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I. Introduction

We arrive at an enhanced understanding of Rheticus' life and work by means of several previously unstudied documents. The first of these is an astrological manuscript put together during Rheticus' first years as a professor in Wittenberg (1536-38). It had been thought that only two lectures in this manuscript were by Rheticus. We show that the vast bulk of the manuscript is to be ascribed to him. (II ε)

As this manuscript places Rheticus' early work in an entirely new light, we must reconstruct its origins and context. We begin with a discussion of the vibrant 'astrological circle' of sixteenth century German Humanism. We rediscover herein how intensely men such as Carion, Camerarius, and Schöner fought to renew the ancient foundations of astrology and establish it as a credible public science. We also expose the incredibly heretical nature of the 'astrological theology' of Rheticus' most formative teacher, Phillip Melanchthon. (II α)

We move from here to a discussion of Rheticus' first speeches in Wittenberg *In Defense of Astrology* (II β) and *A Preface to Arithmetic* (II δ). Rheticus set himself the task of fulfilling that restitution of astrology his formative influences had so passionately sought. He needed some sort of mechanism which might underly astral truth, bring together the various disparate methods, and resolve the apparent arbitrariness of the contemporary predictions. This intent is explicitly stated as early as *In Defense of Astrology*. Yet the task was not easy. Because he believed that this truth had been given by God in a pristine form to antiquity, his astrological query became more akin to a philological expedition. We are able to discern an initial novel attempt to approach the problem of a restitution of astrology, even if it is uncertain and wavering. (II ε)

The final section of chapter II (II ζ) 'Personal Reasons for Leaving Wittenberg', attempts to understand why Rheticus left Wittenberg in October 1538. His decision to leave appears to have been prompted by rather bitter infighting. This arose primarily through his association with a group of young poets, in particular his countryman Simon Lemnius, whose lifestyle and interests ran contrary to the spirit of Luther's reformation. We then suggest that this conflict laid the seed for the eminent spirited rejection of heliocentrism by Luther and other prominent figures.

The investigation then moves to Rheticus' 'Collaboration with

Copernicus' (III). This section begins with the simple question of how Rheticus heard of Copernicus and why he might have been inspired to undertake such a costly and precarious journey. We suggest that Rheticus left Wittenberg, prompted by interpersonal difficulties, with the desire to find answers to the astrological difficulties he had faced in Wittenberg (III α).

Rheticus' *Narratio Prima* is the first published account of heliocentrism and the work for which he is most generally known. Much new light could be shed on this work through a detailed commentary, yet this task belongs to the office of the sorely needed new English translation. I have therefore restricted myself to that part of the work which is specific to Rheticus: the astrological prophecy. This prophecy had long been portrayed as an odd fallacy of an overenthusiastic young mathematician. So it must appear if we have no appreciation of Rheticus' astrological context and objectives. The prognostication in fact holds the key to our understanding of how Rheticus interpreted the astronomical success of Copernicus' work in astrological terms. (III β)

Rheticus' later trigonometric work is often separated from his early astrological/astronomical work as the connection between the two isn't immediately apparent. We show how Rheticus' trigonometric work, which laid the basis for modern trigonometry, grew out of his fascination with the gnomon and sundials. The interest in the gnomon as an instrument of sun-observation used in the original pristine Egyptian science began during his stay with Copernicus. (III γ)

A new collection of lecture notes shows that Rheticus briefly returned to Wittenberg in late 1540 to fulfill his professional obligations. The two lectures on Sacrobosco and one on Pliny contain *no* mention of Copernicus or heliocentrism. These exceedingly dry expositions, the hastiness of his departure, and the fact that a student deridingly referred to him as 'Joachimus Heliopolitanus' (Joachim of the City of the Sun) suggest that neither Rheticus nor heliocentrism were welcome in Wittenberg. (III δ)

The most outstanding new text is what its discoverer R. Hooykaas deemed the '*Treatise on Holy Scripture and the Motion of the Earth*'. Just as Rheticus wrote the first published exposition of heliocentrism, so too did he write the first attempt at reconciling the new theory with Scripture. We suggest that Copernicus was involved with the tract, and that it wasn't published because a censoring committee denied it. We also find in this work the further development of Rheticus' astrological justification of heliocentrism. (III ϵ)

It had long been thought that Tycho Brahe was the first to realize that the comet is a supralunar phenomenon. A brief epistolical passage shows that Rheticus and Copernicus were well ahead of Tycho. (III ζ)

We return in III η to Rheticus' political and social situation in Wittenberg (following his return in 1542). He refused to relinquish his social

involvement with the Wittenberg poets. This stubbornness further exacerbated the familiar difficulties he and heliocentrism faced in Wittenberg and forced him to search for a position elsewhere.

Our study concludes with an elucidation of Rheticus' philosophy of *mathematical realism*. After exposing the specific peculiarity of Rheticus' mathematical realism, we then compare it to Kepler's. This allows us to come to a more general understanding of mathematical realism as a philosophical position and its role in sixteenth century science. (III θ)

My work presents itself as a natural extension of K.H. Burmeister's *Georg Joachim Rhetikus, Eine Bio-Bibliographie*. Burmeister's research provided the foundation of this work by supplying the wheres and whens of Rheticus' life through archival documents, epistolical references and the translation of letters. I have proceeded from this and concentrated solely on the development of his work and thought. Just as Mr. Burmeister gave us an edition of Rheticus' letters to aid the investigation into his life, I have attempted a collection of his works (Chapter IV) to advance our understanding of his scientific thought.

Pages 61-189 of the original works section are not contained in this electronic publication as they were too big due to a plethora of scanned images.

Table of Signs

Editorial

- ‘M’ Marginal comment made in the manuscript
 ‘*’ Uncertainty as to grammar or transcription due to illegibility

Zodiacal signs (modeled upon the signs of the original manuscripts)

Aries ♈, Taurus ♉, Gemini ♊, Cancer ♋, Leo ♌, Virgo ♍, Libra ♎, Scorpion ♏, Sagittarius ♐, Capricorn ♑, Aquarius ♒, Pisces ♓

Planetary signs

Mercury ☿, Venus ♀, Moon ☾, Sun ☉, Mars ♂, Jupiter ♃, Saturn ♄

Other astrological signs

- Δ trine
 □ quartine
 * sextile
 ○○ opposition
 ○ conjunction
 ⤴ head of the dragon (*caput draconis*)
 ⤵ tail of the dragon (*cauda draconis*)

II. Wittenberg 1532-38

α. The Astrological Circle

Horoscopes and the interpretation of astral phenomena had long been central to popular and courtly culture, but theological objections had prevented astrology from becoming a university discipline. This state of affairs changed dramatically when humanists, particularly in Protestant Germany, boldly asserted astrology as an integral part of their spiritual and intellectual lives.

European astrology had yet to be institutionalized, and it looked especially patchwork when compared to the systematic Arabic astrology. The German humanists branded the lack of professionalism in this area a further instance of the ‘bad Latin’ of the scholastics. Criticism was easy. The task however of institutionalizing astrology and presenting it as a rigorous discipline was tremendous.

In the first generation of this new astrological school we find Rheticus’ teacher in Wittenberg J. Volmar (d. 1536), and J. Stoeffler (1452-1531). Stoeffler, who lectured in Tübingen, taught astrology to the very influential members of the second generation, Phillip Melanchthon (1497-1560) and J. Carion (1499-1537). Central to the second generation was also Melanchthon’s confidant Joachim Camerarius (1500-1574). He assumed Stoeffler’s role at Tübingen in 1535.

We know very little about Volmar. He will certainly become the subject of a larger historical study in the coming years as many new primary sources have been discovered.¹ Although a careful study of Volmar’s work has yet to be done, a cursory study of his transcriptions reveals Volmar as a premier transmitter of astrological texts. It seems reasonable to assume that Rheticus’ vast appreciation of so many astrological authorities could only have been attained with Volmar’s instruction and the use of his

¹These include 12 microfiche sets of his transcriptions of various astrological, mathematical, chiromantical, and other occult works (in Jena), an algebraical tract (Leipzig ms. 1696), and a correspondence with the reformer George Spalatin (1484-1545). This highly critical exchange is amazingly difficult to track down. Irmgard Höss (1986) claims “to have seen them once”, at the Anna-Amelia library in Weimar. The library now has no record of the correspondence.

transcriptions. Rheticus would later name Volmar as his teacher and countryman.²

J. Stoeffler (1452-1531) taught at Tübingen from 1511 to his death in 1531. He there produced many of Germany's leading humanists. Stoeffler published very little on what we might describe as astrological theory. His work rather aimed at building a foundation for astrological research, and was used as such by his students. He published several Ephemeridae and almanacs³, and was an expert on the Astrolabe which he considered the key to astrological research.⁴

Of Stoeffler's students, Carion would become the most successful astrologer.⁵ Carion became the court astrologer to the pro-catholic Joachim I⁶ in 1522. He appears to have won favour with Joachim through his highly popular work *Prognostication of the Great Deluge for 1524* published in 1521.⁷ One of over a hundred prognostications predicting a deluge for 1524 on account of the Saturn-Jupiter conjunction in the water sign of Pisces⁸,

²See my translation of *A Preface to Arithmetic* (1536) p.1. Rheticus names Volmar as a compatriot and teacher in his *Letter to Heinrich Widnauer* (1542), in Burmeister (1968), vol. III, p.50. Volmar was actually born in the southern German town of Villingen, yet it is not inconceivable that the family then moved to Feldkirch, as a family of his surname is documented there (Burmeister (1978), p.39).

³*Almanach nova plurimis annis venturis inservientia / per Joannem Stoefflerinum Justingensem et Jacobum Pflaumen Ulmenses accuratissime supputata ...*, Venice 1503; published again in Venice in 1506 and 1522; *Ephemerides ... 1513 - 1531*, Venice 1513; *Ephemeridum opus Joannis Stoeffleri à capite anni ... 1532 in alios 20 proximè subsequentes, ad veterum imitationem accuratissimo calculoelaboratum : ab anno 1532 - 1551*, Tübingen 1531 and 1533; *isagogica in coelestem Astronomicam disciplinam ; Tractatus tres perbreves de electionibus, Revolutionibus annorum, & mutatione aeris; item horariae tabulae per altitudinem solis in die, ac stellarum in nocte ad medium exticlimatis; omnibus his diligentissime recognitis & emendatis* Tübingen 1548; *Veterum Ephemeridum opus, Joannis Stoeffleri ... , ab anno 1499 usque in annum 1544*, Tübingen 1549;

⁴*Elucidatio fabricae ususque astrolabii*, Oppenheim 1513, published again in 1524, 1553, 1564, 1585 and 1594; *Instrumentum astrologicum uerarum distantiarum coniunctionum & oppositionum a mediis*, before 1530; *Coelestium Rerum Disciplinae : Atque Totius Sphaericae peritissimi, Iohannis Stoefflerini Iustingensis, uiri Germani, uariorum Astrolabiorum compositionem seu fabricam, necnon eorundem usuum ac uariarum utilitatum explanationem ...*, Cologne 1535. For more on Stoeffler as he relates to this project cf. Oestmann, G.: 'Johannes Stoeffler, Melanchthons Lehrer in Tübingen', *Philipp Melanchthon in Südwestdeutschland*, 1997, p. 75 - 85, and Moll, C.: *Johannes Stöffler von Justingen: e. Charakterbild aus d. ersten Halbjahrhundert d. Universität Tübingen*, 1877.

⁵Carion appears to have originally been Johannes Nägelin. Nägelin, in modern German *Nelkenlein*, means little clove. Carion was derived from the Greek Caryophyllon (dried clove). We find in Carion's shield three cloves; cf. Warburg, A. (1920), p.532.

⁶1484-1535; *Kurfürst* from 1499.

⁷*Prognosticatio und erklerung der grossen wesserung ... so sich begeben ... Fünffzehen hundert und xxiiij. Jar*, Leipzig 1521.

⁸Cf. Thorndyke, vol. V, ch. xi.

Carion's was the most compelling. Carion continued to enjoy success with *Signification and revelation of true heavenly influx*⁹ and *Judgment on the Comet seen in 1532*.¹⁰ It was however through his wildly popular *Carion's Chronicle*, an astrological interpretation of the history and future of the world, that Carion would become the most significant German astrologer. First published in 1531 in Wittenberg it would undergo more than a hundred subsequent printings. It was translated into German, French, English, Italian, Dutch and Spanish.¹¹

One important feature of highly respected astrologers at this time was that they were the nimblest at crossing religious divides due to the awe in which they were held. Carion was portrayed by the Lutheran Cranach (1530), and yet composed a very ominous horoscope for Luther (see II ζ). And despite being a loyal servant of the passionately Catholic Joachim I, he engaged in several dealings with the astrologically interested Protestant Duke Albrecht.¹²

Melanchthon's main role in the development of the circle was organizational and propagandistic. Melanchthon considered himself not sufficiently trained in mathematics to professionally pursue astronomy and astrology, having pursued the humanistic ideal in his early years.¹³ His reorganization of the mathematics faculty at Wittenberg was a conscious effort at making up for this deficiency among young aspiring humanists.¹⁴ The basics of astronomy, geometry and arithmetic were to be studied first in order to prepare the student for the 'pinnacle' of all mathematics, astrology.

⁹*Bedeutuß und Offenbarung warer himlischer Influxion, von jaren zu jaren werende, biß man schreybt MDXL jar*, Berlin 1526.

¹⁰*Vom Cometen, den man neulich im Jahr 1532 gesehen hat, iudicium gestellet*, Wittenberg 1533.

¹¹Rheticus' teacher Melanchthon apparently had his hand in Carion's *Chronicle* from the very first. This is seen in a letter from him to Carion dated the 17th of August 1524 in which he writes "I have tried to decorate the text with dignified quotes. Others may judge what I have accomplished." (This letter was in the Staatsarchiv at Königsberg before the war; a German translation of it may be found at Warburg (1920), p.493). This involvement wasn't explicitly stated in the title until 1559 *Chronicon Carionis Latine expositi et aucti multis et veteribus et recentibus historiis, in narrationibus rerum Graecarum, Germanicarum et ecclesiasticarum / a Philip. Melanth.*, Wittenberg 1559. This revision became the version which would be reprinted from that time onward, being printed about every other year until 1624.

¹²Carion for example procured, at his discretion, interesting and useful novelties in the economically booming Nuremberg for Duke Albrecht (Cf. Voigt, J.: *Blicke in das Kunst und Gewerbeleben der Stadt Nuremberg im 16 Jh.*, 1862, p. 13ff.) Rheticus would also later avail himself of Albrecht's astrological and astronomical inclinations (cf. III δ). Another example of an astrologer capable of walking on both sides of the religious divide is Luca Gaurico (1476-1558) whom we discuss in II ζ.

¹³See for example Melanchthon's Letter to Hartmann of August 8, 1542; CR (Corpus Reformatorum), no. 2533, col. 854.

¹⁴See sect. I.δ.

Melanchthon's passion for the subject grew tremendously in the wake of the peasant revolt of 1525. Melanchthon saw in this revolt man's inability to accept his fate and God's plan for him. If only, so Melanchthon thought, man could recognize his fate in the stars as fixed and unbending there would be no civil unrest.¹⁵ Astrology became for Melanchthon not only a novel hermeneutic tool but also a much broader political and social message. This innovative validation of astrology opened new avenues for pursuing astrology pedagogically and scientifically. Astrology had to be brought to the masses; each subject needed to understand and follow their specific purpose in God's providence. The Christian scholar was obliged to pursue astrology scientifically, to increase the quality of prognostication in order to better know God.

This bold interpretation and use of astrology brought forth several anti-astrological opponents who would have otherwise been content to let the issue lie had astrology remained confined to its traditional closet. Luther despised astrology and considered it anti-Christian. Although he made several comments to that extent¹⁶, the usually bellicose Luther apparently reneged on pursuing the issue more vehemently to preserve his relationship with Melanchthon. This 'protection' however could not indefinitely save Melanchthon from the wrath of later Lutheran theologians. The issue was central to the anti-Melanchthon backlash which began towards the end of his life.¹⁷

Not considering himself fully competent Melanchthon published comparatively little directly on astrology itself.¹⁸ As gathered from the voluminous Melanchthon-Camerarius correspondence, the greater portion of which contains at least one astrological reference¹⁹, Melanchthon's main interest was in the interpretation of current political events. His many

¹⁵This theme is studied throughout Kusukawa's *The Transformation of Natural Philosophy: The Case of Phillip Melanchthon*, 1995.

¹⁶E.g. "No one shall ever persuade me, neither Paul nor the angel in heaven - not even Philipp [Melanchthon] - to believe in the divinations of astrology, which err so entirely that nothing is more uncertain. For if they twice or thrice correctly divine, they note these cases, if they err, they disguise them." *Tischreden*, VI, p. 668, Aug. 1540.

¹⁷Following Luther's death in 1546 the rod of Lutheran leadership in Wittenberg was passed to Melanchthon. In several issues, including astrology, Melanchthon presented his views as those of the Lutheran path. Following Melanchthon's death in 1560, this interpretation was furthered by Melanchthon's stepson Kaspar Peucer (1525-1602), a student of Rheticus and an avid astrologer. Peucer's insistence upon Melanchthon's vision gradually created an insurmountable rift in the Protestant camp which ended only with Peucer's incarceration. Melanchthon's contribution to the Protestant revolution was consistently downplayed by Protestant historians for several hundred years as a result of this backlash.

¹⁸Most notably a Latin translation, along with the original Greek text, of Ptolemy's *Tetrabiblos* (*Claudij Ptolemaei, De Praedictionibus Astronomicis, cui titulum fecerunt Quadripartitu[m], Gr[a]jecè & Latine : Libri IIII*, Basel 1553.).

¹⁹Those letters which do not contain astrological references are typically short and pertain to pressing matters of business.

speeches before the academy however never delve into actual methods or prognostications. They simply extol the great uses of astrology. His pro-astrology stance is perhaps most clearly articulated in a preface he wrote to an edition of Sacrobosco's *Sphere* in 1531.²⁰ It may be considered the main position paper of the circle upholding astrology in the face of the attacks against it; the reasons Melanchthon gives are often found quoted word for word in the texts of Melanchthon's students. As the Rheticus texts of which I have given a translation reproduce all of these arguments at one point or another, we shall now give an overview of them.

1) *The study of astrology is given a scriptural justification using Genesis 14* "And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days, and years."²¹

2) *The stars could not have been founded in vain.* We find this argument ubiquitously expressed in the mantra-like phrase *sidera non frustra conditi sunt*. This is most eloquently presented in a poem of Melanchthon's which Rheticus would quote during his first years of teaching in Wittenberg:

As you look upon the gliding stars in the clear heaven
and the signs known to Lucina²² with your very eyes
You truly know that some mind existed before those governing everything
and He Who sees our deeds²³

3) *Astrology is a part of 'physics'.* To counteract the many examples of groundless prognostications brought forth in anti-astrological tracts, the circle consistently lays claim to a realm of astrology based on 'physics'. Although the circle never came close to anything resembling a 'physical' justification, it is fair to say that this was their proper aim. For them, a 'physical' astrology

²⁰*Liber Iohannis de Sacro Busto, de Sphaera. Addita est praefatio in eundem librum Philippi Mel. ad Simonem Gryneum, Wittenberg 1531.* This edition, with the preface, continued to be published well into the 17th century. It was erroneously attributed to Rheticus by Burmeister (vol. I, p. 31; vol. II, p. 56), cf. Rosen 'Rheticus as Editor of Sacrobosco' (I have only found a copy of this article in Burmeister's files).

²¹Rheticus uses this citation in *A Preface to Arithmetic*, pg. 5, and then later in the *Treatise on Holy Scripture and the Motion of the Earth* (see III ε) "Yet we entrust more to the authority of the most learned men who refute these delirimenta with strong arguments, as well as to the divine oracles in holy scripture from which it is impious to dissent. These clearly testify that the Sun, Moon and other stars are all certain and permanent works of God, and Holy Scripture adds the reason of the great utility of the founding of the heavenly luminaries: They are signs and distinguish the seasons and years." (*King James Translation*)

²²The Goddess of births; an allusion to natal astrology.

²³*Annotata in Alfraganum* fol. 63, p. 38 (Original Works).

was based on the Aristotelian doctrine of the four elements and the causes which the heavenly bodies bearing the attributes of one or more element effect.²⁴ They also wish to thereby distinguish their art from Arabic astrology:

For although the Arabs invaded the deserted Greek possession with great force, and thereby propagated these arts to the occident and all the way to Spain, their writings nevertheless demonstrate a peculiar class not so concerned with the observation of motions and more with prognostications. They were thus ambitious, and not content with the astrology of Ptolemy, which can be seen as a certain part of physics, and wrote on lots and other *ανατιολογητα*²⁵ forms of prediction. However our [astrologers] shall give their full energy to that particular part of doctrine [i.e. the Ptolemaic ‘physical’ astrology] ...²⁶

This argument is the foundation of Rheticus’ first speech at the academy, *Do the Laws Condemn Astrological Predictions?*, which we discuss in section II β.

4) *The pristine astrology was once practiced in Egypt.* Contrary to what we believe today²⁷, the circle, in particular Rheticus, believed that God had given the Egyptians the complete simple truths of nature. As the circle believed that all science was reducible to astrological truth, they saw in the gnomon the perfect God-given instrument on which the Egyptian science was based. Thus, although Ptolemy’s *Tetrabiblos* and *Centiloquium* or *Fructus* (now considered spurious) was without doubt the astrological authority, it was seen as the work of an already degraded age, far from the pristine Egyptian science. The advancement of astrology was not pursued in the way in which we currently think of the goal of scientific progress. It was rather oriented towards rediscovering lost truths once presented by God unto man. This astrological enterprise was very much a philological one, scouring Arabic, Chaldaic, Greek, Roman and Hermetic sources for possible clues.

5) *God’s providence as seen in the stars is in no way influenced by the devil.* This argument was central in distancing the pursuit of astrology from magic.

²⁴Cf. *Preface to the Sphere of Sacrobosco*, op. cit. p.7. We shall discuss Rheticus’ use of the four-element doctrine later.

²⁵Ie. not guilty of logos.

²⁶*Preface to the Sphere of Sacrobosco*, op. cit., p.5-6.

²⁷Neugebauer (1969) p. 91 writes “Ancient science was the product of a very few men; and these few happened not to be Egyptians.”

It also served to combat Luther's notion that astrology was of satanic origin.²⁸ Magic, according to Melanchthon, had no 'physical' basis.²⁹ Physical in this context meant having no part in God's providence. Just as the miracles of the bible have no astrological foundation³⁰, and are direct manifestations of God, so too does the devil 'work around' the physics of God's Providence, in a manner contrary to 'nature':

[the third form of actions] is against nature, and is propagated by a great motion of the devil. The parricides and prodigal desires of Nero and similar tyrants are not to be attributed to the stars or other natural causes, but rather correctly to the devil.³¹

Rheticus, belonging to the third generation of this new astrological enterprise, thought himself in a position to realize the expectations of the circle's programme of a rigorous science of the stars.

²⁸“Astrology is framed by the devil, to the end people may be scared from entering into the state of matrimony, and from every divine and human office and calling; for the star-peepers presage nothing that is good out of the planets; they affright people's consciences, in regard of misfortunes to come, which all stand in God's hand, and through such mischievous and unprofitable cogitations vex and torment the whole life.” *Table Talk*, DCCXCIX.

²⁹*Preface to the Sphere of Sacrobosco*, p. 11 “Just as other parts of physics do not threaten the Christian religion, so also does astrology not threaten. For we consider this to also be a part of physics.”

³⁰*Preface to the Sphere of Sacrobosco*, p.10.

³¹*Preface to the Sphere of Sacrobosco*, p.11.

β. In Defense of Astrology

The first written piece of work we have of Rheticus' stems from his 'disputatio', the final task a student had to fulfill before obtaining his 'magister' or masters. The student would present a position on a given question which he would then defend in the public session which followed. Rheticus' disputation asked a central question in the hotly-contested astrology vs. anti-astrology debate of the 16th century: '*Do the Laws Condemn Astrological Prognostications?*'.³²

The question was formally directed at Justinian's *Corpus iuris civilis* which strongly condemns the study of Astrology.³³ Yet the essence of Rheticus' defense is not one of legal interpretation. He intrepidly argues that the law has no purview over what he sees as a philosophic discipline. This dramatic entreaty bears a distinct Lutheran semblance. Just as Rome has no authority over religion, so does the law have no jurisdiction over philosophy.

Now, just as it is proper for lawyers to defer to this law, nothing prevents us from deferring to our arts rather than some edict. For we don't have to defend our possession against the opinion of certain interpreters. Aristotle says that the arts will be happy if the skilled judge in their respective arts, and the lawyers teach this judgement. The skillful are to be consulted in each art.³⁴ I therefore hope that they [the lawyers] will freely leave these matters to the philosophers, so that the lawyers might not condemn a part of philosophy. That is my position. [p.4]

The notion that the skilled shall judge over their own crafts laid the groundwork for a further presumption: a new declaration of the proper legal distinction between true and false forms of divination. The substance of this distinction captures the spirit of the circle's new astrological enterprise: 'Physical causes' are divine ordinations. "It is pious and useful - not superstitious - to observe the ordinations of God in nature. For those [predictions] are superstitious which do not have physical causes and the

³²Astrological questions were not foreign to the Wittenberg disputations. Toward the end of 1536, Johannes Reiffenstein (1482-1538) would defend astrology in his '*Should Astrology be applied to Medicine*' (Nov. 16, 1536).

³³Section 9.18.2 of the digest in particular. The *Corpus iuris civilis* was one of many attempts in Late Antiquity to integrate and order the disparate Roman legal system. Although it failed in its own day to attain respect and broad usage, it began to assert a strong influence upon continental lawyers in the Middle Ages. This slowly led to the *Corpus* becoming the most central legal document in continental Europe. That Rheticus chose to challenge the judgement of the *Corpus*, and not one of the thousands of other anti-astrological legislative acts, is a reflection of this fact.

³⁴I have been unable to find this reference.

ordinations of God.[p.4]”

Rheticus’ notion of ‘physical’ is extraordinarily central to understanding his work. Almost all of the following chapters deal with that concept’s development. The following passage presents a conception of ‘physical’ and astrology which the circle’s second generation seemed to share. One strong benefit of this conception is that it beautifully counteracts anti-astrological arguments on a rhetorical level. Yet a grave philosophical question remains with which Rheticus will have to grapple. If God proclaims and effects his providence solely through the motions of the heavens, what does ‘physical cause’ mean? How can one observe the physical cause of a celestial object and the various manifestations of the effects it produces?

Astrological observations are observations of physical causes which are ordinations of God. The predictions of medical doctors are observations of causes and effects. The speed of the pulse in the arteries signifies a vehement heat and the motion of the heart. For the motion of the heart drives the spirits of the arteries. In like manner, the Astrologer will ascertain that the Sun has the power of heating, the Moon that of moistening. He therefore predicts that the Moon effects the more humid temperaments in the air and in the bodies of animals. And that from the first qualities secondary ones will arise. Such an observation therefore is pious and useful in our lives when it arises from Physical causes which are divine ordinations.
[p. 4-5]

The Aristotelian elemental doctrine and the qualities of hot, cold, humid and dry are taken away from their proper sub-lunar sphere of degeneration and corruption and applied to the supra-lunar ‘eternal’ sphere. This is a categorically incorrect extrapolation of Aristotle’s ideas. For cause and effect apply differently to the two spheres. The sub-lunar sphere is changeable and ‘physical’, the supra-lunar sphere on the other hand is unchanging. The qualities of hot, cold, humid and dry apply only to a changing physical world.

In spite of the fact that Melanchthon appeals specifically to Ptolemy’s physical astrology, Ptolemy makes no use of Aristotle’s elemental physics in the *Tetrabiblos*, nor can it be found in the spurious *Fructus*. Curiously however, polemist of the anti-astrological cause were unable to exploit the deficiencies of this argument. This was because *all* of their champions admitted that the moon moistened and the sun dried, most also admitted that Saturn was cold.³⁵

³⁵One finds notable examples of this seemingly paradoxical stance throughout the ages: Plinius the Elder (23/4-79 BC, *Natural History*, Book II, *against astrology* V, 24 et passim; *planets having powers* VI, 34, XVI 79, XXXIX 105 et passim), Pico della Mirandola (1463-1494, *Disputationes adversus astrologiam divinatricem*, Book III, ch.2, Where Pico also adamantly admits that the inferior world is controlled by God through the heavens.), Symphorien Champier (c. 1471-1537; cf. Thorndyke, V, ch. VII.) And Luther himself for whom the stars had certain powers, but unknowable to man (see the section on Luther’s horoscope in II ε).

It is on account of this common belief in the physical power of the planets and stars that the circle possessed an indestructible argument against astrological attacks:

This reasoning teaches plainly enough that it is not possible to simply condemn Astrological predictions as a whole. If they simply condemn predictions, they deny that light is hot, cold, humid or dry. What could be more absurd? At that point when they concede that light is hot, cold, humid or dry, it must be admitted that similar qualities are to be found in the air and in the bodies of animals. If these are the effects, why should the observation be condemned, when the order of causes and effects is a divine ordination? All predict in this fashion, if the pulse languishes, the heart is languid. For the cause is judged from the effect. This is how Hippocrates judges the cause of a foetus' abortion: the womb dries up, because the foetus lacks nutrition.³⁶ Here he argues the effect from the cause. If someone were ignorant of the reasoning of these predictions he would judge that these would likewise be magical. I therefore say that Astrological predictions are of a Physical nature. For these are also observations of causes and effects. [p. 5]

The alchemists had long since used Aristotle's elemental physics as a means of discussing the transformation of gases, fluids and solids. They enjoyed a certain degree of explanatory success insofar as they could ascribe different elements (fire, water, air, earth) and conditions (hot, cold, humid, dry) to different elements and compounds. Metals had an earthlike quality, gases an air like one. The appeal however to elemental physical astrology was much more precarious. In particular, after one has stated that the sun dries and the moon moistens, it is very difficult, if not impossible, to build any further insights with explanatory power. Unable to pursue a physical astrology on this basis, Rheticus focused his attention in these early years upon the only available avenue of research: philological investigation. Clearly however, a different, positive, mode of astrological exploration had to be found.

