

# De Nova Stella

Tycho Brahe

I. L. E. Dreyer (ed.)

Michael P. McLaughlin (trans.)

TYCHONIS BRAHE, DANI  
DE  
NOVA ET NVLLIVS  
ÆVI MEMORIA PRIVS VISA  
Stella, iam pridem Anno à nato CHRIS-  
TO 1572. mense Nouem-  
brj primùm Con-  
specta,

CONTEMPLATIO MATHEMATICA.

*Cui, præter exactam ECLIPSIS LUNARIS, huius Anni, pragmatian, Et elegantem in VRANIAM Elegiam, EPISTOLA quoq, DEDICATORIA accessit: in qua, noua & erudita conscribendi DIARIA METHEOROLOGICA Methodus, vtriusq, Astrologia Studiosis, eodem Autore, proponitur: Cuius, ad hunc labentem annum, Exemplar, singulari industria elaboratum conscripsit, quod tamem, multiplicium Schematum exprimendorum, quo totum fermè constat, difficultate, edi, hac vice, temporis angustia non patiebatur.*



HAFNIÆ,  
IMPRESSIT LAURENTIVS  
Benedictj.

1 5 7 3.

**De Nova Stella**

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Editor: I. L. E. Dreyer, 1913

Translator: Michael P. McLaughlin, April, 2023

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## Translator's Preface

This work consists of an English translation of *De Nova Stella* written by Tycho Brahe in 1573. The text used is that edited by Dryer [3, pp. 16–30]. It is not a complete translation; the prefatory dedications and discussion of astrology are not included. Also, no attempt was made to produce a literal translation. The guiding precepts were as follows:

- What was Tycho trying to say?
- The science must make sense.
- Good Latin deserves good English.

Nevertheless, the end result remains faithful to the original.

All footnotes are those of the translator as is anything inserted [in brackets]. In addition to the original text, material is included on the constellation Cassiopeia in which the nova appeared, the instrument Tycho used to observe it along with some retrospective analysis that Tycho carried out in later years.

## TEXT AND TRANSLATION


DE NOVA ET NVLLIVS ÆVI ME-  
MORIA, A MVNDI EXORDIO PRIVS CON-  
SPECTA STELLA, QUÆ IN FINE ANNJ  
SUPERIORIS OMNIUM PRIMO  
APPARUIT.

5



ANNO præcedente, Mense Nouembrj, die eiufdem vnde- +  
 cimo, vefperi poft Solis occafum, cum meo more fidera  
 cœlo fereno contemplarer, nouam quandam & inufita-  
 tam, præque alijs admodum confpicuam, iuxta capitis  
 verticem, animaduerti fulgere Stellam: cumque mihi, 10  
 qui inde fere a pueritia, omnia cœlj fidera perfecte (non  
 enim magna huic ſcientiæ ineft difficultas) cognita haberem, fatis eui-  
 denter conſtaret, nullam in eo cœlj loco vnquam antea extitiſſe, vel  
 minimam, nedum tam confpicuæ claritatis ſtellam: in tantam rei iſtius  
 admirationem ſum adductus, vt de fide, proprijs oculis adhibenda, du- 15  
 bitare, non puduerit. Cum vero & ab alijs loco monſtrato conſpici poſſe  
 animaduertiſſem, ſtellam reuera illic apparere, nullum mihi amplius  
 mouebatur dubium. Miraculum ſane inter omnia, quæ a mundi ex-  
 ordio, in tota rerum natura extiterunt, aut maximum, aut illi certe  
 æquiparandum, quod in Solaris curſus retentione, Iosue precibus 20  
 impetrata: vel eiufdem obſcuratione, tempore Viſtimæ cœleſtis facta,  
 contigiſſe ſacra te-||ſtantur oracula. Omnibus enim Philoſophis conſtat, A<sup>v</sup>  
 & res ipſa non obſcure declarat, in ætherea cœleſtis mundi regione,  
 nullam fierj alterationem generationis vel corruptionis: ſed cœlum &  
 quæ in eo continentur ætherea corpora, non augerj, non imminuj, non 25  
 variari aut numero, aut magnitudine, aut lumine, aut quauis alia ra-  
 tione: ſed ſemper idem, ſibiſque in omnibus ſimile, nullis terentibus an-  
 nis permanere. Teſtantur inſuper omnium artificum, millenis aliquot  
 ab hinc elapſis annis, factæ obſeruaciones, ſtellas omnes, eundem nu-  
 merum, ſitum, ordinem, motum, & quantitatem, ſemper retinuiſſe, qua- 30  
 lem noſtra etiam ætate, ab ijs quos cœleſtium rerum capit delectatio,  
 obſeruacione diligentj facta, ſeruare conſpiciuntur. Nec vnquam ab vllo  
 artifice antea obſeruatum legimus, nouam aliquam in cœleſti mundo  
 extitiſſe ſtellam, niſi a ſolo Hipparcho, ſi Plinio adhibenda eſt fides.  
 Hipparchum enim aliam a reliquis omnibus prius conſpectis, ſua ætate 35  
 genitam animaduertiſſe ſtellam, autor eſt Plinius, Naturalis hiſtoriæ  
 libro ſecundo: Cuius verba, cum vt in cœteris, ita & hoc in loco ſint  
 illuſtria & magna, non abs re duxi hic annotanda. *Idem* (inquit)  
*Hipparchus, nunquam ſatis laudatus, vt quo nemo magis appro-*  
*bauerit*

**Concerning Something New and Unprecedented  
Since Before the Beginning of the World:  
A Star Which First Appeared At the End of Last Year**

AST year, on the eleventh of November, in the evening after sunset, while gazing at the stars in a clear sky, as per my custom, I noticed a new and unusual star shining brightly just above my head. To me who, almost since childhood, had known all the stars of the sky perfectly (for there is no great difficulty in this skill), it was quite evident that there had never been any in that place before or, at least, no star of such conspicuous brightness. In the event, I was led to wonder whether, indeed, I could trust my own eyes. In fact, it could be noticed by others that a star appeared in the place I pointed out so I no longer had any doubt. Of course, among all the miracles that have occurred in nature since the beginning of the world, the greatest, or nearly so, was that resulting from the prayers of Joshua in arresting the course of the Sun or by the obscuration of the same. Occurring at the time of the heavenly Sacrifice, sacred oracles bear witness to the fact that it happened.

All philosophers agree, and the very fact makes it plain, that, in the ethereal region of the heavenly world, no modification of creation or corruption takes place. Rather, heaven and the ethereal bodies which are contained therein are not increased, nor diminished, nor varied either in number, or in size, or in magnitude, or in any manner but continue to stay the same in every way over the years. Moreover, observations made by all experts, over thousands of years gone by, assert that stars have always maintained the same number, position, order, motion and quantity, even in our own time by those who take delight in heavenly things. Nor have we ever read that any new star was ever observed in the heavenly world by any expert unless Hipparchus if Pliny is to be believed. For Pliny, in his second book of Natural History, says that Hipparchus observed that a star different from all others appeared in his own time. And his words, here and elsewhere, are illustrious and magnificent. He says of Hipparchus, “He was never sufficiently praised

bauerit cognationem cum homine siderum, Animasque nostras  
 partem esse cœli, nouam Stellam & aliam æuo suo genitam de-  
 præhendit, eiusque motu, qua die fulsit, ad dubitationem est ad-  
 ductus, anne hoc sæpius fieret, mouerenturque & eæ, quas puta-  
 A 2<sup>r</sup> mus affixas. Idemque ausus rem etiam Deo improbam, || annume-  
 rare posteris stellas, ac sidera ad normam expangere, organis ex-  
 cogitatis per quæ singularum loca & magnitudines signaret, vt  
 facile ex eo discerni posset, non modo an obirent, nascerenturue,  
 item an crescerent, minuerenturue. Cœlo in hæreditate cunctis  
 10<sup>+</sup> relicto, si quispiam qui rationem eam caperet, inuentus esset. Hæc  
 Plinius. Licet vero illa Plinij verba non obscure testentur, Hipparchum  
 veram stellam in ætherea regione, suo æuo genitam depræhendiße, &  
 hac occasione reliquarum omnium loca, instrumentis debitis (quod  
 nullus ante ipsum præstitit) signaße, vt posteri scirent an sæpius hoc  
 15 fieri posset: tamen non dubitauit interpres Plinij Milichius, illa in Co-  
 metæ alicuius apparitionem detorquere, rei potius incredibilitate, &  
 omnium Philofophorum refragante iudicio, quam autoris sententia  
 eo perductus. Quam enim perperam, de Cometa, hunc locum Plinij  
 interpretatus sit, nemo refragabitur, qui penitius citata Plinij verba in-  
 20 trospecterit. Et quam quæso absurdum est affirmare Hipparchum, vi-  
 rum in omni scientiarum genere excellentem, præque aliis in Mathe-  
 maticis summum artificem, non sciuisse melius inter veras æthereæ  
 regionis stellas, & æris igneum Meteoron, quod Cometam vocant,  
 discernere, quam vt per hanc occasionem omnium affixorum siderum  
 25 catalogum & situm, diuino potius quam humano labore, posteris re-  
 linqueret. Vt taceam, quam ridiculum sit, quod idem Plinij commen-  
 tator, ex verbis prædictis aserat, Hipparchum per istius Cometæ mo-  
 A 2<sup>v</sup> tum (Cometam enim fuisse hanc stellam opinatur) stellarum fixarum  
 situs, & motum, depræhendiße, cum omnium Cometarum cursus sit  
 30 enormis, instabilis, celer, & vagabundus: stellarum vero in octauo orbe  
 affixarum motus regularis, certus, vniformis, adeoque lentus, vt vnus  
 hominis ætate vix progredi animaduertantur. Hæc non vllo carpendi  
 studio commemoro. Non enim est candidj & ingenui ingenij, aliorum  
 labores deprauando calumniarj: sed monere saltem volui, ne alij, hu-  
 35 ius interpretis, viri docti autoritate freti, ad Cometæ alicuius, & non  
 veræ stellæ apparitionem, Plinium detorquerent. Mihi sane dubium  
 non est, Plinium per hæc verba signaße, Hipparchum veram stel-  
 lam & genuinam in cœlo, suis temporibus primum natam, depræhen-  
 diße: Alias enim nec ipse quicquam noui, aut admiratione dignum,  
 40 de tanto viro retulisset, cum Cometæ crebrius conspiciantur, & a quo-  
 uis etiam Mathematicum imperito animaduertantur. Quæ autem &  
 qualis hæc fuerit, & an rursus euauerit nec ne, quoniam ex Plinij  
 verbis

and no one knew more than he about the stars. He understood our souls to be a part of heaven and that, given another new star born in his age and given its motion, shining brightly on that day, was led to doubt that this would happen more often and that those which we consider fixed would also move. Thus, it was an audacious undertaking, even to God, to enumerate the lesser stars as well as standardize the constellations and, with these instruments, record the places and sizes of each, not only whether they were born or died but whether they grew or diminished, so that they could be easily distinguished from it. Heaven was left as an inheritance for all. For anyone who could make use of it, it would have been available.” So spoke Pliny.

It is safe to say that these words of Pliny are not obscure. Hipparchus did perceive a real star in the ethereal region, born at that time and, on this occasion, recorded the positions of all the rest with the necessary instruments (which no one had done before him) so that posterity might know whether this could be done more often. Nevertheless, Milchius [Jacob Milch], a commentator on Pliny, did not hesitate to misconstrue it as the apparition of some comet, given the incredibility of the event and the opposing judgment of all the Philosophers, rather than accept the author’s opinion. How incorrectly interpreted this passage of Pliny, as implying a comet, no one who scrutinizes the quoted words of Pliny will dispute. And how absurd it is to assert that Hipparchus, a man excelling in every kind of science and more expert in mathematics than anyone else, did not know how to distinguish between the true stars of the ethereal region and the fiery meteor of the air which they call a comet or that, on this occasion, the catalog and position of all the fixed stars would have been left to posterity by divine rather than human labor. Not to mention how ridiculous it is that the same commentator of Pliny asserted, from the foregoing words, that Hipparchus had detected the position and motion of the fixed stars by means of this very comet (for he thinks that this star was a comet), since the course of all comets is irregular, unsteady, rapid and wandering. Indeed, the motion of the fixed stars in the eighth sphere is regular, certain, uniform and so slow that they are scarcely observed to progress during the age of one man.

