observed 17 December 1639.

324 Canopus, or α Carinae. First observed 19 December 1639.

325 Achernar, or α Eridani. First observed 20 September 1639.

326 β Orionis. First observed 17 December 1639.

327 Sirius, or α Canis Majoris. First observed 21 December 1639.

22 December [1639]

Meridian elevation of the Sun 74 44 20 south

[The sky] was very clear around sunset and after (today, just like the previous days) and evening stood out for its red colour. […][328] And towards the true end of twilight, that evening, when I almost saw daylight flee, the bright [star of the] Eagle[329] was second to set.[330] She [was] in the middle of the sky,[331] 20°[from the meridian to west], reckoned from the perpendicular to the vernal point.[332] At the end of the twilight, the whole sky was covered by clouds, starting from the east.

23 December [1639]. A rainy and cloudy sky

24 December [1639]

Meridian elevation of the Sun 74 44 45 south

From 7 PM to 8:30 PM.

Western elevation of the Head of Andromeda.[333] 46 13 0

Its azimuth from north to west 34 53 0

270 oscillations of the pendulum:

[41]

Southern meridian transit of the first star of the quintet of the Water Snake.[334]

164 oscillations of the pendulum:

Southern meridian transit of de head of the Water Snake.[335]

NB. About two minutes of time earlier[336], the eastern[337] of the two pitiful [stars] above the second star of the River[338] culminated.

1096 oscillations of the pendulum:

Southern meridian transit of φ of the River.[339]

50 oscillations of the pendulum:

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328 At this point two lines from the Leiden manuscript are omitted in the Paris manuscript, probably because they are hardly readable (also for us).

329 α Aquilae or Altair. First observed 18 September 1639.

330 According to our calculation, the Sun set 59 m 31 s before.

331 *Middle of sky* might mean *meridian.*

332 The symbol ♈ normaly denotes the vernal point. But the text only makes sense, if we consider that the ecliptic longitude of the Sun was 271° 0' 15.8", that is about 90° from the vernal point. So the combination of *o* ♈ in the Leiden and Paris manuscripts probably means 'perpendicular to the vernal point'.

333 Andromeda, or α Andromedae. First observed 26 November1639.

334 η_2 Hydri. First observed 17 December 1639.

335 α Hydri. First observed 22 September 1639.

336 According to our calculation, this duration was 4 min 47 s.

337 TYC 8041-1200-1 in the Phoenix that, according to our calculation, crossed the meridian several minutes before the two previous stars. *First observation.* Its companion is ψ Phoenicis.

338 χ Eridani. First observed 22 September 1639. (Actually the third, above the second star).

339 φ Eridani. First observed 26 November1639.

The second of the quintet of stars of the Water Snake.[340]
505 oscillations of the pendulum:
The third of the quintet of stars of the Water Snake.[341]
47 oscillations of the pendulum:
Fourth [star] of the River on the globe.[342]
135 oscillations of the pendulum:
The meridian elevation of the bright star …
… far above the fourth[343] of the River.[344] 62° 48' 0"
NB These are three stars forming an isosceles triangle[345], of which this is the western star.
672 oscillations of the pendulum:
Southern meridian transit of ι of the River, 5th star[346]
24 oscillations of the pendulum:
Southern [meridian transit of the] 6th star of the River. Not displayed on the globe.[347]
227 oscillations of the pendulum:
The fourth star of the quintet in the Water Snake.[348]
With it culminates the very small 6-magnitude star[349] in the Water Snake and the River, …
… being its meridian elevation 42 7 0
296 oscillations of the pendulum:

[42]

Western [star][350] of the triangle[351] above the 6th star of the River.[352]
43 oscillations of the pendulum:
This star is followed [in meridian transit] by another one, more to south.[353].
Its meridian elevation 61 0 0
448 oscillations of the pendulum:

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340 π_2 Hydri. *First observation.*
341 δ Hydri. First observed 16 December 1639.
342 κ Eridani. First observed 26 November1639. This star crossed the meridian 1 m 49 s before the previous star.
343 κ Eridani. First observed 26 November1639.
344 φ Fornacis, with a visual magnitude of 5.13. *First observation.* Absent in Houtman's catalogue. According to our calculation, this star crossed the meridian before the two previous ones, 59 s before the last one and 2 m 48 s before the anterior one.
345 Not isosceles, but obtuse, since the upper star is rather displaced to the right.
346 TYC 7558-987-1. First observed 16 December 1639.
347 ι Eridani. First observed 16 December 1639. Absent in Houtman's catalogue.
348 ε Hydri. First observed 16 December 1639.
349 ξ Horologii, with a visual magnitude of 5.21. According to our calculation, this star culminated 4 min 51 s before the previous one.
350 β Fornacis. First observed 16 December 1639. According to our calculation, this star crossed the meridian 18 s before the first of the two previous stars, but not the second, because it was chronologically misplaced.
351 Triangle of stars from the Furnace.
352 ι Eridani. First observed 16 December 1639.
353 η_3 Fornacis. *First observation.*

6th star of the River, for me the 8th or the bright one.[354]			
126 oscillations of the pendulum:			
Western elevation of the bright star of the southern foot of Andromeda.[355]	40	11	0
And its azimuth from north to west	30	30	0
152 oscillations of the pendulum:			
Western elevation of the bright star of the southern foot of Andromeda.[356]	39	53	30
Azimuth	31	0	0
From 9 PM to 1 AM.			
Meridian elevation of the 11th star for me of the River[357]	56	42	0 south
Western star of the triangle of the River (7th of the globe)[358]	59	44	0 south
17th [star] of the River on the globe[359]	73	50	0 south
Southern [star] of the triangle of the River (8th of the globe)[360]	59	25	30 south
Northern [star] of the triangle of the River (9th of the globe in the River)[361]	60	50	0 south
15th [star] of the River on the globe[362]	72	30	0 south
14th [star] of the River on the globe[363]	73	10	0 south
[Star[364]] east of the 2 shapeless clouds[365]	22	57	30 south
Eastern [star[366]] of the two bright ones that are below the two[367] [stars] …			
… at west of the River	55	0	0 south
From the two western stars of the River, the upper one,[368] …			
… (the 10th of the River on the globe)	63	31	30 south
[Star] between the River and Dorado[369]	45	50	0 south
From the two western[370] stars of the River, the lower one,[371] …			

354 θ_1 Eridani. First observed 16 December 1639.
355 β Andromedae. *First observation.* This star crossed the meridian 9 s before the previous one.
356 The same star of the previous observation.
357 TYC 7572-1748-1. First observed 17 December 1639.
358 TYC 7034-1311-1. First observed 17 December 1639.
359 τ_6 Eridani. *First observation.*
360 TYC 7570-1585-1. First observed 17 December 1639.
361 TYC 7035-1374-1. First observed 17 December 1639.
362 τ_8 Eridani. *First observation.*
363 τ_9 Eridani. *First observation.*
364 γ Hydri. First observed 17 December 1639.
365 The Magellanic Clouds.
366 α Horologii. First observed 20 December 1639. The western star of the pair is δ Horologii.
367 The two stars are 41 and 43 Eridani. First observed 21 December 1639. 'West' should be 'east'.
368 41 Eridani. 'Western' should be 'eastern'.
369 γ Doradus. First observed 20 December 1639.
370 Should be eastern.
371 43 Eridani. First observed 21 December 1639.

… (the 11th of the River on the globe)	63	18	30 south
[Star] at the western side of Dorado.[372]	34	48	30 south

[43]

[Star] far above the shapeless [cloud].[373]	52	27	30 south
Of the pair [of stars) at east [of the River], the upper one.[374] …			
… (the13rd of the River on the globe)	67	38	30 south
Of the pair [of stars] at east of the River, the lower one,[375] …			
… (the 12th of the River on the globe)	66	51	30 south
Meridian elevation of the end of Dorado's tail.[376]	42	25	00 south
The eastern [star[377]] in ∇[378] above the shapeless [cloud].	55	40	00 south

[Mss Leiden]

[Mss Paris]

[Star] out and west of the Dove.[379]	62	10	00 south
[The star] below the eastern of the two clouds.[380]	40	16	30 south
Rigel[381] of the Orion.	89	31	00 south
Near and above the Large Cloud.[382]	30	41	00 south
[Star] at the end of the right wing of the Dove.[383]	62	29	00 south
[Star] in the back of the Dove.[384]	63	55	00 south
[Star] in the back of Dorado.[385]	35	30	00 south
[Star] in the end of the left wing of the Dove.[386]	65	46	30 south

372 α Reticuli. First observed 20 December 1639. According to our calculation, this star crossed the meridian 34 s before the previous star.

373 δ Caeli. See First observed 21 December 1639. The 'shapeless cloud' is the Large Magellanic Cloud.

374 υ_1 Eridani. According to our calculation, this star crossed the meridian 26 s before the previous star.

375 υ_2 Eridani. See First observed 21 December 1639.

376 α Doradus. First observed 20 December 1639.

377 α Caeli. See First observed 21 December 1639.

378 In the drawing the upper star at left is α Caeli and at right, α and δ Horologii; below is δ Caeli.

379 γ Caeli. See First observed 21 December 1639.

380 ζ Doradus. See First observed 21 December 1639. 'Two clouds' = the large Magellanic Cloud

381 β Orionis. First observed 17 December 1639.This star crossed the meridian 2 m 10 s before the previous star.

382 θ Doradus. First observed 21 December 1639.

383 ε Columbae. First observed 21 December 1639.

384 Phact, or α Columbae. First observed 21 December 1639.

385 β Doradus. First observed 20 December 1639.

386 μ Columbae.

[Star] where the right wing of the Dove comes from.[387]	62	18	30 south
[Star] in the Swift Ship of the Skipper.[388]	47	04	30 south
[Star] where the left wing of the Dove comes from.[389]	64	20	00 south
[Star] where the neck of the Dove comes from.[390]	62	55	00 south
Upper [star] of the pair in the womb of Dorado.[391]	32	20	30 south
Lower [star] of the pair in the womb of Dorado.[392]	31	16	00 south
Head of the Dove.[393]	61	00	00 south
Below Canopus, at right.[394]	43	21	00 south
The southernmost of the three upper [stars] in the branch of the Dove.[395]	63	10	00 south
[Star] of the end of the right and rear foot of the Great Dog.[396]	68	14	30 south
That one in the middle of the three upper [stars] … … in the branch of the Dove[397]	64	56	30 south
The northernmost of the three [stars] in the branch of the Dove.[398]	65	51	00 south
Canopus	45	48	30 south

[44]

25 December [1639]

Meridian elevation of the Sun	74	46	20 south

26 December [1639]

Meridian elevation of the Sun	74	48	40 south

At 7 PM. Saturn with two bright [stars] in the tail of the Sea Goat[399] composed an isosceles triangle. Saturn was further west than the stars, and was separated from the leading [star] in the Sea Goat's tail,[400] just as far apart as the two [stars] in the tail between themselves. However, Saturn and the subsequent [star] [401] in the tail formed the base of the triangle.

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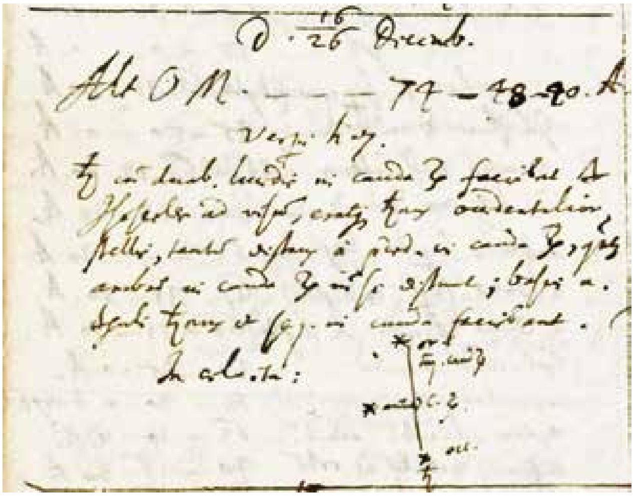
387 β Columbae. First observed 21 December 1639.
388 β Pictoris. First observed 21 December 1639.
389 λ Columbae. *First observation.*
390 γ Columbae. First observed 21 December 1639.
391 δ Doradus. First observed 21 December 1639. This star crossed the meridian 35 s before the previous one.
392 ε Doradus.
393 θ Columbae. First observed 21 December 1639.
394 Canopus, or α Carinae (First observed 19 December 1639) and δ Pictoris (First observed 21 December 1639). Inserted in the margin: *Not in the globe*, which suggests a non-Ptolemeic star.
395 κ Columbae. First observed 21 December 1639.
396 ζ Canis Majoris. First observed 21 December 1639.
397 δ Columbae. First observed 21 December 1639.
398 λ Canis Majoris. First observed 21 December 1639.
399 In Capricornus ('horned goat'), one of the constellations of the zodiac.
400 The leading star of the Tail of the Sea Goat was γ Capricorni.
401 The subsequent star was δ Capricorni. *First observation.*



[Mss Leiden] *[Mss Paris]*

On 27 December [1639]

Meridian elevation of the Sun	74	51	0 south

On 28, 29 and 30 December the sky was fickle
and I also went away to the countryside.

On 31 December [1639]

Meridian elevation of the Sun	75	6	0 south

Fickle night.

~.

[45]

The year 1640 follows with the Observations of the Heavens by Georg Marggrafe, starting on 1 January A.C. 1640, Gregorian [calendar]

	°	'	"
Meridian elevation of the Sun	75	10	15 south

In the following days, fickle sky.

On 6 January [1640]

Meridian elevation of the Sun	75	41	30 south

On 7 January [1640]

Meridian elevation of the Sun 75 50 0 south

On 8 January [1640]

Meridian elevation of the Sun 75 58 30 south

On 9 January [1640]

Meridian elevation of the Sun 76 10 0 south[402]

In the remainder of the month, as well as in February, for the most part we lacked fine weather and several times I went away. In the night following 18 March[403] our house …

[46]

… where we live, spontaneously collapsed altogether while we all were sleeping. But thanks to the extraordinary power of God we all, seven in number, were spared alive, although wounded thence in the limbs. My furniture thence suffered damage, including the chest. Until the house was repaired, what was done after a time span of a trimester, I was constrained to abstain from mathematical works in the meantime. Having also occurred a subluxation of my left armpit, what made me useless for accomplishing anything, it detained me more than two months.

On 11 June [1640]

Meridian elevation of the Sun 58 41 0 north

On 12 and 13 June it rained

On 14 June [1640]

Meridian elevation of the Sun 58 30 50 north

On 15 June [1640]

Meridian elevation of the Sun 58 28 30 north

On 16 June [1640]

Meridian elevation of the Sun 58 26 40 north

On 17 June [1640]. Cloudy.

[47]

On 18 June [1640]

Meridian elevation of the Sun 58 24 40 north

402 This value was adopted, because it matches better to the calculated one.

403 'In the night following 18 March' might mean 'after the change to new date at midnight'.