Rheticus' new legal distinction based on the physical causation of God's Providence through the motion of the celestial bodies also served to distance the circle's astrological programme from other, more controversial, forms of divination. Rheticus classifies the drawing of lots, horology³⁷, the examination of the flight and dung of birds and judicial astrology³⁸ all under *temporal interrogation*:

³⁶This is not to be found in Hippocrates' works. The idea however that the qualities of hot and dry are concurrent with a lack of nutrition may be found in the *Aphorisms*, sect. V, no. 62.

³⁷I.e. Determining the best time to initiate an action.

³⁸I.e. To determine the author of a given crime.

The laws of the codex do not condemn Astrological predictions, only those which do not have causes or physical reasoning. Ptolemy calls these *ἀναιτιολογηται*.³⁹ Such are the predictions of augurs, and much of this sort is mixed up by Astrologers, so that they divine through temporal interrogation, when they promise carnage, or claim to be able to indicate the authors of crime. In like manner, a priest is damned by the law in the ordinances who faked being able to ascertain crimes with the help of an Astrolabe. I think that such superstitious predictions, which the philosophers themselves disapprove of, are to be condemned by those laws.[p. 4]

In the eyes of the circle, this form of prediction is qualitatively inferior to astrology. The reason for this is that God effects his Providence solely through the stars. Thus observations of celestials demonstrate the direct enactment of God's Will, whereas terrestrial observations can only display secondary effects of sidereal powers. Earthly events are only shadows of God's Will.

The distinction between Astrology and temporal interrogation also reflects upon the broader aspirations of the soothsayer. The astrologer reaches for the heavens and strives to understand the broader contours of God's Providence as seen in such critical events like the rise and fall of empires. The terrestrial augur on the other hand is mired in the sins and accidentia of everyday life.

³⁹That is 'not guilty of logos.'

γ. A Preface to Arithmetic

When Volmar died in the Summer Semester of 1536, Melanchthon was given the opportunity to restructure the faculty and organization of the mathematics department in Wittenberg. This process began with Erasmus Reinhold (1511-1553) taking up Volmar's chair. Then, sometime in 1536, Milichius left the liberal arts faculty to pursue medicine. Rheticus filled this chair. In keeping with the duties he was formally charged with, Rheticus gave an *Antrittsvorlesung* or acceptance speech entitled *A Preface to Arithmetic*. The speech aims to exhort the young men of Wittenberg to study mathematics, and in particular Rheticus' first lecture class on rudimentary math.⁴⁰ After the usual themes of the importance of its practical applications and the notion that mathematics may be easily learnt are iterated, Rheticus proceeds to elaborate upon the higher aspirations of the art. Rheticus likens arithmetic and geometry to the wings which propel the soul to the divine in Plato's *Phaedrus*. Rheticus easily convolutes Plato's notion of perceiving the divine as a spectacle of the good, the true and the beautiful by making the heavens the divine. That is, we soar by power of the wings of geometry and arithmetic to the perception of God's providence in the heavens.

Those therefore who are endowed with uncontaminated minds, and who also highly admire noble things, and who wish to reflect upon divine matters in their thinking, they give themselves those wings, Arithmetic and Geometry. Taken up to heaven through the power of these, to wander with their eyes through the natural universe, to see the spaces and limits of the greatest bodies, to see the fatal congresses of the stars, and finally the causes of the greatest things which come about in this life of men, turn your minds to this if you can. [p.10]

Rheticus expands upon this noble vision of the role of mathematics in four key points. Each articulates a critical kernel of his thought which will unfold in his struggle to establish a sound programme of astrological research.

1) *Against the Epicureans*. Epicurean natural science was dedicated to eliminating any metaphysical or theological superstructure which might cloud

⁴⁰A transcription of this lecture along with a German translation by Stefan Deschauer is forthcoming in the *Algorismus* series.

the Epicurean's pursuit of pleasure by forcing ways of living and thinking upon him.⁴¹ It is unclear to what extent the higher metaphysical status of the supra-lunar sphere implied an efficacy of the stars in human affairs for Plato and Aristotle. Many of their followers however, particularly in the Hellenistic period, thought it did. It was the attack on this newfound connection between the metaphysical status of the stars and their astrological efficacy which became a pillar of Epicureanism.⁴² Epicureans mistakenly regarded it as the death-blow to Platonism and Aristotelianism.

The Epicureans were an ideal opponent for Melanchthon and Rheticus to define themselves against. They rhetorically exploited the dependence of Epicurean atheism upon anti-astrology by boldly labeling anyone who stood in the path of astrology's progress as atheists and Epicureans. Melanchthon writes: "There are however some Epicurean Theologians who laugh at this entire part of doctrine, not only do they detract from the faith in predictions, but also find fault in the understanding of the motions, we let them babble away with Epicurus."⁴³ Rheticus echoes this sentiment with: "Therefore, of the philosophers only the Epicureans were ἄθεοι,⁴⁴ as they did not want to view this illustrious testimony of God, namely, certain laws of motion and the amazing harmony." [p.11]

A further Epicurean tenet against which Melanchthon and Rheticus could define themselves was that nothing happened with a purpose in nature, everything was to be explained *ex casu*. Anything containing a purpose in the natural world posed a threat to the mental and spiritual freedom of the Epicurean. It is thus very hard to be a Christian and to maintain that the events of the world are set in motion by the physical properties and accidental interactions of matter. After all, what do the properties of these physical things have to do with God's Providence?

⁴¹Cf. n°. 11 of the *Principal Sayings* of Epicurus "If we had never been troubled by celestial and atmospheric phenomena, nor by fears about death, nor by our ignorance of the limits of pains and desires, we should have had no need of natural science."

⁴²Cf. the following passage from Epicurus' *Letter to Herodotus* "There is yet one more point to seize, namely, that the greatest anxiety of the human mind arises through the belief that the heavenly bodies are blessed and indestructible, and that at the same time they have volition and actions and causality inconsistent with this belief; and through expecting or apprehending some everlasting evil, either because of the myths, or because we are in dread of the mere insensibility of death, as if it had to do with us; and through being reduced to this state not by conviction but by a certain irrational perversity, so that, if men do not set bounds to their terror, they endure as much or even more intense anxiety than the man whose views on these matters are quite vague. But mental tranquillity means being released from all these troubles and cherishing a continual remembrance of the highest and most important truths."

⁴³*Preface to the Sphere of Sacrobosco*, p. 6.

⁴⁴I.e. 'godless.'

For I know that the great dignity and utility of the doctrine of heavenly objects is persuasion enough for you, and that you, as it is proper, abhor with your ears and souls the ravings of Epicurus who derided Astronomy and dreamed that the Sun was vapor lit up through motion in the morning to later extinguish: and stars clouds which have been coincidentally set on fire. To affirm tales is not worthy of man, and certainly not a philosopher. There has never been such a barbarism than not to believe that the stars are certain and permanent works of God, carried by certain laws, by reason of some great use. It is therefore an affront to God to make up such a confusion of things, that the Sun is vapor coincidentally inflamed, and is carried in a coincidental manner... [p. 10]

The above two problems, if the celestial bodies have no power what is the purpose of their harmony and the place of coincidence in God's Providence, were the premier obstacles for the anti-astrologers. They are clearly the most profound sticking points in Pico della Mirandella's *Disputationes adversus astrologiam divinatricem*, and are in large part responsible for the untamed voluminosity of that tome.

2) *The Divine Mind.*

The first understandable things are for that reason numbers, I believe that that is what Pythagoras thought when he defined mind as number: for he meant that the soul is rational. It discerns and seeks order. These are the very characteristics and the first functions of the mind. He aptly defined mind to be number for this reason, namely, because it numbers.⁴⁵

It is natural to ask several questions after reading this passage. Is number inherent in nature? If so, what allows the presumption that my mind knows the same number that nature does? Rheticus' astrological framework enables a surprisingly novel answer to these questions. Instead of yes to all of the above (Pythagoras) or simply no (Aristotle), Rheticus sees God as 'numbering' Providence through the motion of the celestials. It is therefore not a question whether number is inherent in the terrestrial nature we perceive daily, for that nature is predetermined by the mathematical motion of the heavens. Thus it's number is of a secondary or derivative character. Also, by imagining the 'numbering' of the celestials as not simply determining, but also bearing a message for man to behold, there are certain numberings we must strive to understand. Others however God does not intend for us to contemplate. Thus neither are the numbers in nature equal in quality nor are they mute to our ears.

⁴⁵Cf. also "The first understandable things are for that reason numbers, I believe that that is what Pythagoras thought when he defined mind as number: for he meant that the soul is rational, which discerns and seeks an order. These are the very characteristics of the mind and are the first functions of the mind. He aptly defined mind to be number for this reason, namely, because it numbers." [p. 12]

This viewpoint enables two porisms. First, any view of the natural world which claims an irrational or coincidental aspect of nature is immanently refutable on the basis of the rationality of God's plan for us and our ability to grasp that plan. Second, it is not the case that the celestials only proclaim the nature of the world and what it will be on a phenomenal level. By telling us our fates, emblazoned on our horoscopes, the stars will also tell us what our duty in life is. They are a noumenal guide. The following passage, taken from a later speech, illuminates these porisms:

I often bring together all reasonings of the Physicists on God so that I may more clearly refute the illusions of false opinions with which the Epicureans and Academics offend the eyes of men. We learn from Physics that an intelligent nature cannot arise from the irrational, or be born coincidentally. The human mind is an intelligent nature, and bears since birth an immutable capability of separating good and bad. It is therefore necessary that it arose from some more excellent and eternal mind. Who however doesn't see that a different consideration of the arguments is wholly useful? I rather assent to be ruled by the considerations of the voice of heaven, in which God more clearly shows Himself, his nature and His will. [*Oration on Physics*, p. 270]

A further example of refuting Epicurean 'ex casu' thought and thereby coming closer to God may be found in Rheticus' later lecture *Annotata in alfraganum*. He there uses the perfection of the sphere as a refutation of the Epicurean claims that the heavens could be another shape.

...this figure is the first, most perfectly capacious, most fitted for eternity, finally, refuting the dreams of inept philosophers and Epicureans who claim it be anything but a sphere, He constituted it immutable. [*Annotata in alfraganum*, p. 47]

2) *Observation of the Sun*. Rheticus bolstered his attack upon the Epicureans with the claim that God demands that we study the heavens as seen in the testimony of scripture. He then significantly adumbrates his involvement with the heliocentric theory with the import he accords the observation of the sun.

These [the divine oracles in scripture] clearly testify that the Sun, Moon and other stars are all certain and permanent works of God, and holy scripture adds the reason of the great utility of the founding of the heavenly luminaries: They are signs and distinguish the seasons and years. This description, even if brief, nevertheless comprehends great things and shows the study of Astronomy to be good. For, so that I may omit the remaining issues, if the Sun was founded to create and govern the year, it is necessary to observe the course of the Sun. For without the observation of its motion there is no way to determine the seasons and years. It is thus not obscure that the observation of the heavenly motions was approbated and foreseen by God. Nor should we regard these to be trivial reasons as to why divine authority urges us to this doctrine. For besides the great uses which it produces for the common life, this most beautiful order of movements also admonishes us that this nature did not arise coincidentally, but came into existence through an eternal mind, and that it is governed. [*A Preface to Arithmetic* p. 11]

Rheticus however was not alone in his worship of the sun. His most influential teacher, Melanchthon, preceded Rheticus in identifying the sun as the mind and ruler - an argument which Rheticus would use in favour of heliocentrism⁴⁶:

And Plato very clearly says that astronomy is the reason humans have been given eyes. He wanted to thereby say that of all bodies nothing is more beautiful than that celestial light, and that humans in particular are drawn by nature to rejoice in this beauty, and the eyes appear to me to have an even great kindredship with the stars. For just as the Sun illuminates the universe, so do the eyes man, whom many have called a μικρον κοσμον⁴⁷ on account of the many similarities, with its own certain light, just as the stars were founded.⁴⁸

Rheticus would later often use this same analogy of the Sun being the eye of the universe to defend heliocentrism.⁴⁹ The fact that Rheticus attached this particular value to the study of the sun's motion doubtlessly influenced his positive reception of heliocentrism.

4) *The Rise and Fall of Empires*. Astrology, as we have discussed, is not meant as a tool of discovering the inanities of everyday existence. At its best it strives toward an understanding of God's greater plan. Epic events such as the rise and fall of empires represent a clearer perspective of God's intentions and thus of God himself.

Rheticus clearly adumbrates this interest in his attempt to portray the usefulness of mathematics in understanding such enigmatic passages as Plato's explanation of how one state devolves into another (*Republic* Book VIII 546a ff.). His interpretation of that impossible passage employs a concept which is not in Plato's text. This is the first instance of a thought which will persistently resurface in Rheticus' work: there is an exact number relationship in human states which is effected via celestial causes.

As Plato says, the republic is changed through celestial causes, these effect certain changes in cities and empires, he says: in the same way does nature stay in tune as

⁴⁶See *Narratio Prima*, Rosen (1971), p. 139-140.

⁴⁷I.e. a microcosmos.

⁴⁸*Preface to the Sphere of Sacrobosco*, op. cit., p. 3.

⁴⁹See the quote given at the beginning of III γ.

when $4/3$ is joint to $3/2$, that is when $\delta\iota\acute{\alpha}$ τεσσάρων⁵⁰ is added to $\delta\iota\acute{\alpha}$ πέντε⁵¹, that is when the harmony is completed $\delta\iota\acute{\alpha}$ πασ[η]ῶν.⁵² Thus does the period of empires proceed, republics fall and are changed. And he puts forth this cause because when the planes of a cube are completed to solids, nature cannot proceed any further and many dissimilar numbers are created. And so do ignoble citizens who control the state arise from greater men. They overturn the republic gradually to the end of the period. No word is here to be understood without Arithmetic.

⁵⁰That is, '4:3.'

⁵¹That is, '3:2.'

⁵²That is, 'of the whole', an octave. The Greek termini technici are not employed in the original text.

ε. The Lectures 1536-38

Do the Laws Condemn Astrological Predictions? and *A Preface to Arithmetic* allowed us to create a rough outline of the astrological stance Rheticus presented in a hostile environment. And there is indeed no better way to clarify a position than to defend it vigorously against strong opposition. The astrological lectures on the other hand were held *privatim*. Though highly different in their structure and rhetoric, we find that they clearly try to realize the same goal of a ‘physical astrology’ advanced in the two early speeches. That the contents of this manuscript have yet to be examined is in my eyes a grave oversight, for this document is truly one of the most important in the Copernican story. It is so because it allows us to gain insight into Rheticus’ thought prior to seeking out Copernicus in 1539, and offers provocative clues as to why he did so.

Provenance. Several lectures in this manuscript of Paris Ms. lat. 7395 were known to have been conducted by Rheticus.⁵³ We shall however be able to show that significant other parts of the tract were also authored by Rheticus. We must naturally begin with the provenance of the lectures. To such end I give below a Table of Contents of the manuscript. Those pages which are given in *cursive* I have found of most interest, and present a transcription of them in the appendices.

⁵³K.H. Burmeister (1968), vol. I, p.30, Grafton, A. (1999), p.166.

Pages	Title	Scribe
1-36 ^v	Sphaera Johannes de Sacrobosco in compendium digesta	Gugler
39-59	Annotata in spheram Procli a magistro Ioachimo mathematicae professore	'B'
60-85	Annotata in Alfraganum	Gugler
86-	In Astrologiam Annotata	'B'
86 ^v -97 ^v	Septem modus nativitates rectificandi	
87-88	(1)The Way of Antiquity	
88- 90	(2)The Way of the Indians	
90-91 ^v	(3)The Way of the Persians	
91 ^v -93	(4)The Way of the present-day Arabs	
93-95	(5)According to the Orbs of the Moon	
95-96 ^v	(6)According to the Position of Full and New Moon preceding the Nativity	
96 ^v -97 ^v	(7)The Way of the Modern Astrologers	
97 ^v -99	Sequuntur exempla in septem modos rectificandi nativitates	
99-113 ^v 99-109; 109 ^v -113 ^v	Ad faciendum veras figuras revolutionum nativitatum optima et verisima via ad certissima iudicia iudicanda	106 ^v Gugler
114-130 ^v	Ad dirigendum 12 domos caeli ex tabulis aequationum domorum	'B'
130 ^v	In scienda quam voluntatem habet tibi ille qui intrat ad te	Gugler
131-132 ^v	Rectificationes	
133-142	Ordo ac summam ptolomei Libri	'B'
142 ^v -147	Ex tabulis directionum	
147 ^v -148 ^v	Quatuor caeli cardines	Gugler
149-320 ^v	Tractatus integer de nativitatibus	Gugler & 'B'
149-151 ^v	Prologue	

152-155	1. Rectifying the Nativity according to Tetrabiblos Book III ch. 2	Gugler 149-198 ^v
155-169 ^v	2a. Rectifying the Nativity according to Hermetic Doctrine	
157 ^v - 158 ^v	Tables of the Period of the Foetus <i>in utero</i> 2b. How the Seven Planets Govern the period <i>in utero</i> and the Born Life	
170-171	3a. On General Significations and Judgements	
171-172 ^v	3b. The Science of the Astrological Parts	
172 ^v -174	4. On the Significations of the First House	
174-192	5. On the Judgement of the Second House	
192-198	6. On the Significations of the Third House	
198-203 ^v	7. On the Signification of the Fourth House	
203 ^v -210 ^v	8. On Judging the Fifth House and its Significations	'B' 198 ^v -200 Gugler 200-304 ^v
210 ^v -215 ^v	9. On the Signification of the Sixth House	
215 ^v -224	10. On the Significations of the Seventh House	
224-230	11. On the Significations of the Eighth House	
230-235 ^v	12. On the Judgement of the Ninth House	
235 ^v -243	13. On the Significations of the Tenth House	
243-249 ^v	14. On the Signification of the Eleventh House	
249 ^v -255	15. On the Judgement and Signification of the Twelfth House	
255-291 ^v	16. On the Three Directions of Human Life. First concerning Hylech which is the Giver of the Years of Life	
291 ^v -297	17. On Alcocodon and its Election	
297-299	18. On the Judgement of Alcocodon	

299-299 ^v	19. On the Election of Almuten	
299 ^v -300 ^v	20. On Inquiring into the Span of the Life of the Born	'B' 304 ^v -311
300 ^v -307 ^v	21. On those Things and Stars through which Life is taken away	
307 ^v -309	22. On the Perfection and Revolution of the Nativity	Gugler 311-312 ^v
309-310	Complimentum. If the Newborn is Legitimate	'B' 312 ^v -320 ^v
310-320 ^v	Blank	
321	Significatio domini 6 ^{tae} domus secundum praesentiarum in 12 domibus caeli	Gugler
321 ^v -322 ^v	Horoscopes	
323-331	Gugler's Geneology	
331	Prognosticon domini Stephani	
332-370 ^v	Ex libris	
371 ^v		

The Sacrobosco Commentary.

It had previously been supposed that the Sacrobosco lecture was not conducted by Rheticus.⁵⁴ The main reason for thinking this was that a Nicolaus Gugler was enrolled in Leipzig in 1536, and the Sacrobosco lecture was clearly written by Gugler in 1536. It appears however that there are most definitely two Nicolaus Guglers.⁵⁵ These two Guglers were both from Nuremberg and are most likely related. We can be fairly certain that they were not brothers as the Gugler involved in our manuscript wrote out a list of all of his brothers and sisters.⁵⁶ Such a list with the exact birth dates was important in understanding one's own nativity, particularly in the Arabic tradition of horoscope-casting which Rheticus discusses.⁵⁷ We also find in this list the birth date of our Gugler:

⁵⁴Burmeister, K.H. (1968), vol. I, p. 30 and vol. II, p. 18.

⁵⁵Thorndyke recognized this in (1941), vol. V, p.368-371.

⁵⁶Fol. 331.

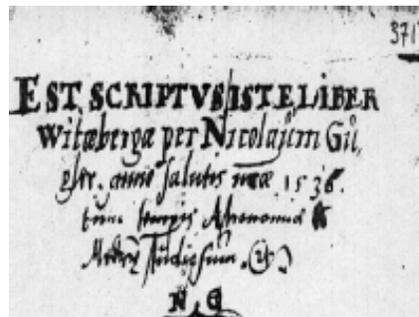
⁵⁷*Tractatus Integer de Nativitatibus* passim in ch. 4-15, and *In astrologiam annotata* 88-90.

Nicolaus Gugler of Nuremberg was born in the year of man's salvation 1521 on the first Friday after the holy day, the 15th of April at 6 o'clock in the day according to the great clock in Nuremberg.⁵⁸

The other Nicolaus Gugler was born on April 7, 1502.⁵⁹ He appears to have been a doctor of both laws, a physician, mathematician, judge at Nuremberg, advocate of the imperial court, and a counselor to the King of Denmark.⁶⁰ Yet he cannot have been our Gugler's father⁶¹ because Gugler writes in the above-mentioned list of birthdays "the father of all the children with Helena Gugler was born in the year of 1480 · he died on the third Sunday before Whitsuntide last April."⁶² That however the two were related and shared a common interest in astrology is seen in the fact that both were from Nuremberg, and both had personal connections with the great Nuremberg astrologer and mathematician Johannes Schöner. Schöner drew up a nativity for the elder Gugler in 1535 and presented it to him on January 13, 1539.⁶³ As we shall later see, the younger Gugler appears to have been staying at Schöner's house with Rheticus at precisely this time.

We find on the first page of the *Sacrobosco Commentary* the inscription "Nicolaus Gugler, Student of Astronomy and Medicine, 1536".⁶⁴

That this lecture took place in Wittenberg is seen from the ex libris at fol.371v:



⁵⁸“Natus est Nicolaus Gugler Noricus anno salutis humanae 1521 am ersten eretag nach dem heytump, idi · 16 · tag aprilis umb · 6 · Ur · Nurmbergischen groser ur · am tag.”

⁵⁹BN 7417, fol. 113v.

⁶⁰BN 7443C on the flyleaf “Nicolaus Guger N.V.I [Norimbergensis Utriusque Iuris] Doctor Imperialis Camarae Advocatus serenissimi regis Danice consiliarus”; at fol. 335r “Nicolaus Gugler Norimbergensis autoritate Pont. et Ces. Iudex ordinarius utriusque juris doctor officialis ** medicus et mathematicus omnia haec scripta curavit 1562.”

⁶¹As Thorndyke op. cit. p.371 suggested - who didn't examine the manuscript we are presently discussing.

⁶²“Der vatter aller kinder mit helena Guglerem ist geborn · anno 1480 · am dritten sontag vor pfingsten den letzten aprilis · Moritur”

⁶³BN 7417, fol. 156r.

⁶⁴“Nicolaus Gugler, *Astronomiae et Medicinae Studiosum*, 1536”, this page is reproduced in Burmeister, K.H. (1968), vol. II, p.18.

EST SCRIPTUS/ISTE LIBER
 Witaeburgae per Nicolaum Gu-
 gler . anno salutis humanae · 1536 ·
 tum temporis Astronomiae &
 Medicinae studiosum
 N.G.

Yet why wasn't the younger Gugler inscribed at the University of Wittenberg at the time of his taking down this lecture? The answer I believe lies in his incredibly young age: If we assume that the lecture was given in the Winter semester, for this was Rheticus' first semester of teaching, Gugler would have been all of 15 years old. It seems plausible that the elder Gugler, who as seen from the titles attributed to him above was an influential personage in Nuremberg, used his connections there, most likely Schöner who was often in contact with Melanchthon, to secure an auditing status for his younger relative. Sacrobosco's *Sphere* was of course one of the first courses a first-year student of the *artes liberales* would hear, and ideal for a member of an astrologically avid family. Gugler formally inscribed himself at the University of Wittenberg in the latter half of the Winter semester of 1537, thus at the beginning of 1538.⁶⁵

It remains to be shown that Rheticus was indeed the author of the Sacrobosco lecture. There are three reasons supporting this assumption:

1) As we have seen in II δ, judging from the lecture announcements which we still have, the teaching of the mathematics faculty was divided such that Rheticus took on the teaching of astronomy and astrology, while Erasmus Reinhold appears to have taught pure mathematics.

2) The structure and content of the *loci* is almost identical to that of the Sacrobosco lecture Rheticus would give in 1540. The teaching method of the *loci* was made especially popular by Melanchthon. It involved giving definitions of key terms and answers to critical questions as an introduction to a given text, much like modern-day Cliff Notes do. We shall return to the structure of the *loci* of the Sacrobosco lecture in III δ.

3) Prefixed to the *Sacrobosco Commentary* is a definition of astronomy which is remarkably similar to that prefixed to the lecture *In Alfraganum Annotata* which we know Rheticus conducted. The definition given is interesting insofar as it helps us understand in what respect Rheticus

⁶⁵Cf. Album Academiae Vitebergensis, ed. Fürstemann, K.E., Leipzig 1841, vol. I, p.168b. One gathers that Gugler inscribed himself in the latter part of the Winter semester from his placement at the end of the list.

thought of astronomy as a representation of reality or rather a fictitious hypotheses used to save the phenomena in this pre-copernican phase.

fol. 61, p. 35

fol.1^v

Definitio Astronomiae

Astronomia est doctrina divinitus hominibus tradita quae per geometriam et Arithmetica inquirat et declarat motus caeli et corporum caelestium, Unde ex consequenti omnes diversitates et vicissitudines apparentiarum propter stellarum motus, earumque ad se invicem et nos varias habitudines contingentum (salvat vocabulum artis significat Eins dings retung sein unnd uber tessen) salvat.

Astronomia est doctrina quae per Geometriam et arithmetica divinitus inquirat et demonstrat diversitatem motus caeli et aliosque corporum caelestium et per consequens omnes diversitates et vicissitudines apparentiarum in planetis et reliquis stellis salvat

As they are so similar I give only a translation of the left-handed column which contains one of the few examples of German in the manuscript.

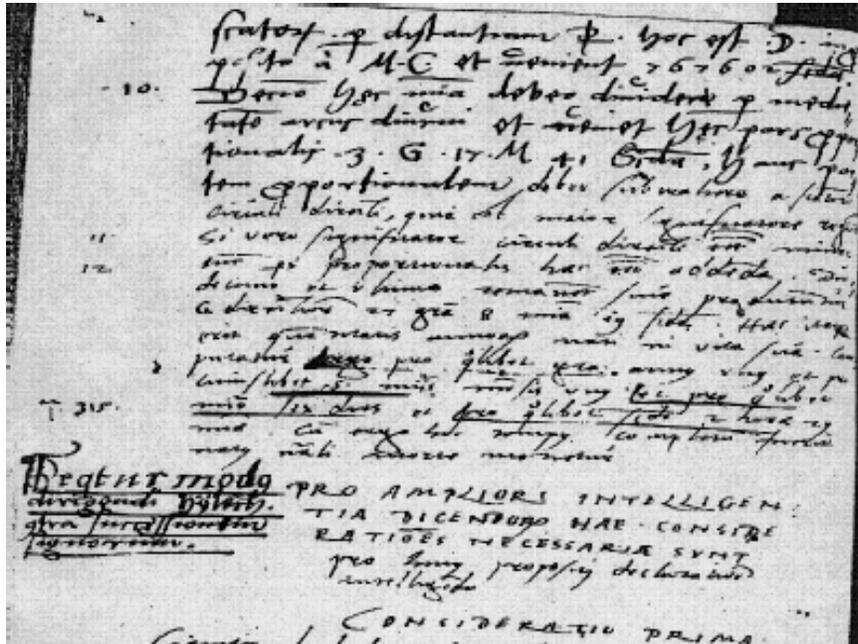
Definition of Astronomy Astronomy is the doctrine which the divine gave men. It studies and declares the motions of the heavens and of the celestial bodies through geometry and Arithmetic. It thus saves all the diversities and changes of the appearances which occur through the motions of the stars, and the various contingent conditions in regards to one another and to us ('saves' is a terminus technicus which means being the salvation of one thing and above it).

The *Sacrobosco Commentary* is truly not very helpful in understanding Rheticus' thought in this period. It is, like his Sacrobosco lectures in 1540, an almost verbatim reproduction of Sacrobosco. We have discussed it at such length however to determine the nature of the manuscript itself. That is, whether it should be seen as a collection of astronomical and astrological lectures which a young student put together or rather the work of Rheticus' *famulus* or assistant who collected and helped transcribe Rheticus' lectures. That the latter is actually the case is supported by the fact that the lecture was by Rheticus. We shall however discuss the issue further in the coming sections.

Annotata in spheram procli

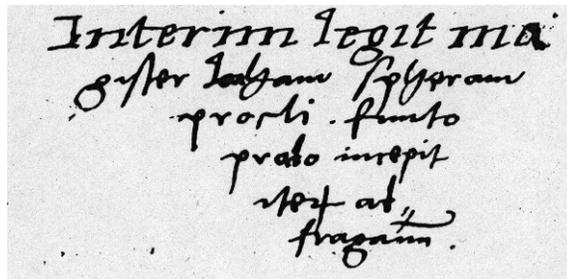
Annotata in spheram procli was clearly taken down by a hand other than Gugler's. The handwriting is also not that of Rheticus. As this second hand

left no clue as to his identity I shall simply refer to him as ‘B’. As one easily gathers from the above-given Table of Contents of the manuscript ‘B’ evidently worked closely with Gugler in transcribing Rheticus’ lectures. The nature of their cooperation becomes clear from the fact that they took turns transcribing. As seen particularly in their transcription of the lecture *In astrologiam annotata* they often changed off in mid-chapter. An example of this follows:



Transfer from Gugler to ‘B’, fol 304v, p.172

Similarly, it appears that while ‘B’ transcribed *Annotata in spheram procli*, Gugler worked on the Alfraganus lecture. We read on fol. 73^v of *Annotata in alfraganum*:



Rheticus reads Proclus, fol.73^v, p. 50-51

Interim legit ma
gister Ioahim spheram
procli. finito
proclo incepit
iterum al
fraganum.

“Meanwhile Magister Rheticus reads *The Sphere of Proclus*. He will begin Alfraganus again after he has finished Proclus.” This passage clearly shows us that Rheticus read both *Annotata in alfraganum* and *Annotata in spheram procli*.