I do not mention these things with any intention of taking them up myself. For it is not for a pure and honest person to slander by distorting the labors of others. But I wished at least to provide a warning lest others, relying on the authority of this learned man, of this interpreter, should misconstrue Pliny as the appearance of some comet and not of a true star. I have no doubt that Pliny meant by these words that Hipparchus had discovered a true and genuine star in the sky, the first born in his time. In other respects, neither he himself nor I knew anything, or anything worthy of respect, of such a man as he had described, when comets are more frequently seen and noticed even by those unskilled in mathematics. But what this was and what it was like, and whether it disappeared again or not,



verbis colligi non potest, in dubio relinquimus. Nec simile quidpiam,  
 vel ante Hipparchi tempora, vel etiam post, annis iam elapsis mille  
 septingentis, ab vlllo artifice (vt dixi) sæpius obseruatum esse legimus,  
 priusquam hac nostra ætate, illa, de qua nunc sermonem instituimus,  
 conspici cœpit. Quod vero illa, neque sit in Elementari & aërea mundi 5  
 regione apparens igneum aliquod meteoron: sed inter cœlestes orbes  
 locum obtineat, postea demonstrabimus. Apparet itaque quam sit hæc||  
 res inusitata, quam admiranda, quam denique omnibus Philosophis A 3<sup>r</sup>  
 incredibilis, nouam & aliam a prioribus nunc demum in cœlo prodijße  
 stellam. Nec Theologis, qui alias multa in mundano orbe miraculose 10  
 contingentia, per diuina mysteria excusare possunt, sufficientes red-  
 dere causas eius rej, possibile existimo. Illis enim per Mosis de mundi  
 fabrica historiam, compertum est, Deum autorem Vniuersi, ex quo  
 cœlos & Elementa, cum omnibus suis ornatibus absoluißet, quieuiße  
 ab omni opere, nec vllam postea rerum nouam condidiße speciem. 15  
 Scio tamen aliquos ex occultiori quadam, & nostro sæculo primum in  
 lucem producta Philosophia aserturos, possibile esse hanc stellam in  
 veteri Iliado (libet enim eorum vocabulis vti) hæctenus latitasse, &  
 nunc demum maturatione sui absoluta, mortalibus conspiciendam  
 prodijße. Et si vero nunc non disputem de huius nouæ (vt putatur) 20  
 Philosophiæ certis vel ambiguis fundamentis: & non ignorem, ex illa,  
 multarum in Natura abstrusarum rerum, & a vulgaribus Philosophis  
 vel incognitarum, vel minus recte intellectarum, causas & progressus  
 explicari posse: tamen mihi verosimile esse, vt hoc miraculum ea rati-  
 one sufficienter saluetur, vix persuadebitur. Nam si huiusmodi in 25  
 cœlo (quod illi quartum & igneum Elementum, non dubitant, suis  
 ducti rationibus, appellare) fierent generationes, cur non sæpius tot  
 elapsis seculis, in tanta cœlj vastitate, animaduersum est noua prodire  
 sidera? Et cur illa quæ hæctenus apparu-||erunt nullam inde a mundi A 3<sup>v</sup>  
 exordio, magnitudinis, luminis, coloris, vel ordinis perpeßa sunt al- 30  
 terationem? Id enim in tanto temporis interuallo, & tanta stellarum  
 copia, fieri oportebat, si cœlo eiusmodi competeret generationis & cor-  
 ruptionis necessitas. Taceant igitur omnes Philosophi, seu veteres, seu  
 noui: taceant ipsi quoque Diuinorum Mysteriorum interpretes The-  
 ologi: taceant cœlestium corporum contemplatores Mathematici, nec 35  
 de modo generationis huius stellæ & tanti miraculi excusatione, se ali-  
 quid certi constituere posse existiment. Nec est quod aliquis sibi per-  
 suadeat, hanc stellam similem esse illi, quæ Magis Orientalibus, cum  
 Saluator mundj nasceretur, apparuit. Illa enim non in cœlo inter reli-  
 quas stellas: sed in ima aëris regione, non procul a superficie terræ lo- 40  
 cum obtinebat. Alias enim nec motu suo, iter, Saluatorem quærenti-  
 bus, nec quiete, domum in qua inueniretur, ostendißet. Sed cum toto  
 cœlo

since this cannot be gleaned from Pliny, we leave in doubt.

Nor have we read that anything similar was ever observed by any expert (as I said), either before or after the time of Hipparchus, not even after seventeen hundred years, prior to this age of ours, of which we now speak, when something began to be seen. In truth, there be not any fiery meteor appearing in the elemental and aerial region of the world but, as we shall show later, among the celestial spheres. It shows, therefore, how unusual this thing is, how surprising, how unbelievable to all philosophers, that a new star, different from those preceding, should now appear in the sky. Nor can theologians, who are otherwise able to excuse many miraculous happenings in the mundane sphere as divine mysteries, account for the causes of this thing except as a possible anomaly. For through Moses' history of the creation of the world, it was discovered that God, the author of the universe, having finished preparing the details of the heavens and the elements, had rested from all work and had not afterwards created any new species in the world.

I realize that some from a more occult philosophy, first disclosed in our time, will assert that it is possible that this star in the old Iliad (for I like to use their terms) has been hidden until now when, brought forth at the time of its ultimate maturity, it has finally become visible to mortals. Now, I will not discuss the bases of this (supposedly) new philosophy, whether certain or doubtful, and I am not unaware of the possibility that it might explicate the causes and behavior of many things in nature which are obscure and which are either unknown or much less understood by common philosophers. However, it seems to me that such a miracle is scarcely plausible. For, if generations of this sort (which, by their thinking, they do not hesitate to assign to the fourth, fiery Element) were to take place in heaven, why was it not more often, after so many centuries, in the vastness of heaven, that new stars were observed to appear? And why have those which have hitherto appeared since the beginning of the world undergone no alteration in size, light, color or arrangement? For, in so great an interval of time, this should have occurred with a great number of stars if the heavens were characterized by this sort of generation and corruption. Therefore, let all philosophers, old or new, be silent. Let the theologians, the interpreters of the Divine Mysteries, also be silent. Let the mathematicians who contemplate the heavenly bodies be silent and not offer excuses for the generation of this star or of so great a miracle with the pretense of something certain. Nor need anyone convince himself that this star is like that which appeared to the Magi when the Savior of the world was born. For that occurred not in heaven among the rest of the stars but in the lowest region of the air, not far from the surface of the Earth. For anyone other than those seeking the Savior, neither by its own movement, nor by its journey nor its subsequent repose would it have opened the door of the house in which He was to be found.

cœlo circumuoluta, nullum habuisset tam exigui spacij in orbe terreno respectum: cum tota terra, cœlo collata, non habeat sensibus incurrentem magnitudinem. Adde quod illa stella solis Magis ab oriente profectis, vt Dominum adorarent, illique tanquam Regi, Deo, & Homini, munera, Aurum, Thus, Myrrham offerrent, apparuit: siue quod Deus peculiariter eorum mentes & oculos illustrauerit, vt illj a longinqua & ignota regione venientes, eum agnoscerent, per quem omnia facta sunt, humanam induisse naturam, quem proprij Iudæj, inter quos  
 A 4<sup>r</sup> nascebatur igno-||rabant: siue quod hi sapientes homines, per occultioris & incognitarum rerum indagatricis Magiæ cognitionem, ea viderint & intellexerint, quæ reliquis hominibus, huius scientiæ ignaris, occulta erant: vnde etiam non immerito Magorum appellationem in sacris literis sortitj erant. Sed qualis ea fuerit stella, quæ illis apparuit, non est huius loci scrupulosius indagare, cum ipsis etiam Theologis,  
 15 ob Magiæ ignorantiam, nihil in hac re certj constet. Sufficit enim demonstrare hanc nouam & inusitatam stellam, quæ nuper apparuit, nullam habere cognationem cum illa, quæ Magis conspiciebatur: nec posse eius generationis modum saluarj, vel a Theologis, vel a Philosophis, nec ab ipsis etiam Mathematicis. Reliquum igitur est, vt statuamus Dei totius Machinæ mundanæ opificis, admirandum hoc esse  
 20 Ostentum, præter omnem naturæ ordinem, a seipso in initio constitutum: nunc demum aduersperascenti mundo exhibitum. Diuina enim maiestas liberrime agit, nec vllis obstricta est Naturæ vinculis, sed cum vult, sistit aquam fluuiis & vertit sidera retro.

25 *Hæc potuit Solis currus inhibere volantes,  
 Cum populi Israël dux Iosue sterneret hostes.  
 Hæc potuit Solis sine Luna, extinguere lumen,  
 Cum suus est factus pro nobis victima Gnatus.*

Quapropter etsi de hoc nouo & nunc primum nato sidere, aliqua in  
 A 4<sup>v</sup> medium adferre constituerim: tamen de || eius generatione, & quibus rationibus extiterit, me nihil affirmare posse, ingenue fateor: sed solum ea, quæ ad Mathematicam considerationem spectant, excutiam.

Dicam enim de eius, quo ad fixas & Zodiacj longitudinem, latitudinemque posito: de ipsius a Terra, centro  
 35 Vniuersi, remotione: nec non de eiusdem magnitudine, lumine, & colore: quibus etiam de huius stellæ effectibus, ab Astrologia petitas coniecturas  
 40 subiungam.

For, surrounded by the whole of heaven, so small a space in the earthly world would have garnered no respect for, compared to the heavens, the whole Earth has a size that is insensible. In addition, that solitary star of the Magi, having gone forth from the east, appeared there so that they might worship the Lord, offering gifts of gold, thyme, and myrrh to the King, to God and to man, or that God especially enlightened their minds and eyes so that, coming from that distant and unknown country, they recognized Him by whom all things were made as having put on a human nature of which his own Jews, among whom he was born, were ignorant and that these wise men, through knowledge of the occult and unknown things, by the investigation of magic, saw and understood those things which were obscure to other men, ignorant of this knowledge. Whence, in the sacred literature, they deserved to be called Magi. But, for the needs of this work, it is not necessary to investigate what kind of star it was that appeared to them since even the theologians themselves, owing to their ignorance of magic, are not certain about this matter. It is enough to have demonstrated that this new and unusual star which has lately appeared to have no relationship to that of the Magi nor can the manner of its generation be explained by theologians or philosophers, not even by mathematicians. Consequently, we are left to conclude that this marvelous portent, distinct from the natural order, was fabricated by God, the artificer of the entire worldly machine, from the very beginning and now, at last, exhibited to the world as evening approached. For the divine majesty acts very freely and is not bound by any bonds of nature but, when it wills, it halts the water of the rivers and makes the stars go backward.

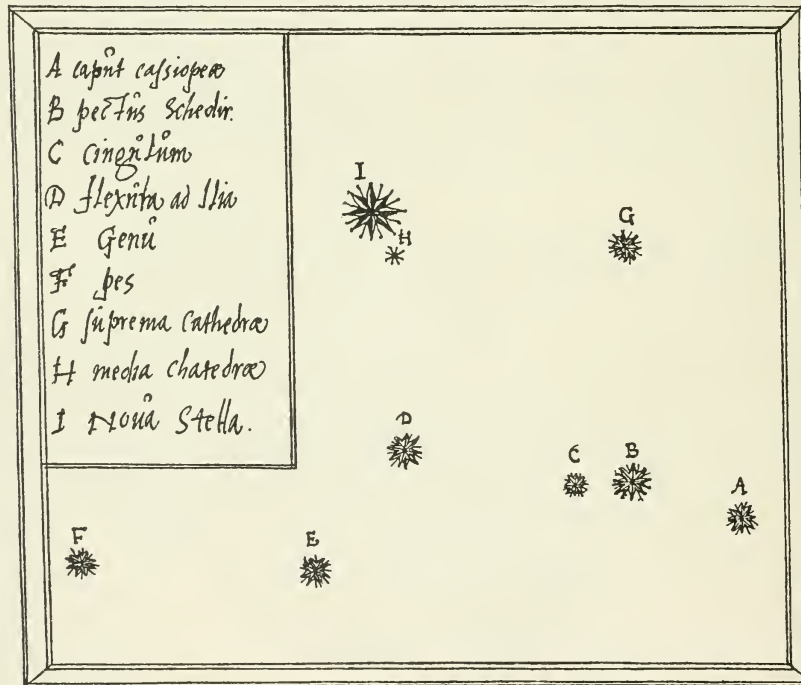
*Thus could the flying chariot of the Sun be checked,  
When Joshua, the leader of the Israeli people, defeated his enemies.  
Thus could the Sun, without the Moon, extinguish its light,  
As the Son was made a sacrifice for us.*

For this reason, although I have decided to focus on this new and nascent star, I frankly confess that I cannot affirm anything about its generation and for what reasons it would have existed but shall address only those topics that pertain to the domain of mathematics. Thus, I shall speak of its longitude and latitude position relative to the the fixed stars and the Zodiac, of its distance from the Earth as well as its size, brightness and color. Also, regarding the effects of this star, I shall submit the predictions of astrology.

# DE HVIVS NOVÆ STELLÆ IN CŒ- LO, QVO AD FIXAS POSITU, & IPSIUS QUO AD ZODIACUM, LONGITUDINE & LATITUDINE.



CONSPICIEBATUR hæc recens nata stella in Boreali 5  
cœlij plaga, versus polum Arcticum, iuxta constellatio-  
nem, quam veteres Magi Cabiopeam appellarunt, vicina  
paruæ istj stellæ, quæ est in Cathedræ medio loco, modi-  
cum ab ea versus Cepheum remota. Constituebat etiam 10  
cum suprema Cathedræ, & ea quæ in pectore Schedir  
appellatur, eaque quæ iuxta incuruationem ad ilia tendit, figuram qua-  
drilateram. Sed vt tota res melius cognoscatur, præcipuas stellas fide-  
ris Cabiopeæ, vnâ cum huius nouæ ad illas positu, oculis subijciam.

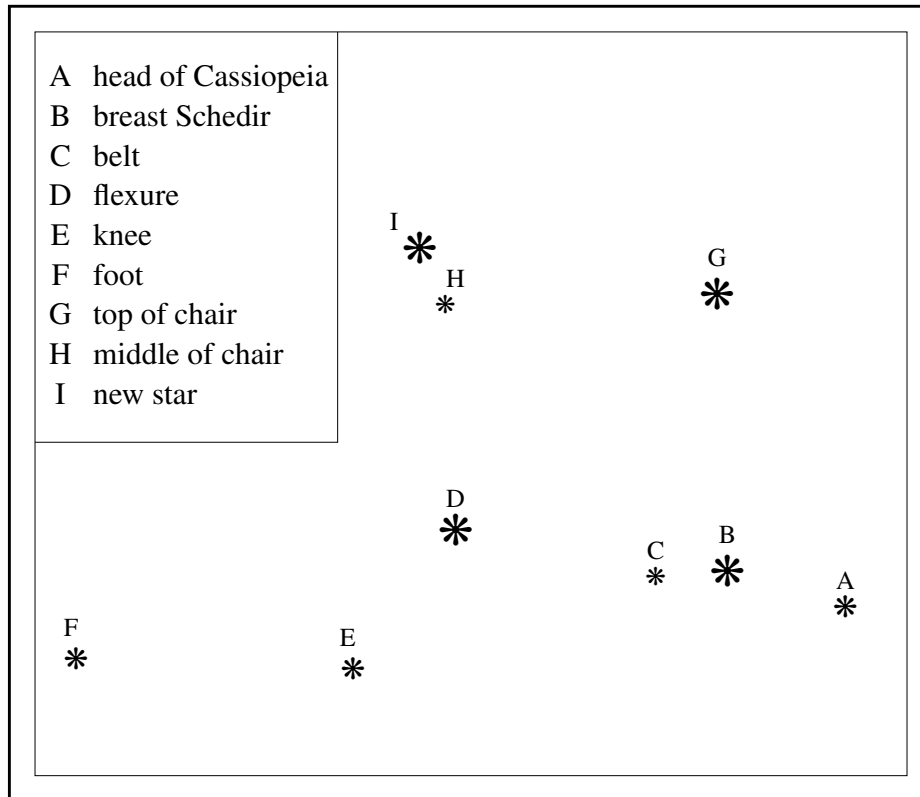


B v

Distantiam

## Concerning the Longitude and Latitude Position of this New Star in the Sky Relative to the Fixed Stars and the Zodiac

**T**HIS newly born star was visible in the northern part of the sky, towards the Arctic pole, near the constellation that the ancient Magi called Cassiopeia and in the vicinity of the small star that is in the middle of the chair, a little distant from it towards Cepheus. Also, it formed a quadrilateral figure with the top of the chair and that which is called Schedir in the breast and the one that makes the bend.<sup>1</sup> But, in order that the whole matter may be better understood, I will present to the eyes the principal stars of the constellation Cassiopeia together with the relative position of this nova.