On 19 June[1640][404]

Meridian elevation of the Sun	58	23	40 north

On 20 June [1640]

From about 9:30 AM			
1. Elevation of the Sun before noon	40	22	30
Its azimuth from north to east	48	50	0
2. Elevation of the Sun	42	31	0
Azimuth as before	46	43	0
3. Elevation of the Sun	46	5	30
Azimuth	42	33	30
4. Elevation of the Sun	47	22	30
Azimuth	40	42	0
5. Elevation of the Sun	48	7	30
Azimuth	39	35	0
6. Elevation of the Sun before the meridian transit	49	0	0
Azimuth from north to east	38	10	0
7. Elevation of the Sun	53	21	0
Azimuth	29	5	0
It was 10:45 according to the sundial[405]			
8. Meridian elevation of the Sun	58	23	30
Azimuth	0	0	0
9. Elevation of the Sun after the meridian transit	58	12	0
Azimuth from north to west	7	47	0

[48]

10. Elevation of the Sun	57	30	0
Azimuth	14	40	0
11. Elevation of the Sun	56	0	0
Azimuth	22	34	0
12. Elevation of the Sun	49	15	30
Azimuth	39	35	0
13. Elevation of the Sun	48	7	30
Azimuth	41	37	0
14. Elevation of the Sun	47	41	0
Azimuth from north to west	42	21	0

It was 2 o'clock on the sundial[406]. By means of the shadow of the gnomon, I also made the previous observations with an upright shaft with 4000 divisions. Therefore in the previous observations:

404 This is the last recorded day in the Leiden observation register ELO, North no. 58.

405 According to our calculation, the sundial hour at the previous observation was 10 h 43 m 34 s.

406 The calculated sundial time at the previous observation was 1 h 55 m 31 s.

1. The length of the shadow was 4660 divisions (as the gnomon had 4000 [divisions])			
Angle between the first and the second observation of the shadow	2°	15'	
2. Length of the shadow 4324 divisions			
Angle	4	0	
4.[407] [Length of the shadow] 3650 divisions			
Angle	1	15	
5. [Length of the shadow] 3554 divisions			
Angle	1	30	
6. [Length of the shadow] 3448 divisions			
Angle	9	0	
7. [Length of the shadow] 2950 divisions			

[49]

Angle	29	0	
8. [Length of the shadow] 2437 divisions			
Angle	8	0	
9. [Length of the shadow] 2455 divisions			
Angle	6	45	
10. [Length of the shadow] 2522 divisions			
Angle	7	6	
11. [Length of the shadow] 2671 divisions			
Angle	17	15	
12. [Length of the shadow] 3415 divisions			
Angle	2	0	
13. [Length of the shadow] 3552 divisions			
Angle	0	45	
14. [Length of the shadow] 3610 divisions			

On 21 June [1640]

From about 9:15 AM.			
1. Elevation of the Sun before the meridian transit	39	15	0
Azimuth from north to east	49	40	0
2. Elevation of the Sun	40	22	30
Azimuth	48	49	0
3. Elevation of the Sun	41	12	0
Azimuth	48	0	0
4. Elevation of the Sun	42	31	0
Azimuth	46	42	0
5. Elevation of the Sun	46	0	0
Azimuth	42	41	0

407 The number [3] is not recorded.

[50]

6. Elevation of the Sun	49	40	0
Azimuth	37	0	0
7. Elevation of the Sun	51	59	0
Azimuth	32	22	0
8. Meridian elevation of the Sun	58	23	30
north			
Azimuth	0	0	0

Second in azimuth from north to West, thus far the same [elevation] as the meridian elevation of the Sun[408]

9. Elevation of the Sun after the meridian transit	58	4	0
Azimuth from north to west	43	41	0[409]

It was about 2 PM in the sundial.

The gnomon with 4000 divisions is used as in the previous observations.

1. Length of the shadow 4851 divisions		
Angle	1°	0'
2. [Length of the shadow] 4661 divisions		
Angle	1	0
3. [Length of the shadow] 4530 divisions		
Angle	1	15
4. [Length of the shadow] 4325 divisions		
Angle	4	0
5. [Length of the shadow] 3830 divisions		
Angle	5	30
6. [Length of the shadow]. 3366 divisions		
Angle	4	30
7. [Length of the shadow] 3100 divisions		
Angle	32	30

[51]

8. [Length of the shadow] 2438 divisions		
Angle	9°	45'
9. [Length of the shadow] 2469 divisions		
Angle	31	15
10. [Length of the shadow] 3510 divisions		
Angle	2	30

11. [Length of the shadow] 3730 divisions

NB. More accurate angles may be shown with the azimuthal circle.[410]

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408 According to our calculation, the elevation had indeed changed 1' 11", but the instrument was not sensitive enough to detect such a difference.

409 This value is at odds with our calculated one (8° 53' 55") and is clearly wrong.

410 The azimuthal circle should be of the 5 feet quadrant, but it is hard to imagine that the solar observations with the gnomon were made in the quadrant room. So this sentence might simply express how better should be the angle measurements with the azimuthal circle.

It rained on 22 June [1640].

On 23 June [1640]

Meridian elevation of the Sun 58 25 0 north

On 24 June [1640]

Meridian elevation of the Sun 58 26 20 north

I observed in the evening with a clear sky, when the twilight was going to end. And I saw its end, as a penance, fled with a broad blush, when the eastern elevation of the Heart of Scorpion[411] was 41 36 0

In the following days. Annoying weather.

On 28 June [1640] with a clear sky

At 10 AM, with my optical instrument[412] set up, I determined through a hole with a diameter of 10 divisions [chosen arbitrarily][413] the diameter …

[52]

… of the Sun, expressed in this same division. Several times I found 73 [divisions], other [times] 74. However, the distance from the hole to the outlined illuminated image of the Sun was 7340 divisions.[414] This observation, repeated after the meridian transit, gave the same result. I mean, no diameter larger than 74 divisions was found, nor one smaller than 73 divisions.

Meridian elevation of the Sun 58 36 0 north

Stormy weather in the following days

On 15 July [1640]

Meridian elevation of the Sun 60 26 30 north

It rained on 16 July [1640]

On 17 July [1640]

Meridian elevation of the Sun 60 47 0 north

411 Antares or α Scorpii. First observed 20 September 1638.

412 The instrument should be a *camera obscura*, set up in the room beneath that one with the 5-foot quadrant.

413 A blackened card with a hole is present among the Leiden manuscripts (*ELO*, North no. 79). See vol. 1, fig. 110.

414 For three small drawings of the Sun, together with some calculations, on a sheet of paper bearing this very date '28 June', see: Vol. 1, fig. 111 (*ELO*, North no. 32). Above the three circular drawings of the sun, in a different small but seventeenth-century handwriting, some words in Dutch are written: *glijck* ('alike'), *wat grooter* ('somewhat larger') and *wat kleender* ('somewhat smaller'). This seems to indicate that at that moment Marggrafe worked together with an assistant.

Rainy during the following days

On 23 July [1640]

Meridian elevation of the Sun	61	55	30 north

On 24 July [1640]

Meridian elevation of the Sun	62	8	20 north

It rained on 25 July [1640]

On 26 July [1640]

Meridian elevation of the Sun	62	34	40 north

On 27 July

Meridian elevation of the Sun	62	49	40 north

[53]

Following days cloudy and rainy

1st of August [1640]

Meridian elevation of the Sun	64	1	40 north

On 2 August [1640]

Meridian elevation of the Sun	64	17	0 north

Following days cloudy and rainy

On 7 August [1640]

Meridian elevation of the Sun	65	40	0 north
At 6:30 PM, when the western elevation of Arcturus[415] [was]	51	20	0
Its azimuth from north to west	41	17	0
After 330 oscillations of the pendulum, …			
… the western elevation of Mercury [was]	6	7	0
Azimuth from north to west	77	42	0
After 245 oscillations of the pendulum, again the elevation of Mercury	4	59	30
Azimuth from north to west	78	0	0
After 343 oscillations of the pendulum, western elevation of Arcturus	48	59	0
Its azimuth from north to west	44	28	0

415 Arcturus, or α Bootis. First observed 15 September 1639.

Later until about 9 PM

Meridian elevation of the eastern [star] of the Southern Triangle[416]	29	53	30 south
[Star] in the Censer[417]	49[418]	51	0 south
[Star] in the Censer[419]	42	49	30 south
First [star] of Scorpion's tail[420] (ε)	64	32	0 south
Second [star] of Scorpion's tail[421] (μ)	60	47	0 south
Third [star] in Scorpion's tail[422] (ζ)	55	25	30 south

[54]

From the pair [of stars] in the Censer, the lower one[423]	42	10	0 south
The upper one[424]	43	0	0 south
[Star] below the upper pair in the Censer[425]	37	49	30 south
[Star] above the pair[426] in the Censer	48	39	0 south
The last [star] in Scorpion's tail[427]	61	10	0 south
The next to the last [star] in Scorpion's tail[428]	61	20	0 south
The sixth [star] in Scorpion's tail[429]	55	26	30 south
The westernmost [star] of the Peacock[430] (χ)	33	40	0 south
The fourth [star] from the end in Scorpion's tail[431]	59	21	0 south
The fifth [star] from the end in Scorpion's tail[432]	58	12	30 south
[Star] in the Archer after Scorpion's tail[433]	61	16	0 south

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416 **Atria**, or α Trianguli Australis, with an apparent visual magnitude of 1.91, is the brightest star in the southern constellation of Triangulum Australe ('Southern Triangle'), forming an apex of a triangle with β Trianguli Australis and γ Trianguli Australis that gives the constellation its name. *First observation.*

417 η Arae. *First observation.*

418 In chronological order, η Arae was the first star to cross the meridian at elevation 39° 46' 21", so instead of 49° in elevation, it should be 39°.

419 ζ Arae. *First observation.*

420 ε Scorpii. *First observation.* This star and the next one crossed the meridian, respectively, 2 m 8 s and 1 m 30 s before the previous one.

421 μ_1 Scorpii. *First observation.*

422 η Scorpii. *First observation.*

423 γ Arae. *First observation.*

424 β Arae is the brightest star in the southern constellation of Ara (the 'Altar', or 'Censer'), with an average apparent visual magnitude of 2.84. *First observation.*

425 δ Arae. *First observation.*

426 α **Arae** with an average apparent visual magnitude of 2.93, is the second brightest star in the southern constellation of Ara (the 'Altar', or 'Censer'). *First observation.*

427 υ Scorpii. *First observation.*

428 λ Scorpii. *First observation.*

429 θ Scorpii. *First observation.*

430 η Pavonis. *First observation.* According to our calculation, this star crossed the meridian 54 s before the previous one.

431 κ Scorpii. *First observation.*

432 ι_1 Scorpii. *First observation.*

433 TYC 7389-2159-1 in the Scorpion. *First observation.*

[Star] in the tail of the Peacock[434] (μ)	34	30	0 south
[Star] of the Censer[435]	48	6	30 south
The first [star] of the bow of the Archer[436] (γ)	67	46	30 south
[Star] of the bow (of the Archer)[437]	61	18	0 south
Meridian elevation of Jupiter	74	31	30 south
and after 127 oscillations of the pendulum, the [star] of the bow …			
… of the Archer, that is the first one eastward[438] (δ)	68	10	0 south
[Star] of the bow of the Archer[439] (ε)	63	36	30 south
[Star] at west of the triangle below the southern Crown[440]	52	3	0 south
—— at south[441]	48	56	0 south
—— at east[442]	52	3	0 south
[Star] in the bow of the Archer[443] (λ)	72	30	0 south
[Star] in the Peacock[444] (ν)	35	39	0 south
[Star] in the Peacock[445] (ι)	30	32	30 south

On 8 August [1640]

Meridian elevation of the Sun	65	57	30[446] north

[55]

In the evening, because of clouds, I could not observe Mercury.			
Meridian elevation of the [star] preceding the Heart of Scorpion[447] …			
… to the north[448]	73	23	30 south
[Meridian elevation] of the Heart of Scorpion	72	29	30 south
[Meridian elevation] of [the star] following Scorpion's head			
to south[449]	70	40	0 south

434 π Pavonis. *First observation.*
435 θ Arae. *First observation.*
436 γ Sagittarii. *First observation.*
437 η Sagittarii. *First observation.*
438 δ Sagittarii. *First observation.*
439 **Kaus Australis**, or ε Sagittarii. Brightest star in the constellation of Sagittarius ('archer'), with a visual magnitude of 1.85. *First observation.*
440 α Telescopii. Brightest star in the southern constellation of Telescopium, with an apparent visual magnitude of 3.5. According to our calculation, this star crossed the meridian 1 s before the previous one. *First observation.*
441 ξ Telescopii. *First observation.*
442 δ_1 Telescopii. *First observation.*
443 λ Sagittarii. *First observation.*
444 λ Pavonis.
445 κ Pavonis.
446 Guessed value.
447 Antares, or α Scorpii. First observed 20 September 1638.
448 σ Scorpii. First observed 13 October 1638.
449 τ Scorpii. First observed 20 September 1638.

[Meridian elevation] of the eastern [star] of the Southern Triangle[450]	29	51	0 south
Henceforth clouds. Again clear sky.			
Meridian elevation of the first [star] in Scorpion's tail[451]	64	31	0 south
Second [star] in Scorpion's head[452]	60	45	30 south
Since then clouds for all the night.			
On 9 August [1640]			
Meridian elevation of the Sun	66	14	30 north
On 10 August [1640]			
Meridian elevation of the Sun	66	32	0 north
Likewise with the portable sextant	66	32	0 north
In the evening a lot of clouds spread just where I wanted to observe. Time: 6:30 PM			
Western elevation of Mercury	8	21	0
Azimuth from north to west	79	38	
After 215 oscillations of the pendulum:			
Western elevation of the bright [star] of the Northern Crown[453]	52	26	0 &
Azimuth from north to west	16	10	0
After 117 oscillations of the pendulum:			
Mercury elevation[454]	7	6	0
Azimuth [From north to west]	79	40	
And after 225 oscillations of the pendulum [was] …			
[56]			
… the western elevation of the bright [star] of the Northern Crown[455]	52	7	0
Azimuth [From north to west]	16	30	
Again hampered by clouds for a while. Henceforth clear sky.			
Meridian elevation of the third [star] of Scorpion's tail (μ)[456]	55	24	0 south
Lower [star] of the pair in the Censer[457]	42	7	0 south
The upper one[458]	43	0	0 south
In the Censer, below the pair, the third star[459]	37	49	0 south

450 Atria, or α Trianguli Australis. First observed 7 August 1640. According to our calculation, this star crossed the meridian 2 m 16 s before the previous one.

451 ε Scorpii. First observed 7 August 1640.

452 μ_1 Scorpii. First observed 7 August 1640.

453 Alphecca, or α Coronae Borealis. First observed 23 September 1639.

454 According to our calculation, Mercury was in this position 1 s before the previous observation.

455 Alphecca, or α Coronae Borealis. First observed 23 September 1639.

456 η Scorpii. First observed 7 August 1640.