Annotata in alfraganum

We can safely assume that *Annotata in Alfraganum* was held in 1537 at the earliest as Alfraganus’ *Elementa Astronomica* were edited by Schöner in Nuremberg at J. Petreius’ printing presses.⁶⁶ That a different edition of the *Elementa astronomica* was not used is seen in the fact that the Al-Battani texts contained in the Schöner edition were also used in the lecture.⁶⁷ They then form a natural chronological progression from the *Sacrobosco Commentary*. The new edition most likely offered a welcome diversion to the teaching of the *Sphere* for which Rheticus had no great affinity.⁶⁸

In astrologiam annotata

It had been previously supposed that only the section 86-148^v had been authored by Rheticus.⁶⁹ This was done for the following reasons which we shall presently address 1) that Gugler was Rheticus’ *famulus* or assistant; 2) that Gugler collected the various lecture transcriptions for Rheticus, for which reason 3) The manuscript came into Rheticus’ possession, and finally 4) passed from Rheticus to the hands of Petrus Ramus (1515-1572) who showed a great deal of interest in Rheticus’ work, and from Ramus to the *Bibliothèque National* where it resides today.

1) Gugler most definitely appears to have been Rheticus’ *famulus*. When Rheticus left in Sept. of 1538 on a trip through Nuremberg, Tübingen and Ingolstadt, Gugler appears to have accompanied him.⁷⁰ Being from Nuremberg, the first stop on the journey was natural enough for Gugler. We find on fol. 332 a short preface to a copy of a handwritten tract of perhaps the most influential astrologer of the renaissance, Luca Gaurico. We also gather

⁶⁶J. Petreius (ed.), *Brevis ac per vtilis compilatio Alfragani Astronomorum peritissimi, totum id continens, quod ad rudimenta Astronomica est opportunum*, Nuremberg 1537. This text appeared a second time in the compilation: J. Petreius, *Continentur in hoc libro: Rudimenta astronomica ... Item Albateggnivs Astronomvs ... De motv stellarvm, ... Item Oratio introductoria in omnes scientias Mathematicas Ioannis de Regiomonte, ... Eivsdem utilissima introductio in elementa Euclidis Item Epistola Philippi Melanthonis nuncupatoria, ad Senatum Noribergensem*, Nuremberg 1537.

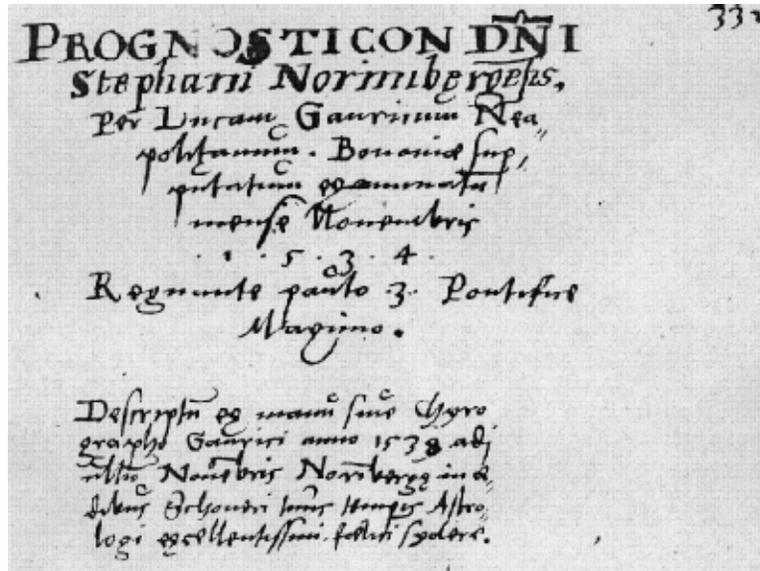
⁶⁷Two separate references are found on p. 66.

⁶⁸See Ch. III δ.

⁶⁹Burmeister, K.H. (1968), vol. I, p. 30 and vol. II, p. 18.

⁷⁰We shall discuss the grounds for Rheticus leaving Wittenberg in section η of this chapter.

from this preface that Gugler completed the copy in Schöner's residence.



Gugler in Nuremberg in November 1538

PROG

NOS

TICON DOMINI

Stephani Norimbergensis,
per Lucam Gauricum Nea
politanum. Bononiae sup
putatum examinatum
mense Novembris

· 1 · 5 · 3 · 4 ·

Regnante Paulo · 3 · Pontifice
Maximo

Descriptum ex manu sive Chyro
grapho Gaurici anno 1538 a[nno]d[ominicae]i[ncarnartionis].
ultimo Novembris Norimbergae in ae
dibus Schoneri tunc temporis Astro
logi excellentissimi foelici sydere.

Prognosticon of Mr. Stephan of Nuremberg by Luca Gaurico of Naples. Calculated and tried in Bologna in November 1534 during the reign of the great Pope Paul 3. gathered from the manuscript of Luca Gaurico in the year of the incarnation of Christ 1538, at the end of November in Nuremberg in the house of Schöner, the best astrologer of that time, under a happy star.”

In light of the close contact Melanchthon and Schöner had in matters political and astrological, it seems probable that Rheticus went to Nuremberg

with Melanchthon's recommendation to study astrology with Schöner and have access to his extensive astrological library. It appears from the above that Rheticus may well have stayed with Gugler at Schöner's residence. This copy of Gaurico's work was thus done by Gugler on Rheticus' behalf.

Further evidence for Gugler being Rheticus' *famulus* is found in the fact that Gugler inscribed himself at the University of Tübingen on 4/28/1539 when Rheticus traveled to visit his family in Voralberg. Rheticus however appears to have either not traveled back through Tübingen in his trip to visit Copernicus or to have had a falling out with Gugler, for Gugler did not travel any further with Rheticus. Through some form of miscommunication the manuscript was left in Gugler's hands.⁷¹

⁷¹That the manuscript was left in Gugler's possession is seen from the late date which is assigned to the death of the mother in his genealogy (331) "hans Gugler hausfrau ist geboren anno 1500 moritur 1545."

ζ. The Astrological Enterprise

As we have seen, Rheticus' valuation of astrology was in large measure determined by Melanchthon's influence. Melanchthon however was no great astrologer or mathematician, and very much needed a competent astrologer in Wittenberg to further astrology pedagogically and scientifically. Given room to pursue this, Rheticus was left to his own devices in creating his own *astrological philosophy* and *research programme*. This chapter explores the development of both of the above during Rheticus' time in Wittenberg.

The astrological philosophy.

Just as we refer to the belief that the world is determined by atoms as an atomic philosophy, so too do we call the belief that everything is determined by the stars an astrological philosophy. And just as there have been many atomic philosophies through the ages, so too have there been many astrological philosophies. Rheticus' astrological philosophy is simple enough to be outlined in four tenets. The scope of these tenets however is extraordinarily far-reaching and touches every aspect of how the world is viewed.

1) *God wants us to know Him, and has thus outlined His Providence in the stars.*

We found this tenet adumbrated in Melanchthon's thought and used in Rheticus' first public speech *Do the Laws Condemn Astrological Prognostications?*. Namely, that a cause and effect astrology refutes the *ex casu* hypotheses of the Epicureans. The there discussed cause and effect astrology was tied to a vague notion of 'physics'. It appears that he construed 'physics' as a sort of unification of all the sciences. This unified science was given to the study of the "works of the world" and the "principles of nature". Furthermore, these divine works and principles were of a decidedly mathematical nature. For in order to reach them one must first have what Rheticus calls the "efficient instrumental cause" of astronomy⁷², and the "wings of the enlightened"⁷³: arithmetic and geometry.

After they [the students] have been decorated with these studies [arithmetic and geometry], they proceed to observe the works of the world and the principles of

⁷²*Annotata in Alfraganum*, p. 36.

⁷³*A Preface to Arithmetic*, p. 10.

nature, and then they shall finally be called φυσικοί

In what sense however is the physical world mathematically determined or written in a mathematical language? We must take care not to endow the Pythagorean ‘all is number’ with a classical or modern meaning. For Rheticus has his own interpretation of Pythagoras. Arithmetic and geometry are not the final determining thing. They are the *causa efficiens instrumentalis* through which God reveals himself unto us. God himself however encompasses number.

The Pythagoreans spoke figuratively in arithmetical words, and they translated these to Physics, and to moral Philosophy: For Pythagoras defined God in the following manner: God takes his departure above the next number after the highest number. [*A Preface to Arithmetic*, p.13]

Clearly then arithmetic and geometry are the precondition for us to understand ‘physics’. Yet what is physics for Rheticus? He sometimes refers to astrology as a part of physics:

Astronomy is the foundation of Astrology, thus all uses of Astrology, that is of that other part of physics, also pertain to astronomy. [*Annotata in alfraganum* p. 39]

And at others equates physics and astrology:

Fate is two-fold, that is the theological, like the stoic, and the physical or astrological. [*Ordo ac summam ptolomei Libri 133^v*]

He also speaks of a ‘true physics’:

This is the common opinion of the astrologers on the election of Hyleg: yet Ptolemy’s method is more correct and more conform to the true physics [*Tractatus integer de nativitatibus* fol. 267]

It would seem that Rheticus saw everything as astrologically determined but was unable to reduce all phenomena directly to astrology. And for these phenomena he used the blanket term ‘physics’. This is seen nicely in a passage we have already quoted in full from his first speech *an leges damnent praedictiones astrologicas?* “Therefore many predictions of a Physical nature are also Astrological. For these are also observations of causes and effects.”

Thus we might also describe our second tenet:

2) *Astrology must reveal the cause and effect physics of God’s Providence* as ‘Astrology must reveal the cause and effect astrology of God’s Providence’!

Rheticus’ early usage of ‘physics’ as applying to both the supra and

sub lunar spheres significantly prepares him for Copernican theory. For the traditional sublunar physics must be extended to all other ‘planets’. (Cf. III ζ)

The remaining two tenets appear to have been arrived at independent of Melanchthon’s influence. They reflect above all the generation gap between Melanchthon and Rheticus. Whereas Melanchthon had been raised in the glory years of ‘event astrology’ based on Arabic conjunctive theory, and devoted most of his astrological thought to it⁷⁴, Rheticus had witnessed its demise in his formative years, most prominently in the failed prognostications for a massive deluge in the year 1524 based on a conjunction of Jupiter and Saturn, and those for the comet of 1532. As a result of this Rheticus turned his attention to natal astrology which he regarded as certain.

3) *Natal astrology, as opposed to event astrology, is certain.*

This tenet is expressed in several scattered statements like “nativities and the fact that human life is governed by the virtue and influx of the 7 planets are entirely certain.”⁷⁵ This does not imply that the practiced art is certain. It is only certain that God effects His Providence through natal astrology, and that He has given us the means to know this Providence.

“The confutation does not make the art impossible. It is not to be damned just because the inexperienced practice the art, just because certain persons misuse the name of astrology. The errors of the art are not to be conferred upon the art itself. I concede however that the art is difficult, and that many erudite men have often been mistaken due to the diversities of the heavens, of the air, of the seeds, of the places, of education, of virtue, of custom, of life, etc.” [*Ordo ac summam ptolomei libri* 133-133^v]

Event astrology relied in large measure upon some variant of the ‘science of astrological parts’. The parts are simply divisions of the Zodiac. Examples of these division which Rheticus himself gives are the divisions of the year into quarters or months⁷⁶ and Alcabitius’ division into twenty-one parts⁷⁷ (instead of the traditional twelve houses). An example of the science

⁷⁴As seen in his extensive correspondence with Camerarius which usually discusses at least one political event in astrological terms per letter.

⁷⁵*Tractatus integer de nativitatibus* 167, p. 110.

⁷⁶*Tractatus integer de nativitatibus* 171^v, p. 114.

⁷⁷*Tractatus integer de nativitatibus* 173^v, p. 115-116.

of parts as applied to event astrology, also taken from Rheticus, is taken from the thirty sixth statement of the spurious *Fructus* attributed to Ptolemy: “Many will be moved to the sword in all societies in which Mars occupies the middle of heaven at the time of its foundation.”⁷⁸ A contemporary example of the science of parts as applied to event astrology is Carion’s prediction of a massive deluge for 1524 on account of the Saturn-Jupiter conjunction in the water sign (ie. part) of Pisces. Rheticus learned of the science of astrological parts from Albumazar’s *Introductorium magnum*⁷⁹ and Alcubitus’ *Introduction*⁸⁰, and discusses it in Chapter III of his *Tractatus Integer de Nativitatibus*. Rheticus uses this chapter to discount these odd variants and introduce the true twelve ‘parts’ or houses, to each of which he then dedicates a chapter (ch. 4-16 of *Tractatus Integer de Nativitatibus*).

We then discover Rheticus’ true opinion in a Misquotation. Although Albumazar only denies the usefulness of a specific variant of the science of parts to event astrology, Rheticus presents it as testimony to the unfruitfulness of *all* methods involving a science of parts applied to event astrology

Albumazar says in his *Great introduction* that there are no parts which the judgements of the stars use in regards to both judgements and the state of affairs and of the fruits of the earth in regards to their fertility, such as is a part of wine, of honey, and of other things of which antiquity spoke in its judgements [*Tractatus integer de nativitatibus*, 172^v-173, p. 115]

Rheticus’ justification of the superiority of natal astrology over event astrology also involves a strong social impetus which he shared with Melanchthon. Namely, that it is the ‘duty’ of each individual to know what lies in their fate. To recognize his role in God’s Providence. And, as we have already seen, if everyone were to understand their fate, there would be no civil unrest⁸¹, no resistance to God’s Will:

Guido Bonati says in the introduction to his complete book, a tract that is on nativities, that all work in astrology is occupied with two matters. The first is the

⁷⁸*Tractatus Integer de Nativitatibus* 172, p. 114.

⁷⁹Abû Ma’shar (ca.786-ca.885).The *Introductorium magnum* appeared in Augsburg in 1489 and Sessa in 1506.

⁸⁰Al-Qabîr şî [Alcabitius Abdylaziz] As is seen from the references to Alcabitius found in this tract Johann of Saxony’s edition of Alcabitius’ ‘*Introduction*’ was used *Alcabitii Ad Magisterium iudiciorum astrorum Isagoge / Commentario Ioannis Saxonii declarata*, Paris, 1521.

⁸¹Cf. also Ptolemy *Tetrabiblos* I, 3, 11: “For, in the first place, we should consider that even with events that will necessarily take place their unexpectedness is very apt to cause excessive panic and delirious joy, while foreknowledge accustoms and calms the soul by experience of distant events as though they were present, and prepares it to greet with calm and steadiness whatever comes.” (Trans. F. E. Robbins)

science of nativities which generally teaches from the figure of heaven which occurs in that hour of a person's birth, namely, what shall occur [*accidere*] to him in his entire life and what will be said of him after he is dead. The other is the science of the revolutions of the years of the world and what occurs in the lower world [in *inferioribus rebus*] in any given year, of good and bad, of heat and dryness. Yet among these two the science of nativities is the more principle and the more useful. More useful because it is the duty of people to know what shall generally occur in all matters of this world. For which reason Ptolemy also says in the *Almagest* "Stupid is he who is ignorant of his own nature."⁸² [*Tractatus integer de nativitatibus* fol. 149, p. 91]

Concurring with Melanchthon, it was necessary to this conception of astrological providence that man has no free-will "The stars govern the body, they conquer the free mind."⁸³

The singular devotion with which Rheticus dedicated himself to natal astrology as opposed to the traditional mix of event and natal astrology practiced by astrologers from Ptolemy to Melanchthon marks a significant break in Rheticus' thought. Singular acts like eclipses and conjunctions no longer portend diseases and wars with the same certainty they did one generation earlier. God's Providence for mankind must be more subtle! For Rheticus, the answer was seen in Providence being effected by the determination of each individual through his horoscope.

Yet Rheticus could by no means leave it at that. For how could God's Providence be rigidly expressed through the summation of the interactions of all these horoscopes? God's providence is indeed miraculous, but not coincidental. It cannot depend on seemingly chance interactions. Less chance was of course the advantage that event astrology offered. God effected in event astrology large-scale events with far-reaching consequences.

Rheticus preempts the efficacy of event astrology by infusing his new natal astrology with a separate assumption he would passionately follow all his life. Namely, that certain individuals are 'illuminated' by God to fulfill His Providence.

4) *God has 'illuminated' specific individuals to a) spread the Good News of His Providence as expressed in the stars, i.e. astrologers, and b) to spread the Good News of the Gospel, i.e. Church leaders and the princely powers who protect them.*

We can perhaps best approach this fourth tenet through Rheticus'

⁸²This sentiment is not to be found in the *Almagest*. The general idea, though not word for word, may be found in *Tetrabiblos* I,3.

⁸³*In astrologiam annotata* 103^v, p. 81.

explication of the four ‘causes’⁸⁴ of astronomy.

Final Cause

It is therefore to be determined which matter moves God to impart astronomy unto man, namely because He wanted to be made visible [*illustrari*] and recognized in nature. Paul to the Romans “that which can be known of God is manifest to those, for God made manifest to them his invisibles from the work of the world through which they have been created, they are observed in the intellect, for clearly His virtue and divinity are eternal.” [*Annotata in alfraganum* 62^v, p. 38]

The notion that ‘that which can be known of god is made manifest to man’ is absolutely central to Rheticus’ understanding of the scientific endeavour. It means to Rheticus not only that which is possible for man to know but also that which is permissible to be known. Thus all areas of nature which can be known are given by God to Man to be known in order to understand His Providence. No area or idea found in scientific study, which can be known, may be considered off-limits. For God has presented us with these invisibles of His creation to be known. As such, investigating them is necessary to our salvation. This fundamental tenet would later form the backbone of his argumentation in his and Copernicus’ ‘*Treatise on Holy Scripture and the Motion of the Earth*’ and doubtlessly was a catalyst in his immediate adoption of the heliocentric hypothesis.

A quick comparison with the original text however reveals that Rheticus’ reading of scripture is substantially misquoted to fit his interpretation.

18 For the wrath of God is revealed from heaven against all ungodliness and unrighteousness of men, who hold the truth in unrighteousness;
 19 Because that which may be known of God is manifest in them; for God hath shewed [it] unto them.
 20 For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, [even] his eternal power and Godhead; so that they are without excuse:
 21 Because that, when they knew God, they glorified [him] not as God, neither were thankful; but became vain in their imaginations, and their foolish heart was darkened. 22 Professing themselves to be wise, they became fools,⁸⁵

Rheticus’ text is twisted to suggest that the ‘invisibles’ are the object of scientific discovery, and are capable of being known through the intellect. It essentially attempts an about face on the interpretation given to the passage by many church fathers and still used in the pulpits today: *to pursue science*

⁸⁴As seen in the Sacrobosco and Alfraganus lectures, analyzing a given subject with respect to the four Aristotelean causes was a favored philosophical and pedagogical apparatus of Rheticus’.

⁸⁵The *King James Translation* of *Rom. 1:18-22*, I quote the *Latin Vulgate* in my edition of *Annotata in alfraganum*.

as a path to recognizing God is tantamount to worshiping false gods. The best example of this interpretation is found in the formative Church father whose anti-science rhetoric defined this passage for future generations:

They did not know this “Way,” and so they fancied themselves exalted to the stars and the shining heavens. And lo, they fell upon the earth, and “their foolish heart was darkened.”⁸⁶

A further stretch of this brief but potent passage is that whereas the original states “Because that which may be known of God is manifest in them; for God hath shewed [it] unto them. 20 For the invisible things of him...”, Rheticus says “that which can be known of God is manifest to those, for God made manifest to them his invisibles”. For Rheticus, the invisibles aren’t just self-evident truths of creation, but are rather revelations of science imparted by God. The Gospel’s “in them” reflects some sort of known inner truth whereas Rheticus’ “to them” suggests an externally imparted knowledge. We shall furthermore find that the ‘them’ in Rheticus’ version are actually messengers of God chosen to reveal His Providence to the common mind.

The Efficient Cause [of astronomy] is God, thereafter the *ratio* or human mind [*mens*], for God excited the minds [*ingenia*] of outstanding men so that they would confer for the consideration and inquisition of nature. [*Annotata in alfraganum* fol. 61, p. 35]

Then, after quoting the preface to Aristotle’s *On the World*⁸⁷ which can and should be interpreted as a call not only for the study of astronomy but astrology as well, Rheticus states

It is clear from the above that the human mind is not the sole efficient cause of Astronomy, if the mind is divinely roused, which as a certain gift endows man with these beautiful and truly divine disciplines. This gift was in Hypparch, Ptolemy and Peuerbach. [*Annotata in alfraganum* fol. 62, p. 36-37]

The belief that God illuminated certain men structured to a large extent Rheticus’ entire life. He continuously sought the ‘luminaries’ of his time and marked their words as Gospel. This belief formed to a certain extent the backdrop of his trip to Nuremberg, Ingolstadt and Tübingen in 1538. Above all however Rheticus would later reflect upon the personages of

⁸⁶Quoted from *Augustine’s Confessions*, trans. by A.C. Outler, 1955, Book V, ch. 3, § 5. cf. also *ibid.* Book VII, ch. 9, § 14.

⁸⁷Presently considered spurious.

Copernicus, Cardano⁸⁸, and Paracelsus⁸⁹ as the luminaries of his time.

‘Great men’ are not however somehow placed upon earth by means of a separate act of God. They are rather ‘physically ordained’ through ‘great constellations’. As such, the nativities of ‘great men’ are to be treated fundamentally different than those of ordinary men. For they are occasioned by ‘great’ celestial events.

It is the most ancient and thus the most tested. It is to understand how the universal and great configurations of heaven influence people through the accidents of great rank in the greater world. For this reason the nativities of great men are not to be rectified if not through these [configurations], seeing that they also depend on such natural configurations because they come to be through them.

[*Annotata in astrologiam* fol. 87, p. 64]

Rheticus then goes on and reinterprets the traditional Ptolemaic distinction of particular and universal. For Ptolemy (*Tetrabiblos* II. 1, 54), the universal are the fates of cities and countries, periodic conditions such as wars and diseases, and the weather, whereas the particular are individuals and lesser events. Rheticus however posits ‘great men’ as particulars of universals (ie. great celestial events). Thus great celestial events do not signify the grand events predicted by the event astrologers, but the birth of a great man.

likewise because the universal necessarily include particulars the genitures of princes are rectified in this manner, just as Ptolemy admonishes us in Ch. 2 of the *Tetrabiblos* when he says that it is necessary for those who wish to observe particulars that they hurry to first observe those which are more universal and the great occasions. Therefore the nativity of the serene prince of Poland⁹⁰ was immediately preceded by the great eclipse of the luminaries which decided his conception [87^v] according to Zarathustra⁹¹ who shows that the subjects descend into the bodies and arise into the world through the shadows of the uterus by the power of some prince of intelligence in heaven. The divine Plato also seems to have thought this, namely the souls descend into the bodies under certain stars. He set this forth however not as a proof but as an assertion, for we spoke insofar as it pertained to the teaching of the physicists in which we delegate the great eclipse of

⁸⁸Whom he visited in 1545.

⁸⁹Whom he met at the age of 18 and later vigorously studied.

⁹⁰The nativity which is here considered is that of Sigismund II, later also known as Sigismund Augustus (1520-1572), who was prematurely crowned in 1530 to ensure his succession.

⁹¹This and the following reference to Zoroaster (Zarathustra) was undoubtedly gained from Haly Abenrager’s *De iudiciis*. Cf. Stegemann, V.: ‘Astrologische Zarathustra Fragmente...’, *Orientalia*, 6, p. 317-336.

the luminaries to Saturn the *dominum* of fate according to the opinion of Hermes,⁹² to which Ptolemy also testifies. [*In astrologiam annotata* p. 64]

The Research Programme

The science of horoscopes was very contentious. It was also surprisingly ‘new’. The circle disregarded the horoscope art of the Middle Ages almost entirely and focused on the many newly available translations of Arabic texts. These Arabic texts were not taken as Gospel however. As we have already noted, these texts were thought to contain ancient truths, yet in corrupted form.

Rheticus’ goal seems to have been to forge a new horoscope science consistent with his theory of great men. This project required four key elements:

1) *An explanation of the properties and circumstances of each of the twelve houses (Tractatus integer de nativitatibus Ch. 4-15)*

Rheticus believed the division of the Zodiac into twelve houses to be the cornerstone of natal astrology. These chapters reflect an effort to glean the most certain information regarding the characteristics of these houses from the authorities available. They all follow a similar structure. It is first ascertained to which aspect of the child’s life the house pertains. For example, the all-important first house determines the child’s 1) nutrition 2) beauty 3) size 4) complexion 5) happiness, and 6) intelligence whereas the second house determines the child’s dignity, substance and fortune. There is usually in this allocation of the house’s powers very little controversy presented as to the opinions of the authorities. There then follow a number of ‘considerations’ which all pertain to the particular powers of the planets in the given house, e.g. (in the first house) “If the sun is ascendent in a diurnal nativity in a water sign then the life of the newborn shall be temperate.”⁹³

An account of a given authority on how to judge the significations of the house is then given, e.g. “Manner of judging the nutrition of the newborn according to the rule of Guido Bonati”⁹⁴. We here regularly find accounts of the opinions of Ptolemy⁹⁵, Guido Bonati⁹⁶ and Haly Habenregel.⁹⁷ Of less

⁹²Ivlii Firmici Materni Ivnioris Sicvli V.C. *Ad Mavortivm Lollianum Astronomicon Lib. VIII. / per Nicolavm Prvcknervm Astrologum nuper ab innumeris mendis uindicati. His Accesserunt ... Ex Arabibus Et Chaldeis Hermetis uetustissimi Astrologi centum Aphorismi*, Basel 1533.

⁹³*Tractatus integer de nativitatibus* fol. 175, p. 117.

⁹⁴*Tractatus integer de nativitatibus* fol. 177^v, p. 120.

⁹⁵Rheticus’ Ptolemy authored the *Tetrabiblos*, the *Centiloquium* (now considered spurious), and several opinions which Haly Habenregel attributes to him in his commentaries of the *Tetrabiblos* and the *Centiloquium*. Also influential was Alī b. Ridwān’s (d. 1068) Commentaries on Ptolemy’s *Centiloquium* (which was very well proliferated in manuscript form

prominence are Abraham the Jew⁹⁸ and Leopold of Austria.⁹⁹

This method is rigidly followed in these chapters. There is, as far as I can tell, no original input outside of the valuations given the listed opinions. Although particular weight is always given to Ptolemy's opinion, 'certain knowledge' of these houses is most often found in those opinions upon which the authorities agreed.¹⁰⁰

2) *A science of the 'three directions' of the nativity: Hylech* 'The Giver of Life' (Ch. 16), *Alcocodon* 'The Planet having the great dominion in Hylech' (Ch. 17 and 18), and *Almuten* 'The Planet having the great dominion before Hylech and Alcocodon' (Ch. 19),

These 'directions' and their role in the general scheme reflect Rheticus' dependence on Arabic astrology. He does however take pains to demonstrate that these concepts were to be found in Ptolemy. Each chapter contains a section entitled "How to judge the Hylech [e.g.] according to Ptolemy", actually however the opinions found in those sections are taken from Haly Habenrudian's commentary of Ptolemy.¹⁰¹ Examples of how these terms are applied are given below.

3) *A science of 'rectifying' the horoscope (In astrologiam annotata)*

Although the logic of the research programme proceeds in the manner of these four steps, *In astrologiam annotata* was written first. Primarily, I believe, because the art of 'rectifying' was thrown into the limelight due to

through John of Seville's translation. It was then printed in various collections, Venice 1484, Venice 1493, Venice 1519) and *Tetrabilbos* (Venice 1519).

⁹⁶*Decem continens tractatus astronomie*, Augsburg 1491, 1506 Sessa, 1530 Basel. This mammoth work will have been one of the key sources of Rheticus's knowledge of Arabic astrology.

⁹⁷Alī ibn abi 'r-Rijāl (d. after 1040), Rheticus primarily uses his *De iudiciis seu liber completus*, Venice 1485, Venice 1503, Venice 1520, Venice 1523.; but also *De Nativitatibus*, (only available in manuscript form. An exemplar may be found in Erfurt under Erfurt 12° 18.).

⁹⁸Or Abraham Avenoris of Todelo (1089-1164); Rheticus uses his *De nativitatibus* which was published in Venice in 1485, and in 1537 in Cologne.

⁹⁹Leopold's (active ca. 1271) *Compilatio de astrorum scientiae*, published in 1489 (Venice and Augsburg) and 1520 (Venice). Rheticus most likely used it as the source of many of his opinions on Arab astrology as the *Compilatio* covers Haly, Sahl Mashallah, Abu Mashar, Thabit and al-Kindi. A full list of Rheticus' sources may be found in the index of persons.

¹⁰⁰After I felt I had understood the structure of these chapters, and was convinced I would find nothing original in them, I ceased my transcription. Thus I only transcribed ch. 4-7.

¹⁰¹See the above footnote to Ptolemy.

the various rectifications of Luther's horoscope. The art of rectifying is also central to Rheticus' natal astrology based on great men.

In Rheticus' scheme, the nativities of great men are rectified post factum. That is, the astrologer may change the time of birth and the interpretation of the horoscope based on his knowledge of the person in question. That this process often involved blatant arbitrary changes to the time of birth is witnessed in the various times assigned in Luther's horoscope (discussed below). Making matters worse are the various methods of rectifying which the astrologer has at his disposal. Rheticus gives seven methods.

Now, for Rheticus, the rectification of the nativity, particularly that of a great man, aims at discovering God's purpose for this individual, and the astral means he uses to effect it. *The rectification does not amount to a bending or massaging of the empirical data.* This is because the empirical data, contrary to current belief, *is epistemologically inferior to the astrological method.* That which is found empirically is inexact and not to be trusted. One never finds Rheticus quoting a given horoscope and the subsequent life of the person as proof against a given astrological method. Further, the number of methods which an astrologer has at his disposal is not a measure of his inconsistency, but of his erudition!

4) *A compilation of nativities of great men* (In astrologiam annotata 323-331). Philosophically, logically and chronologically this astrological work of Rheticus' culminates in a compilation of nativities of great men. Philosophically because it is the premise of Rheticus' astrological philosophy that God effects His Providence through the natal constellations of great men. Logically because every preceding building block of the tract aims at establishing a natal astrology based on great men. Finally, as we discussed in the section on the provenance of the manuscript, these nativities were the last task completed before Gugler transcribed the *Prognosticon of Stephan* while with Rheticus at Schöner's house in Nuremberg.