<sup>1</sup>c.f., Table 1

Distantiam vero huius stellæ a fixis aliquibus in hac Caßiopeiæ constellatione, exquisito instrumento, & omnium minorum capacj, aliquoties obseruauit. Inueni autem eam distare ab ea, quæ est in pectore, Schedir appellata B, 7. partibus & 55. minutis:

B 2 a superiori || uero stellæ G, partibus 5, minutis 21: a flexura denique, & ea, quæ iuxta illa D, 5 partibus minuto 1. Ex his distantijs huius nouæ stellæ a dictis fixis, ipsius locus incidit, quo ad longitudinem in 7G:♄, cum latitudine

10 Septemtrionalj 54 fere partium, paucissimis utrobique neglectis minutis: idque potissimum per duas ultimas distantias, a flexura uidelicet, & suprema Cathedræ innotuit. Nam si

15 harum duarum fixarum loca, secundum longitudinem & latitudinem nota, præsupponamus, non latebit scientiæ triangulorum sphericorum gnaro, noui sideris ab æquinoctio uerno in longitudinem, & ab Eccliptica in latitudinem remotio. Sint enim euidentiore demonstrationis gratia, in sequentj figuratiõne,

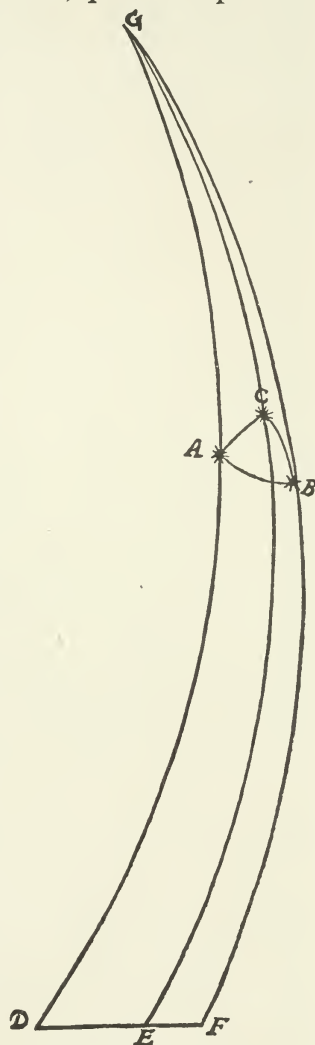
20 duæ stellæ fixæ sideris Caßiopeiæ A & B: quarum A sit illa in Cathedræ parte superiore, quam alij in ascensu medio collocant: B uero illam, quæ in flexura est, iuxta illa, representet: C autem locus nouæ stellæ, & A C,

25 arcus distantiæ eius a suprema Cathedræ: CB, arcus inter hanc & flexuram interceptus: & A B, arcus intercapedinis utriusque fixæ. Sit insuper G polus Zodiacj Boreus, a quo duo quadrantes descendant in Ecclipticam, per prænominatas fixas in A & B positas: per A quidem G D: per B uero G F. Erit itaque D F

30 arcus Ecclipticæ dirimens utriusque fixæ longitudinem, & A D, atque B F, arcus latitudinum earundem fixarum. Pari ratione a polo Zodiacj, per locum nouæ stellæ in C positæ, ||

35 B 2 u ducatur quadrans in Ecclipticam, quæ hîc G E erit. Itaque E locus longitudinis nouæ stellæ, & D E arcus differentiæ longitudinis huius a priori fixa in A posita:

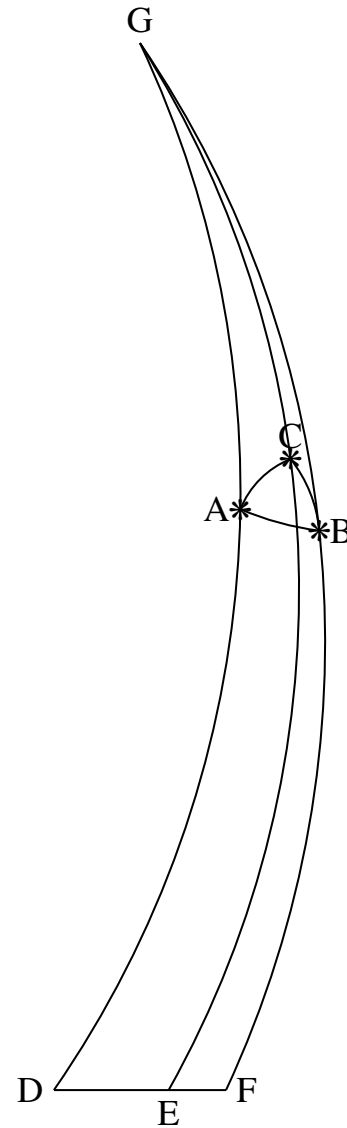
40 C E uero arcus latitudinis, seu remotio ipsius ab Eccliptica. Præsupponantur autem loca longitudinis & latitudinis Fixarum, qualia Copernici abacus, adiecta æquinoctij præcessionem, indicat, ut sit longitudo prioris



Indeed, I have observed the distance of this star from the fixed ones in the constellation of Cassiopeia several times with a very precise instrument, capable of every detail. I found that it is 7 parts 55 minutes distant from that which is in the chest, B, called Schedir, 5 parts 21 minutes from the top of the chair, G, and, finally, 5 parts 1 minute from the flexure and those near it, D.

From these separations of this new star from the fixed locations described, its location falls at a longitude of 7 degrees of Taurus with a latitude of about 54 parts North, neglecting a few minutes. This is made known especially from the latter two separations, namely, from the flexure and the top of the chair. For, if we assume the locations of these two fixed points, in longitude and latitude, then the distance of the new star from the vernal equinox in longitude and from the Ecliptic in latitude will be apparent from a knowledge of spherical triangles.

For a clearer demonstration, in the adjacent figure, let A and B be two fixed stars in the constellation Cassiopeia, where A is in the upper part of the chair and which others place in the middle of the upright. B, on the other hand, will represent that which is next to the flexure. Let C be the place of the new star and AC the arc of its separation from the top of the chair. CB is the arc connecting the latter [C] and the flexure while AB is the arc between the two fixed stars. Moreover, let G be the North pole of the Zodiac from which two quadrants descend to the Ecliptic, through the aforesaid fixed points at A and B, that is, GD through A and GF through B. Therefore, DF will be the arc of the Ecliptic terminating the longitude of both fixed points and AD and BF will be the arcs of the latitudes of the same fixed points. In the same way, from the pole of the Zodiac through the location of the new star at C a quadrant is drawn to the Ecliptic, which here will be GE. Therefore, E is the locus of the longitude of the new star and DE is the arc of the difference in longitude of this one and the fixed one at A. Hence, CE is the arc of latitude or the distance [of C] from the Ecliptic. But, according to the computation of Copernicus, locations of fixed longitude and latitude are supposed to be added to the precession of the equinoxes, indicating that the longitude of





prioris stellæ A in 29. G. 0. M. ab æquinoctio verno, idque in puncto  
 D, cum latitudine boreali 51. G. 40. M. quam representat (vt dixi) ar-  
 cus A D. Longitudo autem posterioris in B positæ, sit in 7. G. 50. M.  $\gamma$ .  
 Idque in puncto F, cum latitudine boreali 49. G. 0. M. quam designat  
 arcus BF. Hinc lubet indagare arcum DE, quantum videlicet E longi-|| 5  
 tudo nouæ stellæ excedat longitudinem fixæ in A positæ, quæ est in B3<sup>v</sup>  
 D, vt E locus longitudinis nouæ stellæ, in Eccliptica cognoscatur. Libet  
 etiam hinc arcus CE quantitatem indagare, vt innotescat etiam huius  
 nouæ stellæ ab Eccliptica remotio, quam latitudinem vocant. Verum 10  
 vt in horum noticiam per triangulorum Sphæricorum scientiam, de-  
 bito processu peruenire liceat, considero omnium primo Triangulum  
 A G B, cuius bina latera in G polo iuncta, nota sunt, per complementa  
 latitudinum fixarum G A, scilicet 38. G. 20. M. G B vero 41. G. 0. M.  
 Est etiam angulus, quem dicta latera comprehendunt notus. Illum 15  
 enim metitur arcus D F, differentia videlicet longitudinis vtriusque  
 fixæ, quæ est 8 Gra. 50. M. Vnde per vigesimam octauam propo-  
 sitionem libri quarti, Iohannis Regiomontani, de triangulis Sphæricis,  
 arcus A B innotescit, quem inuenimus 6. partium cum  $\frac{1}{4}$ , qualem etiam  
 per instrumentum, capiendo vtriusque fixæ distantiam, obseruauit.  
 Habet itaque nunc dictum Triangulum A G B omnia latera nota: 20  
 vnde per vltimam propositionem libri quarti Regiomontani de Trian-  
 gulis, vel tertiam libri quinti eiusdem, Copernici vero de iisdem deci-  
 mam tertiam, Angulus B A G manifestabitur. Inueni autem hunc an-  
 gulum, absoluta operatione numerorum, iuxta dictas propositiones,  
 partium III. Minutorum 46. Nunc etiam pari ratione angulum Tri- 25  
 anguli CAB, qui est ad A, dimetiar: nam & omnia huius || latera nota B3<sup>v</sup>  
 sunt ex antecedentibus, C A part: 5 Minutorum 21: C B, 5 Part. 1 Min.  
 A B 6. Par. 15 Min. Euadit igitur Angulus C A B, per dictas propo-  
 sitiones, partium 49. Minu. 52. Hunc angulum ab angulo B A G prius  
 inuento, aufero, tanquam partem de suo toto, & relinquitur quantitas 30  
 anguli C A G, partium 61, Minu. 44. Nunc progredior ad Triangulum  
 C A G, cuius Angulus, qui ad A, iam innotuit: duo vero latera dictum  
 angulum comprehendentia G A & A C, ex superioribus nota sunt.  
 Quapropter beneficio 28 propositionis libri quarti Regiomontani de 35  
 Triangulis, reliquum latus G C innotescet, partium videlicet 38 Mi-  
 nut: 4. Erat autem arcus G C, complementum latitudinis nouæ stellæ.  
 Vnde sublato eo, a Quadrante, vera stellæ latitudo, partium 53 Minut:  
 56 euadit: quantitas videlicet arcus CE. Pro longitudine vero huius  
 stellæ indaganda, anguli D G E, quantitatem per omnia latera Tri- 40  
 anguli G A C, iam cognita, dimetior, iuxta operationem propositionis  
 34 libri Quarti, vel tertie libri Quinti Regiomontani de Triangulis.  
 Inuenio autem dictum angulum part: 8, & minuti vnus. Hunc vero  
 angulum

the former star, A, is 29 degrees 0 minutes from the vernal equinox and that point D, with a latitude of 51 degrees 40 minutes North, which (as I said) gives the arc AD. As for the longitude of the latter, B, let it be at 7 degrees 50 minutes of Taurus. And that at the point F, with latitude of 49 degrees 0 minutes North, is designated by the arc BF. Hence, it is desirable to determine the arc DE, showing by how much E, with the longitude of the new star, exceeds the longitude of the fixed one placed at A, which is at D, so that E gives the longitude of the new star in the Ecliptic. I would also like to determine the amount of the arc CE from here so that the distance of this new star from the Ecliptic, which they call the latitude, may also be known. But, in order that we may arrive at the determination of these through the knowledge of spherical triangles, by due process, I consider first of all the triangle AGB, the two sides of which are joined at the pole G and are known by the complements of the fixed latitudes GA, namely 38 degrees 20 minutes and GB 41 degrees 0 minutes. It is also known, being an angle enclosed by two sides. The arc DF is measured for them, namely the difference of the fixed length of both, which is 8 degrees 50 minutes. Hence, from the twenty-eighth proposition<sup>2</sup> in the fourth book of John Regiomontanus on spherical triangles, the arc AB is known and found to be  $6\frac{1}{4}$  parts which I also observed by means of an instrument, taking the separation of the two fixed points.

Thus, the aforementioned triangle, AGB, has all its sides known. Hence, by the last proposition<sup>3</sup> of the fourth book of Regiomontanus on triangles, or the third<sup>4</sup> of his fifth book, and the thirteenth<sup>5</sup> of the same of Copernicus, angle BAG will be manifested. I found this angle, by the perfect operation of numbers, according to the propositions cited, as 3 parts 46 minutes. Now also, by a similar calculation, let me measure the angle of the triangle CAB, which is at A, for all the sides of this are known from the preceding: CA, 5 parts 21 minutes, CB, 5 parts 1 minute, AB, 6 parts 15 minutes. Therefore, from the referenced propositions, angle CAB is 49 parts 52 minutes. From angle BAG previously found, I compute it as a part of the whole with the difference, CAG, being 61 parts 44 minutes.

Now I proceed to triangle CAG whose angle, at A, is already known since the two sides of the target angle, comprising GA and AC, are known from above. Therefore, utilizing proposition 28 in the fourth book of Regiomontanus on triangles, the remaining side of the GC will be known, namely, 38 parts 4 minutes. Hence, arc GC, the complement of the latitude of the new star. When measured using a quadrant, the true latitude of the star, namely, arc CE, was 53 parts 56 minutes. But, for the longitude of this star to be determined, angle DGE, already known from all the sides of the triangle GAC, I did the computation using proposition 34 of the fourth book or the third of the fifth book of Regiomontanus on triangles. I found said angle to be 8 parts 1 minute.

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<sup>2</sup>When the two sides enclosing a given angle of a nonright [spherical] triangle are known, the remaining side and the other angles may be found. [2]

<sup>3</sup>In any [spherical] triangle that has three known sides, the three angles may be found.

<sup>4</sup>When three given sides of a spherical triangle are constructed from the arcs of great circles, all the angles of this triangle may be determined.