457 γ Arae. First observed 7 August 1640.

458 β Arae. First observed 7 August 1640.

459 δ Arae. First observed 7 August 1640.

That one above the pair[460]	48	36	0 south
The last [star] of Scorpion's tail[461]	61	6	0 south
The next to the last [star] of Scorpion's tail[462]	61	20	0 south
Soon culminates the tiny [star] below Scorpion's tail[463]			
Clouds again.			
The westernmost [star] of the Peacock[464] (λ) is in the Censer, below the pair, the third star with the meridian elevation of 37º 49'.[465]	33	36	0 south
Fourth [star] from the end of Scorpion's tail[466]	59	18	30 south
Fifth [star] from the end of Scorpion's tail[467]	58	18	0 south
[Star] outside Scorpion's tail[468]	61	11	0 south
The bright nebulosity[469] above this star in …			
… which place Bayer put a nebula	63	25	0 south
[Star] in the tail of the Peacock[470] (μ)	34	30	0 south
[Star] in the Censer[471]	48	4	30 south
Henceforth cloudy sky.			

It rained on 11 August [1640]

On 12 August [1640]

[57]

7:30 PM [the sky] was illuminated.			
Meridian elevation of the Heart of Scorpion[472]	72	29	30 south
[Star] that follows the Heart of Scorpion to south[473]	70	39	30 south
Cloudy again.			

On 13 August [1640]

Meridian elevation of the Sun	67	25	40 north

460 α Arae. First observed 7 August 1640.
461 υ Scorpii. First observed 7 August 1640.
462 λ Scorpii. First observed 7 August 1640.
463 This star might be σ Arae which, according to our calculation, crossed the meridian 16 s before the previous star.
464 η Pavonis. First observed 7 August 1640.
465 δ Arae. First observed 7 August 1640
466 κ Scorpii. First observed 7 August 1640.
467 ι_1 Scorpii. First observed 7 August 1640.
468 TYC 7389-2159-1. First observed 7 August 1640.
469 The bright open cluster M7 in the constellation of Scorpion.
470 π Pavonis. First observed 7 August 1640.
471 θ Arae. First observed 7 August 1640.
472 Antares, or α Scorpii. First observed 20 September 1638.
473 τ Scorpii. First observed 20 September 1638.

On 16 August [1640]

Meridian elevation of the Sun	68	21	0 north

Cloudy night.

On 17 August [1640]

Meridian elevation of the Sun	68	40	30 north

Cloudy night.

On 18 August [1640]

Meridian elevation of the Sun	69	0	15 north

Cloudy night.

On 19 August [1640]

Meridian elevation of the Sun	69	20	0 north

Cloudy night.

On 20 August [1640]

Meridian elevation of the Sun	69	40	0 north

After 6 PM. Because of clouds, I could not make observations.

Meridian elevation of the third [star] of Scorpion tail[474] (ζ)	55	24	30 south
The pair in the Censer, the lower star[475]	42	10	0 south
The upper [star]	43	0	0 south
[Star] in the Censer that is beneath the pair above[476]	37	49	30 south
[Star] in the Censer above the pair[477]	48	39	30 south
Last [star] of Scorpion tail[478]	61	10	0 south
The next to the last [star] of Scorpion tail[479]	61	21	30 south

[58]

The sixth [star] of Scorpion tail[480]	55	24	0 south
[…][481]	33	37	30 south
The fourth [star] from the end of Scorpion's tail[482]	59	20	0 south
The fifth [star] from the end of Scorpion's tail[483]	58	10	30 south

Henceforth cloudy [sky]. Rainy sequence of two days.

474 η Scorpii. First observed 7 August 1640.
475 γ Arae. First observed 7 August 1640.
476 δ Arae. First observed 7 August 1640.
477 α Arae. First observed 7 August 1640.
478 υ Scorpii. First observed 7 August 1640.
479 λ Scorpii. First observed 7 August 1640.
480 θ Scorpii. First observed 7 August 1640.
481 Not filled in. The unquoted star should be η Pavonis. First observed 7 August 1640. According to our calculation, this star crossed the meridian 55 s before the previous star.
482 κ Scorpii. First observed 7 August 1640.
483 ι_1 Scorpii. First observed 7 August 1640.

On 23 August [1640]

Meridian elevation of the Sun	70	40	20 north
Rainy night.			

On 24 August [1640]

Noon. Rainy cloudy.			
After 6 PM. Western elevation of Spica of Virgo[484]	38	20	0 and
Azimuth from west to south	6	0	0
After 138 oscillations of the pendulum.			
Western elevation of Mercury	17	29	0
Azimuth from north to west	88	12	0
140 oscillations of the pendulum.			
Western elevation of Spica of Virgo	36	58	0
Azimuth from west to south	5	55	0
135 oscillations of the pendulum.			
Elevation of Mercury	16	26	30
Azimuth from north to west	88	12	0
141 oscillations of the pendulum.			

[59]

[Western] elevation of Spica of Virgo[485]	35	54	0
Azimuth [from west to south]	6	7	0
128 oscillations of the pendulum.			
[Western] elevation of Mercury	15	20	0
Azimuth [from north to west]	88	36	0
128 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	34	51	0
Azimuth [from west to south]	6	6	0
234 oscillations of the pendulum.			
[Western] elevation of Mercury	14	2	0
Azimuth [from north to west]	88	43	0
137 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	33	25	30
Azimuth [from west to south]	6	20	0
Afterwards.			
That [star] above the pair in the Censer[486] in the meridian			
After 252 oscillations of the pendulum.			
The last [star] of Scorpion's tail[487] in the meridian			
160 oscillations of the pendulum.			
The next to the last [star] of Scorpion's tail[488] culminates			

484 Spica, or α Virginis. First observed 19 September 1638.
485 *Ibidem.*
486 α Arae. First observed 7 August 1640.
487 υ Scorpii. First observed 7 August 1640.
488 λ Scorpii. First observed 7 August 1640.

138 oscillations of the pendulum.
The sixth [star] of Scorpion's tail[489]
389 oscillations of the pendulum.
The fourth [star] from the end of Scorpion's tail[490]
286 oscillations of the pendulum.
Fifth [star] from the end of Scorpion's tail[491]
255 oscillations of the pendulum.

[60]

[Star] outside of Scorpion's tail[492]
155 oscillations of the pendulum.

Western elevation of Arcturus[493]	31	26	
Its azimuth from north to west	59	35	
Meridian elevation [of a star] in the left [shin] …			
… of Hercules of the Dragon[494]	35	41	0 north
Meridian elevation of the following [eastern] star …			
… in the pair of bright stars in the head of the Dragon[495]	30	20	30 north
After about 7:30 PM. Western elevation of Arcturus	25	37	0
Azimuth from north to west	62	25	0
After 118 oscillations of the pendulum.			
Meridian elevation of Jupiter[496]	74	32	30 south
353 oscillations of the pendulum.			
Western elevation of Arcturus	24	1	0
Azimuth [from north to west]	62	51	0
Meridian elevation of the bright [star] of the Lyre[497]	43	22	30 north
From 11:30 PM to 1 AM			
Western elevation of the tail of the Eagle[498]	39	6	30
Azimuth from north to west	65	51	0
182 oscillations of the pendulum.			
Meridian elevation of Saturn	83	48	0 south
897 oscillations of the pendulum.			
Meridian elevation of Mars	79	49	0 south

489 θ Scorpii. First observed 7 August 1640.
490 κ Scorpii. First observed 7 August 1640.
491 ι_1 Scorpii. First observed 7 August 1640.
492 TYC 7389-2159-1. First observed 7 August 1640.
493 Arcturus, or α Bootis. First observed 15 September 1639.
494 ι Herculis. *First observation.*
495 γ Draconis. The other star of the pair is β Draconis.
496 According to our calculation, Jupiter crossed the meridian 1 m 42 s before Arcturus was in the position of the previous observation.
497 Vega, or α Lyrae. First observed 18 September 1639.
498 ζ Aquilae. First observed 18 September 1639.

385 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	33	53	0
Its azimuth [from north to west]	68	6	0

[61]

260 oscillations of the pendulum.			
Meridian elevation of θ in the Crane[499]			
959 oscillations of the pendulum.			
Meridian elevation of Fomalhaut of the Water Carrier[500]	66	34	0 south

On 25 August [1640]

Clouds at noon. After 6:15 PM.			
Spica of Virgo[501] at the western elevation	37	28	0
Azimuth from west to south	5	38	0
After 118 oscillations of the pendulum.			
Western elevation of Mercury	18	9	0
Its azimuth from north to west	88	31	0
123 oscillations of the pendulum.			
Western Elevation of Spica of Virgo	36	33	0
Its azimuth [from west to south]	5	38	0
142 oscillations of the pendulum.			
Western elevation of Mercury	17	10	0
Azimuth [from north to west]	88	37	0
121 oscillations of the pendulum.			
Western Elevation of Spica of Virgo	35	30	0
Azimuth [from west to south]	6	1	0
189 oscillations of the pendulum.			
Western Elevation of Mercury	16	0	0
Azimuth [from north to west]	88	48	0
104 oscillations of the pendulum.			
Western Elevation of Spica of Virgo	34	21	0

[62]

Azimuth [from west to south]	6	2	30
7:30 PM. Western elevation of Arcturus[502]	26	36	30
Azimuth from north to west	61	58	0
163 oscillations of the pendulum.			
Meridian elevation of Jupiter	74	32	0 south

499 The meridian elevation is not given, but this star should be β Gruis (First observed 20 September 1639).

500 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.

501 Spica, or α Virginis. First observed 19 September 1638.

502 α Bootis. First observed 15 September 1639.

377 oscillations of the pendulum.

Western elevation of Arcturus	24	39	0
Azimuth [from north to west]	62	21	0
8 PM. Meridian elevation of the bright [star] of the Lyre[503]	43	23	30 north

Clouds about midnight and after.

On 26 August [1640]

6:15 PM. Western elevation of Spica of Virgo[504]	36	22	30
Azimuth from west to south	5	55	0

126 oscillations of the pendulum.

Western elevation of Mercury	18	10	30
Azimuth from north to west	89	13	0

283 oscillations of the pendulum.

Western elevation of Mercury	17	4	30
Azimuth [from north to west]	89	23	0

378 oscillations of the pendulum.

Western elevation of Spica of Virgo	33	20	0
Azimuth [from west to south]	6	9	0

440 oscillations of the pendulum.

[63]

[Star] above the pair in the Censer[505] in the meridian
171 oscillations of the pendulum.
Last [star] in the tail of Scorpion[506] in the meridian
183 oscillations of the pendulum.
The next to the last [star] of Scorpion's tail[507] in the meridian
89 oscillations of the pendulum.
The sixth [star] of Scorpion's tail[508] [in the meridian]
424 oscillations of the pendulum.
The fourth [star] of Scorpion's tail[509] [in the meridian]
316 oscillations of the pendulum.
The fifth [star] of Scorpion's tail[510] [in the meridian]
192 oscillations of the pendulum.
[Star] after Scorpion's tail[511] [in the meridian]

503 Vega, or α Lyrae. First observed 18 September 1639.
504 α Virginis. First observed 19 September 1638.
505 α Arae. First observed 7 August 1640.
506 υ Scorpii. First observed 7 August 1640.
507 λ Scorpii. First observed 7 August 1640.
508 θ Scorpii. First observed 7 August 1640.
509 κ Scorpii. First observed 7 August 1640.
510 ι_1 Scorpii. First observed 7 August 1640.
511 TYC 7389-2159-1. First observed 7 August 1640.

101 oscillations of the pendulum.			
Western elevation of Spica of Virgo[512]	26	6	0
Azimuth from west to south	6	45	0
After 7:15 PM. Western elevation of Arcturus[513]	26	51	0
Azimuth from north to west	61	28	0
After 218 oscillations of the pendulum.			
Meridian elevation of Jupiter	74	32	0 south
270 oscillations of the pendulum.			
Western elevation of Arcturus	25	7	30
Azimuth [from north to west]	62	22	0
Meridian elevation of the bright [star] of the Lyre[514]	43	24	0 north
11:30 PM.			

[64]

Western elevation of the tail of the Eagle[515]	41	2	0
Azimuth from north to west	64	42	0
637 oscillations of the pendulum.			
Meridian elevation of Saturn	83	47	30 south
825 oscillations of the pendulum.			
Meridian elevation of Mars	79	41	30 south
943 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	32	30	0
Azimuth [from north to west]	68	43	0

On 27 [August 1640]. Cloudy. It rained.

On 28 August [1640]

Clouds at noon.			
6:15 PM. Western elevation of Mercury	17	24	0
Azimuth from west to south	0	38	0
158 oscillations of the pendulum.			
Western elevation of Spica of Virgo[516]	32	24	0
Azimuth from west to south	6	15	0
128 oscillations of the pendulum.			
[Western] elevation of Mercury	16	21	0
Azimuth [from west to south]	0	46	0
97 oscillations of the pendulum.			

512 Spica, or α Virginis. First observed 19 September 1638. According to our calculation, this star was in this position 7 s before the previous observation.
513 Arcturus, or α Bootis. First observed 15 September 1639.
514 Vega, or α Lyrae. First observed 18 September 1639.
515 ζ Aquilae. First observed 18 September 1639.
516 Spica, or α Virginis. First observed 19 September 1638.

Western elevation of Spica of Virgo	31	32	0	
Azimuth[from west to south]	6	18	0	
86 oscillations of the pendulum.				

[65]

[Western] elevation of Mercury	15	38	30	
Azimuth [from west to south]	0	58	0	
554 oscillations of the pendulum.				
Western elevation of Spica of Virgo[517]	29	0	30	
Azimuth [from west to south]	6	35	0	
113 oscillations of the pendulum.				
[Western] elevation of Mercury	13	0	0	
Azimuth [from west to south]	1	21	30	
130 oscillations of the pendulum.				
[Western] elevation of Spica of Virgo	28	8	30	
Azimuth [from west to south]	6	42	0	
108 oscillations of the pendulum.				
[Western] elevation of Mercury	12	6	30	
Azimuth [from west to south]	1	34	0	
113 oscillations of the pendulum.				
Western elevation of Spica of Virgo	27	19	0	
Azimuth [from west to south]	6	45	0	
7:30 PM. Western elevation of Arcturus[518]	27	28	0	
Azimuth from north to west	61	32	0	
349 oscillations of the pendulum.				
Meridian elevation of Jupiter	74	32	0	[south]
299 oscillations of the pendulum.				
Western elevation of Arcturus	25	13	0	
Azimuth [from north to west]	62	22	0	
About midnight clouds came up.				