Although this compilation may not be considered complete, it offers us an excellent reflection of the designs of Rheticus' early natal astrology project. We are to understand our time and surroundings through the nativities of those men who shape it. Important above all however is not the deeds of these men, but the truths which God wished to be revealed through them. This is obviously the case with the New and Old Testament figures Christ and Moses (fol. 323). Although the remaining nativities seem to merely reflect the times, they actually present a very radical protestant viewpoint: After the testimonies of Moses and Christ, Luther is the next messenger of God, who not only has a message, but is bitterly embroiled in a battle with the Babylonian Church and its master in Rome, the Antichrist.

The compilation may be divided into four groups of men who all

participate in this struggle:

1) *The enemies and supporters of the reformation*

Philip I. of Hessen¹⁰², Friedrich III.¹⁰³ (both on 323^v), Johannes Frideric of Saxony¹⁰⁴ (324), Ulrich of Württemberg¹⁰⁵ (324^v), Melanchthon¹⁰⁶ (324^v and 330^v) and Luther (326) face the likes of Erasmus¹⁰⁷ (324), George of Saxony¹⁰⁸ (327), Karl V.¹⁰⁹, Ferdinand¹¹⁰ (both on 328^v), Franz¹¹¹ and

¹⁰²Philipp I. of Hessen, The Brave, * Marburg 13. 11. 1504, + Kassel 31. 3. 1567, *Landgraf* (from 1509). Participated in the victory over Franz von Sickingen 1522/23. Follower of Luther's since 1524. He introduced the reformation to Hessen in 1526, and established the first evangelical University in Marburg in 1527. Leader of the evangelical princes next to the *Kurfürst* of Saxony. In 1529 he occasioned the Marburg religious talks. In 1534 he successfully freed the Lutheran Duke Ulrich (Uldeicus) of Württemberg. Incarcerated by the King from 1547-1552. We read next to his horoscope "Captured by Karl the Emperor in 1547."

¹⁰³Friedrich III., The Wise, * Torgau 17. 1. 1463, + Lochau bei Torgau 5. 5. 1525, *Kurfürst* (from 1486). Occupied himself with the reform of the Kingdom, and provided Luther with protection even though he never committed himself to the new teaching.

¹⁰⁴Torgau 30. 6. 1503, + Weimar 3. 3. 1554, *Kurfürst* (1532-47). Head of the Schmalkaldic union next to Philipp I. of Hessen; Following the fall of Wittenberg (19. 5. 1547) he was forced to relinquish his *Kurwürde* and lands to Duke Moritz. We read next to his horoscope "Captured in 1547 by Karl the Emperor. Alubather says in chapter 145 that when the *dominus* of the 9th house is combusted in one of the angles the born shall be captured during his travels, he shall then be forced into captivity and prison."

¹⁰⁵Reichenweier 8. 2. 1487, + Tübingen 6. 11. 1550, Duke von Württemberg (since 1498). As he occupied the city of Reutlingen he was routed by the Schwabian Union und F. Geyer in 1519. He was lead back to his land only in 1534 by Philip I. of Hessen, after which he introduced the reformation in Württemberg.

¹⁰⁶324^v analyzes the date of Melanchthon's arrival in Wittenberg as a horoscope; 330^v presents his birthdate as 2/16/1497 at 7:06, Melanchthon's astrological associate Gaurico however would later give 2/4/1497 at 19:20 (Hoppmann 98, p. 81).

¹⁰⁷We read next to Erasmus' horoscope "Died on the 11th of July 1536 from dysentery."

¹⁰⁸Georg The Bearded also called The Rich, Meißen 27. 8. 1471, + Dresden 17. 4. 1539, Duke (since 1500). George tried to halt the proliferation of the reformation. He suppressed the Peasant's War in Thüringen.

¹⁰⁹Philipp II., Valladolid 21. 5. 1527, + El Escorial bei Madrid 13. 9. 1598, King of Spain (since 1556) and Portugal (since 1580). Son of Karl V.

¹¹⁰Ferdinand I., Alcalá de Henares 10. 3. 1503, Vienna 25. 7. 1564, King (since 1556). Brother of Karl V.; enabled the Augsburg Religious Peace.

¹¹¹Franz I. Cognac 12. 9. 1494, + Rambouillet 31. 3. 1547, King (since 1515).

Ludwig (both on 329)¹¹², and Albert Bishop of Mainz¹¹³ (330^v).

2) *The relatives of these figures - crucial to several astrological techniques*
 Johannes Ernestus Dux of Saxony¹¹⁴ (324^v), Phillip Melancthon jr. (325^v), Maximilian II¹¹⁵, Phillip II¹¹⁶ (329^v).

3) *Those who staged the struggle*
 Mehmed the Conqueror¹¹⁷ (325^v), Christian I¹¹⁸ (327^v), Friedrich III (328).¹¹⁹

4) *Various figures belonging to Rheticus' circle*
 Rheticus himself (326^v), Johann Schöner¹²⁰, three obscure figures who probably were young astrologers in Wittenberg Schedel(?)¹²¹ (325) Johannes Bechtololus(?) and Nicolaus Brom(?) (330), and finally Albrecht Dürer

¹¹²Ludwig XI., The Horrible, Bourges 3. 7. 1423, + Plessis-les-Tours 30. 8. 1483, King (since 1461).

¹¹³Albrecht II., *Markgraf* of Brandenburg, 28. 6. 1490, + Mainz 24. 9. 1545, Archbishop of Magdeburg (1513), *Kurfürst* (1514), Cardinal (1518).

¹¹⁴Duke Johann Ernst I., Brother of *Kurfürst* Johann Friedrich, Duke of Braunschweig and Lüneburg.

¹¹⁵Maximilian II., Vienna 31. 7. 1527, + Regensburg 12. 10. 1576, Rom. King, King of Bohemia (since 1562), Emperor (since 1564). Son of Ferdinand I.. Leaned towards Protestantism and tried, in vain, to balance the two confessions. We read next to this horoscope the latest marginal remark of the entire manuscript "Elected King in 1562 on the 24th of November."

¹¹⁶Phillip II, Valladolid 21. 5. 1527, + El Escorial bei Madrid 13. 9. 1598, King of Spain (since 1556) and Portugal (since 1580). Son of Karl V.

¹¹⁷Mohammad II (Mehmed the Conqueror) (1432-81), Ottoman sultan, born in Adrianople (referred to as Hadrianapolis in the nativity; now Edirne). During his rule (1444-1446 and 1451-81), he captured Constantinople in 1453 and thus completed the Ottoman destruction of the Byzantine Empire.

¹¹⁸1426, Copenhagen 21. 5. 1481, King of Denmark (since 1448), Norway (since 1450), Sweden (since 1457), Duke of Schleswig and *Graf* of Holstein (since 1460). He succeeded in 1450 with a strong strategic alliance with Norway, and founded in 1460 the union of Schleswig and Holstein with Denmark.

¹¹⁹Friedrich III, Innsbruck 21. 9. 1415, + Linz 19. 8. 1493. Voted King in 1440.

¹²⁰We read next to Schöner's horoscope "Johannes Schöner died in the year 1547 on the 16th of February at the age of 70."

¹²¹Given the latitude 49.5 and the name Schedel my best guess is that this person was a relative of the famous Nuremberg native Hartmann Schedel (+1514) who wrote the *Schedelsche Weltchronik*.

(326^v) whom Rheticus admired greatly.¹²²

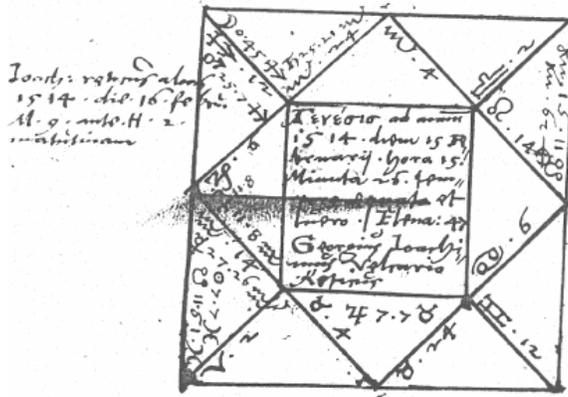
One could present a very exhaustive study on the ‘rectifications’ Rheticus makes to many of these horoscopes. However an appreciation of Rheticus’ fascination of the natal astrology of great men may be obtained through the study of two of these men, one astrologically great, the other not.

Rheticus’ Horoscope

We encounter an interesting puzzle in Rheticus’ own Horoscope. We find there two birthdays, but only one horoscope.

Inner box: Genesis in the year 1514, 15th of February, 15:26 the true and rightly placed time. 47N George Joachim Reticus from Feldkirch¹²³

Margin: Joachim Reticus at another time, 16th Feb. 1514, 9 minutes before the second hour of the morning¹²⁴



326^v; Rheticus’ Horoscope

In a fine bit of detective work, Christian-Paul Berger recognized that the date given in the inner box was not consistent with the horoscope surrounding it, and that the planetary positions of the horoscope rather corresponded with the date given in the margin.¹²⁵ Then, in a rather instructive mistake, Berger pursued his discovery with the aim of showing

¹²²Rheticus writes in his *Chorographie* “Learn in his [Dürer’s] books how one should reproduce a landscape that can be brought to the face.” Rheticus gives Dürer’s date of birth as 5/20/1471 22:29. It is most probably rectified as we find the date of 5/21/1471 13:30 LMT in a horoscope made by Beheim (in a letter to Pirckheimer 1507; Hoppmann (1998) p. 107). It was probably so rectified because Dürer’s *hyleg* would be the Sun in the 5/21 horoscope - which does not bode well as it stands in conjunction with Saturn. By changing it to a nocturnal horoscope the *hyleg* becomes the Moon - which stands in a pleasant conjunction with Venus. It seems however that the 5/21 horoscope had already gained wide acceptance as Dürer was commonly referred to as a *Saturngenie*.

¹²³“Genesis ad annum 1514 · diem 15 Februarii · hora 15 Minuta 26 · tempore aequata et vero · Eleva[tio] 47 Georgij Ioa[chimi] Reticus”

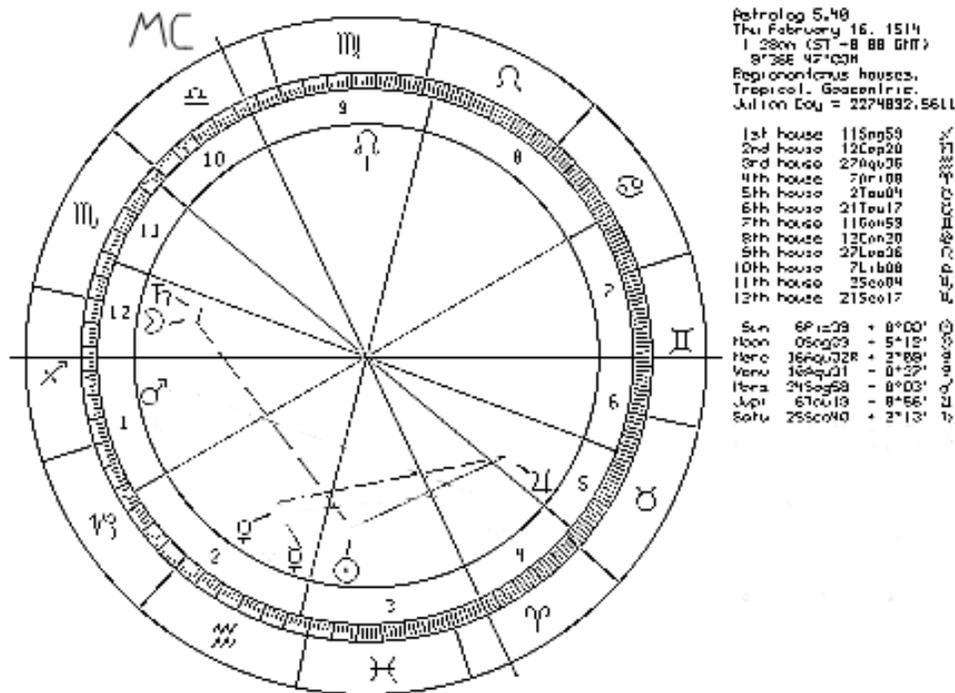
¹²⁴“Ioa[chimus] reticus alias 1514 · die · 16 · febru[arii] M[inuta] · 9 · ante · H[ora] · 2 · matutinam”

¹²⁵Berger, Christian Paul: Georg Joachim Rheticus’ Geburtshoroskop aus astronomisch-chronologischer Sicht, *Montfort*, 43, 1990(1), p. 144-150.

what Rheticus' 'true' birthday was. That is, since the date given in the margin corresponds with the planetary positions of the horoscope, Feb. 16th must be Rheticus' 'real' birthday. He then tries to explain the marginal note as a later comment made by someone who tried to correct an obvious discrepancy.¹²⁶ That such a discrepancy could arise in the first place is attributed to the 'sloppy' and inexact author!¹²⁷

The discrepancy however is far more interesting than sloppy astrology! The Feb. 15th date given in the margin is indeed Rheticus' true birthday, just not a very happy one. We need to consider not the modern astrological interpretation of the horoscope (which is rather benign), but that which would have presented itself from Rheticus' astrological lectures:

A brief explanation of the horoscope is called for. We begin with adjusting the horoscope for the 39 minutes east Feldkirch lies from GMT. As Berger pointed out, this leads to an ephemerid close to that found in the



Feb. 16 1:28am; an unpleasant beginning

horoscope. I have however taken the liberty of massaging the date with

¹²⁶Ibid. 150.

¹²⁷Ibid. 146, where the author mistakenly views the Zodiacal signs as identical with the 12 houses (ie. Aries must always be in the first house), and blames the astrologer for this.

another 16 minutes to 1:28am, as this provides us with an exact correlation of the value Rheticus gives for the beginning of the first house, and is closer in all of the other planetary positions than 1:12.¹²⁸ The line from left to right (Sagittarius to Gemini) denotes the horizon at the birth of the infant. It is the most critical as those stars coming up over the horizon (the *ascendent*) at the time of birth have the greatest influence. The line marked with ‘MC’ (*Medium Caeli*, ‘the middle of heaven’) designates the north-south axis. Although it is now customary to place the 1st house in the lower left hand corner of the scheme of the horoscope, Rheticus does not abide by this convention and his first house may be found anywhere in the wheel surrounding the inner box.

One would assume that the houses would be divided into twelve equal parts. Yet this is only seldom used. The manner of dividing the houses is to this day a hotly contested issue, primarily because Ptolemy never explicitly discussed the issue. Rheticus’ system most closely resembles the ‘Regiomontanus-system’.¹²⁹

Fortunately for us, yet unfortunately for Rheticus, no change in the division of houses or other methodological changes will change the dire interpretation of the horoscope. Critical above all is the conjunction of the Moon and Saturn in the twelfth house. In order to fully appreciate the dreadfulness of this conjunction we must turn to the manuscript itself, and ignore the innocuous interpretations of modern astrology. In its significations, the 12th house is actually rather benign, as it determines alone the nature and strength of one’s enemies and of labour for the newborn. The 12th house does however prepare the ground for the all-important 1st house and ascendent which shall stamp and determine the life of the newborn. In a good example of how Rheticus would like to ‘physically’ explain the forces inherent in astrology, Rheticus says of the 12th house:

For the fumes which rise from the humours of the earth through its virtue, that is of the 12th house (which comes to the earth with its dark and ominous nature), cause a great disturbance and damn the earth because the magnitudes and colors of the stars appear in a different manner, that is they are of a [different] nature through their [the fumes] nature.¹³⁰

¹²⁸The general interpretation of the horoscope does not change with this slight alteration.

¹²⁹I’ve yet to discover the logic behind Rheticus’ division of houses. I offer here three examples of the sizes of the first three houses of the Zodiac through which the remainder are determined: for Rheticus’ horoscope given above 24, 38, 48; for Albrecht Dürer’s 34, 27, 47; for Johannes Schöner’s 24, 31, 41.32.

¹³⁰*Tractatus integer de nativitatibus* fol. 293, p. 161: “Fumositates enim quae elevantur ab humoribus terrae virtute eius hoc est 12^a domus turbant quae venit ad terram cum spissitudine et lugubritate sua et damnant eam quippe quod apparent magnitudines et colores stellarum alterius maneriei id est naturae quaeque sunt per naturam eorum.”

Yet being fumigated by the ‘lot of fortune’, Saturn, isn’t really the worst part of the situation. As we briefly alluded to earlier, a critical aspect of Rheticus’ natal astrology, referred to as the *rebus principalibus in scientia nativitatibus*¹³¹, was the use of the *hyleg*, *alcocodon* and *almuten* to determine the length of a person’s life. Now the choice of these three factors can be a very tedious and uncertain affair. Yet not in our present case. The first rule is if the nativity is nocturnal (which our’s is) then the Moon shall be the *hyleg*¹³², if it is diurnal then the Sun shall be the *hyleg*. The next problem is to decide whether or not the *hyleg*, in this case the moon, is in an ‘apt’ position. This too has the potential to become a very uncertain affair subject to great interpretation and disagreement. Yet, as might have been gathered from the above quote, the 12th house, particularly directly before the ascendent as our moon is, is a very ‘apt place’ for the *hyleg*.

The next step is to see that the nature of the moon’s influence is determined by Saturn, because it stands in conjunction with it. Saturn doesn’t seem to be such a big deal to astrologers these days. For them it is just another in a series. We’ve even named a car after the evil planet. Yet for classical astrology, and in particular renaissance astrology, Saturn, the furthest planet, was deadly. He is the ‘Lot of fortune’, the ‘dominator of fate’ and his influence is distinctly nasty. People whose lives have gone terribly amuck are consistently referred to in the renaissance as ‘children of Saturn’, ‘*Saturnkinder*’.

Yet it gets worse, in chapter 20 “On Inquiring into the Quantity of Life of the Newborn”, Saturn is consistently referred to as the ‘*interfactor*’ or ‘murderer’. The method is very simple the ‘period of life’ is determined by the distance of the *hyleg*, in our case the moon, to the *interfactor*. Thus Rheticus should expect to live a short life.

Also disturbing is the fact that the *alcocoden* is “the planet having the greatest dominion in the place of the hylech”.¹³³ Saturn thus presents itself as the obvious *alcocoden*, because Saturn stands astride the moon - which is the *hyleg*. The *alcocoden* determines the mid-years of a person’s life. Rheticus, if he were to give this constellation credence, would thus have to expect a very short life.

The *almuten* of the nativity determines the later years of a person’s life. It is found as the planet having the most ‘*dignitates*’ in the horoscope after the *hyleg* and *alcocoden*.¹³⁴ Yet there is no other planet in Rheticus’

¹³¹*Tractatus integer de nativitatibus* fol. 293^v, p. 161.

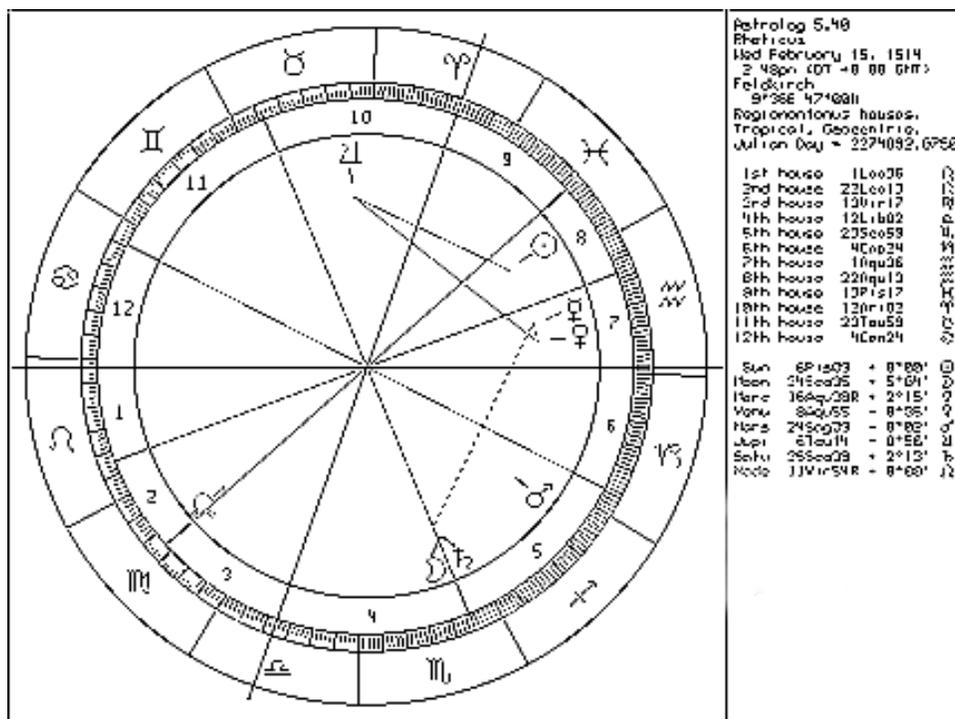
¹³²*Tractatus integer de nativitatibus* fol. 293ff (p. 161ff.) et passim.

¹³³*Tractatus integer de nativitatibus* fol. 297, p. 165.

¹³⁴*Tractatus integer de nativitatibus* fol. 299ff, p. 166ff.

horoscope possessing many potent relationships or characteristics. This fact would support the interpretation of a short life.

It is therefore understandable that the nativity was ‘rectified’ ‘*tempore aequato et vero*’. Thus, after the horoscope was drawn, and the interpretation obvious, a new time was presented in the middle of the chart. This slight alteration in time was very clever, it splits the Saturn-Moon conjunction into the 4th and 5th houses.¹³⁵ And, as it is now a diurnal nativity, the Sun shall be the *hyleg*. The ‘good planet’ Jupiter, which stands in a sextile relation to the Sun shall be the *alcocoden*, and either Mercury or Venus, in quartile with Jupiter, will be the *almuten*.



A benign horoscope

Yet to what extent did this rectification soothe Reticus’ sense of impending doom? It will surely have seemed sensible later in his life when the empirical evidence of his being alive must have counted for something. But in his younger years, did the Feb. 16th date present his life in a fatalistic saturnian glow? Did it drive his interest in astrology like a modern-day cancer patient who passionately takes up medicine in his latter days? Did it

¹³⁵This is however subject to the problem of the division of houses.

contribute to his period of insanity in 1547¹³⁶ and the actions of 1551¹³⁷ which lead to his exile?

Luther's horoscope

*Ego Martinus Luther sum infelicissimis astris natus, fortassis sub Saturno. Was man mir thun und machen soll, kan nimmermehr fertig werden; schneider, schuster, buchpinder, mein weib verzihen mich auff's lengste.*¹³⁸

Rheticus' research interests will have been decidedly influenced by the debate the eminent Italian astrologer Luca Gaurico (1476-1558) brought to Wittenberg shortly after Rheticus' own arrival.¹³⁹ Despite being a Catholic with very definite anti-Lutheran objectives, Gaurico was given a hero's welcome by Melanchthon and others in Wittenberg for four days in late April 1532.¹⁴⁰ Melanchthon was above all interested in obtaining an objective 'rectification' of Luther's horoscope from Gaurico.

Gaurico's prognostication for the years 1503-1535¹⁴¹ had won great notoriety in the explication and prognostication of political events. Melanchthon, whose interest was indeed in such astrological interpretations of political events would write of Gaurico's work "it reads like a history book."¹⁴² Gaurico's reputation grew immensely in Germany after being called

¹³⁶See H.K. Burmeister, vol. I, p.95ff.

¹³⁷See H.K. Burmeister, vol. I, p.109ff.

¹³⁸*Tischreden*, III, p. 193. I, Martin Luther, am born to unhappy stars, perhaps under Saturn. What one should do and make of me shall never be decided, tailor, cobbler, bookbinder, my wife has forgiven me at some length.

¹³⁹Rheticus arrived in Wittenberg in 1532 after Easter as the summer semester was already well under way This is evidenced by the Easter confessional register in Feldkirch (see Burmeister (1972) p.6), and the posterior position of his name on the inscription list in Wittenberg (Karl Eduard Förstemann, *Album Academiae Vitebergensis*, vol. I, 1841, p. 146.

¹⁴⁰As seen from the letter of recommendation which Melanchthon wrote Camerarius for Gaurico when he left to visit Nuremberg (CR. II, 585, May 2; and 587, May 18).

¹⁴¹Although first published in 1507, it only gained great notoriety with a huge publishing at Basel in 1522: *Lucae Gaurici neapolitani Prognostico[n] : Ab ... Anno Millesimi quingentesimo tertio, usq[ue] ad Tricesimum quintu[m] valiturum*

¹⁴²CR. II, 570-571.

to Brandenburg by the pro-catholic Joachim I in 1531,¹⁴³ where he issued horoscopes for the entire Brandenburg nobility.¹⁴⁴ By the beginning of March 1532, Melanchthon would recognize Gaurico as the “Prince of all Philosophy”.¹⁴⁵ The esteem in which Gaurico was held is seen in the fact that even after he published an unfavourable interpretation of Luther’s horoscope¹⁴⁶, and was named a catholic bishop shortly after his visit to Wittenberg¹⁴⁷, he continued to have his admirers in Wittenberg. Among these was Rheticus’ mathematics instructor Jakob Milichius.¹⁴⁸ Rheticus says of Gaurico in our manuscript “Gauricus is the greatest of all astrologers”.¹⁴⁹

The magnitude of the controversy surrounding Luther’s horoscope stems from the ‘Lichtenberg Prophecy’. The prophecy itself is older than Lichtenberg, it dates back to 1415 when John Hus, the radical Bohemian religious reformer, was burned at the stake, and the coming of a new religious messiah was foretold. Lichtenberg predicted the year 1484 on the basis of that year’s Jupiter-Saturn conjunction.

Luther tried to use the prophecy to his advantage, in spite of his anti-astrological stance. He would write:

St. Johannes Hus predicted of me, as he wrote from the prison in Bohemia: They will now roast a goose; but in a hundred years they shall hear a swan sing, ...¹⁵⁰

He also reprinted Lichtenberger’s prophecy in 1527 (Wittenberg) and 1535 (Strassburg). In the prologue to the Lichtenberg edition Luther unveils his position on astrology in a more favourable light than usual. Luther is willing, given the opportunity of the Lichtenberger Prophecy, to allow for the possibility of astrological prognostication:

¹⁴³Luther’s opposition to Melancthon’s astrological interests is further underlined in his interpretation of Gaurico being called by Joachim I: “Joachim called Gaurico to consult him as an exerciser of demons.” *Tischreden*, III. p.515.

¹⁴⁴Compare G. Schuster/F. Wagner (1906), p.496.

¹⁴⁵CR. II, 570.

¹⁴⁶*Tractatus Astrologicus*, 1552, fol. 69^v.

¹⁴⁷In 1534. Apparently for having predicted and shown the previously insignificant Alessandro Farnese his true calling as Pope Paul III (Hoppmann (1998) p.66), and his astrological defamation of Luther (Hoppmann (1998) p.18).

¹⁴⁸Milichius’ copy of Gaurico’s *Tractatus Astrologicus* can be found in the *Ratsschulbibliothek* in Zwickau.

¹⁴⁹*Tractatus Integer de Nativitatibus* fol. 197, p. 39.

¹⁵⁰“St. Johannes Hus hat von mir geweissagt, da er aus dem Gefängnis im Bömerland schreibt: Sie werden jetzt eine Gans braten; aber über hundert Jahren werden sie einen Schwan singen hören, den sollen sie leiden. Da soll’s auch bleiben, ob Gott will.” Quoted from Hoppmann(1998) p. 62.

What do we say then to Lichtenberger and those like him? I say this. Firstly, I hold the foundation of the starry art to be correct, yet the art uncertain, that is, the signs in the heavens and on earth are surely there. It is the work of God and the angels, to warn, to make an art out of it, to understand such in the stars is nothing at all. Secondly, It may well be that God or his Angels moved him many steps in the right direction to wright. Yet God let him see plenty of times that the art was uncertain through his being mistaken. And what is the ultimate conclusion of this? Christians should not ask for such predictions...¹⁵¹

Luther's horoscope was one of the most politically charged controversies of the entire reformation. Melanchthon had vacillated on the issue of Luther's birth date for several decades and had sought astrological advice from all over Europe for its interpretation and rectification. He surely expected some sort of protestant opinion on the horoscope from Rheticus, whom he had charged with the office of teaching astrology in Wittenberg. As the issue of Luther's horoscope had been the hottest astrological topic even before he had arrived in Wittenberg, it will have been the object of intense scrutiny. When we consider the fantastic conjunction found in the horoscope and the 'Lichtenberg Prophecy' which surrounded it, it will surely have served as a sound justification of the theory that God proclaims and effects with Great Constellations those 'great men' who shall carry His message.

This debate had raged throughout Rheticus' time in Wittenberg, despite Gaurico's help. Melanchthon would write in 1539:

We are uncertain as to Luther's time of birth. The day is indeed certain, even almost to the hour, Midnight, as I have myself heard from the mouth of his mother. 1484, I think, was the year. Yet we have tried many horoscopes. Gaurico concurs on the issue of 1484.¹⁵²

This debate and the passions it evoked are reflected in our manuscript which devotes a whole page to the matter:

¹⁵¹Quoted from Hoppmann(1998) p.63-64. "...Was sagen wir denn zum Lichtenberger und des gleichen? Das sage ich. Erstlich / Den grund seiner Sternkunst halt ich fur recht / aber die kunst vngewiss / das ist / Die zeichen am hymel vnd auff erden feylen gewisslich nicht / Es sind Gotts und der Engel werck / warnen und kunst darauff zu machen ist nichts / vnd ynn die sterne solchs zu fassen. Zum andern / es mag dennoch wol daneben / das yhn Gott odder sein Engel bewegt habe / viel stücke / wilche gleich zutreffen / zu schreiben / wie wol yhn das Gott sehen liesse / das die Kunst yngewisse sey / hat er yhn lassen feylen etliche mal. Vnd was ist die summa summarum davon / Christen sollen nichts nach solcher weissagung fragen."