<sup>5</sup>If all the sides of a [spherical] triangle are given, the angles may be found. [1]

angulum metitur arcus DE, differentiam longitudinis nouæ stellæ a longitudine prioris fixarum representans. Quapropter adiecto hoc arcu, partium, vt dixi, 8 & 1 Minuti ad longitudinem prioris fixæ, quam aſumpſimus eſſe in 29 G, 0 Min.  $\vee$ , euadit locus longitudinis ||  
 B4<sup>r</sup> nouæ stellæ in 7. G  $\gamma$  & Min: 1. Latitudinem habens ab Ecliptica  
 ſupra inuentam 53 Part: 56. Minu. quod erat demonſtrandum. Hac  
 itaque ratione, locum longitudinis & latitudinis huius noui ſideris,  
 beneficio doctrinæ Triangulorum infallibilij methodo inquiſiuimus.  
 Proceſſum vero operationis, in inquirendis angulis & lateribus Tri-  
 10 angulorum quibuſue iam commemoratis, iuxta citatas huius doctrinæ  
 propoſitiones, non eſt huius loci plenius explicare, tum quod prolixius,  
 & nimis perplexum fieret hinc totum negotium. Bona enim pars pro-  
 poſitionum libri quarti Regiomont. in hoc opere abſumitur, eo quod  
 omnes, more Geometrico catenatim cohæreant: tum etiam quia diui-  
 15 nior & excellentior ſit Triangulorum ſphæricorum cognitio, quam ſas  
 ſit eius myſteria omnibus propalare. Licet vero non ignorem ſtellarum  
 octauæ orbis loca, non eſſe ſatis exquiſite cognita, vnde fieri poteſt quod  
 loca fixarum, quibus in hac demonſtratione tanquam fundamento uſi  
 ſumus, non præciſe eum, quem aſumpſimus habeant longitudinis &  
 20 latitudinis locum, quapropter locus huius nouæ stellæ, etiam paulo  
 aliter forte conſtituendus eſſet, tamen quia ipſemet in harum fixarum  
 locis, nihil certi obſeruatam habeam, nolui a Ptolomæj & Copernici  
 annotatione recedere. Quin potius, cum illis, quam Alphonſina farrag-  
 ine ſentire, eo quod obſeruatione crebra didicerim, Copernici motus  
 25 propius cœlo accedere, quam aut Alphonſinas aut vllas alias cœle-  
 ſtium motuum tabulas. Confido autem locum || huius stellæ a nobis  
 aſignatum, & beneficio cæterarum fixarum inuentum, non multum  
 a vero aberrare, & dabo operam, ſi Deus vitam prorogauerit, vt loca  
 fixarum ex propria obſeruatione aliquando emendata, in communem  
 30 Aſtronomorum vtilitatem publicentur.

Ex hac inuenta huius Nouæ stellæ longitudine & latitudine, ipſius  
 etiam declinationem, ſiue quod idem eſt, ab Æquatore remotionem  
 minimam, beneficio ſphæralium Triangulorum, inueni Part: 61 Min:  
 58. Quemadmodum per inſtrumentum etiam oculari obſeruatione  
 35 facta, illam eiufdem exquiſite quantitatis inueni. Pari quoque ratione  
 ex nota declinatione & longitudine data, eius aſcenſionem rectam in-  
 quiſui G. 0. M. 22. Vnde hæc stella cum 20. Min. primi Gradus  $\vee$ .  
 cœlum culminat, cum verticij proxima eſt: & cum totidem  $\underline{\Omega}$ , denuo  
 Meridianum tranſit Horizonti vicina. Eſt itaque locus eius circulo,  
 40 quem Colurum Æquinoctiorum vocant, ferme coincidens: idque iuxta  
 limites viæ lacteæ, Caſiopeiæ, & Cepheo interiectos. Verticalis autem  
 eſt illis in terra locis, quæ eleuationem poli Arcticij 62. G. minus 2. M.  
 habent.

But this angle is measured by the arc DE, being the difference in the longitude of the new star from the longitude of the former fixed one [A]. Accordingly, adding this arc of 8 parts and 1 minute, as I said, to the longitude of the former fixed [A], which we assumed to be at 29 degrees 0 minutes of Aries, the longitude of the new star turns out to be at 7 degrees 1 minute of Taurus. It can be shown, from the above, that its latitude from the Ecliptic is 53 parts 56 minutes. In this manner, therefore, we investigated the place of longitude and latitude of this new star, using an infallible method in accordance with the doctrine of triangles.

However, here is not the place to explain more fully the sequence of operations required for investigating the angles and sides of the triangles already mentioned, according to the referenced propositions of this doctrine, as the whole business would become more lengthy and too complicated.<sup>6</sup> For a good part of the propositions in the fourth book of Regiomontanus, it is assumed, in the present work, that all are linked together in a geometric fashion and also because knowledge of spherical triangles be more divine and excellent than is proper to reveal its mysteries to all.

Although I am not unaware that locations in the eighth world are not known with sufficient precision whence it may be that the locations of the fixed stars that I used in this demonstration have not precisely the latitude and longitude that I assumed so that the location of this new star might be somewhat in error, nevertheless, since I myself have not observed anything certain for these fixed locations, I shall not depart from the data of Ptolemy and Copernicus. Much better to agree with them than the hodgepodge of the Alphonsine [tables]. As I had learned by frequent observation, the Copernican motions come nearer to heaven than either the Alphonsine or any other tables of celestial motions. But I trust that the place of this star assigned by us, and found with the benefit of the other fixed points, will not deviate much from the truth and I shall do my best, if God prolongs my life, to publish the places of the fixed points, sometimes corrected from my own observation, for the common benefit of astronomers.

From this determination of the longitude and latitude of this new star, I also found its declination or, what is the same, the smallest distance from the Equator, by virtue of spherical triangles, to be 61 parts 58 minutes. With a precise instrument and with an observation by eye, I found it of the same exact size. In the same manner, given the known declination and longitude, its right ascension was found to be 0 degrees 22 minutes. Thus, this star, with 20 minutes of the first degree of Aries, culminates in the sky when it is near the vertical and, by the same amount, Libra transits the meridian close to the horizon.<sup>7</sup> Its place therefore is nearly coincident with the circle that they call the Equinoctial Colure and near the limits of the Milky Way, in between Cassiopeia and Cepheus. But it is vertical for those places on Earth that have a North pole elevation of 62 degrees minus 2 minutes.

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<sup>6</sup>see [Uraniborg Math Handbook](#)

<sup>7</sup>in the Spring, when Libra is visible at night

habent. Tanta enim est stellæ (vt dixi) declinatio. Atque hæc de nouæ illius stellæ positu, tam quo ad fixas, quam quo ad Ecclipticæ longitudinem et latitudinem, ipsūque Æquatorem, sufficienter, & dicta & demonstrata esse arbitror. Hunc autem positum seruauit toto tempore, ex quo illam primo conspeximus, nec vllō minuto (sæpenumero facta 5 diligenti obseruati-||one) hinc progreda est, elapsis iam mensibus sex. C<sup>r</sup> Quapropter in posterum etiam eodem in loco permanfuram, nec vllō alio motu proprio, quam stellarum fixarum, communi octauæ sphæræ, progreduram auguror.


## DE SITV EIVS, QVO AD MVNDI 10 DIAMETRV M, ET DISTANTIA A TERRA CENTRO VNIUERSI.



**A**RDUUM est, subtilique indiget ingenio, stellarum a nobis indagare remotionem, propter incredibilem earum a terra distantiam: nec vlla ratione commodius & certius 15 id prestari potest, quam per paralaxeos, si quam habent, mensuram. Si enim stella aliqua horizonti vicina, alio in loco cernatur, quam vbi altissima vertici appropinquat, necessarium est eam reperiri in aliquo orbe, respectu cuius terra sensibilem habeat magnitudinem. Quam vero longe remoueat dictus 20 orbis, paralaxeos quantitas semidiametro terræ collata, manifestabit. Sin vero stella tam iuxta horizontem, quam verticem, in eodem primj mobilis puncto cernatur, non dubium est, eam, vel in octaua Sphæra, vel non longe infra, in orbe, cuius respectu tota terra punctj vicem gerat, locum obtinere. Vt || igitur nobis ea ratione innotesceret, vtrum hæc C<sup>v</sup> stella in Elementari regione, aut inter cœlestes orbes existeret, qualemque ab ipsa terra haberet distantiam, indagauimus an vllam, & quantam, haberet paralaxin, idque hoc modo. Interuallum inter hanc & Schedir Casiopeiæ (eo quod hæc stella fere cum noua, Meridianum vnâ obtineat) obseruauim cum verticj proxima esset, 6 tantum gradibus 30 ab ipso zenit remota (ideoque nullam, etiam terræ propinqua in eo loco induceret paralaxin, sed locus eius visus & verus in vnum punctum propter fere coincidentes a terræ centro & superficie lineas, vnitur). Idem præstiti cum longissime a zenit remota, Horizonti proxima esset: & vtrobique eandem præcise a dicta fixa inuenj distantiam nullo minuto variatam, partium videlicet 7 & 55 Minutorum. Idemque per alias 35 stellas multiplicj facta obseruatione expertus sum: vnde hanc nouam stellam nullam habere aspectus diuersitatem, etiam Horizontj vicinam, concludo. Alias enim in minima sua altitudine longius remota fuisse a prænominata

For so great is the declination of the star (as I said). As for matters concerning the position of that new star, I think I have sufficiently established the longitude and latitude with respect to the Ecliptic as well as to the Equator. But it kept this position all the time since we first saw it (repeatedly confirmed through diligent observation), and it advanced not even one minute therafter, six months having already elapsed. Therefore, I predict that it will remain in the same place in the future and will not be moved by any other proper motion than the progression of the fixed stars common to the eighth sphere.

## Concerning Its Location Relative to the Diameter of the World and Its Distance From Earth at the Center of the Universe

T is difficult, and requires painstaking ingenuity, to determine the remoteness of the stars from us on account of their incredible distance from the Earth nor can this be accomplished by any method more convenient and more certain than by means of parallaxes, if they have any. For, if any star close to the horizon is seen in a place other than where it is when approaching its highest verticality, it is necessary to locate it in some sphere relative to which the Earth has an appreciable size. But how far said globe is removed, the amount of parallax added to the semi-diameter of the Earth will show. If, however, a star is seen both near the horizon and at the vertical in the same *primum mobile*<sup>8</sup> point, there is no doubt that it must maintain its place, either in the eighth sphere or not far below, in an orb with respect to which a point may be carried about the whole Earth. Therefore, in order to make it known to us whether this star was in the elementary region or among the celestial spheres, and what distance it had from the Earth, we inquired, in this fashion, whether it had a parallax and how much.

The separation between this [star] and Schedir of Cassiopeia (since this star and the new one are almost on the meridian) I observed when it was close to the vertical, only 6 degrees removed from the zenith. (Therefore, it would introduce no parallax, even close to the Earth, in that position. Rather, its position was visible and true, united in a single point because of the almost coinciding lines from the center of the Earth and from the surface.) I carried out the same thing when it was far removed from the zenith and was near the horizon. And, in each case, I found precisely the same separation from the aforementioned fixed separation, varied by not even a minute, namely, 7 parts 55 minutes.<sup>9</sup> And I have experienced the same thing with other stars, from multiple observations whence I conclude that this new star has no difference in appearance, even near the horizon. These others, at their smallest altitude, would have been farther removed

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<sup>8</sup>the “sphere” supposedly responsible for diurnal rotation

<sup>9</sup>This is his 1573 measurement. See page 48 for his later, improved measurement. (The correct value, to the nearest minute, is 7°50')

a prænominata stella in pectore Caſiopeæ, quam in altitudine maxima. Quapropter non in Elementarj regione infra Lunam, ſed longe ſupra, in orbe, cuius reſpectu terra ſenſibilem non obtineat magnitudinem, collocarj hanc ſtellam neceſarium erit. Si enim in ſuprema  
 5 aëris regione infra concavam ſphæræ Lunarj regionem eſet, ſenſibilem induxiſet in circulo altitudinis variationem, horizontj proxima,  
 C2<sup>r</sup> ab eo loco quem obtinebat verticj vicina. Deſcribatur enim certioris  
 demonstrationis cauſa, circulus repræſentans Meridianum, vel aliquem  
 10 alium verticalem primi mobilis, in quo loca omnium ſtellarum  
 confiderantur, qui ſit CBDE, cuius centrum ſit A: Diameter vero BE  
 verticem, CD Horizontem deſignet: ſit inſuper eodem centro deſcriptus  
 circulus MKL, qui terrenj orbis circumferentiam denotet. Inter  
 hos alius ſignetur circulus GHFI, qui inſimum ſphæræ Lunæ & terræ  
 15 proximum repræſentet ambitum, in quo ſtellam hanc exiſtere fingamus:  
 ſitque primum in maxima ſua altitudine iuxta punctum G: Mani-  
 feſtum eſt quod careat omni diuerſitate aſpectus. Ambæ enim lineæ  
 a centro terræ, & oculo in eius ſuperficie conſtituto educæ, in vnum  
 eundemque primi mobilis circuli, videlicet CBDE cadent locum, in  
 punctum videlicet B, vel prope, ſi ſtella non ſit præciſe in G. Hæc enim  
 20 6 gradibus a vertice remouetur, cum nobis altiſſima ſit, qui tamen nullam  
 ſenſibilem inducunt variationem ab ipſo vertice. Conſtituatur  
 vero hæc ſtella in eodem circulo GHFI, in minima ſua altitudine,  
 idque in puncto O, neceſarium erit eam in alio loco extremj circulj  
 videri, ſi oculus conſtituatur in K ſuperficie terræ, quam ſi in A eiuf-  
 25 dem centro. Duçtis enim lineis a K ſuperficie, & a centro terræ A, per  
 O locum ſtellæ, in extremum orbem BDEC cadet linea ab A per O  
 in P: a K vero per idem O in Q. Eſt igitur PQ, arcus primi mobilis,  
 ſtellæ aſpectus diuerſitatem oſtendens. ||

C2<sup>v</sup> Lubet itaque inueſtigare quantitatem arcus PQ, vt innotefcat quan-  
 30 tam habet hæc ſtella diuerſitatem aſpectus Horizonti proxima, ſi in  
 circulo IGHF proxime infra orbem Lunæ conſtitueretur in puncto O. ||

C3<sup>r</sup> Idque vt commodius fiat, producat ſit lineam QOK, donec alia a centro  
 A producta, illj perpendiculariter incidat, ſitque hæc in puncto R. Cum  
 35 vero angulus BKQ notus ſit per obſervationem: eſt enim complementum  
 altitudinis minimæ, ipſius ſtellæ, videlicet, partium 62, Minut. 5,  
 non ignorabitur ei contrapofitus RKA ipſi æqualis. Eſt inſuper angulus  
 KRA ex hypotheſi reëtus: & latus KA notum eſt per meſuram  
 quamcumque: eſt enim ſemidiameter ipſius terræ: non ignorabitur  
 AR, per 29 propoſitionem Regiomontanj de triangulis planis. Si itaque  
 40 ponatur ſemidiameter terræ KA, partium 100000, tanquam ſinus  
 totus, cum ſit latus reëtus angulo, qui ad R, oppoſitum, euadit latus AR,  
 partium 88363. Nunc demum concipio triangulum ROA, cuius duo  
 latera



from the star in the breast of Cassiopeia referenced above [Schedir] than at their greatest altitude. Therefore, it will be necessary to place this star not in the elemental region below the Moon but far above, in an orb relative to which the Earth does not attain an appreciable size. For if it were in the highest region of the air below the concave region of the lunar sphere, it would have exhibited a detectable variation in the altitude of its orb near the horizon compared to the place which it occupied when near the vertical.