It rained on 29 August [1640]

[66]

On 30 August [1640]

From 6:15 PM to 8 PM.				
Western elevation of Mercury	17	50	0	
Azimuth from west to south	1	47	0	
After 117 oscillations of the pendulum.				
Western elevation of Spica of Virgo[519]	31	1	0	
Azimuth from west to south	6	28	0	

517 Spica, or α Virginis. First observed 19 September 1638.
518 Arcturus, or α Bootis. First observed 15 September 1639.
519 Spica, or α Virginis. First observed 19 September 1638.

74 oscillations of the pendulum.			
[Western] elevation of Mercury	17	0	0
Azimuth [from west to south]	2	2	0
92 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	30	14	30
Azimuth [from west to south]	6	37	0
119 oscillations of the pendulum.			
[Western] elevation of Mercury	16	10	0
Azimuth [from west to south]	2	10	0
105 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	29	21	0
Azimuth [from west to south]	6	41	0
88 oscillations of the pendulum.			
[Western] elevation of Mercury	15	27	0
Azimuth [from west to south]	2	14	30
113 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	28	36	30
Azimuth [from west to south]	6	42	0
88 oscillations of the pendulum.			

[67]

[Western] elevation of Mercury	14	45	0
Azimuth [from west to south]	2	21	30
120 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo[520]	27	47	30
Azimuth [from west to south]	6	43	0
80 oscillations of the pendulum.			
[Western] elevation of Mercury	13	51	30
Azimuth [from west to south]	2	24	0
106 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	27	3	30
Azimuth [from west to south]	6	45	0
116 oscillations of the pendulum.			
[Western] elevation of Mercury	13	5	0
Azimuth [from west to south]	2	27	0
89 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	26	18	0
Azimuth [from west to south]	6	47	0
105 oscillations of the pendulum.			
[Western] elevation of Mercury	12	20	30
Azimuth [from west to south]	2	36	0
105 oscillations of the pendulum.			

520 Spica, or α Virginis. First observed 19 September 1638.

Western elevation of Arcturus[521]	31	5	0	
Azimuth from north to west	59	43	0	
122 oscillations of the pendulum.				
[Western] elevation of Mercury	11	27	30	
Azimuth [from west to south]	2	45	0	
216 oscillations of the pendulum.				

[68]

Western elevation of Arcturus[522]	30	0	0	
Azimuth [from north to west]	60	24	30	
557 oscillations of the pendulum.				
Western elevation of Arcturus	28	6	0	
Azimuth [from north to west]	61	7	0	
536 oscillations of the pendulum.				
Meridian elevation of Jupiter	74	31	0	[south]
281 oscillations of the pendulum.				
Western elevation of Arcturus	25	20	0	
Azimuth from north to west	62	20	0	
1957 oscillations of the pendulum.				
Meridian elevation of the bright [star] of the Lyre[523]	43	23	30	[north]

I did not observe Saturn and Mars due to their proximity to the Full Moon.

On 31 August [1640].

Meridian elevation of the Sun	73	30	0	north

On 1 September. 6:15 PM.

Western elevation of Spica of Virgo[524]	27	34	0	
Azimuth from west to south	6	47	0	
138 oscillations of the pendulum.				
Western elevation of Mercury	15	19	0	
Azimuth from west to south	3	25	0	
135 oscillations of the pendulum.				
[Western] elevation of Spica of Virgo	26	30	30	
Azimuth [from west to south]	6	49	0	
124 oscillations of the pendulum.				

[69]

[Western] elevation of Mercury	14	20	0	
Azimuth [from west to south]	3	31	30	
123 oscillations of the pendulum.				

521 Arcturus, or α Bootis. First observed 15 September 1639.
522 *Ibidem.*
523 Vega, or α Lyrae. First observed 18 September 1639.
524 Spica, or α Virginis. First observed 19 September 1638.

[Western] elevation of Spica of Virgo[525]	25	32	0
Azimuth [from west to south]	6	52	0
130 oscillations of the pendulum.			
[Western] elevation of Mercury	13	20	0
Azimuth [from west to south]	3	38	0
119 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	24	34	30
Azimuth [from west to south]	6	57	0
A little later I observed Jupiter this way.			
Western elevation of Arcturus[526]	26	36	0
Azimuth from north to west	61	55	0
171 oscillations of the pendulum.			
Meridian elevation of Jupiter	74	31	0
382 oscillations of the pendulum.			
Western elevation of Arcturus	24	48	0
Azimuth [from north to west]	62	38	30

On 2 September [1640].

[Northern] meridian elevation of the Sun	74	13	15

6:15 PM.

Western elevation of Spica of Virgo	27	28	30
Azimuth from west to south	6	35	0
112 oscillations of the pendulum.			
Western elevation of Mercury	16	10	0

[70]

Azimuth from west to south	3	33	30
112 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo[527]	26	35	0
Azimuth [from west to south]	6	39	0
119 oscillations of the pendulum.			
[Western] elevation of Mercury	15	18	30
Azimuth [from west to south]	3	41	30
117 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	25	42	0
Azimuth [from west to south]	6	43	0
138 oscillations of the pendulum.			
[Western] elevation of Mercury	14	19	30
Azimuth [from west to south]	3	47	0
121 oscillations of the pendulum.			

525 Spica, or α Virginis. First observed 19 September 1638.
526 Arcturus, or α Bootis. First observed 15 September 1639.
527 Spica, or α Virginis. First observed 19 September 1638.

Western elevation of Arcturus[528]	30	26	0
Azimuth from north to west	60	2	0
116 oscillations of the pendulum.			
Western elevation of Mercury	13	19	30
Azimuth [from west to south]	3	51	0
109 oscillations of the pendulum.			
Western elevation of Arcturus	29	42	30
Azimuth [from north to west]	60	20	30
119 oscillations of the pendulum.			
[Western] elevation of Mercury	12	30	0
Azimuth [from west to south]	4	7	0
96 oscillations of the pendulum.			
Western elevation of Arcturus	28	57	0
Azimuth [from north to west]	60	41	0

[71]

This evening I also examined Mercury, as soon as it could be seen, near the twilight, using the telescope, because it was at its greatest [eastern] elongation. It appeared clearly divided in two halves, with one part less bright than the other one. Mercury, however, visibly sparkles like a star, no matter what height it is seen above the horizon. I did not observe Jupiter because it became cloudy.

On 3, 4 and 5 [September 1640]: fickle sky.

On 6 September [1640]. Clouds at noon.

6:15 PM. Western elevation of Arcturus[529]	29	46	0
Azimuth from north to west	60	12	0
163 oscillations of the pendulum.			
[Western] elevation of Mercury	15	25	0
Azimuth from west to south	5	13	0
109 oscillations of the pendulum.			
Western elevation of Arcturus	28	51	0
Azimuth [from north to west]	61	0	0
148 oscillations of the pendulum.			
[Western] elevation of Mercury	14	31	0
Azimuth [from west to south]	5	22	0
113 oscillations of the pendulum.			
Western elevation of Spica of Virgo[530]	21	51	0
Azimuth from west to south	7	8	0
110 oscillations of the pendulum.			

528 Arcturus, or α Bootis. First observed 15 September 1639.

529 *Ibidem.*

530 Spica, or α Virginis. First observed 19 September 1638.

[72]

[Western] elevation of Mercury	13	39	0
Azimuth [from west to south]	5	38	0
137 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo[531]	21	0	0
Azimuth [from west to south]	7	22	30
105 oscillations of the pendulum.			
Western elevation of Mercury	12	47	30
Azimuth [from west to south]	5	47	30
149 oscillations of the pendulum.			
Western elevation of Arcturus[532]	26	17	0
Azimuth [from north to west]	61	50	0
146 oscillations of the pendulum.			
Western elevation of Spica of Virgo	19	30	0
Azimuth [from west to south]	7	14	0

Mars was already rising near sunset[533], and was also near its perigee[534] in the Water Carrier. Conspicuous in brightness, it shines and overcomes Jupiter somewhat in brightness.[535] Quite different in colour, Mars is red like a prune, whereas Jupiter shines with a clear light.

On 7 September [1640]. Clouds at noon.

6:15 PM. Western elevation of Spica of Virgo	20	10	0
Azimuth from west to south	6	42	30
110 oscillations of the pendulum.			
[Western] elevation of Mercury	12	31	0
Azimuth from west to south	5	57	0
125 oscillations of the pendulum.			

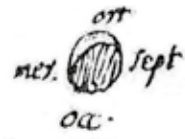
[73]

Western elevation of Spica of Virgo[536]	19	10	0
Azimuth [from west to south]	7	4	0
86 oscillations of the pendulum.			
[Western] elevation of Mercury	11	39	0
Azimuth [from west to south]	6	13	0
75 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo	18	33	30
Azimuth [from west to south]	7	12	30

531 Spica, or α Virginis. First observed 19 September 1638.
532 Arcturus, or α Bootis. First observed 15 September 1639.
533 About 1 h 17 min before sunset.
534 Mars reached a minimum geocentric distance on 20 August 1640.
535 At that time, Mars had a visual magnitude of -2.6, and Jupiter -2.3.
536 Spica, or α Virginis. First observed 19 September 1638.

And at the same time[537], the Meridian elevation of Jupiter [was] 74 30 0 south
Before making these observations of Mercury and Jupiter, I examined Mercury closely with the telescope. Immediately after [the planet] emerged from twilight, it seemed to me distinctly furrowed, the bright part towards the east or above, the shaded part towards the west or below. [538] This means Mercury is horned, [539] like Venus, with its horns pointing west, which is usually what happens to the moon when it's west. [540]

[Mss Paris]



[Mss Boulliau]

The rest of the night was cloudy.

On 8 and 9 [September 1640]. Stormy and rainy sky.

On 10 September

Meridian elevation of the Sun 77 17 0 north

[74]

In the evening I was prevented by friends [from doing the observations].[541]
Clouds at night.

On 11 and 12 [September 1640]. Rainy clouds.

On 14 September [1640]. Cloudy at noon.

6:15 PM. In the twilight, when the stars had not yet appeared, Jupiter crossed the meridian.

Its meridian elevation [was] 74 30 0 south
After Mercury became visible, I observed with the telescope and it appeared horned.
Subsequently: Western elevation of Mercury 9 22 0
Azimuth from west to south 8 33 0
103 oscillations of the pendulum.
Western elevation of Spica of Virgo[542] 13 36 0
Azimuth from west to south 8 10 0

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537 According to our calculation, the meridian transit of Jupiter occurred 2 m 57 s before the previous observation.

538 According to our calculation, the clear and shaded parts are reversed in the description, as well as in the drawing.

539 According to our calculation, Mercury was not horned, but gibbous.

540 Mercury's horns pointed east. When the moon washes in the west, Mercury's horns point east.

541 It was around Marggrafe's 30th birthday. He was born 20 September 1610 (old style).

542 Spica, or α Virginis. First observed 19 September 1638.

After 123 oscillations of the pendulum.			
Western elevation of Arcturus[543]	20	5	0
Azimuth from north to west	64	36	0
136 oscillations of the pendulum.			
[Western] elevation of Mercury	7	51	0
Azimuth [from west to south]	8	52	0
120 oscillations of the pendulum.			
Western elevation of Spica of Virgo	12	7	30
Azimuth [from west to south]	8	37	0
104 oscillations of the pendulum.			

[75]

Western elevation of Arcturus[544]	18	50	0
Azimuth [from north to west]	64	55	0
105 oscillations of the pendulum.			
[Western] elevation of Mercury	6	36	30
Azimuth [from west to south]	9	1	0
123 oscillations of the pendulum.			
[Western] elevation of Spica of Virgo[545]	10	51	0
Azimuth [from west to south]	8	32	0
153 oscillations of the pendulum.			
[Western] elevation of Arcturus	17	31	0
Azimuth [from north to west]	65	18	0
Then, I measured the following [meridian] elevations of stars in the south:			
Meridian elevation of Jupiter[546] in the Archer	67	45	0 south
⎧besides γ [547] in the Southern Crown,			
⎪the second [star] from the top[548]	59	40	0 south
⎪τ of the Archer[549]	69	55	0 south
⎩Eastern [star] of the head of the Archer[550]	76	30	0 south
⎧Upper [star] of the two closest each other under			
⎩the feet of the Archer[551] (not on the globe)	53	3	0 south

543 Arcturus, or α Bootis. First observed 15 September 1639.

544 *Ibidem.*

545 Spica, or α Virginis. First observed 19 September 1638.

546 Jupiter had already crossed the meridian more than half an hour before the previous observation. Moreover, the meridian elevation was much higher (74° 30' 49"). So it seems that the observation was instead of ζ Sagittarii.

547 γ Coronae Australis.

548 Alphecca, or α Coronae Australis. First observed 23 September 1639.

549 τ Sagittarii. *First observation.* According to our calculation, this star crossed the meridian about 30 s before the previous star.

550 π Sagittarii. *First observation.*

551 β_1 Sagittarii with magnitude 3.96. Absent in Houtman's catalogue. The other star is β_2 Sagittarii with magnitude 4.27.

⌊[star] at east and above these two[552] 56 50 0 south
Not on the globe

On 15 and 16 [September 1640]. Fickle and cloudy sky.

On 17 September [1640]. Cloudy at noon.
It was a clear evening indeed, but fog on the western horizon prevented me from seeing Mercury. Before 10 PM.

[76]

Meridian elevation of κ of the Water Snake[553] or λ	19	9	0
[Star] in the Southern Fish (ι)[554]	63	25	0 south
[Star] in the Southern Fish (θ)[555]	65	32	0 south
[Star] star] in the head of the Crane (α)[556]	59	4	0 south
Second [star] of the arrow in the left hand of the Indian, … … the upper one from the pair above the beak of the Toucan (δ)[557]	41	28	0 south
Lower [star], that is, the third one of the same arrow (ε)[558]	39	53	0 south
Western elevation of the tail of the Eagle[559]	41	41	0
Its azimuth from north to west	64	18	0
After 399 oscillations of the pendulum.			
Meridian elevation of Saturn	83	20	0 south
48 oscillations of the pendulum.			
Meridian elevation of Mars	79	43	0 south
528 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	38	1	0
Azimuth [from north to west]	66	23	0
Repetition			
Meridian elevation of the end of the beak of the Toucan[560] (α)	36	10	0 south
Neck of the Toucan (γ)[561]	31	29	0 south

552 **Rukbat** (meaning 'the archer's knee'), or α Sagittarii, is not a particularly bright star in the constellation of Sagittarius, with a visual apparent magnitude of +3.97. *First observation.* Absent in Houtman's catalogue.
553 ν Octantis. First observed 21 September 1639.
554 ι Piscis Austrini. First observed 23 September 1639.
555 θ Piscis Austrini. *First observation.*
556 Not α but γ Gruis. See 20 September 1639.
557 δ Indi and the other star of the pair is ε Indi. *First observation.*
558 ε Indi.
559 ζ Aquilae. First observed 18 September 1639.
560 α Tucanae. First observed 20 September 1639. But according to our calculation, this star crossed the meridian before the two previous observations (41 s and 6 m 30 s, in this order).
561 δ Tucanae. First observed 22 September 1639.