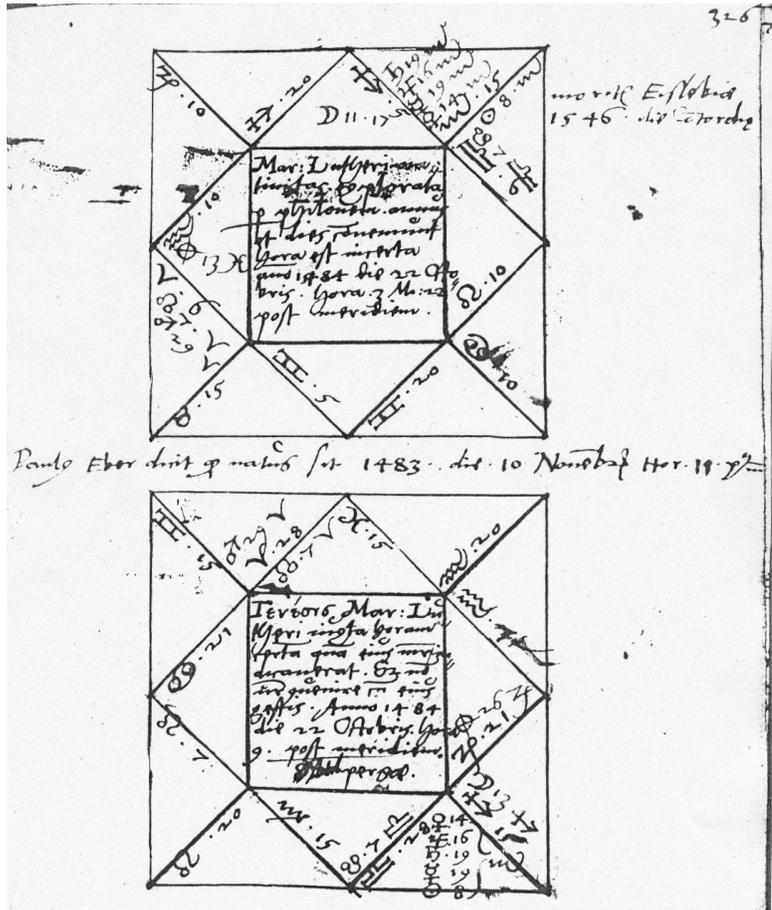
¹⁵²In a letter to Osiander; CR IV, 1053.

margin: he died in Eisleben on 1546 on the day of concord¹⁵³

inner box: The nativity of Martin Luther as explored by Philo, the year and the day are correct, the hour is uncertain. 1484 on the 22nd of October 3:22 PM¹⁵⁴

middle: Paul Eber says that he was born in 1483 on the 10th of November at 11PM¹⁵⁵

inner box: Genesis of Martin Luther with the correct hour which his mother proclaimed. It does not however reflect his deeds. In the year 1484 on the 22nd of October at 9PM *¹⁵⁶



Now, from the standpoint of good propoganda, Eber’s claim is clearly superior. It most importantly retains the suggestive power of the Lichtenberg prophecy for 1483. Eber’s suggestion also cleverly splits the great conjunction in the 3rd and 4th houses and thereby weakens the impression of a catastrophic ‘satanic’ figure. The opposition of the moon would also effect a ‘calming’ ‘peaceful’ influence¹⁵⁷:

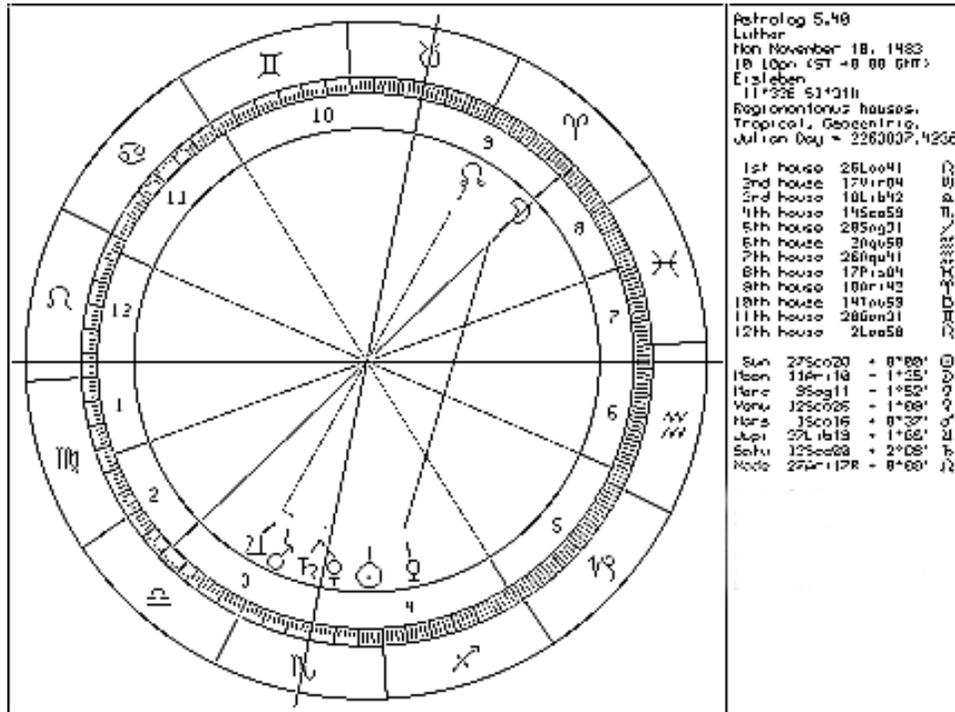
¹⁵³Moritur Eislebiae · die concordiae [Feb. 18]

¹⁵⁴Mar[tini] Lutheri nativitas · explorata per philonem · annus et dies conveniunt hora est incerta anno 1484 die 22 Octobris · hora · 3 Mi[nuta] 22 post meridiem

¹⁵⁵Paulus Eber dicit quod natus sit 1483 · die · 10 Novembris Hor[a] · 11 · pm

¹⁵⁶Γενέσις Mar[tini] Lutheri iuxta horam certam quam eius mater indicaverat · Sed non cur* convenire cum eius gestis · Anno 1484 die 22 Octobris hora 9 · post meridiem *

¹⁵⁷I have in the following graph, as in those that follow as well, modified the time to obtain the closest match possible with the given planetary positions and houses.



Nov. 10, 1483; Eber's rectification - to become the official date

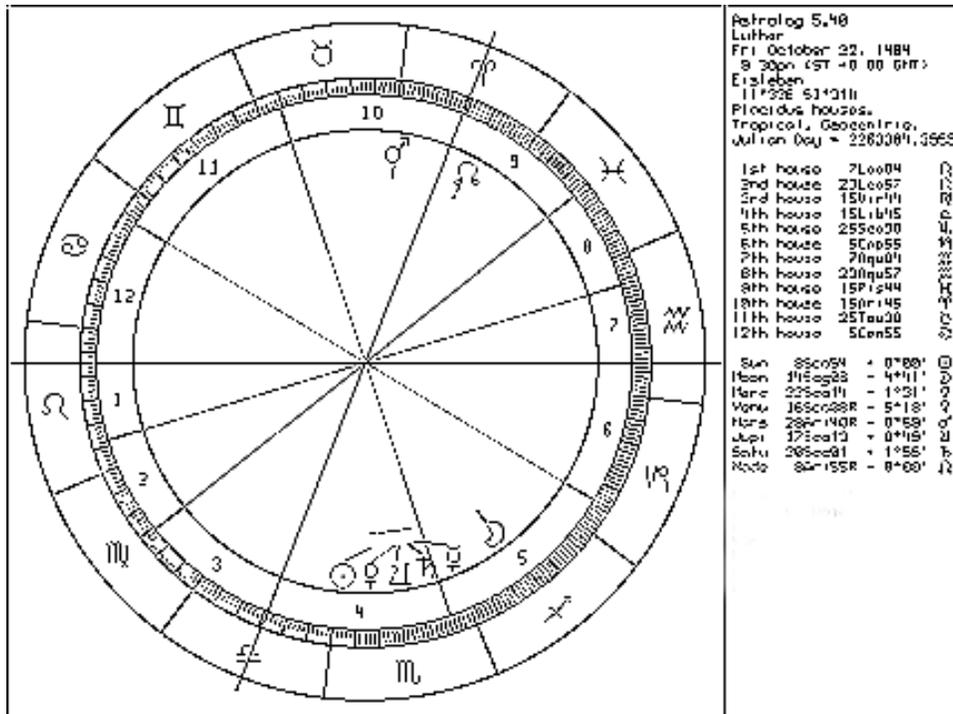
This horoscope suits the Reformation's needs excellently. Why then does Melancthon go out of his way to further rectify it with suggestions of a birthdate in 1484, clearly contrary to Luther's mother's testimony and the explicit wishes of Luther? We find that Melancthon, at least *privatim*, wasn't about to compromise his astrological interpretations of current events for the sake of propoganda. We learn from a letter sent to Schöner around 1532 that Melancthon had become significantly more certain of his interpretation of 1484:

Carion alters the genesis of Luther which Philo has investigated to the ninth hour. The mother says however that he was born around midnight (but I think she is mistaken). I prefer yet another nativity, and Carion prefers it also, even though it is amazing on account of the position of Mars and the opposition to the fifth house, it [the nativity] has a great conjunction with the ascendent. Nevertheless, no matter what hour he was born in, this amazing conjunction in Scorpio cannot but bring forth a very truculent man.¹⁵⁸

¹⁵⁸“Genesim lutheri quam philo inquisivit transtulit carion in horam 9. Mater enim dicit Lutherum natum esse ante dimidium noctis (sed puto eam fefelli) ego alteram figuram praefero et praeferit ipse carion etsi quoque haec est mirrifica propter locum ♀ et ♂ in domos 5 quae habet coniunctionem magnam cum ascendente. Caeterum quacunqu hora natum est hac mira ♂ in ♏ non potuit non efficere virum acerrimum.” Taken from Warburg(1920), p. 501.

The horoscope of the otherwise obscure Doctor Philo-Pfeyl¹⁵⁹ to which Melanchthon refers is that which we find in our manuscript at the top of the page. It is, as far as I know, the only original copy of it we have. The rectified horoscope given at the bottom of the page to the 9th hour is given in the above-quoted letter to Schöner, our manuscript copies it exactly - except for the interpretation given in the inner box. We find the same horoscope again in 'Erasmus Reinhold's astrological manuscript.'¹⁶⁰

The key difference between the Philo-Pfeyl horoscope and Eber's, beyond no longer corresponding to the Lichtenberg Prophecy, is that Mars now stands in opposition to the great conjunction instead of the Moon. This was disastrous from the point of view of propoganda, primarily because it confirmed what every Catholic thought: Luther was bellicose and nasty:



Oct 22, 1484 at 9pm; a bellicose Luther

This rectification to late October 1484 provides us with an excellent insight into Melanchthon's relationship with Luther. Melanchthon saw Luther

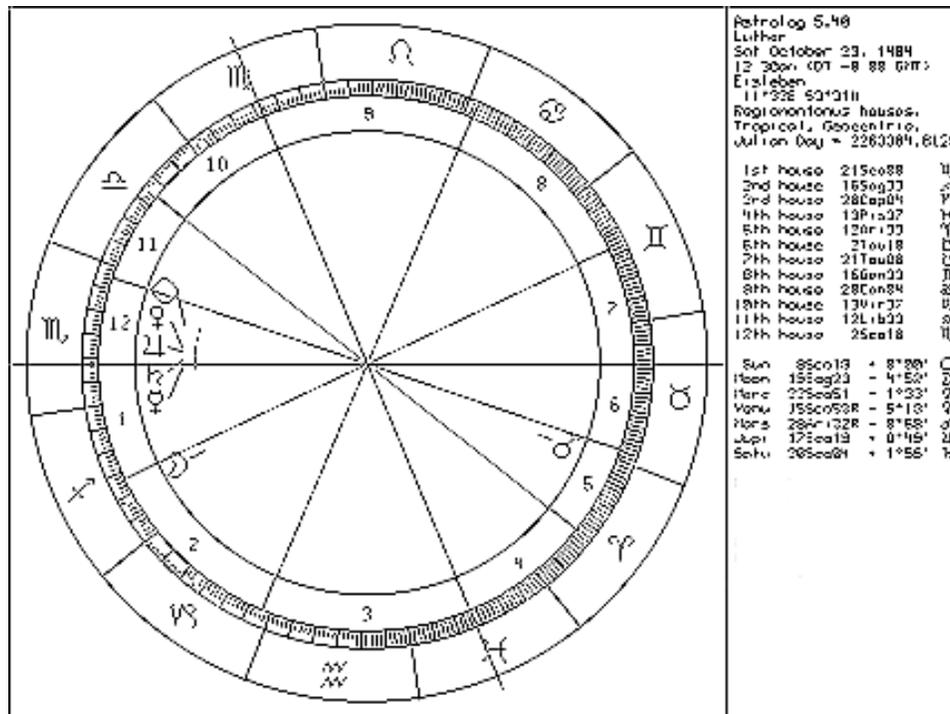
¹⁵⁹Johann Pfeyl (1496-1541); Warburg (1920) p. 501.

¹⁶⁰Leipzig, Stadtbibliothek, Cod. 935, p. 158. I call this massive collection of horoscopes Reinhold's only in deference to A. Warburg who first discussed it. I have studied it at some length and have been unable to reach a conclusion as to who the author was. Reinhold's authorship must be called into question as he was not an avid astrologer.

as bellicose. And in all fairness to Melanchthon, just about every attempt on his part to reconcile Wittenberg with the Catholics through delicate diplomacy was promptly ripped apart by the ‘*martial*’ Luther. His feelings manifest themselves in this nativity whose interpretation he concludes with: “Nevertheless, no matter what hour he was born in, this amazing conjunction in scorpion cannot but bring forth a very truculent man.”

This deeper psychological interpretation was however lost on Melanchthon’s students Rheticus and Reinhold. Rheticus says that the horoscope does not fit with Luther’s deeds. Reinhold on the other hand denotes the horoscope as ‘coniecturalis’, and contents himself by saying that “it is good that Mars does not stand with [the great conjunction]”¹⁶¹ and does not mention Mars in opposition.

Yet Melanchthon and Carion (who worked for the anti-protestant Joachim I) wished to accentuate Luther’s bellicosity even further by placing Mars in the ascendent and opposed to the great conjunction! Though not explicitly drawn up in a nativity - a prudent action on Melanchthon’s part -, we can easily reconstruct Melanchthon’s intentions from the above quote. We know that we need a great conjunction in the ascendent (which is in Scorpion) standing in opposition to Mars in the fifth house. We also know that Melanchthon disagreed with Luther’s mother’s assertion that he was born



A little into the witching hour; Melanchthon foresees a very bellicose man

¹⁶¹“& bonum est ☿ non sit coniunctum.”

before midnight. Thus, if we move the horoscope to just a little past midnight, we obtain the desired requirements and the most bellicose horoscope: Mars stands in opposition to the great conjunction in the ascendent.

Despite all these private astral lucubrations however Melanchthon prudently accepted Paul Eber's 1483 date in his public statements. And as he did so in a speech given during Luther's funeral services¹⁶² it has become the official date of Luther's birth.

Conclusion

Rheticus' enterprising plan appears quite forceful when presented as a general outline. Even remarkably novel when the philosophical background is taken into account. And perhaps this formed the necessary inspiration for such a large project. Yet what resulted was an extremely weak and tenuous document. The main reason for this failure was the inability to find the sought 'physical' mechanism which might hold it all together. As we have seen, only a physical astrology involving cause and effect processes was in Rheticus' eyes a valid science. Upon finding no such mechanism however Rheticus had to settle for a cacophony assembly of opinions of astrological authorities for each separate astrological issue involved in his general strategy. Perhaps because some sort of mechanism was still being sought each opinion was duly and 'objectively' listed with no critical valuation.

This research, which obviously required a great deal of labour and an impressive erudition, presents itself as diametrically opposed to what we would today naively consider scientific research to be. For what it essentially does is catalogue the opinions of the astrological authorities as if they were each separate and distinct pieces of empirical evidence, capable of being taken out of the context of the tract in which they were originally written. As such, the opinions of the authorities represent less a list of possible solutions to a given empirical problem, but the empirical material itself.

Rheticus appears to have taken these pieces of empirical evidence very seriously. Though we have already witnessed several cases in which Rheticus misrepresented an author, those cases all involved the nature of the astrological enterprise itself and its philosophical background. In contrast, those opinions which involve astrological methods are quoted religiously. It is because these opinions are quoted so strictly that we oftentimes will find completely disparate opinions within a section where a given question was to be answered. For example, 'the manner according to Ptolemy, ... the manner according to Abraham the Jew...'

We face a difficult quandary when we juxtapose these unharmonious

¹⁶²*Oratio In Fvnerere Reverendi Viri D. Martini Lvtheri / Recitata Vitebergae A Philippo Melanchthone* 1546 p.1, and *Historia de vita et actis reverendiss. viri D. Mart. Lutheri verae Theologiae Doctoris* 1548 p. 1.

doxographies with the repeated assertion that natal astrology is a certain science. Rheticus must have felt this quandary very deeply, and it was most likely the desire to have it resolved which lead him, at least in part, to seek out the astrological authorities J. Schöner and Johannes Hartmann (1489-1545) in Nuremberg, Peter Apian (1495-1552) in Ingolstadt, and Camerarius and the second generation of the Stoeffler school in Tübingen in 1538.

η. Personal Reasons for leaving Wittenberg

In September 1538 Rheticus would leave, with Gugler, on a trip that would take him through Nuremberg, Ingolstadt, Tübingen, Feldkirch, and finally Ermland where he would meet Copernicus. He would not return until late 1540, when he stayed for only a couple weeks to give some basic lectures in astronomy.¹⁶³ Then, following the delivery of *De Revolutionibus* to the press in Nuremberg in 1543, Rheticus did not return long to his professorial post in Wittenberg, but was rather secured a position in Leipzig through Melanchthon and Camerarius.

I hope to have made plausible in the preceding some of Rheticus' intellectual reasons for undertaking such a journey; that he was interested in obtaining answers to astrological questions, answers that might resolve many of the apparent contradictions in his astrology and ideally provide some sort of cause and effect 'physical' mechanism which could simplify the system. Also that he was seeking men who had been divinely inspired by God to proclaim His Providence. Yet no amount of intellectual ambition will ever be able to fully explain the length and persistence of Rheticus' absence from Wittenberg.

A more comprehensive account of Rheticus' absence from Wittenberg lies in the terrible scandal of Rheticus' friend Simon Lemnius, a scandal which came close to permanently dividing the most powerful figures of the Reformation in Wittenberg.

Rheticus' circle of friends

Lutheran communities are today known for their inhibitions and proud morals. The historic Wittenberg presents a vivid contrast. A large percentage of the students were raucous, inebriated, stated their sexual desires explicitly, and dressed to fit the part. This was known throughout the land, and the admonitions of the leaders of church and state exerted very little effect. *Kurfürst* Johann Friedrich of Saxony found himself forced to reprimand the university directly in 1538. This was particularly vexing for the *Kurfürst* as he had just given the University a 'permanent funding' or '*Fundation*' in 1535¹⁶⁴:

¹⁶³See ch. III δ.

¹⁶⁴Proclaimed May 5, 1536; Friedensburg, W.: *Urkundenbuch der Universität Wittenberg*, 1926., vol. I, p.172-184.

It has been certifiably reported to us that many improprieties take place and are to be found in our University of Wittenberg. According to which our foundation, which was especially ordered with disputations in all faculties, is not pursued and suffers from unindustrious and lackadaisical teaching...according to which most of the teachers do not vigorously and strongly control their colleagues and students. But in spite of the fact that they have for that reason no particular industry, they rather let the youth do and go as they please and wish, through which their vice grows with their lack of teaching. And it is reported that an unindustrious student at times seduces another, which causes more grief and ignominy to the parents who send their sons and children there for the discipline and teaching at their financial burden. When they again return home, they are made fun of and cursed, over which considerable unease arises among our citizens in Wittenberg, and has been felt for many years now. The youth also drastically overdress and are prodigal, and thereby burden their parents so much that it is talked of far and wide...all of which shall bring our university to destruction in short time if it is not investigated...¹⁶⁵

Exemplifying this new lifestyle and its freedoms was a group of young poets in Wittenberg. Like Rheticus, they proudly attained to the most eloquent Latin of their class, and were masters of Ancient Greek. As such, they attained the attention, and protection, of Melanchthon. Their love of Latin led them to the seductive Ovid. The example followed in the promiscuous *Ars amatoria*¹⁶⁶ combined with the licence found in Luther's lewd language led them to a genre of poetry that would, even today, be considered of poor taste. The main members of this group were George Sabinus (1508-1560)¹⁶⁷, Simon Lemnius (1511-1550), Michael Toxites

¹⁶⁵Kurfürst Johann Friedrich addressing the University of Wittenberg March 6, 1538; Friedensburg, W.: *Urkundenbuch der Universität Wittenberg*, II vol., 1926. p. 188-190. "Uns gelangt glaublich an, das sich in unser universitet zu Witembergk viel unrichtigkaiten erhalten und zutragen; so sol auch unser foundation, als sunderlich mit dem verordneten disputiren in allen faculteten, auch mit unvleissigem und seumigem lesen nicht nachgegangen...so sollen sich doch die preceptores eins grossen teils understehen, die gesellen und studenten hoch und ubermessig zu ubernhemen, aber gleichwohl dorumb kainen sonderlichen vleiss bei den studenten haben, sondern die jhugent ires willens und gefallens gehen und thun lassen, dadurch dan ire untugent mit vorseumnus der lhar wachsen, auch je zu zeiten ein unvleissiger den andern vorfuren solle, davon dan iren elderen, welche ire shone und kinder zucht und lhare halben dohin schicken, gegen iren aufgewandten unchosten mher betrubnus und unrum, wan si wider anheimkommen, auch spoth und schimpferfolget, uber das unsern burgern zu Witembergk daraus allerlei unruhge entstehet und etwas mher dan gotlob nun etzlich jhar her gespurt ist worden. so sol sich auch die jhugent vhost sehr uberklaiden und uberchostigen und ire eltern dadurch dermassen beschwerden, das weit und ferne davon gered werde, ...: welchs alles, wo nit dorein gesehen werde, unser universitet kurzlich ainen grossen abfahl bringen wurde,..."

¹⁶⁶Rheticus later quotes this work in his *Narratio Prima* (p.314), "Ignoti nulla cupido" ("That which is unknown is not desired"; *Ars Amatoria*, III, 397) subversively substituting 'knowing the sexual' with 'knowing astronomy'. Rheticus uses this quote again in his *Letter to Heinrich Widnauer* (1542), reproduced in Burmeister (1968), Vol. III, p. 50.

¹⁶⁷Son in law of Melanchthon. Sabinus was the oldest of the group, the most successful, and in many ways its leader. His works before 1538 were *Oratio ad Philippum regem Macedonum de concordia domi constituenda et bello transferendo in Asiam contra barbaros /conversa ex graec. a Georgio Sabino* 1531; *Elegia de adventu Caroli V. Caesaris : scripta Augustae ad Eobanum Hessum* 1531; *Caesares Germanici ...* 1532; *Hodoeporicon itineris Italici* 1535; *Duo epitaphia*

(1514-1581)¹⁶⁸, Johannes Stigel (1515-1562)¹⁶⁹, Melchior Acontius (1515-1569)¹⁷⁰, Kaspar Bruschi (1518-1557)¹⁷¹. This group cooperated on a number of projects. This cooperation and Ovid's influence is clearly seen in the work of 1536 *Erotica Georgii Sabini Brandeburgensis Duo Epithalamia, Alterum Latinis versibus a Melchiorio Acontio, Alterum Graecis a Matthia Illyrico*¹⁷² *scriptum*. Another fine example of this cohesiveness and their bond to Melanchthon is well-seen in the title of the 1537 work *De Nuptiis Georgii Sabini et Annae, carmen heroicum Melchioris Acontij. Epithalamion Sabini, et ad eundem propempticon, autore Ioanne Stigelio. Ad Philippum Melanchthonem aliquot Elegiae, eiusdem Stigelij*. Rheticus' connection to this group continued well after he had left Wittenberg. Circa 1542 Melchior Acontius wrote a dedicatory poem to introduce Rheticus' *Tabulae astronomicae*.¹⁷³ Also around this time period Rheticus conceptualized the poem *On the Twelve Houses of the Zodiac and the Beer of Breslau* which Bruschi brought to verse, which we discuss in III η.

Rheticus' connection to this tight-knit group was most likely established through his fraternity of fellow students from Rhätien. This group evidently struck a great bond and expressed this by all bearing the name 'Rheticus' at about the same time (circa 1533). In Georg Joachim Rheticus' case, this alias became a welcome solution to the confusion of bearing his

/ alterum latinis versibus a Georgio Sabino, alterum graecis a Mathia Illyrico scriptum 1536. Sabinus appears to have been friends with Rheticus; he sent his greetings to him through Camerarius in 1549 (printed in Sabinus' *Poemata*, 1581, p. 520).

¹⁶⁸See the excellent biography by C. Schmidt *Michael Schütz genannt Toxites : Leben eines Humanisten und Arztes aus dem 16. Jahrhundert*, 1888. Toxites was later crowned *poeta laureatus*, and became, like Rheticus, one of the early followers of Paracelsus.

¹⁶⁹The young Stigel was by 1538 already a recognized poet having published, besides those works mentioned above, *De discessu ab urbe Jena 1536 m. Febr. : Access. eiusd. ad Georg. Rhauum typograph. de morte uxoris eius carmen consolat*, 1536; *Ad Phil. Melanchthonem aliquot elegiae* 1537; *In immaturum obitum ornatissimi iuvenis et eximii pictoris Joannis Cranochii, Lucae filii ... Epicedion* 1538.

¹⁷⁰Also known by his German name Folst. Acontius was already a well-established poet in 1538 having published, besides those works quoted above, *In Icona Divi Christophori Carmen*, 1536 and *Propempticon Georgii Aemylii* [Georg Oemler] *scriptum ad Melchiorum Acontium et Christophorum Pannonium, abeuntes in Sylesiam* 1537.

¹⁷¹Despite his young age, Bruschi was already a respectable poet by 1538 having already published in 1537 *Progymnasmata Gasparis Bruschi Egrani, Scripta ab authore Anno aetatis suae XVIII. ...*. Bruschi was later crowned *poeta laureatus*.

¹⁷²Mathias Flacius (1520-1575).

¹⁷³*Tabulae astronomicae in gratiam studiosae iuventutis ... ed., De ascensionibus signorum in sphaera recta, et oblique ad latitudinem 52 graduum*, two editions are undated but prior to 1545 the third is from 1545.

mother's maiden name¹⁷⁴, and in a few years the literate community would come to know him as simply Rheticus. This fraternity was composed of Lemnius (Santa Maria), Toxites (Sterzing), Mathhäus Rodt (Lindau; +1555), Anton Reuchlin (Isny)¹⁷⁵, and Johannes Hommel (1518-1562; Memmingen).¹⁷⁶

The 'Shitpoet' Simon Lemnius

The Dysentery of Luther on the Shitpoet Little Lem¹⁷⁷

How well doth thy theme and thy poem fit you, little Lem
 Shit is thy theme, Shit is thy poem
 The shitty little Lem was worthy of a poem of shit
 For Shit only looks good on shit
 Unhappy the prince whom ye praise with thy poem of shit
 Whom ye beshit with your shit
 Ye press the shit with your stomach
 Ye would love to caca a violant mound
 Yet, Shitpoet, ye produce nothing
 If ever the proper punishment should catch up to your crime
 You, shit, shall be a miserable cadaver for the crow

After initially studying in Ingolstadt, Lemnius came to Wittenberg with a tidy inheritance¹⁷⁸ in 1534. He was immediately embraced and encouraged by Melanchthon who was a great admirer of his humanistic talents, and quickly attained the title of magister in 1535. Lemnius would attain a considerable reputation in the following years as a lecturer of Ancient Greek, and as a poet. He donned a shepherd's flute and became very close to

¹⁷⁴Rheticus was forbidden to use his father's name after he was executed for sorcery. See Burmeister (1968), vol. I, p. 9.

¹⁷⁵Grandson of the famous astrologer and humanist Johann Reuchlin (1455-1522). Anton R. became a prominent Lutheran theologian.

¹⁷⁶Hommel heard Rheticus lecture in Wittenberg and was to later succeed him as Professor of Mathematics in Leipzig, see Burmeister (1978), Vol. I, p. 39.

¹⁷⁷The text is from the end of September 1538 and is reproduced in L. Mundt: *Lemnius und Luther : Studien und Texte zur Geschichte und Nachwirkung ihres Konflikts (1538/39)*, II vol., Europäische Hochschulschriften. Reihe 1, Deutsche Sprache und Literatur, vol. 612, 1983. vol. II, p. 337.

¹⁷⁸Lemnius gives the sum as 400 Gulden in his *Apologia Simonis Lemnii poetae Vitebergensis contra decretum, quod imperio et tyrannide M. Lutheri et Ionae Vitebergensis universitatis coacta iniquissime et mendacissime evulgavit*, 1539, reprinted in *op. cit.*, vol. II, p. 246.

the Wittenberg poets, in particular Sabinus and Stigel. He, like his fellow poets, “took pleasure in certain peculiar ways of life.”¹⁷⁹ On Sept. 10, 1537 Melanchthon wrote a letter on Lemnius’ behalf asking the city of Augsburg to assist Lemnius for a further year.¹⁸⁰ The letter seems aimed more to glorify Lemnius to his countrymen than anything else, as Lemnius was not a financially needy student.

The fateful collection of two books of epigrams¹⁸¹ appeared on June 6th of 1538. We don’t know what motivated Lemnius to write. It appears that he felt the need to aggressively distinguish himself and the new group of Wittenberg poets from the dominant personalities there. We can only speculate that he somehow wished to defend the group. The work is very much written in the style of the new group of poets. It is raucous, dirty, and caustically ironic in its personal innuendo. Just about all of the city’s high figures are attacked in insinuation after insinuation. Lemnius however disguised all of his attacks by hiding the names under the mantle of classical allusions and colorful Greek word creations, much in the humanistic style of the group. Such a method of attack was of course an insult in itself, as it implied that the insulted lacked the erudition to understand that they were being mocked. Lemnius however did make sure they knew. He dedicating the work, with the most glowing of praise, to Luther’s main enemy in Germany, Archbishop Albrecht of Brandenburg and Mainz.