For a more certain proof, let circle CBDE be described, with center A, representing the meridian or some other vertical [circle] of the *primum mobile* to which the places of all stars are referenced. Let diameter BE describe the vertical, CD the horizon. Moreover, let circle MKL be described, with the same center, which denotes the circumference of the Earth. Between these, let there be another circle, labeled GHFI, which represents the lowest sphere of the Moon and the Earth nearest to the sphere in which we imagine this star to exist.

First, let it be at its greatest altitude near the point G. It is manifest that it lacks all diversity of aspect.<sup>10</sup> For both lines, drawn from the center of the Earth and drawn from the eye on its surface, fall into one and the same place on the *primum mobile* circle, that is, CBDE, at point B, or near it if the star is not precisely at G. For this is 6 degrees distant from the vertical, the highest for us, which, nevertheless, does not introduce any appreciable variation from the vertical itself. But, if this star is placed in the same circle, GHFI, at its lowest altitude, point O, it will be necessary to see it at a different place in the outer circle if the eye is placed at K on the surface of the Earth than if at A in the center of it.<sup>11</sup> For, by drawing lines from the surface at K and from the center of the Earth, A, through O, the place of the star, the line from A through O will fall on the outer circle, BDEC at P but, from K to the same, at Q. It is therefore PQ, the arc of the *primum mobile*, that constitutes the diversity of the aspect of the star.

It would therefore be desirable to investigate the amount of the arc PQ, i.e., to find out how much diversity of aspect this star would have when close to the horizon were it placed in the IGHF circle just below the Moon's sphere at point O. So that this may be done more conveniently, let line QOK be extended, until another [line], drawn from the center, A, intersects it perpendicularly at point R. Let angle BKQ be known from observation; it is the complement of the altitude minimum of the star itself, namely, 62 parts 5 minutes. Not unknown, then, the equal and opposite angle RKA. In addition, angle KRA is a right angle by hypothesis [construction] and side KA is known from any sort of measuring: the semi-diameter of the Earth, or that AR is known from proposition 29 of Regiomontanus regarding plane triangles.<sup>12</sup> Therefore, if the semi-diameter of the Earth KA, is taken to be 100,000 parts, the whole sine opposite the right angle at R, the side AR equals 88,363 parts. Now, finally, consider triangle ROA, of which two

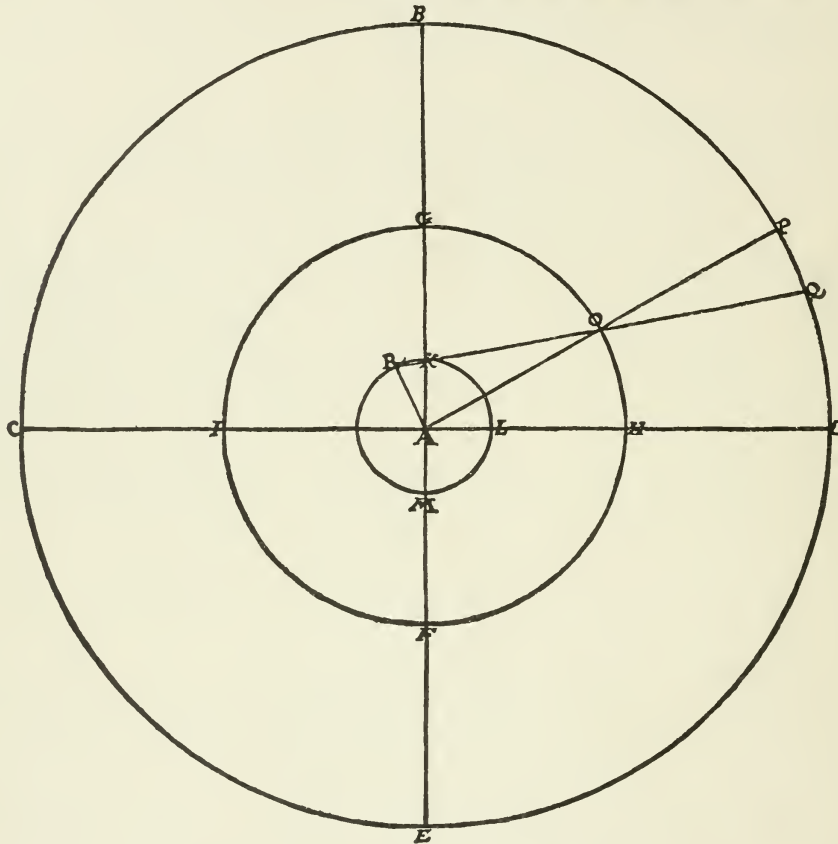
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<sup>10</sup>That is, it is on a line extending to the center of the Earth.

<sup>11</sup>In other words, there will be noticeable parallax.

<sup>12</sup>When one of the two acute angles and one side of a right triangle are known, all the angles and sides may be found.

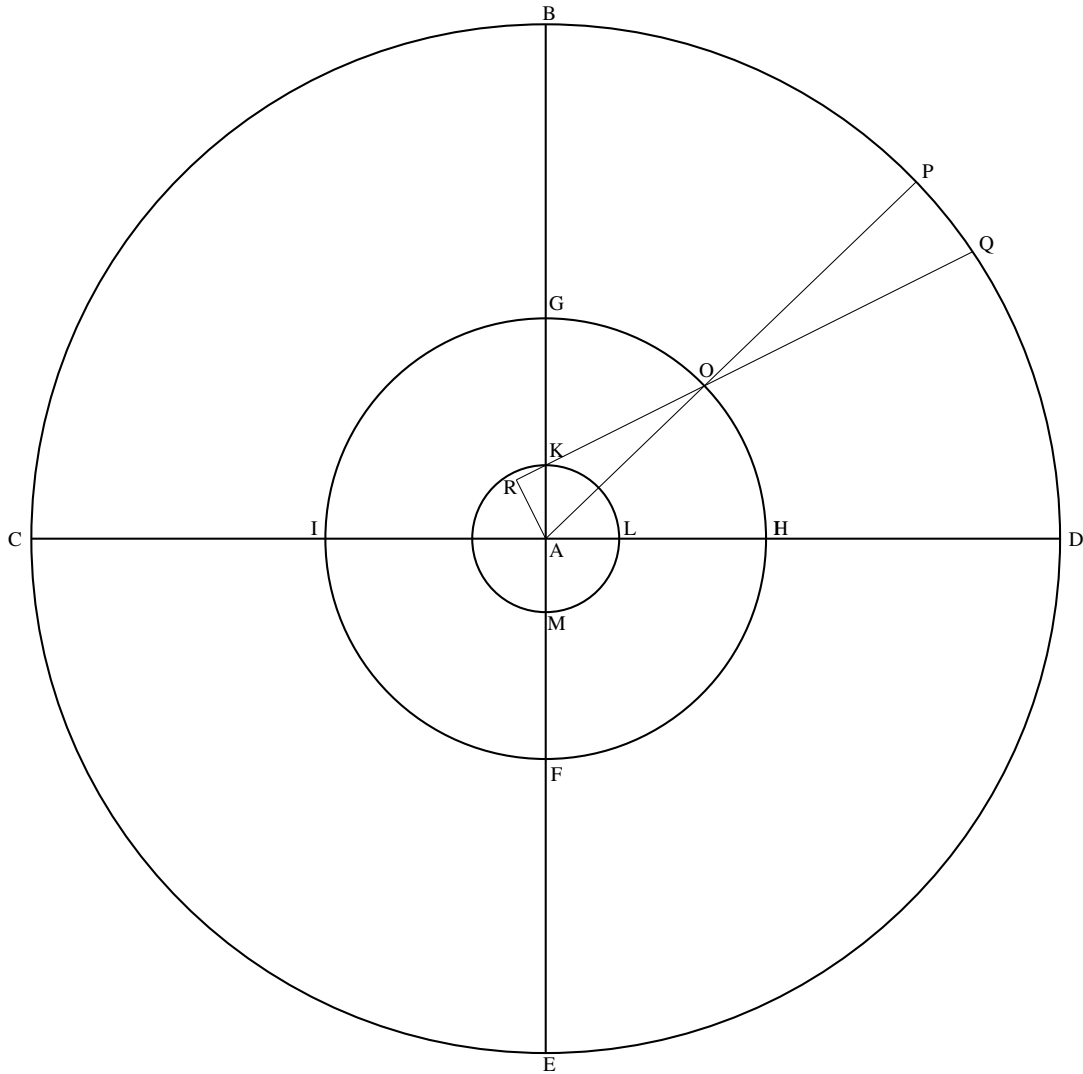
latera RA, & AO, nota sunt. Est enim AO distantia a centro terræ ad infimam superficiem orbis Lunæ, quam vnâ cum Copernico statuimus partium 5200000, qualium semidiameter terræ AK, erat 100000 (lubet enim maioribus numeris negotium hoc abfoluere, vt calculus eo fit commodior & exactius innotefcat) cumque in dicto triangulo angulus 5  
ORA ex hypothefi rectus fit, per 27 propositionem Regiomontanj de



triangulis planis, non latebit angulus ROA. Multiplicato enim latere AR in totum finum, producantur 8836300000, qui numerus per latus AO diuifus, relinquit 1699 partes, finum videlicet angulj ROA, cuius arcus est 0 partium,  $58\frac{1}{2}$  || Minutorum, qui numerus anguli quæfitj C3v determinat quantitatem. Huic vero angulo ROA, æqualis est angulus POQ: est enim illj contrapofitus, vt patet ex elementis Geometriæ. Idcirco arcus PQ, qui hunc angulum metitur (nam propter immenfam distantiam

sides, RA and AO, are known.

Since AO is the distance from the center of the Earth to the lowest surface of the Moon's sphere, which we estimated with Copernicus to be 5,200,000 parts, of which the semi-diameter of the earth AK was 100,000 then, from the hypothesis that ORA is a right angle, by proposition 27 of Regiomontanus<sup>13</sup> on



plane triangles, angle ROA will not be unknown. Indeed, when side AR is multiplied by the whole sine to give 8836300000, which number, divided by the side AO, gives 1699 parts, viz., the sine of the angle ROA, whose arc is 0 parts  $58\frac{1}{2}$  minutes, which provides the value of the angle sought. But to this angle ROA the angle POQ is equal since it is opposite to it as is clear from the elements of geometry. Hence, arc PQ, which defines this angle (since, because of the immense

<sup>13</sup>When two sides of a right triangle are known, all the angles can be found.

distantiam inter Sphæram Lunæ & primum mobile, arcus PQ non  
 differt sensibilibiter ab arcu circuli interuallo OP iisdem lineis inter-  
 cepto) stellæque designat paralaxin, erit minorum  $58\frac{1}{2}$ , quod erat  
 quærendum. Tantam igitur habuisset hæc stella in O posita, aspectus  
 5 diuersitatem, ab eo loco, quem prope verticem obtinebat, in eum vbi  
 Horizonti proxima conspiciebatur. Id autem per multas & diligentes  
 obseruationes (vt supra dixi) factas, exquisito & minime fallaci instru-  
 mento, falsum inuenimus. Vnde concludo hanc nuper visam stellam  
 non esse in circulo IGHF, suprema videlicet æris regione, proxime  
 10 infra Lunæ orbem, nec in aliquo loco adhuc terræ propiore. Tunc  
 enim maiorem induxisset quantitatem arcus PQ, maiorque fieret aspec-  
 tus diuersitas: sed longe supra sphæram Lunæ, in ipso cælo locum ob-  
 tinere, idque in orbe aliquo, tanto interuallo a terra remoto, vt linea  
 KA semidiameter terræ, non habeat respectu eius sensibilem quanti-  
 15 tatem: sed tota terra illi collata nil præter puncti vicem habere animad-  
 uertatur, idque in octaua sphæra, vel non longe ab hac in altioribus  
 trium superiorum Planetarum orbibus fieri, ab artificibus compertum  
 C4<sup>r</sup> est. Vnde hæc stella in ipso cælo, vel in octauo orbe cum || reliquis fixis,  
 vel in proxime huic subiectis sphæris constituetur. Quod autem nec in  
 20 orbe Saturni, nec Iouis, Martis, aut aliorum Planetarum existat, hinc  
 patet, quod elapso iam sex mensium spacio, nullo minuto ab eo loco,  
 in quo primum eam conspeximus, motu proprio progressa est, quod  
 fieri oportebat si in aliquo Planetarum orbe esset. Moueretur enim  
 motu ipsius orbis peculiari, contra primi mobilis rationem, nisi in al-  
 25 tero polorum, orbium secundi mobilis quiesceret, a quo tamen 28 par-  
 tibus, vt supra ostendi, remouetur. Toti enim orbis proprijs polis reuo-  
 luti, sua circumducunt sidera, vel ab illis, (vt Plinio & quibusdam alijs  
 placere video) circumaguntur. Nisi quis receptam a Philosophis &  
 Mathematicis sententiam negare velit, solasque stellas immotis orbi-  
 30 bus conuolui (quod absurdum est) asserere. Vnde si hæc stella in aliquo  
 orbium septem errantium siderum constitueretur, necessario cum ipso  
 orbe, cui affixa esset, contra diurnam reuolutionem circumduceretur.  
 Atque hic motus etiam in lentissimo Saturni orbis progressu tanto tem-  
 poris interuallo, etiam absque omni instrumento intuenti animad-  
 35 uerteretur. Quapropter hæc stella noua nec in Elementari regione in-  
 fra Lunam, nec in orbibus septem errantium siderum, sed in octaua  
 sphæra inter reliquas fixas locum habet, quod erat demonstrandum.  
 Hinc sequitur illam non esse aliquam peculiarem Cometarum speciem,  
 nec quoduis aliud apparens igneum Meteoron. Hæc enim omnia  
 C4<sup>v</sup> non in ipso cælo generantur, sed infra || Lunam in superiorj æris re-  
 gione existunt, vt omnes testantur Philosophi: nisi quis cum Albategi-  
 nio statueret velit, Cometas, non in aëre, sed in cælo nasci. Ille enim se  
 Cometam