On 18 September [1640]

Meridian elevation of the Sun	80	20	40 north

[Mss Paris]

In the evening the sky was clear, but because extended clouds amassed around the west[562], which dissipated only one and a half hour after sunset, I could not find, neither observe, Mercury[563] …

[77]

… with the instruments[564]. Meridian elevation of Jupiter	74	29	30 south[565]
10 PM to 12 PM at the end.			
Meridian elevation of 11 of the Water Snake[566] (λ)	19	5	0 south
Head of the Crane[567] (α)	59	4	30 south
Western elevation of the tail of the Eagle[568]	41	30	0
Azimuth from north to west	64	30	0
210 oscillations of the pendulum.			
[Star] that is in the hindquarters of the Water Carrier[569] in the meridian			
173 oscillations of the pendulum.			
Meridian elevation of Saturn	83	18	30 south
56 oscillations of the pendulum.			
Meridian elevation of Mars	79	47	30 south
572 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	32	50	0[570]
Azimuth [from north to west]	66	31	0
103 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	37	28	30
Azimuth [from north to west]	66	40	0
Meridian elevation of the northern [star] of …			
… the three stars in the tail of the Crane[571] (χ)	44	58	30 south

562 The figure might illustrate the clouds crowded in the western sky.

563 Mercury was already about to set.

564 The instruments could be the 7-foot telescope and the 5-foot quadrant.

565 *B* in the original, but it should be *A*.

566 ν Octantis. First observed 21 September 1639.

567 γ Gruis. First observed 20 September 1639.

568 ζ Aquilae. First observed 18 September 1639.

569 **Sadalmelik**, or α Aquarii, with an apparent visual magnitude of 2.94, is the second brightest star in the constellation of Aquarius ('Water Carrier') . *First observation.*

570 Due to too large an error in azimuth, and also because the next western elevation of the same star is higher, an elevation of 37° 50' 0"seems more plausible.

571 ε Gruis. First observed 20 September 1639. The other stars of the triad are η and ζ Gruis.

Fomalhaut of the Water Carrier[572]	66	33	30 south
[Star] below the Water Snake[573] (not on the globe)	14	51	0 south

On 19 September [1640]

Meridian elevation of the Sun	80	44	20 north

In the evening Jupiter and Mars were visible, right …

[78]

… at sunset. However, not Saturn, although Mars was near. But a quarter of an hour later they were seen together, a little after the Sun had set.

Meridian elevation of Jupiter	74	29	30 south

1307 oscillations of the pendulum.

Western elevation of Arcturus[574]	20	28	30
Azimuth from north to west	64	18	0

345 oscillations of the pendulum.

Western elevation of Arcturus	19	17	30
Azimuth [from north to west]	64	50	0

1256 oscillations of the pendulum.

Western elevation of Spica of Virgo[575]	7	15	0
Azimuth from west to south	8	58	0

189 oscillations of the pendulum.

Western elevation of Arcturus	14	5	0
Azimuth from north to west	66	20	0

The sky was very clear everywhere, and there was red evening glow in the west. But I never could see Mercury, although I searched for it very carefully and for a long time. Spica in the constellation of Virgo, already 4 or 5 degrees above the horizon, was barely visible. Mercury eventually emerged with difficulty. I know that the sky is less illuminated by the twilight and the red evening glow. But the Moon rose in the West, horned …

[79]

… and in sextile [= ca. 60 degrees] to the Sun, whose light also contributes. And Mercury's retrograde motion could also provide some cause of its own [why the planet is so hard to see].

10 PM (a little earlier):

Western elevation of the tail of the Eagle[576]	42	11	0
Azimuth from north to west	64	12	0

279 oscillations of the pendulum.

Star in the haunch of the Water Carrier[577] [north] in the meridian

572 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.
573 γ_1 Octantis. Absent in Houtman's catalogue.
574 Arcturus, or α Bootis. First observed 15 September 1639.
575 Spica, or α Virginis. First observed 19 September 1638.
576 ζ Aquilae. First observed 18 September 1639.
577 Sadalmelik, or α Aquarii. First observed 18 September 1640.

263 oscillations of the pendulum.

Meridian elevation of Saturn	83	17	30 south

46 oscillations of the pendulum.

Meridian elevation of Mars	79	54	0 south

724 oscillations of the pendulum.

Western elevation of the tail of the Eagle	37	34	0
Azimuth [from north to west]	66	24	0

127 [oscillations of the pendulum.]

Western elevation of the tail of the Eagle	37	8	0
Azimuth [from north to west]	66	48	0

On 20 September [1640]

Meridian elevation of the Sun	81	8	0 north

In the evening I observed with a very clear sky, when the twilight was about to end. Already that evening redness had disappeared in the western region.

The elevation of the Heart of Scorpion[578] was	45	48	0

[80]

However, in order to discuss the evening redness of the serene sky, when the Sun has plunged below the horizon (it can be seen very clearly that the Sun disappears without rays) and a little later after dawn, a golden colour of yellow hue spreads over an arc in the west, up to 5, 6 or 7 degrees elevation in the center, and after about half an hour this reddening colour becomes as a flame a little mixed with smoke. And this coulor is retained until it gradually disappears during twilight, and a star staying in its range cannot be seen. For this reason, I have not been able to see Mercury in its range, today and yesterday either. I truly saw Spica of Virgo[579], because [this star] [was] higher and out of the arch. Its descent followed the disappearance of the twilight. For, first the upper reddish part starts to disappear, then the lower part, finally fades.

10 PM. Western elevation of the tail of the Eagle[580]	40	26	0
Azimuth from north to west	65	21	0

105 oscillations of the pendulum.

Meridian elevation of Saturn	83	15	30 south

36 oscillations of the pendulum.

[81]

Meridian elevation of Mars	79	58	30 south

589 oscillations of the pendulum.

Western elevation of the tail of the Eagle[581]	37	36	30

578 Antares, or α Scorpii. First observed 20 September 1638.

579 Spica, or α Virginis. First observed 19 September 1638. Its western elevation when the Sun set was 18° 23' 29".

580 ζ Aquilae. First observed 18 September 1639.

581 *Ibidem.*

Azimuth [from north to west]	66	42	0
63 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	37	20	0
Azimuth [from north to west]	66	50	0

On 21 September [1640]

Meridian elevation of the Sun	81	31	30 north

On 22 September [1640]

Meridian elevation of the Sun	81	55	30 north

In the same noon, the gnomon [of the sundial] with 4000 divisions was set upright. The length of the shadow was 587 of the same divisions.[582] Around sunset, I waited in the observatory for the time of the coming culmination of the Moon, about 6:22 PM[583]. The Moon, in its first quarter and a few degrees in [the constellation of] Capricornus, also coincided with the meridian [at ninety degrees], with a difference of about 36'. And after sunset the whole sky was covered by clouds, so that I could not at all satisfy my wishes.

On 23 September [1640]

Meridian elevation of the Sun	82	18	0 north
About 9:45 PM			
Western elevation of the tail of the Eagle	41	10	0

[82]

Azimuth from north to west	64	50	0
216 oscillations of the pendulum.			
Meridian elevation of Saturn	83	10	0 south
149 oscillations of the pendulum.			
Meridian elevation of Mars	80	11	30 south
547 oscillations of the pendulum.			
Western elevation of the tail of the Eagle[584]	37	52	0
Azimuth [from north to west]	66	28	0
256 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	36	59	0
Azimuth [from north to west]	67	8	0

582 According to our calculation, the length of the shadow should be 566 divisions.

583 It is noteworthy that the hour angle of the Sun at the meridian transit of the Moon was 6 h 22 m 50 s.

584 ζ Aquilae. First observed 18 September 1639.

At 10:30 PM, I saw three satellites of Jupiter in the western region [of the sky], one being above [Jupiter] and two below, with intervals to Jupiter depicted here, approximately 1½, 1 and 5.

[Mss Paris]

On 24 September [1640]. Cloudy.

On 25 September [1640]

Meridian elevation of the Sun	83	4	20 north
After 9:45 PM			
Western elevation of the tail of the Eagle[585]	40	53	30
Azimuth from north to west	64	43	0
158 oscillations of the pendulum.			

[83]

Meridian elevation of Saturn	83	9	0 south
171 oscillations of the pendulum.			
Meridian elevation of Mars	80	24	30 south
516 oscillations of the pendulum.			
Western elevation of the tail of the Eagle[586]	37	59	0
Azimuth from north to west	66	38	0
211 oscillations of the pendulum.			
Western elevation of the bright [star] of the Lyre[587]	21	10	0
Azimuth from north to west	43	33	0

On 26 September [1640]

Meridian elevation of the Sun	83	27	40 north
9:45 PM			
Western elevation of the tail of the Eagle	41	51	0
Azimuth from north to west	64	15	0
397 oscillations of the pendulum.			
Meridian elevation of Saturn	83	9	0 south
157 oscillations of the pendulum.			
Meridian elevation of Mars	80	30	0 south
596 oscillations of the pendulum.			

585 ζ Aquilae. First observed 18 September 1639.
586 *Ibidem.*
587 Vega, or α Lyrae. First observed 18 September 1639.

Western elevation of the tail of the Eagle	37	44	30
Azimuth [from north to west]	66	32	0
120 oscillations of the pendulum.			
Western elevation of the bright [star] of the Lyre	21	13	30
Azimuth from north to west	43	29	30

Next day rainy.

[84]

On 30 September [1640]

Meridian elevation of the Sun	84	59	30 north
Cloudy night			

On 1st October [1640]

Meridian elevation of the Sun	85	22	0 north

On 2 October [1640]

Meridian elevation of the Sun	85	45	0 north
8:45 PM			
Western elevation of the tail of the Eagle[588]	41	58	30
Azimuth from north to west	64	11	0
346 oscillations of the pendulum.			
Meridian elevation of Saturn	83	5	0 south
485 oscillations of the pendulum.			
Meridian elevation of Mars	81	14	0 south
566 oscillations of the pendulum.			
Western elevation of the bright [star] of the Lyre[589]	20	59	0
Azimuth from north to west	43	31	30
237 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	36	9	0
Azimuth from north to west	67	8	0
119 oscillations of the pendulum.			
Western elevation of the tail of the Eagle	35	41	30
Azimuth [from north to west]	67	31	0

On 3 October [1640]

Meridian elevation of the Sun	86	9	0 north

588 ζ Aquilae. First observed 18 September 1639.
589 Vega, or α Lyrae. First observed 18 September 1639.

[85]

Following night cloudy, rainy, windy.

On 4 October [1640]

Meridian elevation of the Sun	86	32	0 north

Two fickle days

On 7 October [1640]

In the morning from 4 to 7 AM, Mercury could not be seen, in spite of the clear sky.[590] Morning twilight was just emerging, when Orion's reddening shoulder[591] stood two degrees from the meridian to the west[592].

About 5:15 AM. The eastern elevation of the Lion's Mane[593] [was]	22	25	0
Azimuth from east to north	27	36	0

271 oscillations of the pendulum.

Eastern elevation of the Mane of the Lion	23	35	0
Azimuth from east to north	28	8	0

280 oscillations of the pendulum.

Following [star] in the front foot of the Twins[594]. The preceding [star] or the heel of the Twins[595] in the meridian 810 oscillations of the pendulum.

Bright [star] of the foot of the Twins[596] in the meridian

118 oscillations of the pendulum.

Meridian elevation of the center of the bisected Moon	61	38	30 north

[86]

(The Moon was bisected and 90°[597] coincided almost with the meridian, but the Moon stood apart only about 37 minutes[598] from the time of culmination, or of the 90° from east by calculation.)

1634 oscillations of the pendulum.

Center of the Sun seen in the eastern horizon[599]

In azimuth from east to south	5	42	0

590 A similar situation was reported for the evening of 19 September 1640.

591 **Betelgeuse**, or α Orionis, is the second-brightest star in the constellation of Orion, and usually the tenth-brightest star in the night sky. It is a semiregular variable star whose apparent visual magnitude varies between 0.0 and 1.6.. *First observation.*

592 Betelgeuse was at this position when the Sun was 17° 44' 37" below the eastern horizon. Mercury rose 18 m 16 s later.

593 γ Leonis. *First observation.*

594 μ Geminorum. *First observation.*

595 η Geminorum. According to our calculation, this star crossed the meridian 4 m 7 s before the previous observation.

596 γ Geminorum. *First observation.*

597 Maybe 90° of ecliptic longitude.

598 According to our calculation, the Moon at 90° of ecliptic longitude would cross the meridian not 37, but 20 min later.

599 Therefore elevation = 0°.

1469 oscillations of the pendulum.

Eastern elevation of the Sun	5	46	30
Azimuth from east to south	4	39	0

826 oscillations of the pendulum.

Eastern elevation of the Sun	9	7	30
Azimuth from east to south	4	4	0
Meridian elevation of the Sun	87	42	0 north

On 8 October [1640]

Meridian elevation of the Sun	88	4	40 north

On 9 October [1640]

Meridian elevation of the Sun	88	27	0 north

From 8 PM up to 9:15 PM

Meridian elevation of the [star] following the tail of the Sea Goat[600]	80	21	30 south

312 oscillations of the pendulum.

Western elevation of the tail of the Eagle[601]	44	22	0
Azimuth from north to west	62	42	0

383 oscillations of the pendulum.

Western elevation of the tail of the Eagle	43	4	0[602]

[87]

Azimuth [from north to west]	63	22	0

543 oscillations of the pendulum.

Meridian elevation of Saturn	83	0	0 south

730 oscillations of the pendulum.

Meridian elevation of Mars	82	9	30 south

566 oscillations of the pendulum.

Western elevation of the tail of the Eagle[603]	35	49	0
Azimuth from north to west	67	14	0

105 oscillations of the pendulum.

Western elevation of the tail of the Eagle	35	30	0
Azimuth [from north to west]	67	29	0

On 10 October [1640]

Cloudy in the noon. From 8 PM.

Meridian elevation of the [star] following the tail of the Sea Goat[604]	80	22	30 south

914 oscillations of the pendulum.

600 δ Capricorni. First observed 26 December 1639.
601 ζ Aquilae. First observed 18 September 1639.
602 Elevation corrected, due to an obvious mistake by the French copyist, who mistook a 3 for an 8.
603 ζ Aquilae. First observed 18 September 1639.
604 δ Capricorni. First observed 26 December 1639.