An an example of an epigramm we shall consider the satire of Rheticus’ counterpart in Wittenberg Erasmus Reinhold.

To Empedocles¹⁸²

Take prudent care, if you can,
That your student does not become the teacher of your wife
You observe the stars outside, he observes your wife inside
You do your thing, he does his to your wife¹⁸³

The identification of Reinhold and Empedocles is significant. After Meno is left unsatisfied by Socrates’ definition of figure and color [*Meno*

¹⁷⁹In a letter of a student (Johannes Conon) to Stephan Roth shortly after the scandal broke (19th of June 1538). In *op. cit.*, vol. II, p. 321-322.

¹⁸⁰Reproduced in L. Mundt *Op. cit.* vol. II, p.316; this request was granted in a later dated Feb. 1, 1538, *op. cit.* vol. II, p. 317.

¹⁸¹*Epigrammaton Libi duo*, Wittenberg, 1538. This edition is now *very* rare.

¹⁸²The reference to Empedocles (fl. 450 BC), within the context of the satire, is based on Empedocles’ belief that sense information is nothing at all and that only the rational is valid.

¹⁸³Text reproduced in *op. cit.*, vol. II, p.81.

75bff], Socrates offers him an Empedoclean definition which is meant to conform to Meno's base nature [78cff]. Although other sources suggest that Empedocles was not an early atomist,¹⁸⁴ the idea of color arising through an interaction of pores and effluences is very suggestive of it. The identification of Reinhold and Empedocles aims to highlight Reinhold's anti-astrological tendencies. As we have already discussed, a key rhetorical device of the circle's astrological programme was to label anti-astrologers as atomists and Epicureans.

Almost all of the epigrams are of this nature. No one is specifically named, but the reference is obvious enough. The true divisiveness of the whole matter however lied in the fact that Lemnius exposed the most sensitive insecurity of the mocked person. Thus when the commotion around the epigrams began, and several outraged people came forth and said 'this is an insult to me!' Lemnius' response was 'why are you angry with me for seeing yourself in my epigramm!' The above-quoted epigramm is a fine example of this process. Lemnius would write in his defense of 1539:

I wrote it to a certain Empedocles. Yet a certain magister Erasmus [Reinhold] thought that he was meant, even though his name isn't even Empedocles - as if noone observed the stars but him, noone besides him had students, noone besides him a faithless wife. Even if this was the case, he was the one who interpreted the poem that way. If he attributes what I said of Empedocles to himself and his wife, why does he blame me? He is the one who is guilty!¹⁸⁵

There are about one-hundred figures in the first edition who are attacked in this fashion. The only ones praised on the other hand are Melanchthon and the group of poets. Rheticus is clearly one of these as well. Lemnius would later call upon Rheticus to attest to his virtue during the University's brief stay in Jena when they were often together.¹⁸⁶ Indeed, many historians have wondered why there was never any collaboration between Rheticus and Reinhold, not to mention the slightest friendship. The Lemnius scandal certainly put an end to any affection between the two, and also reflects the fact that they stood on opposing ground in regards to their associates and philosophy prior to the scandal.

The printing of Lemnius' first two books of Epigramms began in the heart of Wittenberg under Nikolaus Schirlentz. Schirlentz claimed that

¹⁸⁴Diogenes Laertius in particular.

¹⁸⁵*Apologia Simonis Lemnii poetae Vitebergensis contra decretum, quod imperio et tyrannide M. Lutheri et Ionae Vitebergensis universitatis coacta iniquissime et mendacissime evulgavit*, 1539, reprinted in *op. cit.*, vol. II, p. 222.

¹⁸⁶*Apologia Simonis Lemnii poetae Vitebergensis contra decretum, quod imperio et tyrannide M. Lutheri et Ionae Vitebergensis universitatis coacta iniquissime et mendacissime evulgavit*, 1539, reprinted in *op. cit.*, vol. II, p. 182.

Lemnius had said that Melanchthon had given his approval.¹⁸⁷ The reaction was swift. Melanchthon, who was rector, was forced to stop the printing before it had even reached 100 copies, and Luther ordered those printed immediately burned. Yet Melanchthon did not place Lemnius under armed guard. According to Lemnius' account, who maintained to the very end that there was no innuendo to be found in the work, he wished to stay but was persuaded to leave by his friends. He apparently also had help in leaving. Although Melanchthon strongly denied that he aided Lemnius' escape, Lemnius seems to later insinuate, as only Lemnius can, that Melanchthon did indeed help him escape. "And another man of great erudition and authority came in the middle of the night. He had always embraced me wonderfully. He arrived very sorrowful and told of such atrocious things, and he spoke of what malicious charges might arise."¹⁸⁸ The university demanded on the 11th that Lemnius stand trial before the senate on the following day.¹⁸⁹ Lemnius however had escaped using Melanchthon's good will that he would stay of his own volition. Lemnius quickly found many eager Catholic patrons.

Luther clearly perceived that Lemnius was aided and that he still, even after his flight, had his supporters in Wittenberg. If Lemnius had acted alone, Luther might have been able to dismiss Lemnius as an innocuous aberration. As it was however, he was forced to take action. On the 16th of June, Luther made a public *Declaration against Lemnius* in which he directly attacks the young group of poets and Lemnius' supporters:

I ask again all of us, and in particular the poets and his dissemblers, that from now on that nefarious shitimbecile [Scheisspfaffe] shall not be publicly praised or glorified in the church, the school or the city. If they do otherwise and praise that godless imbecile here in Wittenberg, who damned himself and would have us all dead, they may await, together with their lord, what I undertake against them. On this matter I shall soon speak again.¹⁹⁰

The situation began to escalate further in September with the publication of Lemnius' third book which he published with the first two

¹⁸⁷Schirlentz was imprisoned. *Op. cit.* vol. II, p.322.

¹⁸⁸"media nocte etiam alius quidam supervenit vir summae et eruditionis et autoritatis, qui me semper mirifice fuerat amplexus. Is multo tristiora attulit adeoque rem atrocem narravit et, quid calumniae possent, edocuit..." In his *Apologia Simonis Lemnii poetae Vitebergensis contra decretum, quod imperio et tyrannide M. Lutheri et Ionae Vitebergensis universitatis coacta iniquissime et mendacissime evulgavit*, 1539, reprinted in *op. cit.*, vol. II, p.269-284. Ref. to Melanchthon p. 230.

¹⁸⁹L. Mundt *Op. cit.* vol. II, p.318.

¹⁹⁰Reproduced in *op. cit.*, vol. II, p.320.

books.¹⁹¹ Lemnius, now with the solid backing of Catholic princes and clergy changed his mode of attack. He now focused his hatred entirely upon Luther. The attacks are no longer concealed and unabashedly portray Luther involved in various humiliating sexual attacks. Then, in the spring of 1539, he published his *Apologia Simonis Lemnii poetae Vitebergensis contra decretum, quod imperio et tyrannide M. Lutheri et Ionae Vitebergensis universitatis coacta iniquissime et mendacissime evulgavit* wherein he offers his version of events and proclaims those guilty who saw themselves in his epigrams. Lemnius followed this up with *The Hore War of the Monk (Monachopornomachia)*, a truly vile attack on Luther.

Melanchthon was severely implicated. He had been Lemnius' supporter and was clearly suspected of aiding his escape. Rumours also began to surface that members of Melanchthon's family had aided Lemnius after he was already on the run.¹⁹² We gather the full extent of the matter in a letter from Veit Dietrich to Camerarius wherein it is stated that "Phillip himself believes that he is threatened with exile, and lonesomely searches for a reason that would excuse him" and that this exile was even called for publicly before the senate by the influential Veit Amerbach.¹⁹³

Yet Melanchthon would be able to weather the storm. His political influence sunk of course drastically, but he was simply too important a figure to the reformation to be exiled or relegated. The situation for Lemnius' friends was more precarious. They were all formally called before the court¹⁹⁴ under suspicion of helping Lemnius write the epigrams. It wasn't just an official exile or relegation they had to fear, there were hundreds of scandalized citizens throughout the city who, now with Lemnius gone, sought an object of revenge. They also could no longer count on Melanchthon's influence to protect them. Lemnius didn't help their situation further by continuing to publish the praises of his friends alongside the defamations of

¹⁹¹*Epigrammaton: libri III.*, Leipzig 1538.

¹⁹²In a letter from Melanchthon to Camerarius dated the 31st of August 1538. In *op. cit.*, vol. II, p. 336.

¹⁹³Veit Amerbach to Camerarius July 8, 1538. In *op. cit.*, vol. II, p. 331. Cf. also Justus Jonas to George of Anhalt, 16th June 1538: "Philipp is almost wasting away in his sorrows." *op. cit.*, vol. II, p. 320; Melanchthon to Eustachius of Schlieben, 8th July: "I have never been in greater danger here, and many events have made me suffer. Certain persons are extraordinarily enraged with me on account of Lemnius." *op. cit.*, vol. II, p. 332; Melanchthon to Chancelor Gregor Brück, 10th July: "Most Honourable Chancelor, it saddens me to have fallen in such disfavour." *op. cit.*, vol. II, p. 334; Melanchthon to Camerarius, 22nd July: "The poems of Lemnius have created a great tumult here." *op. cit.*, vol. II, p. 335; Melanchthon to Camerarius, 31st August: The court suspects that my relatives helped him. ... I showed Lemnius that which is most beautiful in the Epigrams in Pausanias a year ago - the Argivian Juno. You know that I take great pleasure in such allegories" *op. cit.*, vol. II, p. 336; The gravity of the situation is also expressed in Camerarius' Biography of Melanchthon from 1566 *op. cit.*, vol. II, p. 342-3.

¹⁹⁴*Apologia Simonis Lemnii poetae Vitebergensis contra decretum, quod imperio et tyrannide M. Lutheri et Ionae Vitebergensis universitatis coacta iniquissime et mendacissime evulgavit*, 1539, reprinted in *op. cit.*, vol. II, p. 249.

everyone else. Lemnius even wrote that he was aided by a group of friends while on the run.¹⁹⁵ All of the Rheticus' aforementioned friends would leave Wittenberg in the months after the scandal broke.

The unpleasantness of Rheticus' situation is expressed in the fact that he left Wittenberg in mid-October in the midst of the scandal, and was never to return there for a significant length of time. Rheticus did of course have scientific interests in leaving Wittenberg, as we discussed in the previous section. That it was Lemnius who set Rheticus afoot is suggested in Melanchthon's Letter of Recommendation for Rheticus dated the 15th of October:

To the great Joachim Camerarius at the Academy of Tübingen, his best friend. Greetings! This youth is our professor of mathematics. He has a nature suitable to these arts and not abhorrent to *humanitas*. As he is above all a φιλομαθής, he has a strong command over that to which he is dedicated. Now he has gone forth [*expatiatus est*] to confer with Schöner and Apian on certain themes. Our mathematician wanted to greet you: he truly loves you greatly, not only due to your virtue and doctrine but also because of our friendship. I tell you this and beseech you, so that you will embrace him. He may not reach you for a while, for which reason I write less ... I also want you to compose an elegy against Lemnius. It should not contain insults but an honest and grave denouncement.¹⁹⁶

We must ask however if Rheticus' own profligate lifestyle contributed to the uncomfortable nature of his situation in Wittenberg. As speculation upon the exact nature of Rheticus' personal life is not warranted due to the paucity of our information on the subject, we shall simply put forth what is known.

Rheticus' lectures contain several non sequitur sections concerning 'sexual astrology'. For example, amidst a very critical discussion on the difficult concept of astrological parts, we find a section entitled 'To be noted highly and greatly, when a house of any given nativity or revolution begins and how long it lasts in its significations':

It is good to sleep together in Aries, Cancer, Libra and Capricorn because they signify potency: In this matter it is also favourable when the moon should apply to Mars Venus because signifies delight¹⁹⁷ and Mars a lot of sperm, and take care that the Moon doesn't apply to Saturn because that signifies frigidity and likewise tedium and honour. And if the Moon should be applied to the Sun with the reception it signifies great pleasure for both, and don't let the Moon be in Pisces, because that

¹⁹⁵Lemnius had the courtesy to write "among them were men of significance", *Apologia Simonis Lemnii poetae Vitebergensis contra decretum, quod imperio et tyrannide M. Lutheri et Ionae Vitebergensis universitatis coacta iniquissime et mendacissime evulgavit*, 1539, reprinted in *op. cit.*, vol. II, p. 232.

¹⁹⁶CR, VII, 597.

¹⁹⁷The logic here is that the Moon is a bearer of the qualities of Venus.

signifies diseases. And the Moon in Gemini, Libra or Aquarius signifies good pleasure and delight.¹⁹⁸

We then relapse into the main text where an explanation of a perpetual calender is given. After that however a section is given entitled “Notes in the figures of the nativities, how to know how many women a man or how many men a woman shall have”. This pattern is then followed in the next couple of pages wherein we find the section “if you wish to sleep with a woman so that she won’t conceive” (fol. 102^v, p. 80), “to sleep with a woman in order to have a child” (fol. 102^v, p. 80), and “Go to the ladies” (103^v, p. 82). Similarly, at the end of the mammoth *Tractatus integer de nativitatibus*, we find an addition entitled “Complimentum, If the newborn is legitimate” (312^v-320^v) subtitled “the bastard”.¹⁹⁹

Now Rheticus by no means invented sexual astrology, he even gives Haly Habenragel as a direct source for the chapter “if you wish to sleep with a woman so that she won’t conceive”.²⁰⁰ The oddity of these passages and their contrast to the main text lies however not just in the subject material. Our suspicions must be aroused when we consider that Rheticus was dictating to the extraordinarily young Gugler, and that it was precisely for the crime of sexually molesting a young adolescent for which Rheticus was charged in 1551 in Leipzig. Rheticus obviated this charge by permanently exiling himself to Poland. This is perhaps the context of Melanchthon’s admonition to Rheticus that he get married in 1541.²⁰¹

The consequences of this situation didn’t cease with Rheticus’ departure. When Rheticus briefly returned to Wittenberg in 1540, he and the idea for which he was now a diplomat were mocked. Heliocentrism was initially considered wholly innocuous to the Catholic Church, yet it was rejected out of hand by Luther and many others in Wittenberg. As we shall see in the next chapter, the idea was mocked in association with Rheticus, whom the students called ‘Heliopolitanus’, ‘He from the City of the Sun’.

¹⁹⁸*In astrologiam annotata*, fol 99v-100.

¹⁹⁹“Hurenkind”, literally “child of hores” - one of the rare examples of German found in the text.

²⁰⁰*In astrologiam annotata* fol. 102^v, p. 80: “desumptus ex halii in electio 7^a domus · cap · 165 · ”

²⁰¹We quote this letter in III η.

II. The Collaboration with Copernicus 1538-1543

We now move from a discussion of texts and events which had garnered very little attention to perhaps the most written about phase in the whole history of science. Despite this plethora of literature however, the representations of Rheticus' role in the Copernican revolution are very uniform. They portray Rheticus as a man without a face, a young mathematically talented *tabula rasa* upon which the great Copernicus writes. They then proclaim that the inscribed tablet is called upon by the muses and writes the *Narratio Prima*, the first published account of heliocentrism. Further, they suggest that by threatening to publish a second narration (without Copernicus' consent?) the devious Rheticus forced Copernicus to publish *De Revolutionibus*.

This homogeneous representation of Rheticus' role results from 'great man syndrome'. Not only with heliocentrism, but with several other key developments in the history of science, the attention is focused upon the 'genius' who brought it forth. There are two main reasons for this form of historical depiction: 1) Our culture has developed, particularly since the Renaissance, a cult of genius. Indeed, Rheticus and his search for the great men who have been charged by God to proclaim His Providence is a perfect example of this. Certain men are seen through the shade of this cult as being, if not divinely inspired, simply head and shoulders above the rest, possessing that special something which the rest of us lack.¹ 2) The second reason is a pragmatic one: it was expedient for the first wave of historical research to restrict its study to the principal figures.

Our plan for this chapter is therefore very simple, we shall shift the limelight away from the Great One to Rheticus. In so doing new(!) historical documents and forgotten tidbits shall come to our attention and collectively demand a reassessment of the most significant event in the history of science.

¹Cf. the excellent empirical studies by E. Zilsel: *Die Geniereligion: ein kritischer Versuch über das moderne Persönlichkeitsideal mit einer historischen Begründung*, 1918; and *Die Entstehung des Geniebegriffes: ein Beitrag zur Ideengeschichte der Antike und des Frühkapitalismus*, 1926.

α. Nuremberg, Ingolstadt, Tübingen, Feldkirch

It is highly unlikely that Copernicus was more than an obscure figure for Rheticus in late 1538. Rheticus himself writes that he heard of Copernicus and his great reputation during his journey.² Now, to have known and thought highly of Copernicus at this time one had to have belonged to a circle which was interested in the type of pure mathematical astronomy exhibited in Copernicus' *Commentariolus* and *Letter against Werner*. Yet Rheticus' teachers in Wittenberg were only interested in astronomy as a means to solve astrological problems. For we found at no point in the works prior to his journey any interest in astronomical problems. Astronomy, by itself, was in that early period of Rheticus' thought only a handmaiden to astrology. Like Melanchthon, Rheticus saw the final cause of astronomy in God's will to be known through His astrological Providence.³

That Rheticus did not originally intend to seek out Copernicus is also seen in the intentions and grounds for his journey. As we have seen, Rheticus' persistent absence from Wittenberg was not necessarily of a scientific nature, and rather resulted from the scandal of his friend and compatriot Simon Lemnius. Indeed, Rheticus quite probably hoped to attain a professorship at one of the universities he was to visit. Rheticus' scientific interests furthermore, based at least on the texts available to us, were of an astrological and not an astronomical nature. That Rheticus wished to find answers to astrological questions is also seen in the persons he sought out on his journey.

Johannes Schöner and George Hartmann in Nuremberg.

Visiting Schöner was a very natural action for Rheticus. Schöner had become the most renowned astrologer in Germany following Carion's death in 1537. Rheticus would also find him easily accessible by virtue of Schöner's close friendship with Melanchthon. Melanchthon most certainly wrote Schöner to recommend Rheticus just as he had wrote Camerarius (quoted at the end of II ζ). This accessibility is evidenced by the fact that Rheticus apparently stayed in Schöner's house with his *famulus* Gugler during his stay in Nuremberg.⁴

Staying in Schöner's home was optimal for Rheticus as it gave him

²In the dedicatory letter to Heinrich Widnauer given in the *Orationes Duae*. The Latin text and a German translation of this letter is given in Burmeister (1968), Vol. III, p. 49ff.

³*Annotata in alfraganum* fol. 62, p. 36 et passim.

⁴See Ch. II, sect. ε.

easy access to Schöner's superb library. Having lived in the printing center of Nuremberg all his life Schöner will undoubtedly have had one of the most impressive mathematical libraries in Europe. Indeed, Rheticus most likely wished to visit with Schöner's library as much as with Schöner himself. That Rheticus took advantage of Schöner's library in the hope of finding answers to many of his astrological difficulties is seen in the fact that he had Gugler copy a previously unpublished manuscript on nativities by the most famous European astrologer of the time Luca Gaurico.⁵

A glimpse of the eager conversation held between Rheticus and Schöner is found in the dedicatory letter by Johannes Petreius (1497-1549) to Rheticus in his edition of Antonius de Montulmo's⁶ book *On the Judgements of Nativities*.⁷ That the dedicatory letter is prefaced to Montulmo's book is by no means arbitrary. Like Rheticus, Montulmo had attempted a comprehensive catalogue of opinions on natal astrology. Common is also the attempt to ground natal astrology in the *hyleg*, *alcocodon* and *almuten* and their relation to the houses and killers (*interfectores*).⁸ Yet Montulmo goes further than Rheticus and confidently pronounces and defends an opinion on each subject. Schöner also became very interested in Montulmo at this time⁹ and most likely led Rheticus to the work. This Montulmo renaissance however was not to be constrained to Nuremberg, for the 'King astrologer' Gaurico also published it with his master work.¹⁰ When we consider the resemblance of Montulmo's work with Rheticus', the fact that Montulmo's work so confidently addressed many of the key astrological questions Rheticus sought to answer may have been the reason Rheticus did not pursue an edition of his *Tractatus integer de nativitatibus*.

⁵See Ch. II, sect. ε.

⁶Of Montulmo we only know that he lived in the 15th century and supposedly also wrote on magic.

⁷*Antonii de Montulmo, artium ac medicinae doctoris, de iudiciis nativatum liber praeclarissimus. Additionibus Iohan. de Monte regio illustratus, necunquam ante hac aeditus. Norimbergae apud Iohan. Petreium Anno salutis M.D.XL. Mense Augusto.*

⁸This closeness in approach is readily gathered from the Table of Contents of Montulmo's book: "I. Disserit an ad hoc quid planeta sit Almuten loci alicuius, necessarium sit ut eum locum aspiciat. II. Duos modos rectificandi nativitates ostendit, utrumque tamen veris argumentis reicit, suamque de rectificationibus sententiam subiungit. III. Est de nutritione nati & de genituris monstrosis. IIII. Docet rationem inquirendi Hylech & Alcocodon atque Almuten nativitatis. V. De tempore vitae nati varias auctorum opiniones recitat, quibus suam etiam annectit sententiam. VI. Est de interfectorebus. VII. De directionibus. VIII. De forma & complexionem corporis. IX. De natura, intellectu, sensu ac moribus nati. X. De divitiis & paupertate nati, quando & qua occasione uentura sit. XI. & ultimum. De morte nati, eiusque conditione.

⁹It is a fair assumption that it was he and not Petreius who edited the 1540 edition.

¹⁰Gaurico included the Montulmo edition in his: *Tractatus astrologiae indicariae de nativitatibus ... compositus per D. Lucam Gauricum ... Addito in fine libello Ant. de Montulmo*, Nuremberg 1540.

This letter suggests that Rheticus first heard of Copernicus during his conversations with Schöner. Petreius states that Schöner “had liberally communicated that which he believed would be useful to you in this branch of learning. This longing for learning thereafter drove you to the final border of Europe, to that excellent man whose method of observing the motions of the heavenly bodies you set forth for us in a lucent description.” The ‘lucent description’ is Rheticus’ *Narratio Prima* which we discuss in the following chapter. The fact that Rheticus framed that account of heliocentric theory as a letter to Schöner supports the interpretation that Schöner introduced Rheticus to Copernicus..

Petreius’ letter is central to our present narrative:

To George Joachim Rheticus, Master of the Liberal Arts and Industrious
Student of Mathematics¹¹

I often consider, my dear Joachim, the dissimilarity of times and minds. For it hasn’t been many years since the time when no part of letters was ably investigated. There was no understanding of languages, and not only the Schools but also the Churches were filled with useless disputations. However, because rewards were not lacking for the students, many happy minds learned these matters with great labours, which can now be unlearned with not less labour. As we all now rightly deplore this misfortune another arises. There are few scholars in the present illumination of the good letters and all erudition who bring that will to teaching which both the welfare of the state and the dignity and advantage of individuals demand. As I have you as a witness to this deplored misfortune, who not only studied at the famous Wittenberg Academy but also taught there, is further speech necessary? There are few who occupy themselves with the study of languages. That of which there is nothing superior in this life than the word of God is disloyally neglected by Philosophy, just look either to that part of doctrine which diligently considers the work of God and the miraculous founding, or to that part which embraces the precepts of mores and the instituting of the honest life. This occurs not because we lack talented minds, but because almost all of them are imbued with perverse opinion: For they esteem not that which is commonly beneficial, but rather act like mean merchants who respect coins and profit. For which reason my dear Joachim I congratulate that courage. Because you could easily follow the profitable arts through the example set by others, yet you gave yourself another path, so that you might attain a certain and firm understanding of the most beautiful arts. A year has gone by since you were here with us. You were not here for goods, in search of gain

¹¹The Latin text of this letter is given in Burmeister(1968), Vol. III, p. 19-21. It has however been ‘rectified’ with 28 alterations (excluding the resolution of Latin abbreviations). His translation (*op. cit.* p.21-23) and Swerdlow’s (‘Johannes Petreius’s Letter to Rheticus’, *Isis*, 83(2), 1992, p. 270-274) are disparate.

like the merchants, but to know the most famous man of our state, deserving of the highest in letters, Johann Schöner. And to confer on the calculation [*ratio*] of the motions which the admirable celestial bodies have. You judged it to be the most fruitful commerce, and thought it to your benefit that our Schöner not only delighted in your mind by virtue of his incredible education, but also liberally communicated that which he believed would be useful to you in this branch of learning. This longing for learning thereafter drove you to the final border of Europe, to that excellent man whose method of observing the motions of the heavenly bodies you set forth for us in a lucent description. Even if it doesn't follow the usual method taught in the schools, I nevertheless would find it an excellent treasure if his observations would be communicated to us upon your instigation, as we hope shall come to pass. This part of doctrine which examines the motions of celestial bodies bears great use for all aspects of life. I therefore not only think highly of you, but also have great hopes that much light will be brought to your works in this part of doctrine. Our fellow citizen Johann Regiomontanus doubtlessly had the same eagerness in his youth whose many and great works our Schöner has edited. As we recently found this book on nativities in his library we decided that this Montulmo should be edited, even though we edited a similar Arabic work only a short while ago. For not only can there be no activity more dignified for the good man than the conservation of the works of learned men, but also because this same part of philosophy has certain and great uses for life, if it is instituted correctly without superstition. Yet I want, my Joachim, to dedicate this previously unedited author in your name not only because I love you for your virtue and remarkably robust desire to learn, but also so that you might have a certain reward for your labours and study from us. There have always been mathematically inclined men in this our state, and I don't think it ever achieved greater fame though its riches, buildings or other niceties than through its cultivation of these studies and such men as Regiomontanus and Werner. If wares are to be exported from here into almost the entire world, what prohibit publishing here for the entire world the works of the most learned men which are conserved by great men? I believe that I deserve merit in this regard. Yet Schöner deserves more respect and praise, for he commends his inclination towards these studies to the entire world, and increases the dignity of the state not a little more than those who neither know nor admire nothing but riches. It shall be your duty to not only approve of our work, but also to know and praise Schöner's particular affection for you and all studious men. Farewell, Nuremberg, The First of August 1540.

Johann Petreius, Citizen and Printer in Nuremberg

In contrast to Wittenberg and Tübingen, pure mathematical astronomy

had a long tradition in Nuremberg. Schöner was the last prominent figure in this tradition. He formed the bridge between this older more sober mathematics and the new humanistic astrology. As mentioned in Petreius' letter, Schöner had edited a great number of Regiomontanus' works. Schöner's good friend and Nuremberg colleague Johannes Werner (1468-1528) had also done much to revive the mathematics of Peurbach and Regiomontanus. It was through Copernicus' critique of Werner's work, the *Letter against Werner*, that the Nuremberg circle would have first discovered Copernicus.

Rheticus was also lead to Werner's work by George Hartmann (1489-1564). Although by office a vicar at St. Sebaldus in Nuremberg, Hartmann passionately took part in Nuremberg's mathematical circle. Rheticus became acquainted with Hartmann and the spherical trigonometry found in two manuscripts of Werner's which were in Hartmann's possession *De triangulis sphaericis* and *De meteorscopiis*.¹² This is seen in a dedication to Hartmann given in Copernicus' trigonometry which Rheticus edited in 1542:

You [Hartmann] are aware of the great uses of the doctrine of triangles in the other areas of geometry and of its particular importance in astronomy, for which reason it often arises in Ptolemy. That is why those who have tried to explicate Ptolemy have discussed the triangles at great length. I wish we might still have the works of Menelaus and Theodosius. The lucubration of Regiomontanus [...] has now been recently published. Yet long before he could have seen it the great and learned Mister Nicolaus Copernicus wrote eruditely on the triangles as he investigated Ptolemy and the doctrine of motions. I know that you will admire this writing when you see how such great matters have been so artfully put together. It so happens that I publish this work now because we have found the doctrine of triangles necessary in the explanation of Ptolemy. And I dedicate it to you so that I might provoke you to edit that which you have in this subject, be it old or new.¹³

Rheticus apparently had an idea of what his provocation was to effect. For Hartmann gave Rheticus Werner's two previously unedited manuscripts shortly thereafter. As we shall see, the publishing and scientific investigation of these manuscripts would occupy a good part of the rest of Rheticus' mathematical life.

The following sentence of the dedicatory letter then reveals that Hartmann had been familiar with Copernicus' brother in Rome. Hartmann could have thus easily have been the source of Rheticus' information on Copernicus. Indeed the origin of Rheticus' statement in the *Narratio Prima*

¹²Hartmann was intimately familiar with this work of Werner's. The manuscript *Weimar Landesbibliothek no. F. 324* contains a copy of the two cited works of Werner's made by Hartmann. Hartmann presumably made the copy when he decided to give Rheticus the original.

¹³Dedication to *De lateribus et angulis triangulorum*, Wittenberg 1542, the Latin original and a German translation are given in Burmeister (1968), Vol. III, p. 45ff.

that Copernicus gave public lectures on astronomy in Rome - which many historians are keen to dispute - may be Hartmann and not Copernicus. Particularly because the recollection of having given lectures in the grandiose light in which Rheticus paints the scene¹⁴ is uncharacteristic of the unassuming older Copernicus.

In addition to informing Rheticus about Copernicus and trigonometry, Hartmann acquainted him with his studies on the magnet.¹⁵ Hartmann's magnetic investigations are now famous by virtue of their discovery of the inclination of the magnetic needle. Like Columbus, who independently discovered the dip of the needle, Hartmann's research into the magnet was driven by the need for better map-making tools.

This geographic interest of Hartmann's proved highly significant to Rheticus' work. Following the Nuremberg visit, Rheticus undertook the first map of Prussia during his stay with Copernicus in Ermland, and wrote a primer on map-making techniques for Duke Albrecht in Danzig in which he would quote Hartmann's work.¹⁶ Schöner was also interested in Geography and wrote a short work on it.¹⁷ As we shall see, Rheticus would also incorporate geography into his philosophical conception of how God's astrological Providence was effected. That the plan of composing a map of Prussia was a reason to visit the east, independent of seeking out Copernicus, will later be seen in the fact that Rheticus picked up a new geographically interested *famulus* in Wittenberg on his way to Ermland.

Peter Apian in Ingolstadt?