distance between the sphere of the Moon and the *primum mobile*, the arc PQ does not differ significantly from the arc of a circle intercepted by the same lines OP) it determines the parallax of the star. It will be  $58\frac{1}{2}$  minutes, which was [the quantity] sought. This star, therefore, having been placed in O, had such a diversity of aspect that, from the place which it occupied near the vertical, it was visible to one near the horizon. But this, after many careful investigations (as I have discussed above), made with a precise and trustworthy instrument, we found to be false. I conclude that this recently seen star is neither in circle IGHF, that is, in the uppermost region of the air, immediately below the orb of the Moon, nor in any place still nearer to the Earth. For then it would have introduced a larger value to the arc PQ and the diversity of aspect would have been greater. Rather, it occupies a place far above the sphere of the Moon, in some orb in the sky itself, and so distant from the Earth that line KA, the semi-diameter of the Earth, is negligible in relation to it. But it was discovered by experts that the entire Earth combined appears as nothing but a point from the eighth sphere or, not far from it, from the higher spheres of the three higher planets. Whence this star is situated in heaven itself or in the eighth orb with the remaining fixed [stars] or near this sphere. But the fact that it exists neither in the orb of Saturn nor of Jupiter, Mars or any of the other planets is evident from this: that, after a period of six months had already passed, it had advanced in its own motion not even a minute from the place in which we first caught sight of it, which would have happened were it in any planetary orb. For it would be moved by the motion of the specific orb itself, opposite to the direction of the *primum mobile* unless it resided at another of the poles of the orbs of the *secundum mobile*<sup>14</sup> from which, however, it would have moved 28 parts as was shown above. For all the orbs, revolving about their own poles, circumnavigate their stars, or are circumnavigated by them (please see Pliny and some others). Unless someone wants to deny the received opinion of Philosophers and Mathematicians and to assert rather that only stars are moved by motionless spheres (which is absurd).

Therefore, were this star situated in some orb of the seven planets, it would necessarily revolve with the very orb to which it was fixed, contrary to the diurnal revolution. And, even for the very slow progression of the orb of Saturn, this movement would be noticed over such an interval of time even without any instrument for observation. For this reason, this new star has no place in the elemental region below the Moon nor in the orbs of the planets but in the eighth sphere among the rest of the fixed [stars]. Q.E.D.

From this, it follows that it is not a particular kind of comet nor does it appear to be anything like a fiery meteor since all these things do not originate in heaven itself but exist below the Moon, in the upper region of the air, as all Philosophers attest. Unless one wishes to agree, with Albatignius, that comets are born not in the air but in the sky.

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<sup>14</sup>the “sphere” supposedly responsible for periodic retrogressions

Cometam supra Lunam in sphaera Veneris obseruasse existimat: quod an fieri possit, nobis nondum constat: Sed Deo dante aliquando, si nostra aetate aliquis extiterit Cometa, eius rei certitudinem inquiremus. Hoc etsi verum esse ponamus (quod vnâ cum omnibus Philosophis vix admitto) tamen non sequitur hanc stellam Cometarum esse speciem: tum propter ipsam formam, quam habet cum veris stellis communem, & ab omnium hactenus visorum Cometarum figura dissimilem: tum quod nullo motu proprio, tanto tempore, vel in latitudinem, vel in longitudinem processit, vt in Cometis fieri animaduersum est. Licet enim hi aliquando in vno loco per aliquot dies quiescere videantur: tamen non ita diu, nec ita exacte, diligenter per instrumenta exquisita obseruatione facta, eundem seruant positum. Concludo igitur hanc stellam, non esse vllam Cometarum speciem, vel aliquod igneum meteoron, siue infra Lunam, siue supra generentur: sed lucentem in ipso firmamento esse stellam, nulla aetate a mundi exordio ante nostra tempora prius conspectam. Atque hæc de stellæ eius situ, tum quo ad zodiacum, tum quo ad mundi diametrum, & cœli orbis, sufficienter dicta demonstrataque existimo: nunc ad reliqua progrediar. ||

## DE EIVSDEM MAGNITVDINE, LVMINE, ET COLORE.




MAGNITUDO stellarum duobus modis ab artificibus consideratur: vno, quo ad visibilem & apparentem diametrum: altero, quo ad veram, quam in ipso cœlo habent quantitatem. Licet enim stellæ nobis admodum conspiciantur exiguæ, & non aliter quam paruæ faces in cœlo lucentes appareant: tamen per ingeniosas Mathematicorum obseruationes compertum est, eas non solum totj terrestri globo æquales esse, sed longe illum sua magnitudine excedere: adeo vt vix aliqua tam exigua in firmamento conspiciatur stella, quin decies octies, ad minimum, terrenam molem exuperet: vt taceam aliquas primum honorem obtinentes, centies quinquies terram magnitudine excedere. Id licet multis incredibile videatur: tamen immensam earum a nobis distantiam considerantj nullum mouebit dubium. Quapropter etsi hæc noua stella, exigua quo ad visum appareat: tamen reuera ingentem habet magnitudinem. Non tamen semper eiusdem apparuit quantitatis. Nam ab initio, mense Nouembrj, quo primum conspici cœpit, non solum omnes stellas fixas, sed ipsos etiam Planetas, et quidem Iouem tum terræ proximum, Venerisque illustre sidus, visibili quantitate exsuperauit: || postea paulatim imminuj cœpit, adeo vt mense Decembrj,

For he thinks that he observed a comet above the Moon, in the sphere of Venus. Whether this can happen is not yet clear to us but if, God willing, a comet occurs sometime during our age, let us investigate this assertion.

Even if we suppose that this is true (which, along with all Philosophers, I scarcely admit), nevertheless, this star does not have the appearance of a comet both because of its very form which it has in common with true stars and, unlike the shape of all comets seen hitherto, because it progressed without any motion of its own, either in latitude or in longitude, as has been observed for comets. For, although these sometimes seem to stay in one place for several days, yet not so long nor so exactly do they maintain the same position when carefully observed using meticulously constructed instruments. I therefore conclude that this star is not any kind of comet or any fiery meteor, whether below or above the Moon but to be a star shining in the firmament itself, something never seen in any age since the beginning of the world until our time.

I think that I have sufficiently discussed and demonstrated those matters concerning the position of this star, both in relation to the zodiac and also in relation to the diameter of the world and the celestial spheres, so let me now proceed to the rest.

## **Concerning the Same with Regard to Size, Luminosity and Color**

HE size of stars is determined by experts in two ways: one, from the visible and apparent diameter, and another, from the actual value that it has in heaven itself. For although the stars as visible to us are very small, and appear no different from little torches shining in the sky, nevertheless, by ingenious observations of Mathematicians, it has been discovered that they were not only equal in size to the whole globe of the Earth but far exceeded it, so much so that scarcely any star that is visible in the firmament is so small that it would not exceed the mass of the Earth by at least a hundred and five times. This may seem incredible to many yet, considering their immense distance from us, there is no doubt.

Therefore, although this new star may appear small to the eye, it is really of great size. However, it did not always appear of the same size. For, from the beginning, in the month of November when I first saw it, its visibility exceeded not only all of the fixed stars but also the planets themselves, even Jupiter, then the neighbor of the Earth, and Venus, a brilliant star. Afterwards, it began to decrease little by little, so much so that by the month



Decembrj, Ioui fere æquaretur: in Ianuario, illo paulo minor, et fixis primj honoris maior, quibus in Februario et Martio æqualis apparuit, confpiceretur. Demum etiam plus imminuta est, adeo vt hoc tempore in initio nimirum Maij, stellas secundi honoris non excedat. Quemadmodum vero quo ad visibilem diametrum hac ratione imminuta est, sic etiam quo ad veram, variatam esse consentaneum est. Ab initio autem quando longe excedebat stellas primæ magnitudinis, incredibilj quantitate totam Terræ molem superabat. Nam si stellæ fixæ primæ magnitudinis, Terram (iuxta Mathematicos) centies quinquies exuperant, & hæc noua tantundem a Terra, quantum illæ (vt supra demonstrauimus) remouetur, maioremque longe obtinuit visibilem diametrum, necessario etiam longe plus centenis vicibus molem, quam Terra & Maria efficiunt, ab initio exceßit. Sed progressu temporis imminuta, iam non maior esse poterit ipsa Terra, quam sunt stellæ secundi honoris.

Lumen vero stellæ, confpicitur esse præ cæteris fulgidum & radians: adeo vt ab aliquibus in initio etiam interdiu iuxta meridiej tempus, cælo nulla aëris densitate offuscato, nonnunquam cerneretur. Scintillat etiam, vt reliquæ stellæ fixæ, & plurimum. Vnde etiam patet eam non esse inter orbis planetarum, sed in sphæra octaua vna cum reliquis fixis (prout supra quoque asseruimus) collocarij. Planetæ enim non scintillant, sed solum stellæ fixæ, & inter eas aliquæ magis, aliquæ vero minus: siue quod earum maxima a nobis remotio hoc efficiat per aërem intermedium, vt quidam opinantur, quod tamen non credo: alias enim Saturnus Apogeus, cum proximus est stellis fixis, etiam scintillaret: siue quod fixa sidera super propria centra perpetuo circumgirantur, & inde pro aëris qualitate scintillationem aspectuj immittant, vt potius cum Platonicis statuo.

Quantum vero ad colorem huius stellæ attinet, non semper eundem retinuit, sed ab initio albicans videbatur, & propius Iouiali splendori acceßit: progressu autem temporis, lumine coarctato & inspissato, in rutilantem & Martium fulgorem degenerauit: qualis est Aldeboræ, aut illius, quæ in dextro humero Orionis rubescit. Non tamen vsque adeo rutilans fuit, quemadmodum hæc in humero, sed propius ad colorem Aldeboræ acceßit. Nunc autem relicto isto Martio rubore, in liuidam transiit albedinem, ita vt hoc mense Maio, quiddam Saturnium & Veneri simile præ se ferat.

Quod autem hæc stella tam magnitudinem quam colorem, vt diximus, sensibilibiter mutauerit, id non sufficienter probat, eam in Elementari regione, infra orbem Lunæ collocarij, & peculiarem esse quandam Cometarum speciem, vel aliam quamuis igneam exhalationem. Si enim possibile fuit, nouum aliquod corpus, in ipso æthere generari, quod

of December, Jupiter was almost its equal. In January, it was seen to be a little smaller than that and greater than the fixed stars of the first rank with which it appeared equal in February and March. Finally, it was even more diminished so that, at the current time, the beginning of May, it does not exceed stars of second rank. But, just as the visible diameter was reduced in this manner, so also its true [diameter] varied consistently with this. But, at the beginning, when it far exceeded stars of the first magnitude, it exceeded the whole mass of the Earth by an incredible amount. For, if the fixed stars of the first magnitude had exceeded the Earth a hundred and five times (according to Mathematicians), and this new one was as distant from Earth as the former (as we have shown above) and manifested a far greater visible diameter, it necessarily also exceeded the mass of the land and seas far more hundreds of times initially. But, diminished by the progress of time, the Earth itself could be no greater than stars of the second rank.

Indeed, the light of [this] star is seen to be brighter and more radiant than other [stars], so much so that it might be distinguished from those others, sometimes being perceived at the beginning of the day or even near noon when the sky was not obscured by any density of air. It also sparkles, like the rest of the fixed stars, and very much. Accordingly, it is also evident that it is not among the orbs of the planets but is located in the eighth sphere with the rest of the fixed [stars] (just as we claimed above). For the planets do not sparkle, only the fixed stars, and among them some more, some less or that those of greatest distance from us are affected by the intervening air, as some think, which, however, I do not believe. Otherwise, Saturn at apogee, when it is nearest to the fixed stars, would also sparkle. Or, that the fixed stars are perpetually revolved around their own centers, and thence send out a scintillation in appearance due to the quality of the air. Rather, I concur with the Platonists.

As regards the color of this star, it did not always stay the same but, at the beginning, it was seen to be white and came close to the brightness of Jupiter but, over time, the light became constrained and dull and degenerated into a reddish, Martian brightness such as Aldebaran, or that which blushes on the right shoulder of Orion [Betelgeuse]. It was not, however, as glowing as this one on the shoulder but came close to the color of Aldebaran. But now, having left that red of March, it changed to a livid white so that, in this month of May, it looks similar to Saturn and Venus.

But, as we have said, the fact that this star has appreciably changed both its size and its color does not sufficiently prove that it is placed in the elemental region, below the orb of the Moon, and that it is a peculiar kind of comet or some other fiery exhalation. For, were it possible for some new body to be generated in the ether itself,

quod de hac stella supra infallibilibus demonstrationibus, contra omnium Philosophorum || sententias & decreta, probauimus: longe minus D 2<sup>v</sup> impossibile & absurdum censebitur, hanc ipsam nouam stellam, aliquam alterationem magnitudinis & coloris admittere. Imo vero, quemadmodum illa aliquando in cœlo, præter communes Naturæ Leges 5 extitit, ita etiam si in eodem aliquando, contra easdem Naturæ Leges conspicj (vt credibile est) desinat, non video, quid priori, hinc magis absurdum consequatur.