η of the Crane[605] in the meridian
266 oscillations of the pendulum.
Western elevation of the bright [star] of the Lyre[606] 24 9 0
Azimuth from north to west[607]
106 oscillations of the pendulum.
Meridian elevation of Saturn 82 59 30 south
796 oscillations of the pendulum.
Meridian elevation of Mars 82 18 0 south
384 oscillations of the pendulum.
Western elevation of the tail of the Eagle 36 22 0
Azimuth from north to west 67 6 0

[88]

128 oscillations of the pendulum.
Western elevation of the bright [star] of the Lyre[608] 20 19 0
Azimuth [from north to west] 43 59 0
133 oscillations of the pendulum.
Western elevation of the tail of the Eagle[609] 35 30 30
Azimuth [from north to west] 67 21 0

On 11 October [1640]

In the morning from 4 AM. Searching for Mercury, that is never the same for me, given what I experienced on 19 September of this year.[610] For although Mercury has already reached its greatest elongation,[611] yet it hardly rises before the onset of twilight[612], and when the Sun rises to 4, 5 or 6 degrees [of elevation], it is almost pure day, so that Mercury cannot be discerned from the brightness of daylight. The [horned] Moon also approached in the eastern region [of the sky].[613]

When the meridian elevation of Sirius[614] was 81 50 0 south
However, it was already full day, half an hour after sunrise, as you may judge from this observation.

605 Cannot be η Gruis because it crossed the meridian much later. So the star might be α Gruis (First observed 20 September 1639).
606 Vega, or α Lyrae. First observed 18 September 1639.
607 Azimuth not given.
608 Vega, or α Lyrae. First observed 18 September 1639.
609 ζ Aquilae. First observed 18 September 1639.
610 Marggrafe refers to the difficulty of observing Mercury near the horizon.
611 According to our calculation, Mercury would reach its maximum elongation two days later (i.e. the greatest distance in degrees of arc from Mercury to the Sun). The perigee would not be reached until 13 January 1641.
612 According to our calculation the Sun's elevation was -14° 52' 29" when Mercury rose.
613 At sunrise the Moon's eastern elevation was 44° 48'52".
614 Sirius, or α Canis Majoris. First observed 21 December 1639.

[89]

Meridian elevation of the Sun	89	12	0 north

On 12 [October 1640]. Cloudy and it rained.

On 13 October [1640]

Meridian elevation of the Sun	89	56	30 north[615]

Cloudy night.

On 14 October [1640]

Meridian elevation of the Sun	89	33	40 south
From 8 PM to 9 PM. Western elevation of the tail of the Eagle[616]	42	39	0
Azimuth from north to west	63	40	0

423 oscillations of the pendulum.

Meridian elevation of Saturn	82	58	0 south

429 oscillations of the pendulum.

Western elevation of the bright [star] of the Lyre[617]	22	50	0
Azimuth from north to west	41	57	0

715 oscillations of the pendulum.

Meridian elevation of Mars	82	56	30 south

500 oscillations of the pendulum.

Western elevation of the tail of the Eagle	35	11	30
Azimuth [from north to west]	67	24	0

170 oscillations of the pendulum.

Western elevation of the tail of the Eagle	34	36	0
Azimuth from north to west	67	53	0

159 oscillations of the pendulum.

Western elevation of the bright [star] of the Lyre	18	49	0
Azimuth [from north to west]	45	38	0

[90]

Second half of the night cloudy, it rained.

On 15 October [1640]

Meridian elevation of the Sun	89	11	0 south

Cloudy night.

On 16 October [1640]

Meridian elevation of the Sun	88	49	30 south

615 South, according to our calculation.
616 ζ Aquilae. First observed 18 September 1639.
617 Vega, or α Lyrae. First observed 18 September 1639.

On 17 October [1640]

Meridian elevation of the Sun 88 27 30 south

I was absent almost a month for the sake of chorography[618] and topography.

On 13 November [1640]

As is well known, the sky was not clear for the observation of the solar eclipse which was taking place, but the beginning and the end were duly observed.[619]

So a little more than 10:30 AM, at the eastern elevation of the Sun at 67 12 0

it was the beginning [of the eclipse], here in Mauritia[620], about an hour and a half in the afternoon[621], [when] the Sun had a western elevation [of] 67 26 0

The solar eclipse in Mauritia came to an end, when ….[622]

… the Meridian elevation of the darkened Sun [was] 79 51 0 south

At that moment the observation of the maximum [of the eclipse] appeared [to occur] close to the beginning of the evening twilight . It was a dark sky. The inclination …

[91]

[Mss Paris]

… to the south [of the eclipsed Sun] [was] nearly [as in the figure].[623] The clouds hindered an accurate observation. The obscuration was 10 digits.[624] The eclipse began above [the solar disc], in the west and ended below in the east. All sections were curved. Suddenly, I noticed that the horns bent downward[625], [when] the western elevation of the Sun [was] 79 14 0

And when the light seemed to recover 6 digits, …

618 Chorography: description of the country.

619 The total solar eclipse of 13 November 1640 was only partial visible in Recife.

620 According to our calculation, the eclipse began in Recife 6 m 23 s earlier, when the eastern elevation of the Sun was 65° 48' 8".

621 According to our calculation, at 13 h 22 m 52 s.

622 According to our calculation, the Sun was at this western elevation 13 m 57 s before the end of the eclipse.

623 According to our calculation, the meridian in the sketch should be rotated about 45° westward if north is to be kept up.

624 A digit is 1/12 of the diameter of the Sun. So 10 digits are about 83% of the solar diameter, while our calculation predicted that 80.4% of the solar diameter was covered at maximum of the eclipse.

625 According to our calculation, this was at 11h 12m 32s.

… the western elevation of the Sun was 77 38 0[626]

On the next page, see the skippers' observations of this solar eclipse.

On 14 November [1640]

Meridian elevation of the Sun 79 35 40 south

On 15 November [1640]

Meridian elevation of the Sun 79 20 20 south

Two rainy days

On 18 November [1640]

Meridian elevation of the Sun 78 37 0 south

On 9 November [1640]

Meridian elevation of the Sun 78 23 30 south

On 20 November [1640]

Meridian elevation of the Sun 78 10 0 south

Cloudy for seven days, mixed with rain.

[92]

On 28 November [1640]

Meridian elevation of the Sun 76 37 30 south

On 29 November [1640]

Meridian elevation of the Sun 76 27 0 south

On 30 [November 1640]. Cloudy.

On 1 December [[1640]

Meridian elevation of the Sun 76 8 30 south

I went out again in the following weeks.

On 20 December [1640]

Meridian elevation of the Sun 74 39 40 south

On 21 December [1640]

Meridian elevation of the Sun 74 39 30 south

On 22 December [1640]

Meridian elevation of the Sun 74 40 0 south

Drab sky in the following days

626 According to our calculation, when the Sun was at this elevation, much more than 6 digits were eclipsed (= 50%).

	On 28 December [1640]			
Meridian elevation of the Sun		74	53	30 south
	On 29 December [1640]			
Meridian elevation of the Sun		74	57	30 south
	On 30 December [1640]			
Meridian elevation of the Sun		75	2	0 south
	On 31 December [1640]			
Meridian elevation of the Sun		75	6	20 south

~.~

[93]

Observations of the Solar Eclipse [on] 13 November 1640. ~ Some [information] from the skippers

Beneath the southern latitude of 20º 05' removed 23 miles from the continent or the Brazilian coast,[627] skipper [Leendert Reijnsen Verhochen] observed the beginning [of the eclipse] at 11:02 AM and the end at 1:17 PM with [a darkening of] 8 digits, or two-thirds, with a clear sky, and a wind from the north-northwest.[628] The longitude of his location is estimated at 346º 28'.[629]

~.~

627 This latitude is about 24 km north of Vitória, ES, in Brazil.

628 The English translation of the original Dutch letter is as follows: 'In the year of our Lord 1640 | Item, on the 13th of November, when the clock pointed at 11:02 h, the eclipse of the Sun started, and he became 2/3 part obscured, and it lasted until the clock was 1:17 h, and were at this Friday on [an altitude of] 20 degrees, 5 minutes , and a latitude of 346 degrees, 28 minutes, south of the horizon, and we were beyond our route 23 miles and we had nice weather, with the wind north, north-west. | The skipper, Leendert Reijnsen Verhochen'.

629 Subtracting this longitude from 340º 8.5' (The longitude of Mauritia according to *Tractatus Topographicus & Meteorologicus Brasiliae, cum Observatione Eclipsis Solaris*, in the *Historia Naturalis Brasiliae* (1648), we get a longitude difference of 6º 19.5', which, added to today's value of Marggrafe's observatory in Recife, gives 41º 12' 07" W. This longitude with the latitude -20º 5' S corresponds to a location more than 100 km inland Brazil! When the true location was 23 miles from the Brazilian coast, the total error in longitude was about 1.5º.

The year of Christ 1641 follows
with the celestial
observations of Georg Marggrafe

On day 1, 2 and 3 of January, cloudy and it rained.

[94]

On 4 January 1641 in the Gregorian calendar.

Meridian elevation of the Sun	75	29	30 south

On 5 January [1641]

Meridian elevation of the Sun	75	36	30 south

On 6 January [1641]

Meridian elevation of the Sun	75	44	0 south

On 7 January [1641]. Cloudy

On 8 January [1641]

Meridian elevation of the Sun	75	59	30 south

On 9 January [1641]

Meridian elevation of the Sun	76	8	0 south

On 10 January [1641]

Meridian elevation of the Sun	76	17	0 south

In the serene evening, I checked how long I could write a letter in the ordinary language perfectly. The [next] day, after sunset, no candle being used, I was able to read perfectly for a long time, until Mirach or the girdle of Andromeda[630] had the western elevation of

	41	1	0
And its azimuth from north to west[631]	29	21	0

The Sun set today at 6 h 12 m

Meridian elevation of the head of Medusa[632]	42	20	0 [north]

[95]

Because the sky was very clear, I also paid attention to the duration of the evening twilight. But I saw that the redness was chased away, soon after the real end of the twilight[633] when the bright rib of Perseus[634] culminated at the elevation of 33 19 30 north

630 β Andromedae. First observed 24 December 1639.
631 According to our calculation, this observation was 49 m 50 s after sunset.
632 Algol or β Persei. First observed 22 September 1639.
633 According to our calculation, the end of the twilight occurred 1 h 10 m 58 s after sunset.
634 Mirfak, or α Persei. First observed 22 September 1639.

It is to be noted here that the twilight lasts a little longer when the Sun moves toward the southern [zodiacal] signs, and is shorter [when the Sun moves] toward the northernmost ones, which will also be clear from the observations collected.
At 8 PM, Mars was visible halfway between the [star] in the middle of the Fishes[635], and the following one.[636] However, not in a straight line, but a little more southerly than the straight line, in this way:

[Mss Paris]

[Mss Lisbon]

11 January [1641]

Meridian elevation of the Sun	76	26	40 south

12 January [1641]. Fickle [weather]

13 January [1641]

Meridian elevation of the Sun	76	48	30 south

14 January [1641]

Meridian elevation of the Sun	76	59	30 south

[96]

On 15 January [1641]

Meridian elevation of the Sun	77	10	30 south

On 16 January [1641]

Meridian elevation of the Sun	77	21	30 south

On 17 January [1641]

Meridian elevation of the Sun	77	33	30 south

On 18 January [1641]

Meridian elevation of the Sun	77	46	0 south

At 6:30 PM, I peeked with my telescope at the conjunction of Saturn and Venus: at the said

635 ε Piscium. *First observation.*
636 ζ Piscium, eastern in relation to ε Piscium. *First observation.*

time Venus stood apart from Saturn two-third diameter of my telescope.[637] One hour later, Venus was still Western.
Now Venus was already closer to Saturn. Then both were setting.[638] People who live more to the west may have observed the true conjunction.
Concerning the latitude, Venus will either appear bound to Saturn, or pass [Saturn] as close to the south as possible[639]. My calculation, based on the Rudolphine [Tables], predicted that Venus would pass one arc minute to the south of Saturn.[640] Venus and Saturn were [further] observed with the naked eye.
Venus radiated exceedingly, [641] and a little higher to the right …

[97]

… stood Saturn,[642] almost touched by its rays, and barely distinguishable from Venus. predicted this conjunction of Saturn with Venus to be best observed in New Spain and I told the truth. We have been lucky indeed!

On 19 January [1641]

Meridian elevation of the Sun	77	59	0 south

At 7 PM, Venus had passed Saturn, stepping forth more to the east. It was seen that the distance of Venus to Saturn was the same as between the southern[643] and northern[644] [stars] in the preceding horn of the Ram (γ and β in Bayer).
Three days of fickle weather

On 23 January [1641]

Meridian elevation of the Sun	78	52	0 south

Two cloudy days

On 26 January [1641]

Meridian elevation of the Sun	79	38	0 south

Three cloudy days

On 30 January [1641]

Meridian elevation of the Sun	80	43	0 south

On 31 January [1641]

Meridian elevation of the Sun	81	0	0 south

Following days. Stormy weather

637 This means that the field-of-view of Marggrafe's telescope was approximately 11.5'.
638 According to our calculation, Venus set 4 s before Saturn.
639 According to our calculation, at the maximum of the conjunction Venus approached the south of Saturn.
640 According to our calculation, the separation was over twice this value.
641 The apparent visual magnitude of Venus was -4 while the Saturn was +0.9.
642 According to our calculation, this situation in fact occurred about 3 h after sunset.
643 γ Arietis. *First observation.*
644 β Arietis. *First observation.*

[98]

On 7 February [1641]

Meridian elevation of the Sun 83 6 30 south

On 9 February [1641]

I departed and I was absent nine uninterrupted months for the sake of Geography. Coming back in November, I spent one month in Mauritia, but most part I was absent in neighbouring places, also for the sake of Geography.

On 10 December [1641]

I departed from here to the southern part of Brazil for the sake of Chorography[645] and Natural History. Meanwhile, I was forced to abstain from astronomical work. In the future, however, God granting life and health and resuming uninterrupted work, I will finish all that still remains [to be done] in this part [of the world].

On 16 June, in the year of Christ 1642

I came back from that journey which started in December of the past year.

~.~

[99]

Σ • Θ •[646]

Georg Marggrafe's
Astronomical observations
In the year of Christ 1642

On 14 April [1642], in the evening in Fortress Ceulen, located at the mouth of the Potengi river which is popularly named Rio Grande, I observed with my instrument – which was a sextant – the beginning of a lunar eclipse,[647] when the elevation of Procyon[648] or the Anti Dog[649] in the western part of the sky was 31° 31' 0".[650]
A little later the sky, previously clear, was covered by clouds. And it rained and I did not see the Moon any further until it was seen darkened more than 10 digits.[651] Then excellent

645 Chorography: description of the country.

646 The abbreviation Σὺν Θεω means 'With God', or 'With Gods help'.

647 According to our calculation, this was a total eclipse of the Moon on 14/15 April 1642, entirely visible from that location (Fortaleza dos Reis Magos, Natal, RN). For the calculation we used the latitude 5° 45' 23" S and longitude 35° 11' 42" W from Google Earth.

648 α Canis Minoris. First observed 20 December 1638.

649 'Anti-Dog', because in relation to Sirius, 'the Dog star', the star Procyon is on the opposite side of the Milky Way.