We learned from Melanchthon's letter of recommendation to Camerarius (quoted in II ζ) for Rheticus that a visit was planned for Ingolstadt and Peter Apian (1495-1552). It is nevertheless unclear whether the visit was substantial, if it took place at all. For when Rheticus recounts this journey in the dedicatory letter to the Mayor of his hometown Feldkirch, given in his *Orationes Duae*, Ingolstadt is left out. These orations celebrated Rheticus' status as a confirmed professor in Wittenberg, and are therefore proudly dedicated to his origins in Feldkirch. Given this context of the dedication, where name-dropping is the order of the day, Apian's absence is all the more

¹⁴*Narratio Prima*, Rosen (1971), p. 111.

¹⁵Hartmann's letter on the inclination of the needle to Duke Albrecht of 1544 may be found in Hellman, G.(ed.): *Rara magnetica 1269-1599*, Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus; no. 10, 1969.

¹⁶The *Chorographie*; Hipler, Franz: 'Die Chorographie des Joachim Rheticus', *Zeitschrift für Mathematik und Physik*, v. 21, 1876, p.125-150.

¹⁷*Ioannis Schoneri Carolostadii Opusculum Geographicum: Ex Diversorum Libris ac cartis summa cura & diligentia collectum, accommodatum ad recenter elaboratum ab eodem globum descriptionis terrena*, Nuremberg 1533, Johannes Petreius.

conspicuous.

Rheticus never seems to have appreciated Apian's work, and later disparagingly referred to it as an 'art of threads' [*ein Faden kunst*].¹⁸ This unfavourable opinion reflects a fundamental difference in their respective approaches to astronomy. Apian was a cartographer and populizer of science who, in stark contrast to Rheticus, saw his work as central to the common good and not as an inquiry into God's astrological Providence. This difference is further reflected in the fact that he did not belong to the astrological circle described in chapter II α . As such, not even the influential Melanchthon knew Apian well enough to recommend Rheticus to him. That they did not enjoy a scientific discourse was especially tragic for Rheticus as Apian had written important works on trigonometry¹⁹ and cartography.²⁰

Camerarius and Tübingen.

We unfortunately have very few hints as to how long Rheticus stayed in Tübingen and what he did there. We can only be certain that Rheticus made the acquaintance and earned the respect of Camerarius.²¹ Camerarius' approach to astrology was very similar to Melanchthon's. He also had little mathematical training, was passionate about the astrological explication of current political events, and his astrological research consisted in the philological excavation of methods of prognostication.²² As such, he quite naturally filled the shoes of Johannes Stoeffler who had been Melanchthon's and Carion's astrological teacher in Tübingen.²³

Achilles Pirmin Gasser in Feldkirch.

Rheticus' humanistic friendship with Gasser was central to all of his ventures. Gasser had encouraged him to study in Wittenberg and most likely wrote a letter of recommendation to Melanchthon. He was also one of the

¹⁸This is recollected in a letter by Thadeus Hayck to Tycho Brahe [1588, F.R. Friis, *Tychonis Brahei et ad eum doctorum virorum epistolae ab anno 1588, 1900/07*, p. 28.] Burmeister however rejects Björnbo's assertion [Björnbo (1907), p. 28.] that Rheticus had a poor opinion of Apian [Burmeister (1968), Vol. I, p. 39.], and maintains that 'Fadenkunst' was a contemporary terminus technicus not implying anything negative.

¹⁹*Instrumentum sinuum sive primi mobilis* 1534 wherein the first table of sines was printed.

²⁰A world map *Typus orbis universalis* illustrated the 1520 Vienna edition of Solinus' *Polyhistor seu de mirabilibus mundi; Cosmographia seu descriptio totius orbis* 1524, and a large scale map of Europe (1534) which no longer exists.

²¹Camerarius would consistently mention Rheticus in a glowing light in his letters to Melanchthon following this visit.

²²Camerarius did however have a much greater inclination towards temporal techniques like the drawing of lots and chiromancy. See the excellent: 'Camerarius and the Historical Doctor Faustus' by F. Baron, in: *Joachim Camerarius (1500-1577)*, ed. F. Baron, Munich 1978, pp.200-222.

²³Stoeffler died in 1531, and Camerarius taught in Tübingen from 1535-1541.

first to openly proclaim the greatness of Copernicus' work following the publication of Rheticus' *Narratio Prima*.

Rheticus came to Feldkirch armed with several new books for Gasser's prolific library from Petreius' presses. These works give a clear reflection of Rheticus' interests at the time: 1) Ptolemy's *Tetrabiblos* and the *Karpos* which is known in the Latin tradition as the *Centiloquium*.²⁴ 2) Schöner's *Opusculum astrologicum*²⁵, and 3) the work which was critiqued by Copernicus in his *Letter against Werner*, Werner's *De motu octavae sphaerae tractatus duo*.²⁶

Gasser in turn satisfied Rheticus' growing interest in magnetism and geography by showing him the rare manuscript *Epistola de magnete* written by Petrus Peregrinus de Maricourt (fl. ca. 1269). This work influenced both Rheticus and Gasser. Rheticus cited it in his *Choreography* (1541) and Gasser published it for the first time in 1558.²⁷

As a connection between astrology and magnetism is not immediately evident to us, we must look to Peregrinus' work to find what will have been an obvious conclusion to Rheticus and his contemporaries. Peregrinus convinced himself that the poles of the magnet orient themselves on the meridian and that all meridians converge on the celestial poles. He then discarded the common notion that the magnet pointed to the pole star with his knowledge of the fact that the pole star revolves around the celestial north pole. Consequently, in contrast to Gilbert who saw the earth as a giant magnet, Peregrinus imagined the magnet to derive its powers from the celestial poles. Further, every part of a spherical magnet received its power from the corresponding part of the celestial sphere. Magnetism for Gilbert is a terrestrial or sublunar power, for Peregrinus and Rheticus it is a power derived from the celestial sphere. The idea that a given part of the celestial sphere should have its own power coincides with Ptolemy's notion in the

²⁴The *Centiloquium* is now believed to be spurious. ΚΛΑΥΔΙΟΥ ΠΤΟΛΕΜΑΙΟΥ ΠΗΛΟΥΣΙΕΩΣ ΤΕΤΡΑΒΙΒΛΟΣ ΣΥΝΤΑΞΙΣ ΠΡΟΣ ΣΥΡΟΝ ΑΔΕΛΦΟΝ. ΤΟΥ ΑΥΤΟΥ ΚΑΡΠΟΣ ΠΡΟΣ ΑΥΤΟΝ ΣΥΡΟΝ, Nuremberg 1535, Johannes Petreius. The Greek edition was done by Camerarius. That Rheticus gave this book to Gasser in April of 1539 may be seen from the inscription found in the edition of this work at the Cracow University Library: "suo D[omino] D[octori] Achilli Gassaro Georgius Joachimus Rheticus a[nn]o 1539 d[onum] d[edit] mense Aprili Veldkirchij".

²⁵Ioannis Schoneri Carolostadii Opusculum Astrologicum : ex diuersorum libris, summa cura pro studiosorum utilitate collectum, subnotata continens: Instructio intelligendae Ephemeridos. Isagoge Astrologiae iudiciariae. De electionibus communibus. Canones succincti natiuitatum. Tractatus integer electionum M. Laurentij Bonincontrij Miniarensis. Assertio contra clauniatores Astrologiae D. Eberhardi Schleusingeri clariss. Philosophi atq[ue] Medici, Nuremberg 1539, Johannes Petreius. The inscription found in the edition of this work kept at the Uppsala University Library reads: "Suo D[omino] D[octori] Achilli Gassaro G. Joachimus Rheticus d[onum] d[edit] 1539 Velcuriae".

²⁶Nuremberg 1522, Friedrich Peypus. The inscription found in the edition of the Cracow University Library reads: "D[omino] D[octori] Achilli Gassaro Georgius Joachimus Rheticus d[onum] d[edit] 1539 Velcuriae".

²⁷Petri Peregrini Maricurtensis De Magnete seu Rota perpetui motus libellus, Augsburg 1558.

Tetrabiblos that given geographical regions of the earth affect the horoscopes of those born there in a manner specific to the celestial influence that region feels. This idea of Ptolemy's establishes the connection between astrology and geography.

Our only chronological knowledge of this trip is that Rheticus spent April 1538 in the company of his family and Achilles Pirmin Gasser. Considering the fact that Rheticus never matriculated at the University of Tübingen (which was the custom) and most likely didn't have much of an encounter with Apian, we may assume that the vast bulk of this trip was spent in Nuremberg.

*Heinrich Zell.*²⁸

A good part of our account has addressed the question as to why Rheticus went to Ermland. It has traditionally been assumed that Rheticus was interested in Copernicus' heliocentric theory, and that this formed the motivation of his journey. Yet we have suggested that Rheticus became aware of Copernicus' work through his confutation of Werner's treatise *On the Motion of the Eighth Sphere*, and that his interests in general were of an astrological nature. A further reason to travel evidently also rested in the fact that Rheticus was no longer welcome in Wittenberg. Yet is this by itself a plausible reconstruction of Rheticus' motivations to undertake such an expensive and perilous journey to a man who might not even receive him?

Several clues suggest that composing a map of Prussia presented itself as a further reason for the sojourn. Rheticus became acquainted with Map-making and the magnet through George Hartmann in Wittenberg and Peregrinus' famous treatise in Feldkirch. Rheticus then left his *famulus* Gugler in Tübingen, and picked up an experienced map-maker in Heinrich Zell in Wittenberg on his way to Ermland.

Heinrich Zell was born into a famous printing family in Cologne in 1508.²⁹ Like Rheticus, who was only four years older, his wealthy parents sent him to Basel to obtain a humanistic education. He inscribed there during the winter semester of 1532/33. He appears to have at this time become acquainted with the famous map-maker Sebastian Münster (1489-1544), with

²⁸I have not been able to discover anything on Zell beyond that in: Burmeister, K.H.: 'Der Kartograph Heinrich Zell (1518-1564)', *Studia Copernicana XVI*, 1978, offprint.

²⁹The founder of this family tradition was Ulrich Zell (†1507). Zell had worked with printers Fust und Schöffer in Mainz until that city was sacked in 1462. Zell then came to Cologne where he became that city's first printer. More than 120 printings are attributed to him.

whom he participated in composing his famous map of Europe (1536).³⁰ Münster taught Hebrew in Basel, and Zell's mastery of that seldom language testifies to his having studied under Münster. Zell also employed the rare manner of writing Hebrew advanced by Münster, the *Notula Hispanica*.

Münster had already conceived his work-intensive scheme for the seminal *Cosmography universalis*³¹ in the late 1520's.³² This scheme involved mathematically trained individuals mapping out a given section of what would become a much larger European map. This is precisely what Rheticus and Zell undertook in their 1542 map of Prussia.

Following what will have been a baccalaureate in Basel, the nineteen year-old Zell became a Latin teacher at Alt St. Peter in Strassburg. After a year there, Zell then inscribed himself at Wittenberg in the Summer Semester of 1538. Zell quickly established himself among several of the up and coming humanists there, and played the main role in the production of Plautus' *Amphitryo*.³³

It is unclear whether Rheticus heard of Zell through his contacts in Basel or Wittenberg. Zell's job as *famulus* does however appear to have been arranged prior to his arrival, as Rheticus' stay in Wittenberg was so brief. That map-making was central to Zell in these early years is further seen in the later maps he created throughout his entire life.³⁴

Heliocentrism is introduced to Wittenberg.

We have discussed several factors which suggest that Rheticus first learned of Copernicus during his travels across Germany in late 1538 and early 1539. This impression is further reinforced by the fact that Rheticus appears to have himself introduced the notion of heliocentrism to Wittenberg during the brief visit in which he picked up Zell. For Luther himself would write the following famous lines shortly after Rheticus' departure:

³⁰Only a single, defect, copy of this map now exists. It is described in: Bagrow, Leo: 'Der deutsche Kartograph Heinrich Zell', *Petermanns Mitteilungen*, 72 1926, p.63-66.

³¹*Cosmographia: Beschreibu[n]g aller Lender durch Sebastianum Munsterum in welcher begriffen/ Aller völcker/Herrschaften/ Stetten/ und namhafftiger flecken/ herkom[m]en: Sitten/ gebreüch/ ordnung/ glauben/ secten/ und hantierung durch die gantze welt/ und fürnemlich Teütscher nation. Was auch besonders in jedem landt gefunden/ unnd darin beschehen sey. Alles mit figuren und schönen landt taflen erklet/ und für augen gestellt*, Basel 1544.

³²In his Letter to Beatus Rhenanus (1485-1547) from 1526, and particularly his *Erklärung des neuen Instruments der Sonnen* (Oppenheim, 1528; Burmeister, K.H.: *Sebastian Münster. Eine Bio-Bibliographie*, 1964, p.42 Nr. 31.).

³³Zell's copy of this book (tellingly printed in Basel, 1535), now in the Stadtbibliothek in Lindau (Sig. Ca. III. 482), states that he had the main role in the production carried out on the 17th of Feb. 1539.

³⁴An account of these is given in Burmeister, *op. cit.*, p. 435-441.

Mention was made of a certain new astrologer who demonstrates that the earth moves and not the heavens, sun and moon. And if someone were to be moved by walking or by ship he would believe that he would be standing still and that the earth and trees would be moving. But it's really like so: Whoever wishes to be so clever should let nothing please him that others respect; he must do something of his own, just as he does who places astrology on its head. And even though confusing I still believe in Holy Writ, for Joshua commands the sun to stand still, not the earth.³⁵

β. The Narratio Prima

³⁵*Tischreden*, vol. 4, Nr. 4638, June 4, 1539: “De novo quodam astrologo fiebat mentio, qui probaret terram moveri et non coelum, solam et lunam, ac si quis in curru aut navi moveretur, putaret se quiescere et terram et arbores moveri. Aber es gehet jtzunder also: Wer do will klug sein, der sol ihme nichts lassen gefallen, das andere achten; er mus ihme etwas eigen machen, sicut ille facit, qui totam astrologiam invertere vult. Etiam illa confusa tamen ego credo sacrae scripturae, nam Iosua iussit solem stare, non terram.”

A detailed discussion of the *Narratio Prima* would necessarily entail the sorely needed new English translation and critical edition. As this is not our present objective, we shall continue to highlight Rheticus' own thought, and thereby discover why the text is not a 'Copernican Treatise'. We will accomplish this by further illuminating those dark recesses which the sensibilities of historians past were loathe to become intimate with. As such, we begin with Rheticus' astrological appreciation of Copernicus' work.

The mutual justification of astronomy and astrology.

Ptolemy clearly differentiates astronomy and astrology. The *Almagest* deals with astronomy, the *Tetrabiblos* with astrology. Each can be read independent of the other. This division is enabled by Ptolemy's 'weak' assertion of astrology: the celestial bodies forebode events, but do not effect them necessarily. In contrast, a 'strong' assertion of astrology sees God's Providence being carried out exactly and necessarily through the motions of the heavens. The strong assertion cannot suffer the Ptolemaic division, because for it each astronomical postulation of celestial movements bears direct consequences for God's astrological Providence.

This difference results from two different religious perspectives: the weak assertion flourished with the spiteful Gods of Antiquity and their inability to effect a plan for mankind through the planets which represent them. The strong assertion on the other hand came to its full expression in the all-knowing Providence of the God of Rheticus and Kepler. What lies between these two positions was commonly held in the Middle Ages, and to a certain extent by the Rheticus of chapter two: 'We do not know, and cannot know, the mathematical methods God uses to effect his astrological Providence (they certainly cannot be the complicated epicycles of Ptolemy). We therefore rely on our knowledge of planetary influences and their relationship to a given position of the zodiac.' For the adherents of this middle view, mathematical astronomy is of little use, for it is the phenomena of the planets which are the ambassadors of God's Providence. Astronomy is therefore the handmaiden to astrology: how astronomy is effected is unknown - as such we are only interested in it to determine the positions of celestial phenomena.

An excellent example of the transition from this 'middle view' to the 'strong assertion' may be found in a letter of Melanchthon's of 1538 which we have anachronistically retained for this section. At Rheticus' urging Melanchthon affixed Sacrobosco's *Computus Ecclesiasticus*³⁶ to the earlier edition Sacrobosco's *Spherem*, along with a dedication, on Rheticus' behalf,

³⁶The *Computus Ecclesiasticus* is a short treatise on the calendar and the important religious holidays *Libellvs Ioannis De Sacro Bvsto, de Anni ratione, seu ut vocatur vulgo, Computus Ecclesiasticus / Cum Praefatione Philippi Melanchthonis*, Wittenberg 1538.

to his steadfast friend and countryman Achilles Pirmin Gasser. Melanchthon begins with the prime uses of astronomy, i.e. determining historical dates and having a good calendar, both of which he and Rheticus often cite elsewhere. Then, after a brief history of the calendar, Melanchthon explains how astronomy is actually astrology:

... Should we spurn this diligence of great men? Or believe that it was begun in inane curiosity without grave causes? These methods [determining the length of the year] could surely not have been calculated - neither the Egyptian, Greek, Arabic, nor Roman - without the great science of the celestial motions. I certainly do not doubt that it [astronomy] was indeed created through the counsel of a single God so that the first parents could note the years diligently, so that they could think back to the beginning of the world, and so that posterity could number those spaces [of time]; likewise so that the differences of religions would be considered, and so that the series of that which has been foretold of the celestial and history should be retained. If one believes these grave causes are not enough, he does not have the Cyclopic mind. We must therefore admit that the first parents, who excelled in wisdom and duty, were divinely forced to observe and propagate the distinction of the years. Indeed, without an understanding of the motions of the heavens the year cannot be bound by the ends of the equinoxes and be correctly described. For which reason it is necessary that they were students of the entire doctrine of celestial motions. Is it not arrogant to spurn the discoveries of not only the other great men, but also of the first parents, who were leaders of mankind and teachers of the true religion and of true wisdom?

Adolescent students for this reason love this doctrine of the celestial motions, and judge it to be useful to life, because of the description of the year and other reasons. But because some disapprove of *μαντική*,³⁷ we find unlearned persons also condemning the doctrine of motions by the same token. The contempt of this entire Philosophy is certainly confirmed in the uncultivated. Even though I do not dispute divination in this place, nevertheless, if we wish to correctly judge, this same doctrine of motions is particularly *μαντική*. For it bears witness to the fact that there is an eternal mind, artisan and conductress of the world, and that we have been created for immortality and the recognition of God. This *μαντική* is to be spurned? What more truly becomes soothsayers than confirming true and pious opinions of God in the hearts of men? We must therefore admit that this same doctrine of motions is *μαντική* and useful to life and mores. It is clearly a form of

³⁷I.e. the art of prognostication.

prediction as it results from the κράσεις³⁸ of bodies, and judges minds or predicts tempests from some significant conjunction of stars, on account of which

ἄλλοτε μητροῦνι πέλει ἡμέρη, ἄλλοτε μήτηρ.³⁹

It is indeed more prophetic to confirm minds through the known and very certain laws of motions, for they truly state that there is a God, who ordains and governs these motions, who wants to be known by men. He founded these varieties of motions on account of their uses. And, as he invites us to the recognition of Himself, he deals out rewards for the good and punishments for the impious. Yet I discussed this at greater length elsewhere.⁴⁰

I strongly approve of the advice of George Joachim Rheticus to affix this method of the year to the little book on the Sphere, written by the same author Johann de Sacro Busto. ...

But George wanted me to dedicate this little book to you in particular so that he might show the memory of your old friendship, and that you are thanked through my voice, because you encouraged him to these studies, moved by the celestial significations, as he indeed would have embarked upon a far different path of life and abhorred this Philosophy. For which reason he realizes that he owes you much, as you recalled him to these arts by virtue of your authority.⁴¹

This assertion of Melanchthon's (perhaps inspired by Rheticus) that astronomy is astrology marks a significant advance on the paper of 1531. As in that position paper, this postulation cannot be absolved from the context of a defense of astrology: astrology cannot be attacked without simultaneously attacking astrology. As we have already noted, the astrological stances of this group were in large part determined by the need to defend astrology from outside hostility.

Melanchthon's idea is very elegant. Astronomy is seen both as a tool God has given man to remember his works, and as a constant exposition of His power. That is, the wonderful mathematics behind astronomy and the

³⁸Usually 'the mixtures', but given the astrological context: 'the conjunctions'.

³⁹Hesiod *Works and Days*, 825: "Sometimes a day is a stepmother, sometimes a mother". The context is: "These days are a great blessing to men on earth; but the rest are changeable, luckless, and bring nothing. Everyone praises a different day but few know their nature. Sometimes a day is a stepmother, sometimes a mother. [825] That man is happy and lucky in them who knows all these things and does his work without offending the deathless gods, who discerns the omens of birds and avoids transgression." Trans. by Hugh G. Evelyn-White, posted at www.classics.mit.edu.

⁴⁰Referring to his Preface to the 1531 edition (which was reprinted in the 1538 edition) which we extensively discussed and cited in chapter 1.

⁴¹The Latin text of this dedicatory letter (written in the middle of August, 1538) is in CR, VII, col. 573-576.

exactitude of the celestial movements perpetually confirm mens' minds in God. The astronomer who tracks the path of a given planet is therefore not doing not just math, but is discovering the mathematical basis of God's astrological Providence. It is this assertion, that God is effecting His Providence through exact mathematical relationships which we may understand - and not simply planetary phenomena - which allows the identification of astrology and mathematical astronomy.

Rheticus echoes this claim of Melanchthon's almost word for word in a 1540 speech:

Even though I said at the beginning that I would not speak of the matter of divination, I nevertheless add this, this same doctrine of the celestial movements is in and of itself *μαντική*⁴², and is the most excellent and most certain great divination governing life. For these laws of motion testify that the world did not arise by coincidence, but rather was founded by an eternal mind, and that mankind is the concern of this founder. As the laws of movements clearly show, it cannot be denied that this doctrine is truly *μαντική* of the most supreme, for this knowledge of God and of Providence truly awakens souls to virtue. The Physicus predicts rain if southerly or warm west winds blow, if northerly winds then fair weather. Isn't divination so much more useful which confirms souls on providence so that they don't dream that the world came into existence coincidentally? It was with great cause that God gave us this testimony of himself.⁴³

This surely does sound impressive on a piece of paper. Yet the objection will have been immediately raised to sit heavily on the astrologer of Wittenberg's shoulder's: How can this claim be substantiated? Traditional astrology sees the conflicting natures of the planets bringing about Fate through their interactions, not the mathematical methods behind their movements. The various natures and attributes of the planets is rooted in the polytheistic worldview of Antiquity - the persistent war of the gods' and their respective planets is intimately intertwined with man's fate. Yet in order for Melanchthon's poetic vision to be realized the ubiquitous authority of ancient astrology must be cast away in favour of a new mathematically determined Providence of God. But where's the substance? Where are these mathematical methods?

Much has been written on the absolute authority Ptolemy's *Almagest* has exerted. Yet this authority pales in comparison to that of the *Tetrabiblos*. This is because every astrologer has to base his claims within the tradition. For the fact that astrology has been used for so long and by so many cultures is its primary source of validation. Its age gives it the allure of revered experience. Ptolemy's *Tetrabiblos* is the link to this tradition. Clearly, even

⁴²I.e. 'prognostication.'

⁴³*Oration on Astronomy and Geography*, p. 264. The same idea is again expressed on p. 265.

before Rheticus' time, many opposing viewpoints had been developed in the Arabic and European traditions, but they were all commentaries of Ptolemy's vague text. Ptolemy for example doesn't prescribe a method of house division; it for that reason remains, even today, one of the most hotly-contested issues.

Rheticus was simply not capable of fulfilling this mammoth task in Wittenberg. Certain seeds however had been planted in Wittenberg which would make Copernicus' work seem like a revelation to the seemingly unanswerable charge inherent in Melanchthon's claim:

Most importantly, Rheticus would be able to relieve Ptolemy of his absolute authority with his notion that the Egyptians possessed the pristine God-given astrology/astronomy. As such, the *Tetrabiblos* is only a faint shimmer of that ancient science. As we shall see in the following section, Rheticus believed that their science rested on the gnomon, 'the most perfect scientific instrument', which was used to observe the King planet, the Sun.

Secondly, Rheticus readily found the sought after mathematical astrology in Copernicus. As we shall shortly see, he was able to bind this new mathematical astrology to the 'Prophecy of Elijah' which was of considerable influence among the members of the astrological circle.

Third, Rheticus simply had not had his eyes opened to the level of mathematical astronomy found in Copernicus in the course of his previous studies. That Rheticus then believed Copernicus to be a 'great man' bearing a new message of God followed easily upon his natal astrology of great men.⁴⁴

We begin with Rheticus' discovery of the Prophecy of Elijah within Copernican astronomy in his *Narratio Prima*:

The monarchies of the world change with the motion of the eccentric.

I should add an important prognostication. We find that all monarchies began when the center of the eccentric occupied a significant position on the small circle. Thus, when the eccentricity of the Sun was at its maximum, the Roman Empire declined to a Monarchy, and likewise when it [the eccentric] grew smaller, so did this [the Roman Empire], as if growing old, it failed, and then finally died. When it reached the quadrant and middle end, the law of Mohammed arose; another great empire therefore began and swiftly grew to the rhythm of the motion. At present the eccentricity will reach its minimum in one-hundred years, and this empire will likewise have completed its period. So that it is already in these times at its highest summit, from which it will fall just as fast, God willing, with an even greater crash.

⁴⁴See section I. ζ.

We look forward to the coming of our Lord Jesus Christ when it reaches the center of the eccentric at the other middle end, for it was at this point when the world was created. This reckoning doesn't differ much from the prophecy of Elijah who prognosticated under divine influence that the world would last 6000 years. Two revolutions are nearly made in this time. This small circle thus appears to most truly be that Wheel of Fortune, through whose revolutions the monarchies of the World take their beginnings and are changed. For in this same way are the great changes of the entire history of the world seen, as if inscribed on this circle. Further, I shall soon hear from you [Schöner] personally, God-willing, how it may be understood from great conjunctions and other erudite conjectures of what nature these empires were destined to be, whether constituted by just or tyrannical laws.

The relationship of this prognostication to the rest of the *Narratio Prima* seems initially entirely unclear, because it does not appear to be connected with what preceded or what follows it in the text. Yet when we put it in the context of Rheticus' trip to Nuremberg and the reasons why he may have wanted to visit Copernicus, we realize that the prophecy is especially central.

The eccentric holds the clues to the problems discussed in Werner's *De motu octavae sphaerae*: the change in the obliquity of the ecliptic and the precession of the equinoxes. These two classical problems determine the course of the sun and thereby provide the foundation for the determination of the courses of the other planets, as their positions may only be known in relation to the sun. That Werner's problems are clearly that which interested Rheticus most in Copernicus' work is clearly seen in the simple fact that the *Narratio Prima* deals only with Book III of *De Revolutionibus* - which addresses that set of problems.

Rheticus understands from his study of *De Revolutionibus* that

a) The change in the precession of the equinoxes follows a cycle of 1717 Egyptian years from a low of a change of 36" seconds a year to a high of 64" seconds a year, and then back to 36". This cycle is comprehended in a much larger cycle of 25,826 years.

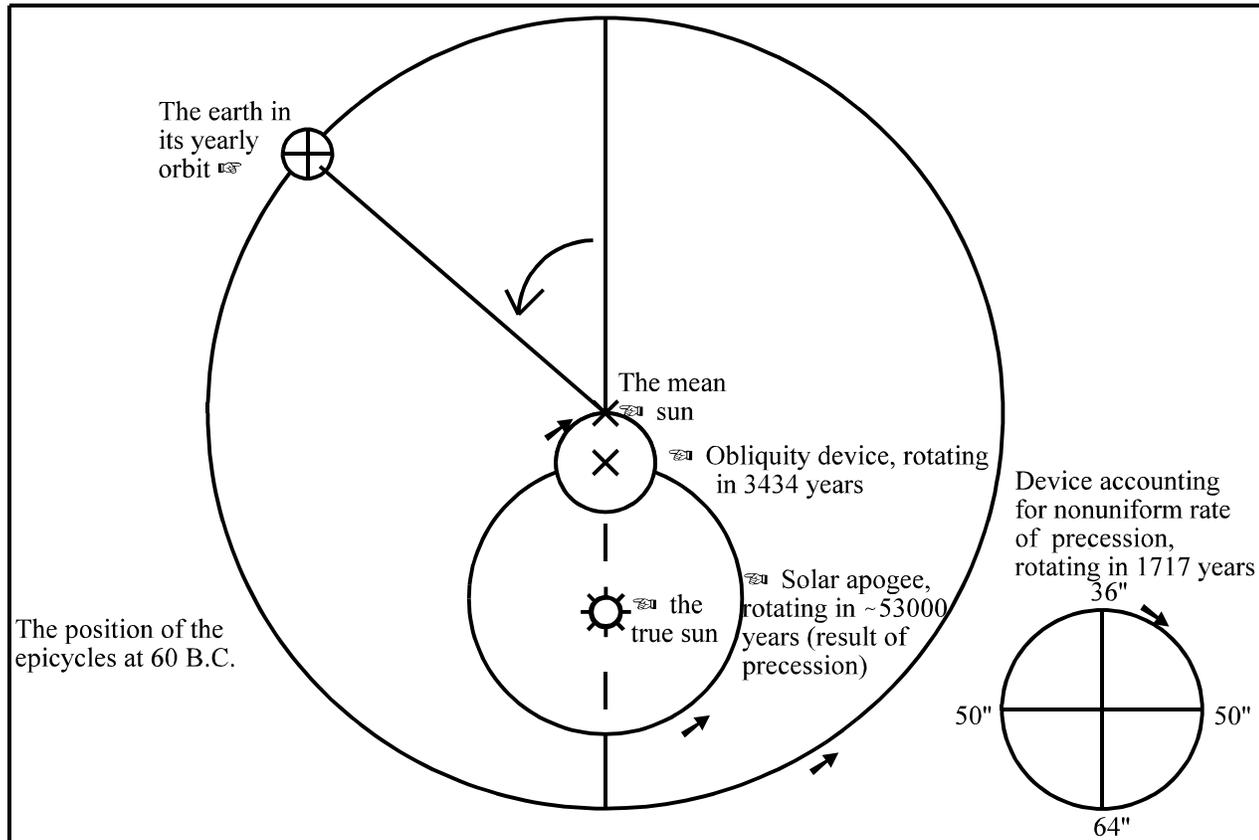
b) The change in the obliquity of the ecliptic runs from a high of 23° 52' to a low of 23° 28' and back in 3434 years, thus in double the time of the nonuniform cycle of the speed of the precession of the equinoxes.

c) These two cycles begin at exactly the same time. Rheticus gives this date as 60 B.C., Copernicus as 64 B.C.⁴⁵

⁴⁵*De Rev.* III, 21.