## ASTROLOGICUM IUDICIUM DE EFFECTIBUS HUIUS NUPER NATÆ STELLÆ

10



TSI de effectibus huius stellæ aliquid certj constituere longe superet Astrologiæ metas, & verisimile sit, Deum, maius quippiam per hanc, mundo ostendere, quam beneficio vllius scientiæ Physicæ a quouis mortalium præsciri possit: tamen breues coniecturas ab Astrologiæ fontibus petitas subiungam, quatenus nonnulla huius artis beneficio præsciri possibile est, & mihi cognita pro temporis breui occasione in mentem veniunt: nihil hac in parte derogantes Theologorum, vel aliorum quorumuis sententiæ, nec nostras coniecturas pro Edictis prætoriiis aut oraculis vendentes. Verisimile est autem, quemadmodum || huius stellæ miraculum, præ omnibus, quæ a mundj exordio facta sunt, est rarissimum & maximum: sic etiam rarissimos & D 3<sup>r</sup> maximos habituram hanc stellam effectus. Quapropter illam plus ostenti habere iudico, quam vlli superiorum Planetarum congressus, etiam illj, quos vocant maximos: aut vllæ luminarium quantæcumque eclipses: vel vllæ aliæ, quouis modo stellarum in cœlo congressus aut configurationes. Hæc enim omnia, etsi magnas in hunc inferiorem mundum habeant potestates, vt indies veri experiuntur Artifices: tamen, quia crebrius fiunt, & naturali ordine, non tantas habere possibile est significationes, quantas hæc recens nata stella, quæ præter omnem Naturæ ordinem, nunc primum in cœlo extitit, omnesque reliquas fixas, sua magnitudine & luminis fulgore plurimum exuperat. Qui vero & quales futuri sint huius stellæ effectus, admodum difficile est ex Astrologiæ fundamentis indagare. Hæc enim Ars, ex multiplici, & raro fallenti experientia, suas constituit Conclusiones, nec nisi semel, tempore Hipparchi factum esse legimus, quod noua in cœlo prodierit stella. Vnde ab experientia, iudicium hac in re petere, ambiguum peneque impossibile est. Verisimile tamen esse iudico, quod veluti circa Hipparchi tempora, qui floruit iuxta annum mundj 3840, ante Christum annis

which, regarding this star, we have proved above by infallible demonstrations, contrary to the opinions and decrees of all the Philosophers. One would have thought it far less impossible and absurd to grant this novel star some alteration of size and color. Indeed, if it somehow or other existed in heaven, in spite of the common laws of nature, so what if it likewise exhibited appearances contrary to those same laws of nature (i.e., it is credible). I do not consider that more absurd than the former.

## A Constellation Cassiopeia

*Cassiopeia* is wholly circumpolar above latitude 44 North so it goes from right-side-up to upside-down and back over the course of a day. In the figure below, the image is rotated compared to the plot shown on page 14.

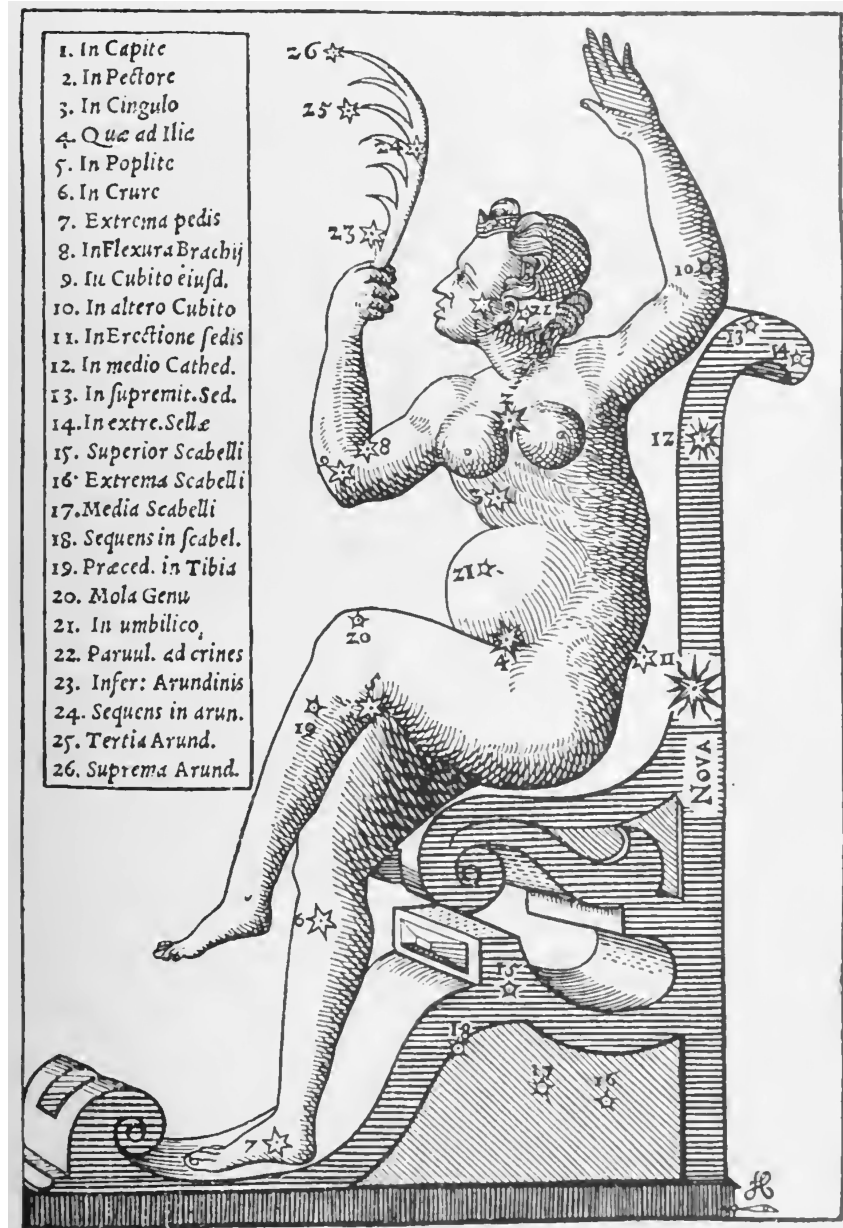


Figure 1: Cassiopeia [4, pg. 319]

Some data for stars referenced later are given in Table 1. Those in the figure on page 14 are shown with a second label in parentheses (legends not completely consistent).

Table 1: Principal Stars in Cassiopeia

| Label  | Tycho              | Symbol     | Current      |               |
|--------|--------------------|------------|--------------|---------------|
|        | Location           |            | RA (HH.MMSS) | Dec (DD.MMSS) |
| 1 (A)  | head               | $\zeta$    | 00.3658      | 53.5349       |
| 2 (B)  | chest              | $\alpha$   | 00.4030      | 56.3215       |
| 3 (C)  | belt               | $\eta$     | 00.4906      | 57.4855       |
| 4 (D)  | flexure            | $\gamma$   | 00.5643      | 60.4300       |
| 5 (E)  | calf               | $\delta$   | 01.2549      | 60.1408       |
| 6      | leg                | $\epsilon$ | 01.5424      | 63.4012       |
| 7 (F)  | end foot           | $\iota$    | 02.2940      | 67.2409       |
| 11 (H) | upturn of the seat | $\kappa$   | 00.3300      | 62.5554       |
| 12 (G) | middle of chair    | $\beta$    | 00.0910      | 59.0901       |
| (I)    | nova stella        | SN 1572    | 00.2518      | 64.0900       |

The position data above are not what Tycho would have observed (due to precession). However, he was measuring only angular separations of the nova from the “fixed” stars of Cassiopeia. Such separations are unaffected by precession.<sup>15</sup>

Tycho’s measurements regarding this nova, visible for about a year, were carried out with a hastily constructed half-sextant<sup>16</sup> which was not as accurate as the instruments that he had available in later years. However, utilizing the latter, he was able, eventually, to publish better data.

<sup>15</sup>but are affected very slightly by proper motion

<sup>16</sup>For Tycho’s description in his *Astronomiae Instauratae Mechanica* (1598), see Appendix B [5, pg. 80].

## B Tycho's Half-sextant

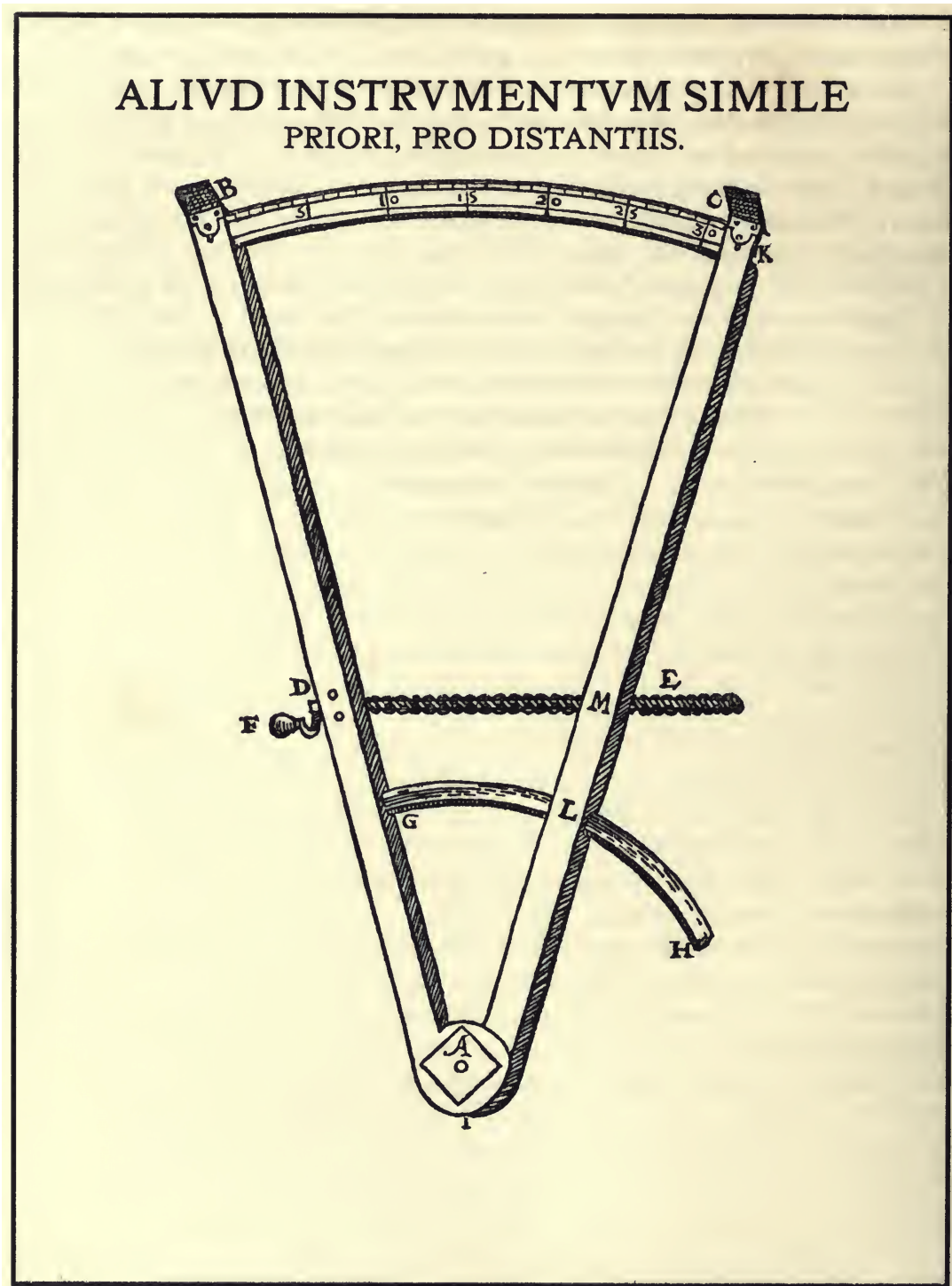


Figure 2: "Another Instrument Like the Previous, for Separations"

D4<sup>r</sup>

EXPLICATIO FABRICÆ ET  
VSVS.



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15  
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30  
35

PARARAM vero jam antea, cum in adolescentia Augustæ Vin-  
delicorum in superiore Germaniâ aliquandiu morarer, simile  
quoddam Instrumentum ex lignea tamen materiâ solummodo  
constans, & fulcro destitutum, cum levitate suâ alias utcun-  
que tractabile eßet. Id vero inde discedens, amplissimæ ejus  
Reip. Consuli Paulo Hainzelio optimæ memoriæ horum studiorum aman-  
tissimo & mihi familiarissimo dono reliqui. Cumque reverso mihi in Patriam  
nova illa & supra modum admiranda stella Cœlitus mox illuxisset, pro ejus  
Distantijs a vicinis Cassiopeæ stellis subtiliter denotandis aliud ejuscemodi  
mihi confieri curavi. Cujus hîc Ideam habes. Arcus ejus, in quo divisiones  
sunt, intelligitur per BC. Estque hic duodecimæ saltem partis unius Circuli,  
sive Graduum 30. eo quod pro minoribus Distantijs, quales hæ erant, de  
quibus diximus, sic sufficeret; nec suâ longitudine gravis aut molestus foret.  
Possunt nihilominus alij etiam Arcus eidem applicari, sive ampliores sive bre-  
viores, prout lubuerit. Regula AB & AC juxta A Centrum conjunctæ, & ibi ad  
invicem convolubiles, ipsamque circumferentiam juxta B & C continentes,  
longitudinem habent 4 cubitorum; latitudinem trium digitorum & crassitudi-  
nem duorum. Sunt enim quadrilateræ; constantes ex ligno apprime sicco ar-  
boris Juglandum: quod mutationi ex aëris qualitate quam minimum præ-  
cæteris est obnoxium. Ubi vero Regulæ circa A Centrum copulantur, Me-  
tallico clavo, foramine etiam & totâ contexturâ laminulis æneis confirmantur.  
Arcus ipse solide est metallicus: non tamen nimis crassus aut latus, ne pon-  
dere noceat: dum sic cavetur, alterationis, cui lignea materia subjacet, ob-  
staculum. Pinnacidia apud BC etiam sunt Orichalcica, & ita adaptata, ut in-  
terius eorum latus interiori quoque Regularum superficiæ præcise correspon-  
deat: & ab alterâ parte inferiori cochlea est, quâ pinnacidium mobile peractâ  
observatione firmatur, donec numeratio in limbo facta sit. Quin & alia quæ-  
dam oblonga cochlea juxta DE, extat, cujus beneficio angulus Instrumenti  
BAC contrahitur & relaxatur, prout exigit intercapedo dimetienda. Et licet  
hæc cochlea in directum eat, potest nihilominus circulari ductui, qui fit circa  
DE supra centrum A sufficere: cum ab alterâ parte, ubi matrices habet, in  
claviculis rotundis convolubiles exhibeat; prout in antecedenti etiam insinua-  
vimus. Quin & intra hanc cochleam versus Centrum oculo adhuc propior est  
circumferentia



## B.1 Explanation of Construction and Use



NCE before, in adolescence, while I was staying in Augsburg in upper Germany, I had fashioned a similar instrument constructed solely of wood and which, being very light and lacking a support, could be moved around to any orientation. Indeed, upon departing and with the fondest memories of these studies, I left it as a most loving and, to me, a most appropriate gift to Consul Paul Hainzel. And when, on returning to my country, with that new and exceedingly wonderful star of the heavens appearing just afterwards, I carefully devised something of the same kind to measure its distance from the neighboring stars of Cassiopeia.