650 According to our calculation, the Moon entered the umbra 2 m 46 s after Procyon was at this western elevation.

651 A digit is 1/12 of the diameter of the Sun. So 10 digits are about 83% of the solar diameter.

weather returned and I watched the beginning of the total (eclipsed) Moon when the eastern elevation of the Heart of Scorpion[652] was 32° 24' 0"[653]
Afterwards the sky was covered by clouds again. Before the Moon's exit …

[100]

from the Earth's total shadow, the sky became clear again and the Moon was illuminated by spurious light for a long time, before receiving some true light. Clouds prevented me [of observing] the beginning of the exit [of the Moon] from the total shadow. Henceforth, the sky [was] very clear until the full end of the eclipse, which I observed when the elevation of the left shoulder of the Archer[654] in the eastern region was 35° 18' 0"[655].
The eclipse started from the lower eastern part [of the Moon]. The first recovery of light was likewise from the east. The eclipse abandoned [the Moon] completely in the west. Skipper Jacob Abrahamsen also observed this eclipse at the mouth of the river Ipanema,[656] in the captaincy of Ceará at the southern latitude of 4° 50'. The beginning of the eclipse,[657] if observed, should be 9:30 PM and the end[658] 1:15 AM. [The skipper] stated that the total duration of the submergence [of the Moon] in the shadow of the Earth [was] 1 hour and 15 minutes.[659]

On 3 October [1642], according to the Gregorian calendar

Meridian elevation of the Sun 86 4 40 north

On 7 October [1642]

About 11 PM the beginning was taking place …

[101]

… of the lunar eclipse,[660] here in Mauritia, and 151 oscillations of the pendulum after its beginning, the eastern elevation of Mars was 48 43 30[661]

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652 Antares, or α Scorpii. First observed 20 September 1638.

653 According to our calculation, the totality of the eclipse started 6 m 21 s before Antares was at this eastern elevation.

654 σ Sagittarii according to Pingré, *Annales Célestes* (1901), 158. First observation 19 September 1638.

655 When this star was at this elevation, the Moon had left the umbra 6 m 43 s before, but would leave the penumbra only 55 m 1 s later.

656 This letter, dated 15 April 1642, written by Jacob Abrahamsen, pilot of the bark *Schevelingen*, is preserved among the Leiden documents (*ELO*, North no. 2). Today a city called 'Upanema' is located at the Rio do Carmo, a tributary of the Rio Apodi, so probably this river near the border of Ceará is meant.

657 The beginning should refer to the Moon entering the umbra.

658 The end should refer to the Moon leaving the umbra.

659 This duration should refer to the totality of the eclipse.

660 According to our calculation, this total eclipse of the Moon of 7/8 October 1642 was entirely visible from Recife.

661 According to our calculation, Mars was at this position 39 s before the Moon entered the umbra.

The sky was clear, but there were many fast moving clouds, for which reason I could not choose the star I wanted. At the time of the Eclipse, the meridian elevation …

… of the centre of the Moon was 76 14 30 north

After 214 oscillations of the pendulum, …

… the eastern elevation of Aldebaran[662] [was]

35 39 0

At the beginning of the total [lunar eclipse] clouds hindered the observation of emerging from the umbra [or total shadow]. During the total eclipse, the Moon was barely visible. Before total immersion [in the shadow of the Earth], [the Moon] shone with little light, but the darkened part was inconspicuous when the Moon began to regain light. The beginning of observation [was noted] from the rising, the emergence likewise from the rising.

Two minutes after the complete end of the [lunar] eclipse, the western elevation of the western tail of the Southern Fish[663] was 16 50 0

Note that at the beginning of the eclipse the longitude of Mars was 6º 8'[664] and the descending[665] southern latitude 1º 56'[666], therefore the right ascension of Mars …

[102]

… was 34º 20'[667] and its declination 11º 45' north[668].

Right ascension of Aldebaran[669] 63º 53'[670]

and declination 5º 44' north[671]

Right ascension of the occiput[672] of the Southern Fish[673] 34 4º 4'[674]

and declination 1º 21' north[675]

On 15 October [1642]

Meridian elevation of the Sun 89 23 0 south

662 α Tauri. First observed 16 December 1639.

663 This star is γ Piscium according to Pingré, *Annales Célestes* (1901), 160. (*First observation*). It was at this elevation 28 m 7 s before the Moon left the umbra.

664 The calculated ecliptic longitude of Mars when the Moon entered the umbra was 24º 57' 57.5". The longitude quoted in the manuscript may be the complement for the boundary of 30º of the first zodiacal sign.

665 Old arithmetic expression of the ecliptic latitude.

666 The calculated ecliptic latitude is -0º 41' 20.1".

667 According to our calculation, 44º 18' 12.9".

668 According to our calculation, +14º 45' 34.8".

669 α Tauri. First observed 16 December 1639.

670 According to our calculation, 63º 52' 43.65".

671 According to our calculation, +15º 43' 52.2".

672 Back of the head. First observed 7 October 1642.

673 γ Piscium. First observed 7 October 1642.

674 According to our calculation, 344º 40' 1.5".

675 According to our calculation, +1º 20' 43.4".

On 2 November [1642]

About 6:30 PM. Western elevation of the Heart of Scorpion[676]	14	32	30
Its azimuth from west to south	25	52	0
After 264 oscillations of the pendulum.			
Western elevation of Mercury	5	10	0
Azimuth from west to south	21	53	30
After 152 oscillations of the pendulum.			
Western elevation of the Heart of Scorpion	13	3	0
Azimuth from west to south	25	55	0

On 7 November [1642]. Gregorian calendar

About 6:30 PM. Western elevation of the Heart of Scorpion	9	34	0
Azimuth from west to south	25	50	0
After 166 oscillations of the pendulum.			
Western elevation of Mercury	7	32	30
Its azimuth from west to south	23	50	0
After 93 oscillations of the pendulum.			

[103]

Western elevation of the Heart of Scorpion[677]	8	35	30
Azimuth [from west to south]	26	23	0
After 130 oscillations of the pendulum.			
Western elevation of Mercury	6	37	30
Azimuth [from west to south]	23	52	0
After 129 oscillations of the pendulum.			
Western elevation of the Heart of Scorpion	7	44	30
Azimuth [from west to south]	26	12	0
After 127 oscillations of the pendulum.			
Western elevation of Mercury	5	49	0
Azimuth [from west to south]	23	52	0
After 157 oscillations of the pendulum.			
Western elevation of the Heart of Scorpion	6	50	0
Azimuth [from west to south]	26	26	0
After 117 oscillations of the pendulum.			
Western elevation of Mercury	4	53	30
Azimuth [from west to south]	23	56	0
After 129 oscillations of the pendulum.			
Western elevation of the Heart of Scorpion	5	58	30
Azimuth[from west to south]	26	34	0

On 8 November [1642]. 6:30 PM

Western elevation of Mercury	10	41	30
Azimuth [from west to south]	23	52	0

676 Antares, or α Scorpii. First observed 20 September 1638.
677 *Ibidem.*

After 198 oscillations of the pendulum.

Western elevation of the bright [star] of the Lyre[678]	25	10	0

[104]

Azimuth from north to west	41	22	0

After 230 oscillations of the pendulum.

Western elevation of Mercury	9	10	0
Azimuth [from west to south]	23	54	0

After 397 oscillations of the pendulum.

Western elevation of the bright [star] of the Lyre[679]	23	42	30
Azimuth [from north to west]	42	33	0

I observed the Heart of Scorpion[680] at almost the same elevation above the horizon as Mercury[681], but more to the south[682]. Rising clouds, prevented a further comparison with Mercury.

On 9 November [1642]. Gregorian calendar

From 6:30 PM to 7 PM

Western elevation of Mercury	11	35	0
Azimuth from west to south	23	52	0

After 134 oscillations of the pendulum.

Western elevation of the bright [star] of the Lyre	24	59	0
Azimuth from north to west	41	35	0

After 120 oscillations of the pendulum.

Western elevation of Mercury	10	37	0
Azimuth [from west to south]	23	53	0

After 158 oscillations of the pendulum.

Western elevation of the bright [star] of the Lyre	24	15	30
Azimuth [from north to west]	42	9	0

[105]

After 202 oscillations of the pendulum.

Western elevation of Mercury	9	19	0
Azimuth [from west to south]	23	58	0

After 179 oscillations of the pendulum.

Western elevation of Mercury	8	48	0
Azimuth [from west to south]	24	3	0

678 Vega, or α Lyrae. First observed 18 September 1639.

679 *Ibidem.*

680 Antares, or α Scorpii First observed 20 September 1638.

681 According to our calculation, at the last observation, α Scorpii was 7' 24" higher than Mercury.

682 According to our calculation, at the last observation, the azimuth of α Scorpii was 1° 21' 45" more southern than those of Mercury.

After 188 oscillations of the pendulum.			
Western elevation of the Heart of Scorpion[683]	6	54	30
Azimuth from west to south	26	22	0
After 149 oscillations of the pendulum.			
[Western] elevation of Mercury	7	40	30
Azimuth [from west to south]	24	13	0
After 215 oscillations of the pendulum.			
Western elevation of the bright [star] of the Lyre[684]	21	53	0
Azimuth from north to west	43	40	0

On 20 November [1642]

From 6:30 PM to 7:15 PM.			
Meridian elevation of Fomalhaut of the Water Carrier[685]	66	40	0
After 189 oscillations of the pendulum.			
Western elevation of Mercury	12	3	30
Azimuth from west to south	25	33	0
After 272 oscillations of the pendulum.			
Western elevation of the tail of the Swan[686]	29	43	0
Azimuth from north to west	27	20	0
After 166 oscillations of the pendulum.			

[106]

Meridian elevation of Jupiter[687]	88	38	0 south
After 235 oscillations of the pendulum.			
Western elevation of Mercury	9	40	0
Azimuth [from west to south]	25	45	0
After 153 oscillations of the pendulum.			
Western elevation of the tail of the Swan[688]	28	43	0
Azimuth [from north to west]	28	40	0
After 139 oscillations of the pendulum.			
Western elevation of Mercury	8	40	0
Azimuth [from west to south]	25	51	0
After 170 oscillations of the pendulum.			
Western elevation of the tail of the Swan	28	8	0
Azimuth from north to west	29	27	0

NB. As soon as Mercury could be seen in the evening twilight, I inspected [the planet] carefully with the telescope and it showed up horned. In the same evening from 9:30 PM

683 Antares, or α Scorpii. First observed 20 September 1638.
684 Vega, or α Lyrae. First observed 18 September 1639.
685 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.
686 Deneb, or α Cygni. First observed 19 September 1639.
687 According to our calculation, Jupiter crossed the meridian 13 s before the previous observation.
688 Deneb, or α Cygni. First observed 19 September 1639.

to 11:30 PM. the meridian elevation of Achernar[689]	39	13	30 south
[Star] following Achernar in the River[690]	42	58	0 south
Western [star][691] of the pair above the third [star][692] of the River	50	10	0 south
Third [star] of the River	44	52	30 south
This [star] culminated 30 seconds[693] after the third [star] of the River			
The eastern [star] [694] of the pair above, the third [star] of the River	49	8	0 south
Third [star] of the twist of the neck of the Water Snake[695]	28	50	0 south
Head of the Water Snake[696]	34	56	0 south
Third [star] of the River[697]	45	0	30 south
Fourth [star] of the River[698]	48	56	0 south
Third [star] from the quintet in the Water Snake[699]	28	0	0 south

[107]

Fifth [star] of the River[700]	53	49	0 south
In the River (the star that should be the 7th)[701] [is] absent on the globe	56	50	0 south
Above it [the previous star] and far away[702]	64	17	30 south
Meridian elevation of the second star in the twist of the Water Snake's neck[703]	28	29	0 south
Sixth [star] of the River[704]	56	31	0 south
First [star] in the twist of the Water Snake's neck[705]	29	7	0 south
Upper or second [star] of the neck of the Water Snake[706]	32	47	0 south
Far above it [the previous star] the next one culminating[707]	37	9	0 south
(I omitted two stars here)			
Eastern [star] below the 20th of the River[708]	67	48	30 [south]

689 Achernar, or α Eridani. First observed 20 September 1639.
690 TYC 8475-1390-1. First observed 18 December 1639.
691 ψ Phoenicis. *First observation.*
692 χ Eridani. First observed 22 September 1639.
693 According to our calculation, 57 s.
694 TYC 8041-1200-1. First observed 24 December 1639.
695 η_2 Hydri. First observed 17 December 1639.
696 α Hydri. First observed 20 September 1639.
697 φ Eridani. First observed 26 November1639.
698 κ Eridani. First observed 26 November1639.
699 δ Hydri. First observed 16 December 1639.
700 TYC 7558-987-1. First observed 16 December 1639.
701 ι Eridani. First observed 16 December 1639. Absent in Houtman's catalogue.
702 β Fornacis. First observed 16 December 1639.
703 ε Hydri. First observed 16 December 1639.
704 θ_1 Eridani. First observed 16 December 1639.
705 ζ Hydri. First observed 17 December 1639. According to our calculation, this star crossed the meridian 4 m 22 s before the previous star.
706 β Horologii. *First observation.*
707 μ Horologii. *First observation.*
708 α Fornacis. The 20th star of the River is τ_3 Eridani. Both first observed 16 December 1639.

On 21 November [1642]

From 6:30 PM to 10 PM.			
Meridian elevation of Fomalhaut of the Water Carrier[709]	66	40	0 south
After 150 oscillations of the pendulum.			
Western elevation of Mercury	13	1	30
Azimuth from west to south	25	50	0
After 157 oscillations of the pendulum.			
Western elevation of the bright [star] of the Eagle[710]	40	23	0
Azimuth from north to west	73	18	0
After 122 oscillations of the pendulum.			
Western elevation of Mercury	12	2	0
Azimuth [from west to south]	25	51	0
After 131 oscillations of the pendulum.			
Western elevation of the bright [star] of the Eagle	39	24	0
Azimuth [from north to west]	73	55	0

[108]

After 122 oscillations of the pendulum.			
Western elevation of Mercury	11	9	0
Azimuth [from west to south]	25	53	0
After 128 oscillations of the pendulum.			
Western elevation of the bright [star] of the Eagle[711]	38	33	30
Azimuth [from north to west]	74	2	0
I inspected[712] Mercury at twilight and it showed up furrowed[713] in the manner of Venus.			
Meridian elevation of β where the beak of the Toucan leaves[714]	38	6	0 south
[Star][715] in the straight line, …			
… almost between Fomalhaut[716] and ζ Phoenicis[717]	63	44	0 south
Third northern [star] ζ of the right wing in the Phoenix[718]	58	24	0 south
[Star] ε in the middle of the three in the same wing[719]	53	41	0 south
Southern [star] δ of the three in the same wing[720]	50	49	0 south

709 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.
710 Altair, or α Aquilae. First observed 18 September 1639.
711 *Ibidem.*
712 With the telescope.
713 According to our calculation, both planets were gibbous.
714 γ Tucanae. First observed 21 September 1639.
715 γ Sculptoris. *First observation.*
716 Fomalhaut, or α Piscis Austrini. First observed 20 September 1639.
717 β Sculptoris. First observed 22 September 1639.
718 Also β Sculptoris.
719 ι Phoenicis. First observed 22 September 1639.The other two stars are TYC 8456-967-1 (First observed 23 September 1639) and ε Phoenicis.
720 TYC 8456-967-1. First observed 23 September 1639.

[Star] under δ of the Phoenix[721] (not on the globe)	46	6	30 south
[Star] above the Phoenix[722] (not on the globe)	68	9	0 south
Upper [star] δ in the branch of the left wing of the Toucan[723]	31	59	0 south
Lower [star] 5 in the branch of the same wing[724] (which culminates soon after the previous star[725]) or first among the three[726] [stars] and western to ζ[727].	30	39	30 south
[Star] of the right wing of the Phoenix[728] (ν)	43	30	30 south
[Star] in the Phoenix that can be said its beak[729] (not on the globe)	50	34	30 south
[Star] in the middle of the wing (ζ)[730]	31	20	0 south

[109]

[Stars] on the twist of the neck of the Water Snake { the sixth[731] (ι)	19	1	0 south
[Stars] on the twist of the neck of the Water Snake { the fifth[732] (θ)	24	13	0 south
Bright [star] on the neck of the Phoenix[733] (α)	54	2	30 south
Its small [star][734] β	52	36	0 south
[Star] in the back of Toucan[735] (η)	33	19	0 south
The southern one of the three [stars] … … at the right foot of the Phoenix[736] (κ)	47	31	0 south
[Star] where the left wing of the Phoenix leaves[737] (η)	50	11	0 south
Upper [star] of the two in the hearth …			

721 σ Phoenicis. First observed 24 September 1639. Absent in Houtman's catalogue.
722 δ Sculptoris. Absent in Houtman's catalogue.
723 η Tucanae. *First observation.*
724 ε Tucanae. First observed 21 September 1639.
725 According to our calculation, this time interval was 2 m 29 s.
726 The three stars from west to east are ε, ζ and β_1 Tucanae.
727 ζ Tucanae. First observed 21 September 1639.
728 π Phoenicis. According to our calculation, this star crossed the meridian 41 s before the previous one.
729 ε Phoenicis. Absent in Houtman's catalogue.
730 ζ Tucanae. First observed 21 September 1639.
731 β Hydri. First observed 20 September 1639.
732 According to our calculation, between the previous and the following meridian transits there was no meridian transit of a naked eye star at such elevation. θ Hydri crossed the meridian at 24° 47' 51", 2h 55m 53 seconds after the previous star.
733 Ankaa, or α Phoenicis. First observed 20 September 1639.
734 κ Phoenicis. First observed 22 September 1639.
735 β_1 Tucanae. First observed 21 September 1639.
736 λ_1 Phoenicis. According to our calculation, this star crossed the meridian 51 s before the previous one.
737 μ Phoenicis. *First observation.*

… under the right foot of the Phoenix[738]	38	50	0 south
[Star] in Phoenix[739] (not on the globe)	45	16	30 south
Above the Phoenix[740] (not on the globe)	66	55	0 south
The northern one of the two [stars] in the hearth …			
…under the left wing of the Phoenix[741] (λ)	9	39	0 south
The lower one of the two [stars] in the hearth …			
… under the right foot of the Phoenix[742] (ν)	41	8	0 south
[Star] above λ of the Phoenix[743] (not on the globe)	50	50	0 south
Fourth [star] η [744] on the twist of the neck of the Water Snake,	27	29	0 south
[Star] above μ of the Phoenix[745] (not on the globe)	53	6	0 south
Southern one (μ) of the two stars in the hearth			
under the left wing of the Phoenix[746]	47	19	0 south
Achernar[747]	39	13	0 south
On 22 November [1642]			
In the evening the meridian elevation of Fomalhaut of the			
Water Carrier	66	39	30 south
After 171 oscillations of the pendulum, …			
… the western elevation of Mercury [was]	13	37	0
[110]			
Azimuth from west to south	25	39	0
After 210 oscillations of the pendulum.			
Western elevation of the bright [star] of the Eagle[748]	39	51	0
Azimuth from north to west	73	20	0
After 182 oscillations of the pendulum.			
Western elevation of Mercury	12	19	0
Azimuth [from west to south]	25	42	0
After 180 oscillations of the pendulum.			
Western elevation of the bright [star] of the Eagle	38	24	0
Azimuth [from north to west]	74	10	0

738 η Phoenicis. The other star is ζ Phoenicis (First observed 29, respectively 26 November 1639).
739 ρ Phoenicis. Absent in HOUTMAN's catalogue.
740 α Sculptoris. Absent in HOUTMAN's catalogue.
741 β Phoenicis. First observed 26 November1639. The other star of the pair might be δ Phoenicis.
742 ζ Phoenicis. First observed 26 November1639. The companion star is η Phoenicis.
743 ν Phoenicis northeast of β Phoenicis. Absent in HOUTMAN's catalogue.
744 κ Tucanae. First observed 16 December 1639.
745 γ Phoenicis. Absent in HOUTMAN's catalogue. The star μ is δ Phoenicis. Both first observed 26 November1639.
746 δ Phoenicis. First observed 26 November1639. The companion star might be β Phoenicis.
747 Achernar, or α Eridani. First observed 20 September 1639.
748 Altair, or α Aquilae. First observed 18 September 1639.

After 138 oscillations of the pendulum.			
Western elevation of Mercury	11	15	0
Azimuth [from west to south]	25	50	0
After 131 oscillations of the pendulum.			
Western elevation of the bright [star] of the Eagle	37	30	0
Azimuth [from north to west]	74	12	0
After 157 oscillations of the pendulum.			
Western elevation of Mercury	10	8	30
Azimuth [from west to south]	25	56	0
After 154 oscillations of the pendulum.			
Western elevation of the bright [star] of the Eagle	36	21	0
Azimuth [from north to west]	74	56	0

Furrowed Mercury pointed the horns to west or downward[749].

On 20 December [1642]

Meridian elevation of the Sun	74	40	0 south

[111]
Σ × Θ ×[750]

Observations of the Heavens by Georg Marggrafe of Liebstadt from the Margraviate of Meissen in the year of Christ 1643

On 20 February

From 7:15 PM to 10 PM			
Meridian elevation of the back of the Dove[751] (γ)	63	53	30 south
[Star] in the back of Dorado[752]	35	30	0 south
[Star] where the right wing of the Dove comes from[753]	62	17	0 south
[Star] in the Swift Ship[754] of the Skipper[755]	47	3	0 south
Northern [star] among the two in Dorado near …			
… the pole of the ecliptic[756]	32	23	30 south
Canopus[757]	45	47	30 south

749 According to our calculation, Mercury was not horned, but gibbous with the convex side turned towards the east.
750 The abbreviation Σὺν Θεω means 'With God', or 'With Gods help'.
751 Phact, or α Columbae. First observed 21 December 1639.
752 β Doradus. First observed 20 December 1639.
753 β Columbae. First observed 21 December 1639.
754 Argo Navis, a constellation in the southern sky.
755 β Pictoris. First observed 21 December 1639.
756 δ Doradus. First observed 21 December 1639. The other star of the pair is ε Doradus.
757 Canopus, or α Carinae. First observed 19 December 1639.

The shoulder of the helmsman of the Ship[758]	55	20	0 south
[Star] in the knee of the left and rear foot of the Greater Dog[759]	66	5	0 south
[Star] at left of Canopus in the deck of the Ship[760]	48	0	0 south
[Star] below the previous one, far and more to the south[761]	36	42	0 south
[Star] in the end of the tail of the Flying Fish[762]	28	21	0 south
[Star] in the end of the right wing of the Flying Fish[763]	30	59	0 south
Upper and far [star] in the shield of the Ship[764] (λ)	55	37	0 south
Last [star] of the left wing of the Flying Fish[765]	26	30	0 south
[Star] in the Ship above the two nebulae[766]	46	11	0 south

[112]

On 10 March [1643]. Gregorian Calendar.

From 8:00 PM to 10:30 PM.

Meridian elevation of the [star] at the end of the right wing …

…of the Flying Fish located in the Ship.[767] (θ)	58	32	0 south
(Not on the globe) The star above the contiguous nebulae[768]	46	14	0 south
[Star] at the left wing of the Flying Fish[769]	26	31	0 south
[Star] in the Ship[770] (δ)	59	12	0 south
[Not on the globe] Contiguous nebulae[771]	38	35	0 south
[Star] in the Ship[772] (ζ)	51	59	0 south
[Star] in the womb of the Flying Fish[773]	30	42	0 south
[Star] at left of the nebulae[774] (μ)	39	53	30 south
First [star] of the left wing of the Flying Fish[775]	27	57	0 south

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758 ν Puppis. *First observation.*

759 κ Canis Majoris. *First observation.*

760 τ Puppis. *First observation.*

761 **α Pictoris**, with an apparent visual magnitude of 3.27, is the brightest star in the southern constellation of Pictor. *First observation.*

762 γ_2 Volantis. *First observation.*

763 δ Volantis. *First observation.*

764 σ Puppis. *First observation.*

765 ζ Volantis. *First observation.*

766 χ Carinae. *First observation.* The two nebulae are in the region of the open star cluster NGC 2516.

767 TYC 7650-3052-1 in the Poop Deck (Puppis).

768 χ Carinae. First observed 20 February 1643. Absent in Houtman's catalogue.

769 ζ Volantis. First observed 20 February 1643. According to our calculation, this star crossed the meridian 1 m 54 s before the previous star.

770 ζ Puppis. *First observation.*

771 Here it becomes clear that the two contiguous nebulas are the region of the open cluster NGC 2516 with the crowd of stars. Nebula, therefore not included in Houtman's catalogue.

772 γ Velorum. *First observation.*

773 ε Volantis. *First observation.*

774 ε Carinae. The nebulae are related to NGC 2516. *First observation.*

775 κ_2 Volantis. *First observation.*

First [star] of the right wing of the Flying Fish[776]	33	19	0 south
Last [star] of the tail of the Chameleon[777]	22	32	0 south
Western [star] from the two in the Ship[778]	46	35	0 south
[Star] in the Ship[779]	39	46	0 south
[Star] in the Ship[780]	44	52	0 south
[Star] next to the last of the tail of the Chameleon[781]	22	0	0 south
[Star] in the Ship[782]	38	59	0 south
[Star] in the Ship[783]	52	31	0 south
[Star] in the Ship[784]	56	13	0 south
Second [star] from the last of the tail of the Chameleon[785]	20	40	0 south
Head of the Flying Fish[786]	33	15	0 south[787]
Western [star] from the two in the Ship[788]	40	41	0 south
[Star] below it[789]	37	23	0 south
Eastern [star] from the two [in the Ship][790]	40	25	0 south

[113]

[Star] in the Ship[791]	30	1	0 south
[Star] above the aforementioned pair[792]	44	44	0 south
[Star] in the Ship[793]	59	17	0 south
[Star] in the Ship[794]	42	48	0 south

776 β Volantis. *First observation.*

777 α **Chamaeleontis**, with an apparent visual magnitude of 4.06, is a solitary star in the southern circumpolar constellation of Chamaeleon. . *First observation.*

778 o Velorum. The companion is δ Velorum. *First observations.*

779 *V343* Carinae. *First observation.*

780 δ Velorum. See two footnotes above..

781 θ Chamaeleontis. *First observation.* According to our calculation, this star crossed the meridian 4 m 38 s before the previous star.

782 *HJ* 4156 in Carina. *First observation.*

783 TYC 8169-1192-1 in the Sails of the Ship (Vela). *First observation.*

784 λ Velorum. *First observation.*

785 η Chamaeleontis. *First observation.* According to our calculation, this star crossed the meridian 2 m 59 s before the previous star.

786 α **Volantis** is a binary star in the southern constellation Volans. It has an apparent visual magnitude of 4.00, which is just bright enough to be seen with the naked eye. *First observation.*

787 The original value 35° 15' 0" was corrected for 33° 15' 0", because of an assumed flaw of the French copyist.

788 *V357* Carinae. The companion is ι Carinae.

789 TYC 8944-3281-1 in the Keel of the Ship (Carina).

790 ι Carinae. *First observation.*

791 β Carinae. *First observation.*

792 κ Velorum. *First observation.*

793 ψ Velorum. *First observation.*

794 *N* Velorum. *First observation.*

[Star] eastern to the two in the Ship[795]	40	36	0 south
[Star] in the Ship[796]	37	20	0 south
[Star] in the Ship[797]	34	50	0 south
[Star] in the Ship[798]	45	20	0 south

Henceforth I departed abroad for the sake of Geography and Natural History.
I came back on the second [day] of April [1643].

Partial Lunar eclipse

On 4 April [1642], according to the Gregorian Calendar, the sky was clear in the morning. The clouds were moving, the wind came from of the land. At 4:30 AM, the eclipse had not yet begun.[799] Later, the clouds covered the western [sky], so that I could not see the Moon anymore. When the Moon emerged from the clouds, it it was at a four-degree elevation to the west.[800] It stood in the clarity of the twilight, [801], missing a quarter [circle] to the south, slightly to the left. Again [the Moon] disappeared and was no longer visible. Nothing further [of this eclipse] was visible, because the clouds did not grant any observations before setting.

[114]

On 21 June [1643]. The clearest sky.

Meridian elevation of the Sun	58	23	30 north

On 22 June [1643]

Meridian elevation of the Sun	58	23	30 north

The end of Georg Marggrafe's observations.

~

795 TYC 8597-2340-1 in the Keel of the Ship (Carina). The two in the Ship are ι and *V357* Carinae.

796 *I* Carinae. *First observation.*

797 υ Carinae. *First observation.*

798 ϕ Velorum. *First observation.*

799 According to our calculation, the Moon entered the umbra at 5:25:19 local solar time.

800 According to our calculation, the Moon's azimuth was 265° 48' 43", or 4° 11' 16" west.

801 According to our calculation, when the Moon was at this western elevation, the Sun would rise 16 m 31 s later.

INDEX

Georg Marggrafe (1610-1643) is today hailed as the principal author of an influential account of the natural history of Northern Brazil and as compiler of the first accurate map of the area, which is considered as one of the most elegant products of seventeenth-century Dutch cartography. But initially he had the ambition to become known in astronomy. With the support Johan Maurits van Nassau-Siegen, then governor-general of colonial Dutch Brazil, he built in Recife the first European-style astronomical observatory on the South American continent, where he systematically charted the southern stars. He intended to supplement the famous astronomer Tycho Brahe, who charted the Northern sky half a century before. But Marggrafe's untimely death (and the negligence of a Leiden professor) prevented the publication of his valuable observations. As a result, Marggrafe did not achieve fame in astronomy, but instead became famous for his equally remarkable other achievements.

This book presents Marggrafe's stunning biography and is supplemented by a text edition of his astronomical legacy, prepared for the printing press in the 1650s, but only now finalized.

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