This is the idea. Its arc, in which there are divisions, is given by BC. And here it spans the twelfth part of one circle, or 30 degrees, sufficient to accommodate smaller separations such as those of which we have spoken without being heavy or unwieldy due to its length. If desired, other arcs, whether larger or shorter, may be substituted. Bars AB and AC, joined near the center, A, and there collapsing to each other, and subtending the circumference near B and C, have a length of 4 cubits.<sup>17</sup> These are four-sided with a width of three fingers and a thickness of two. They are formed from especially dry wood of a walnut tree no more subject to change from the quality of the air than is the rest [of the instrument]. The bars are joined at the center, A, with a metallic nail, with the hole and the entire assembly reinforced with brass plates.

The arc itself is solidly metallic but not too thick or too wide lest it be impaired by weight; moreover, so that this alteration, as it affects the wooden material underneath, is not an obstacle. The pinnacidia at B and C are also brass and so adapted that their inner sides correspond exactly to the inner surface of the bars. Underneath, there is a screw by which the movable pinnacidium is secured once the observation has been completed and until the numbering has been done on the scale.

In addition, there is another oblong screw, DE, with the help of which the angle of the instrument, BAC, is contracted and relaxed as the interval demands. Although this screw goes in a straight line, it may nevertheless accommodate a curve which is around DE above the center, A, while on the other side, where there are lists, it exhibits enclosing round pegs just as we have insinuated. Furthermore, inside this screw, towards the center of the eye,

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<sup>17</sup>1 cubit = 40 cm [5, pg. 319]

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circumferentia quædam GLH, priori Regulæ juxta G affixa, & altera apud L  
 transiens, cujus officium est, ambas Regulas in suo plano cohibere, ne ob lon-  
 gitudinem nonnihil diftrahantur. Potest etiam in eodem Arcu a posteriore parte  
 firmari Angulus Instrumenti. Distat vero is a centro quasi pro tertiâ parte  
 longitudinis Regularum, ut commode isthuc applicatâ alterâ manu regi queat 5  
 in eo motus Regularum atque stabiliri. Habet insuper duo manubria ab alterâ  
 parte, quæ hic repræsentari non poterant. Pedestale illi nullum jam tum con-  
 struxeram; sed cum non nimis grave esset Instrumentum, supra fulcrum  
 aliquod transversum firmiter infra positum, poterat in quævis stellarum  
 plana haud admodum difficulter verti & contineri; donec observatio peracta 10  
 foret.

USUS ejus est quemadmodum in priori, applicato oculo ad I & circumactò  
 manubrio F, unaque circumductâ cochleâ DE contrahatur vel dilatetur An-  
 gulus Instrumenti BAC, donec ambo sidera, quorum remotiones quærimus  
 intra pinnacidia B & C ad amussim & centraliter cernantur. Tunc enim Arcus 15  
 pinnacidij & Regulis ibidem interceptus, observatorem voti compotem red-  
 dit. At quoniam centrum visus centro Instrumenti respectu cujus Divisiones  
 procedunt, applicari non potest, prohibente solidâ parte, quæ est ab A in I;  
 idcirco necessarium est, Distantias, oculo Excentrice constituto demensas &  
 in Arcu numeratas justo majores esse ipsi Cælo competunt. 20

Quare ut huic incommoditati subveniretur, Tabellam quandam construx-  
 eram, eandemque ab alterâ Instrumenti parte denotâram, ut semper in  
 promptu esset, quæ Parallaxes Instrumenti suppeditavit, quantum nimirum  
 juxta singulos observationis factæ Gradus subtrahendum esset, ut vera & ipsi 25  
 Cælo consona proveniret intercapedo, atque profus eadem, quæ ex Centro  
 Instrumenti prodiret si centrum visus eidem uniretur. Quâ vero ratione hæc  
 Tabula juxta Triangulorum planorum inductiones concinnata sit, demonstra-  
 tur a nobis in Progymnasmatibus Instaurationis Astronomicæ volumine nostro  
 primo pag. 342 in capite eiusdem quarto; quod alias a pag. 335. usque in 343.  
 luculentam hujus Instrumenti descriptionem exhibet. Ad quod lectorem de 30  
 hoc plura cognoscendi cupidum remitto. Inveniet etiam ibidem paulo post  
 Distantias Novæ stellæ a vicinioribus Cæbiopeæ ac quibusdam alijs, tum quo-  
 que fixarum inter se exactissime eodem Instrumento mensuratas, atque in  
 usum deductas. Nullum enim aliud huic officio accommodum tunc ad manus  
 habebam: utpote nuper e peregrinatione Germanica domum reversus, & 35  
 Pyronomicis potius exercitijs quam Astronomicis tunc occupatus.

Licet

there is another circumference, GLH, one end attached to the first bar near G and the other passing through L, the purpose of which is to restrict both bars to a plane lest they should be somewhat distorted due to their length. The back of same arc can also serve to strengthen the angle of the instrument. Actually, it is separated from the center by a third of the length of the rulers so that the motion of the rulers, as necessary, may be controlled and stabilized using the other hand. It also has two handles on the opposite side which could not be shown here. I had not at that time constructed any pedestal for it but, since the instrument was not too heavy, whenever it was firmly placed on top of some transverse support, it could be turned and held with little difficulty in any of the planes of the stars until the observation was completed.

Its use is the same as with the previous one. With the eye applied at I, the handle F is rotated and the circumscribing screw, DE, contracted or dilated until both of the stars whose separation we seek are aligned at the front and centrally to pinnacidia B and C. At that point, the arc, delimited by the pinnacidia and the rulers, provides the observer with his determination. But, since the center of the view is the center of the instrument as well as the sequence of the divisions, it is not appropriate because of the solid portion which is from A to I. Consequently, it follows that these separations, as measured by an eccentrically situated eye and so quantified in the arc, should really be greater than those proper to the heavens themselves.

Wherefore, in order to remedy this inconvenience, I had constructed a certain table and recorded the same on the other side of the instrument, so that it might always be at hand, which furnished the parallax of the instrument: how much, certainly, should be subtracted from each degree of observation made so that the truth and harmony with Heaven itself would come from the interval, in other words, exactly as it would appear from the center of the instrument if the center of sight were joined to it. That this table is computed in accordance with relations of planar triangles is demonstrated by us in our *Progymnasmata Instaurationis Astronomicae* (vol. I, ch. 4, pg. 342).<sup>18</sup> Elsewhere, pp. 335–343, there is a clear description of this instrument. I leave this to the interested reader. He will also find there, a little later, the separations of the new star from neighboring Cassiopeia and some others and, also, of those fixed stars to each other, measured very exactly by the same instrument and later utilized. For I had, at that time, nothing else available for this task as I had lately returned home from a German pilgrimage and was then more occupied with alchemical endeavors than with astronomical ones.

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<sup>18</sup>*Preliminary Exercises for the Restoration of Astronomy* [4] (see Section B.2)

Licet vero hoc Instrumentum non adeo Excellens sit, atque ea, quæ post-  
 modum fucceßivis aliquot annis excogitavi, & magno labore atque sumptu  
 confieri feci, ideoque postea a me antiquatum: tamen illud qualecunque sit,  
 cum & ufui non incommodum existat, hîc una cum cæteris delineandum  
 5 exponendumque duxi, quo & eorum rationem haberem, quibus operosa  
 illa & sumptuosa adeo Instrumenta, construendi non suppetit facul-  
 tas. Illi itaque hoc contenti rectius & præcisius, quam ante hac  
 per Radium Astronomicum factum est, stellarum scrutabun-  
 tur intercapedines: modo Parallaxin de  
 10 quâ dixi, rite & expedite  
 præcaveant.

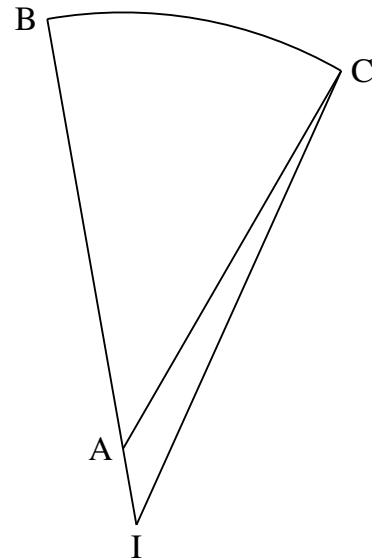


It is true that this instrument is not so excellent and, given those that I subsequently devised over several successive years and to which I devoted a great deal of labor and expense, it was eventually rendered obsolete by me. Nevertheless, for what it's worth and since there is no disadvantage to its use, I have here drawn up and explained it, along with the rest, since it may be of advantage to those for whom it is not possible to construct laborious and costly instruments. Having therefore satisfied themselves with this, intervals between the stars will be investigated more directly and more precisely than was done before by means of the astronomical cross-staff. But let them quickly and properly correct for the parallax which I have discussed.

## B.2 Excerpts From the *Progymnasmata*

But because the pupil of the eye could not engage the center of the instrument, along with the arc and, indeed, its sequence of divisions, being hindered by that solid part which is from A to I, it meant that the distances of the eccentric eye were placed beyond the arc's central location and the intervals observed actually inflated and altogether inconsistent with Heaven itself. I had a table annotated on the back of the instrument which, giving the parallax of the instrument, showed how much the observed degrees of the stars' angular separation should be subtracted, as if it were viewed from the center of the instrument, so as to be true and consistent with Heaven itself. Thus, I was alleviating this effort with a small savings. Now, the computation of these parallaxes and their table were as follows.

In the adjacent figure, let A denote the center of the instrument. Let AB and AC be its two rules but let the eye of the collimator be next to I, the latter being always in a straight line along the inner surface of rule BA. Thus, it produces no parallax on that side; the rule BA remains at rest while the other, AC, is approaching and receding from it. In this way, BA is extended to I and from I the eye to C. Straight line, IC, is drawn to the other pinnacidium near the norm of which the view is transferred to pinnacidium C. I say that the parallax of the instrument is given by the angle ACI. Assuming that angle BAC is known from observation, external angle CAI is obtained from arc BC as the complement of two straight lines when two sides of triangle ACI are given that subtend a known angle. CA is the length of the rule from the center to the pinnacidium which can be subdivided into several parts, in this case a thousand, and it will soon be seen how many of these parts AI takes up for the sides of AI will be given in the same parts. Consequently, from the laws of plane triangles, it is clear that angle ACI, representing the desired parallax in the separation of the observed stars, must always be subtracted from the apparent separation since the eye, being positioned at I, will, upon seeing both stars, enlarge the arc BC compared to its being at A in the middle of the arc.



Accordingly, for each degree of the whole sextant, a table is generated providing a diversity of perspective to the instrument although from one degree to another there is no great difference in parallax. And, if one wishes to execute the matter very precisely, this difference can be interpolated.

In this fashion, we have corrected that discrepancy by which the eye was not set up at the center of the instrument so that you may be satisfied and so that this instrument be more exact in determining separations than an astronomical cross-staff.

Separations of Principal Stars of Cassiopeia from Each Other

| Separation<br>Of | From | Location           | Degrees | Minutes         |
|------------------|------|--------------------|---------|-----------------|
| 12               | 1    | head               | 6       | $33\frac{1}{2}$ |
|                  | 2    | Schedir            | 4       | 59              |
|                  | 3    | belt               | 5       | 19              |
|                  | 4    | flexure            | 6       | $12\frac{1}{2}$ |
|                  | 5    | calf               | 9       | 42              |
|                  | 6    | leg                | 13      | $17\frac{1}{2}$ |
|                  | 7    | end foot           | 17      | 26              |
|                  | 11   | upturn of the seat | 4       | 44              |
| 2                | 1    | head               | 2       | 41              |
|                  | 3    | belt               | 1       | 42              |
|                  | 4    | flexure            | 4       | 40              |
|                  | 5    | calf               | 6       | 56              |
|                  | 6    | leg                | 11      | 33              |
|                  | 7    | end foot           | 16      | 28              |
|                  | 11   | upturn of the seat | 6       | 27              |
| 4                | 1    | head               | 7       | 20              |
|                  | 3    | belt               | 3       | 3               |
|                  | 5    | calf               | 3       | 35              |
|                  | 6    | leg                | 7       | 19              |
|                  | 7    | end foot           | 11      | $56\frac{1}{2}$ |
|                  | 11   | upturn of the seat | 3       | 35              |
| 11               | 1    | head               | 9       | 3               |
|                  | 3    | belt               | 5       | 23              |
|                  | 5    | calf               | 6       | $48\frac{1}{2}$ |
|                  | 6    | leg                | 9       | $9\frac{1}{2}$  |
|                  | 7    | end foot           | 12      | 49              |
| 1                | 3    | belt               | 4       | 17              |
|                  | 5    | calf               | 9       | 6               |
|                  | 6    | leg                | 13      | 53              |
|                  | 7    | end foot           | 18      | 54              |
| 3                | 5    | calf               | 5       | $19\frac{1}{2}$ |
|                  | 6    | leg                | 9       | 53              |
|                  | 7    | end foot           | 14      | 45              |
| 5                | 6    | leg                | 4       | 50              |
|                  | 7    | end foot           | 9       | 56              |
| 6                | 7    | end foot           | 5       | 9               |

Separations of the New Star  
 from Certain Fixed Stars in the Constellation Cassiopeia  
 Carefully Checked and Verified

| Separation |    | Location           | Degrees | Minutes         |
|------------|----|--------------------|---------|-----------------|
| From       | To |                    |         |                 |
|            | 1  | head               | 10      | 22              |
|            | 2  | Schedir            | 7       | $50\frac{1}{2}$ |
|            | 3  | belt               | 6       | 53              |
|            | 4  | flexure            | 5       | 2               |
| Nova       | 5  | calf               | 8       | $3\frac{1}{2}$  |
|            | 6  | leg                | 9       | 48              |
|            | 7  | end foot           | 12      | $58\frac{1}{2}$ |
|            | 11 | upturn of the seat | 1       | 31              |
|            | 12 | middle of chair    | 5       | 19              |



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