Let us represent these variations in a drawing:

It must first be noted that this drawing is strictly for the readers' benefit. Rheticus did not use any representational figures in the *Narratio Prima*. The result of this was that Rheticus was never forced to show how he



thought the above variations took place. That is, a physical representation would commit the author to either a heliocentric or geocentric perspective. This lack of commitment is further demonstrated by Rheticus' discussion of these movements as a result of the motion of the earth, the sun⁴⁶ or even the 'eighth sphere'.⁴⁷ Many commentators, moved by the belief that remnants of the old system must be found in a new paradigm, decry a betrayal of heliocentrism in Rheticus' apparent ascriptions of these motions to the sun. Others suggest that Rheticus is solely interested in phenomenological representation and not physical truth.

Rheticus saw the mathematical symmetry of these devices as a divinely inspired truth. As such, they are epistemologically more valid than

⁴⁶As when he described Book III as 'on the motion of the Sun' and other passages, Rosen (1971), p.114, 117 et al.

⁴⁷Op. cit. p.110.

any given interpretation of what ‘actually happens’ - be it geocentric or heliocentric. This philosophy enables Rheticus’ appreciation of Copernicus’ work: *De revolutionibus* is neither a handbook on how to save the phenomena, nor is it a presentation of physical truth as we would view it today. Rheticus saw in Copernicus’ work the mathematical truths which govern God’s astrological Providence.

This interpretation resulted in part from a misunderstanding of the provenance of these variations. Rheticus appears not to realize that the ideas that one oscillation of the obliquity is precisely twice the period of the variation of the velocity of precession and that these two began at the same time (60 B.C.) were convenient assumptions on Copernicus’ part. He also doesn’t appear to understand that they are part of one problem, the derivation of one depending on that of the other. It rather seems to him that a *mathematical truth* is being revealed.

The apparent efficacy of the nonuniform change in the precession of the equinoxes alone will not have convinced Rheticus of the divine origins of Copernican mathematics. The fact that this mechanism fit quite nicely with the so-called ‘Prophecy of Elijah’ must have come as the decisive revelation. Elijah soothsaid that the world would last 6000 years. These 6000 years would consist in 2000 years of chaos, 2000 years of law and 2000 years of the Messiah. The Prophecy of Elijah wasn’t simply a random prognostication which Rheticus might be able to massage into a Copernican framework. It was rather the most influential concept of God’s Providence in Wittenberg. Indeed, it was the only instance of augury that Luther and Melanchthon were both passionately committed to.

The interest in the Prophecy of Elijah appears to have reached its summit during Rheticus’ years in Wittenberg. It began when Melanchthon added a significant new twist to Carion’s edition of his *Chronica* (1531) by suggesting that the Prophecy of Elijah revealed the sense and direction of history’s seemingly arbitrary march.⁴⁸ His source for this obscure prophecy was the accomplished Spanish rabbi Paul of Burgos (1351-1435)⁴⁹. Yet, unbeknownst to Wittenberg, the Prophecy ultimately derived from the *Babylonian Talmud*.⁵⁰ Rheticus cited Paul of Burgos in his lecture *Tractatus*

⁴⁸Melanchthon explains this to Carion and his source of the prophecy in his 1531 letter to him (reprinted in Warburg (1920), p. 536-540). Melanchthon’s addition may be found on p. 24 of the 1560 edition (*Chronicon Absolytissimum Ab Orbe Conditio : usque ad Christum deductum; In quo non Carionis solum opus continetur, verum etiam alia multa eaq. insignia explicantur ... / Philippo Melanthon autore*, Basle 1560. He also cites the prophecy in his *Oratio de Orione* (CR, XII, p. 46).

⁴⁹*Scrutinium Scripturarum*, 1434, Distinctio III, Chapter IIII.

⁵⁰*The Babylonian Talmud*, (ed. Epstein, I., 1935-48), *Sanhedrin*, Vol. II, p. 657.

*Integer*⁵¹ and would later use him extensively in his ‘*Treatise on Holy Scripture and the Motion of the Earth*’.⁵²

Luther also saw the Prophecy of Elijah as the basis of all historical development. This is very explicitly professed in his *Supputatio annorum mundi* (*Calculation of the World’s Years*; Wittenberg, 1541) which leads with the prophecy on the title page. The *supputatio* was ostensibly a practical attempt by Luther to order Biblical events for his extensive commentaries, and was begun around the time of Rheticus’ first days as a professor in Wittenberg.⁵³ Yet it is also clear that he, like Rheticus later, tried to embed the Prophecy of Elijah into a broader scheme. He in particular tried to bind it to the Prophecy of Daniel and the 70 ‘year-weeks’.⁵⁴ Yet Luther would probably never have attached such a central importance to the Prophecy had he known its Talmudic source.⁵⁵ Melanchthon may well have hidden this provenance from him as it is only well after Luther’s death that he revealed the original Hebrew.⁵⁶

Rheticus bases his identification of this prophecy and the magical symmetry of the two Copernican devices on the fact that two revolutions of 3434 ‘almost’ make 6000. This nonconformity is not arbitrary but rather pregnant with eschatological implications. For Melanchthon conceives of the length of this third period as dependent on our sins: “And on account of our sins, which are many and great, if years shall not be, they shall not be.”⁵⁷ Rheticus identifies this day of judgement with the end of the above 3434 cycle. Furthermore, as we read in the prognostication above, the rise and fall of empires moves to the beat of the nonuniform motion of the change in the precession of the equinoxes:

⁵¹*Tractatus integer de nativitatibus* fol. 292^v, p. 160.

⁵²He there used *Biblia cum postillis Nicolai de Lyra, et expositionibus Guillelmi Britonis in omnes prologos S. Hieronymi et additionibus Pauli Burgensis*, Venice 1482, on pp. 22, 23, 28 and 39.

⁵³I.e. 1536, Cf. *Kritische Gesamtausgabe*, vol. 53, p. 7.

⁵⁴For a discussion of this in Luther’s thought cf. *Ibid.* p. 10-15. The Biblical reference is to the highly difficult passage *Daniel* 9:24.

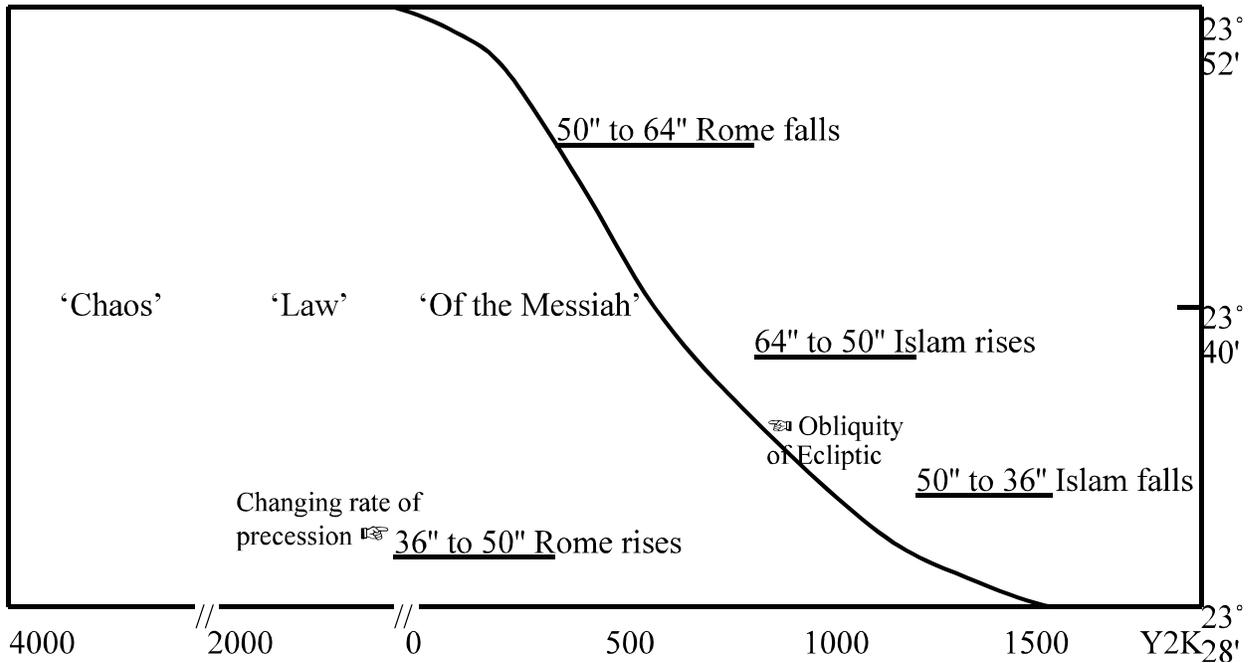
⁵⁵Luther references the above-cited text of Paul of Burgos.

⁵⁶The Hebrew text is found in a page inserted into a Wittenberg Bible from 1556 which now belongs to the church of Pritzlow near Stettin. The signature reads: “Scriptum Anno 1559 postquam Christus ex virgine Maria natus est. Anno a mundi initio 5521. Scriptum manu Phillipi Melanthonis.” (Koestlin, J.: ‘Ein Beitrag zur Eschatologie der Reformation’, *Theol. Studien und Krit.*, LI, 1878, p.125-135, p. 128).

⁵⁷In the Latin Edition of the *Chronica Carionis*, *op. cit.*, p.24. The same sentiment is also expressed in the German edition of this work, and in the speech *De Orione* (CR, XII, p.46ff.).

Melanchthon was keen to ‘rectify’ the ‘chaos’ (*inane*) of the first 2000 years as it opposed his vision of the beginning of science and the testimony of God in this period. Rheticus will have undoubtedly followed Melanchthon’s interpretation here:

Yet whatever the reason was for Elias to have said this, there can be no doubt that the first age was the most prosperous [*florentissima*], because the nature of men was less languid, as seen in their longevity.⁵⁸ And it was an excellent grace [*decus*],



because the wisest sages, full of divine light, lived at the same time. They were witnesses to God, Creation, the promise made, and they discovered and illustrated many arts.⁵⁹

Rheticus’ prognostication appears at first to be arbitrarily placed in the middle of what should be a discussion of mathematical astronomy. For Rheticus then proceeds to discuss how the observations of the ages empirically and theoretically confirm the proposed motions of the precession of the equinoxes and the obliquity of the ecliptic. To many these appear to be two separate discussions, the first astrological, the second astronomical. Rheticus’ prognostication is therefore consistently taken out of the context of the entire chapter entitled “The monarchies of the world change with the

⁵⁸Referring to the extraordinary ages of individuals recalled in the Old Testament.

⁵⁹In the Latin edition to *Carions Chronica*, *op. cit.*, p. 24.

motion of the eccentric”, and presented as an immature exuberance of a young mathematician. It is then stated that the prognostication is the ‘only’ part of the *Narratio prima* which is not a faithful rendering of *De revolutionibus*. Yet the astrological and the astronomical discussions clearly belong to one common science. This is most clearly seen in his rebuttal of Pico della Mirandella with which he ends the chapter:

For if such a doctrine of celestial matters had existed a little before our time, Pico [Della Mirandella] would have had no opportunity in his eighth and ninth book to impugn not only astrology but also astronomy. For we find with each passing day how significantly the common calculation differs from the truth.⁶⁰

Pico’s eighth book of his *Disputationes adversus astrologiam*⁶¹ makes light of the fact that if a ninth or even tenth sphere is necessary to explain matters like the precession of the equinoxes then ancient astrology cannot be correct. For another sphere would imply another celestial body.⁶² Also, if there is a precession of the equinoxes, how can the ancient zodiacal signs correspond to ours?⁶³ Pico’s ninth book⁶⁴ contains two central critiques which Rheticus believed resolved through Copernicus’ work: 1) “The beginnings of cities, kingdoms, actions, and laws are unknown, and no art has been handed down by the astrologers which could investigate this.”⁶⁵ and 2) “The inequality of the year and the maximum declination of the sun.”⁶⁶ and “Conflicting opinions on the motions of the eighth orb.”⁶⁷ Copernican astronomy supplies the firm foundation upon which true astrological claims may be made. The doubts which Pico raises as to the astronomical foundations of astrological decisions in these chapters all pertain to matters of Copernicus’ third book and Werner’s *De motu octavae sphaerae*. The answers however do not lie in the motion of the earth, they rest in the

⁶⁰Rosen(1971), p.127.

⁶¹“Octavo libro continetur de numero sphaerarum, differentia imaginum et signorum, et imaginibus invisibilibus.”

⁶²Book VIII, ch. I and II.

⁶³Book VIII, ch. III and IV.

⁶⁴“Nono libro continetur de incertitudine natalis horae ac aliorum initiorum, et aliis erroribus astrologorum.”

⁶⁵Book IX, ch. VI.

⁶⁶Book IX, ch. IX. the subject matter of this chapter is carried over into the tenth chapter.

⁶⁷Book IX, ch. XI.

mathematical truth of the divine celestial variations.⁶⁸

Rheticus' prognostication was not a first attempt at drawing out the astrological implications of Copernicus' divine mathematics. Rheticus continued to hold on tightly to it. We find Rheticus again prophesying the end of the Turkish empire as a result of the eccentric we discussed above as late as 1557. As then, it is not important whether he discusses the motion as a result of the motion of the sun, the earth, or the eighth sphere, paramount is the mathematical variation itself. In 1557 Rheticus describes the variation as an anomaly of the fixed stars (the eighth sphere):

Your Royal Serene Majesty [King Ferdinand], presently conscribes, as we hear, a great army within the empire to repel the incursions of the Turks. We pray to Christ, the Son of God in heavens that he grant Your Royal Serene Majesty victory. He sits to the right of God the father and is called upon to break the enemies of the Christian name like the vase of a potter, so that no shard remains in which a small fire might be carried.

We said that the stars govern these inferior natures through the order of nature. However the Founder of the heavens who calls them by name prescribes their measure and end, where He wants, He stops their course. If He desires an effect, it is so changed, as when He stopped the course of the Sun in heaven for Joshua and recalled the Sun for Sedachia. Of that which pertains to the stars however I have no doubt that the Turkish empire faces eminent complete ruin, suddenly, not foreseen, approaching the influx of the Trigon of fire, and languishing in the powers of the Trigon of Water. The anomalies of the orb of the fixed stars accede to their third end. How often one given thing attains the end, that it always comes to pass in the world and in the great mutations of empires is seen in the histories. And at that time, God the founder of nature lets His judgment fall. Displacing the powerful from their seat and exalting the humble.⁶⁹

Osiander's reception of Rheticus' prognostication

Osiander (1498-1552) is known in the Copernican story for his unauthorized insertion of a preface to *De Revolutionibus* in which it is stated that the work strives only for an accurate saving of the phenomena and does not attempt a 'real' description. His name is then invariably used in all discussions of the difference between a 'realistic' and 'utilitarian' approach

⁶⁸An alternative interpretation is that, despite knowing their derivation, Copernicus also felt touched by the divine in the face of the symmetry of the motions. Moesgaard concludes his 'The 1717 Egyptian years and the Copernican theory of precession' (*Centaurus*, 1968, p. 120-138): "Rheticus' astrology is quite unparalleled in the works of Copernicus. That, however, does not necessarily imply that Copernicus did not privately attach a special cosmogonical importance to the period of 3434 Eg. years. If he did so, this would provide one good reason for his dogged resistance against the publication of *De Revolutionibus*. The detection of the period 1717 Eg. years might, in the words of another canceled passage from the Ms. of the *De Revolutionibus*, be a 'secret of philosophy' which 'should not be thrown for posterity to scramble for', but 'was that clean and clear water which, thrown into a deep and muddy well, would disturb the mud only, and be wasted.'"

⁶⁹From the Preface to *Ioannis Veneri Mathematici Norimbergensis, De triangulis sphaericis, Libri quatuor. De Meteoroscoopiis, Libri Sex*. Cracow 1557., p. 5. Cf. my translation given in this volume.

to astronomy and science in general. I argue throughout this work that this simplistic juxtaposition is unproductive in our discussion of Rheticus. It also appears that the ‘to save the phenomena approach’ isn’t even accurate for Osiander.

In a recently discovered letter fragment we see that Osiander was so persuaded by Rheticus’ prognostication that he claimed he had discovered it first!

... [it] began to reign in the year of the world 3234 at the time of the Henneans⁷⁰ (according to an exact computation of holy scripture, which I have in the most completed form). I easily saw that the unequal motion of the years was around 1716, thus the beginning of the World began in such a manner that the quadrant had to have been traversed up until it became retrograde. In the year 429 it was directed to the east, thereafter again at 858 retrograde to the west, for which reason the motion changed four times in nearly 3000 years, with the remaining 200 it was 34,⁷¹ in the fifth habitat. Although the motion could have been distributed differently among these years, the above stated observations nevertheless drive me so that I cannot do otherwise. This locus, if I am not mistaken, clearly bears witness to these same observations, you are surely not unaware of this motion and as this same most learned man with his divine mind has been restored to us, he should put forth his work with great confidence. You shouldn’t however wonder that I say that this motion was known to them, it is to be found in Pliny’s description drawn from Petosyri and Necepso,⁷² the maximum variation of the declination was also clearly not unknown to them, which nevertheless noone suspected from Hypparch to the time of Ptolemy among the Latins and the Greeks. Pliny’s description is in Book 2 chapter 16. The Sun is thereupon carried between the two unequal parts in the windy path of the dragons. These thoughts may perhaps appear absurd to you, yet I recognized, as many Greeks, I do not descend to the level of others, but prepare in their minds, [for] they will not be able to understand the new manner of thought. Yet if it is to be mistaken, they will grant opportunity for the inventions of others to perish. And I hardly believe that Ptolemy’s mistake was so large, much rather that of his times, the ancient wisdom of the

⁷⁰Henna, now Castro Giovanni, was where Pluto carried off Persephone.

⁷¹I’m not sure what “with the remaining 200 it was 34” (“reliquis ducentis triginta quatuor fuit”) is supposed to refer to.

⁷²Necepso ad Petosyri are mentioned in II, 88 of Pliny’s *Natural History* as “showing the Aegyptia ratio”, yet there is nothing in all of Pliny’s work which remotely resembles that which Osiander says it does. The only work available on Necepso and Petosyri (both second century B.C.) is: *Fragmenta magica/ Nechepsonis et Petosiridis*. Ed. Ernestus Riess Göttingen : Dieterich, 1891, p. 325 - 400 (*Philologus* / Supplementband ; 6). It is doubtful however that Osiander had access to a manuscript of this text - it was not published prior to 1891.

Egyptians had already decayed at that time. Yet enough of this, of that above, just as I ask you again and again that you offer me your friendship, I ask that you apply yourself diligently and win over the friendship of that man for me as well. I don't risk writing him at the present, and although I didn't intend to, you will certainly not keep these my triflings from him. May he be healthy, on account of the gifts of his mind, and the free way of life, and I congratulate myself, for I have abstained until now from publishing, nor have I deflowered his glory, as it is well deserved. Take this unfounded, tumultuous, and very full letter in good counsel.

Nuremberg, March 13, 1540

A. Osiander⁷³

The notion that Osiander had independently discovered the efficacy of the little circle without any prior knowledge of Copernican theory is silly. Yet such an absurd claim is in keeping with the personality of the arrogant and bellicose Osiander who saw himself as the true Luther. This is clear in hindsight, but what did Rheticus make of this? Considering the fact that Rheticus would expand his prognostication from the workings of just one to a complete system of the four Copernican circles (discussed in III ε), and also attempted to base this 'system' in Scripture, suggests that Osiander's letter may well have come as a very welcome validation of Rheticus' astrological pursuits. His view that science had declined since the Egyptians is also remarkably similar to Rheticus' stance.

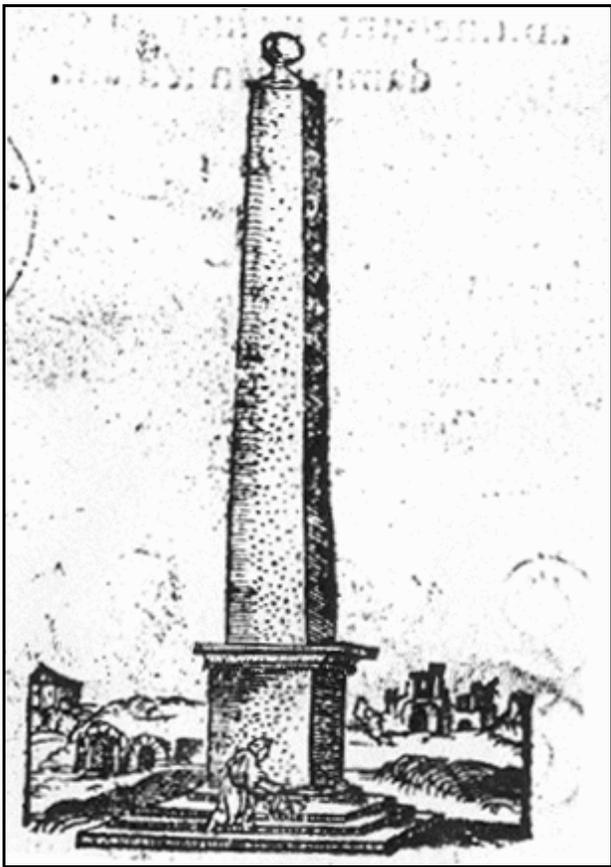
That Osiander had deemed Rheticus worthy of correspondence will have been of significance to the young scholar. For Osiander's theological writings had been very influential in the east. This trend would continue and is reflected in his appointment as the head theologian of the University of Königsberg in 1549 by Rheticus' protector Duke Albrecht. Rheticus will have also known that Melanchthon had gone to great lengths to reconcile the differences between Osiander and Luther to further the purposes of the reformation.

⁷³Latin original in List, Martha: 'Margin alien zur Hand exemplar Kepler von Copernicus: De. Rev.', *Science and History, Studia Copernicana XVI*, p.456/10-18.

γ. The Gnomon

“King Mitres, commanded in a dream, was the first to construct Obelisks in

Egypt, as Plinius explains. Galen also testifies that God wants us to consider His Geometry in nature. For as he did not attempt to adduce geometrical demonstrations in his anatomical books, he did not want to deter doctors of his generation from their study. Commanded in dreams by God, he constructed a geometrical demonstration of the make-up of the eye.⁷⁴ Plinius testifies that the Obelisks were dedicated to the God of the Sun and that this is the Egyptian word for them.⁷⁵ For the Sun is the King and Monarch of the State of Heaven, to whose rhythm and motions the other stars are moved. It is also the eye of the entire world, through whose light everything else is illuminated. So it is through the Obelisk alone that all the laws of the celestial state will be able to be understood exactly and written. Alone the obelisk can open the eyes of the masters of the art, and bring forth the light of the observations to be made of the motions of histories yet to be written and the apt demonstrations of the motions to be investigated, so that through this



Rheticus' Obelisk; placed on the title page of all of his later works.

significance.” [Preface to Werner's *De Triangulis Sphaericis*, p. 305-306]

⁷⁴Galen, *On the Usefulness of the Parts of the Body*, Vol. II, 93 (Trans. May, M. T., 1968, p. 490): “...I dreamed I was being censured because I was unjust to the most godlike of the instruments and was behaving impiously toward the Creator in leaving unexplained a great work of his providence for animals...”

⁷⁵Plinius, *Natural History*, Book 36, ch. 14. The Egyptian *Tekhen* means both ‘sunbeam’ and ‘obelisk’. Rheticus appears to have had the Plinius text before him as he wrote, as this last sentence mirrors Plinius’.

Rheticus' fascination with the gnomon was the driving force behind his later mathematical and astronomical work. The beginnings of this fateful and follied passion are to be found in his trip to Ermland. This is most appropriate, for Rheticus consciously undertook this later work 'as a student of Copernicus'.

There are two references to the gnomon from this first part of his collaboration with Copernicus (1539-1540). We find on the final page of the edition of Witelo's works,⁷⁶ which Rheticus gave Copernicus, a brief calligraphic expose on the length of the shadows the gnomon casts at various places of the world.⁷⁷ Though the passage unfortunately offers little insight into the nature of Rheticus' interest in the gnomon, it does highlight the curious stranglehold the gnomon exercised over Rheticus' imagination. He introduces it as "the umbilicus, which they call the gnomon." Plinius says that 'they' call the gnomon the '*umbilicus*'. But Plinius was the only person in antiquity to have referred to the gnomon in this manner. Etymologically, Plinius' '*umbilicus*' stems from the banal pin which was used to roll up ancient manuscripts. Rheticus however, who repeatedly and emphatically uses '*umbilicus*', was clearly fascinated with the suggestion of a connection with a higher source through the nourishing 'navel'.

In a passage of the *Encomium Borussiae*, which was appended to the *Narratio Prima*, Rheticus mentions being deeply impressed by a gnomon owned by Copernicus' great friend Tiedemann Giese (1480-1550). "He [Giese] also managed to have a gnomon truly worthy of a prince brought to him from England. I examined this instrument with the greatest pleasure of the soul, for it was made by a great workman not ignorant of mathematics."⁷⁸ It is clear from the description that Giese's 'gnomon' is actually what we would consider a sundial. Further, the fact that it was brought from England reveals that it was most likely made by Nicolaus Kratzer (1487-1550). It is conceivable that Rheticus even knew that the gnomon was Kratzer's, for the description 'worthy of a prince' fits Kratzer's role as a servant of Henry the Eighth. This is significant because Kratzer spearheaded a passion for the gnomon which was to find wide public resonance at the colleges of Oxford. Yet, whether Rheticus knew that the Gnomon was Kratzer's or not, all of Kratzer's gnomons were inscribed with poems extolling their celestial

⁷⁶Witelo (~1230~1280) *Vitellionis ... Peri optikes, id est de natura, ratione & proiectione radiorum uisus, luminum, colorum atq. formarum, quam uulgo perspectiuam uouant; libri 10*, Nuremberg 1535.

⁷⁷A photocopy of this passage may be found on the final page of Dobrzycki, J.: 'Uwagi o swewdzkich zapiskach M. Kopernika', *Kwartalnik Historii Nauki i Techniki*, Rok XVIII, Nr. 3, 1973, p. 485-494. Given are Carthage, Mauritanea (Morroco), Arabia and Persia, Rhodes and Cyprus, Lydia, Alexandria, and Athens.

⁷⁸Rosen(1971) p.195.

provenance and Egyptian origins.⁷⁹

We now face one of the most intriguing and difficult problems in understanding Rheticus' work. We know that Rheticus' interest in the gnomon began at this time. We also have a plethora of passages wherein Rheticus extolls the study of the gnomon, with its emphasis on solar observations, as the proper continuation of Copernicus' work. Yet Rheticus never explicitly tells us just how this gnomon research is to proceed.

It seems that Rheticus, blindly driven by what he believed to be the divine provenance of the gnomon, did not himself know how this research programme was to be accomplished. Repeated setbacks did not however dissuade him from the seeming absolute divine promise of the gnomon. Moreover, there really was no way that the gnomon could have significantly enhanced 16th century astronomy.

As we mentioned earlier, this passion for the gnomon appears to have arisen during his stay with Copernicus, and that he undertook this enterprise 'as a student of Copernicus'. This, and how he proceeded with the gnomon research, becomes clear from the following passage:

As this enquiry is of such great moment, & Mr. Copernicus has brought this province to us, whom I not only cherish and observe as a praeceptor, but also as a father. I have also striven to always please him. After I sufficiently prepared myself in Geometry & Arithmetic, I chose Cracow as my place of observation,⁸⁰ because Copernicus studied in Frauenburg as his place of observation. For Cracow is equally distant from the occident, and is under the same meridian. Here, with the help and generosity of Mr. Johann Boner⁸¹, I erected an Obelisk, 45 Roman feet⁸² tall. For in my judgement no other instrument has been superior to the Obelisk.⁸³

The key I believe in understanding Rheticus' conception of his life-long pursuit of the gnomon is that he says he was 'preparing' himself for it. This pure mathematical work was exclusively occupied with trigonometry. As it turned out, this trigonometric work took on a life of its own and the gnomon project, though always a goal, was never realized.

⁷⁹Several of these inscriptions are reprinted in North, J.: 'Nicolaus Kratzer - The King's Astronomer', *Studia Copernicana*, XVI, 1979, p. 205-234. A discussion of the public interest in the gnomon at Oxford is also to be found therein.

⁸⁰Rheticus here conveniently leaves out the fact that his stay in the east was a result of his self-exile to avoid facing charges of sexual misbehavior.

⁸¹† 1562, a wealthy Krakow merchant.

⁸²The roman foot is 11.65 inches.

⁸³*Preface to Werner's De triangulis sphaericis*, p. 305.

The trigonometry.

Just as the *Narratio Prima* has been labeled a ‘Copernican Treatise’, so too has any trigonometric contribution to *De Revolutionibus* on Rheticus’ part been overlooked. This in spite of the fact that Rheticus published the trigonometric section of *De Revolutionibus* in 1542. A cursory glance at theorems XIV and XV of the manuscript of *De Revolutionibus* also reveals significant work done in Rheticus’ handwriting. Although this does not represent any sort of major contribution in the history of science - for the trigonometry section is a mirror image of Ptolemy’s⁸⁴ - it does show that Rheticus made an at least minor contribution in the finishing theoretical touches of *De Revolutionibus*.

⁸⁴I do not understand Schmeidler’s claim that the trigonometric section was independently developed by Copernicus. I also do not see why he thinks that Rheticus made alterations to theorem VI (Schneider: *Kommentar zu De Revolutionibus*, vol. 3,1 of the *Gesamtausgabe*, 1998, p.26ff.).

δ. Rheticus' Return to Wittenberg in 1540⁸⁵

A hitherto unknown set of lectures informs us of a brief visit Rheticus payed Wittenberg in late 1540 in order to fulfill his teaching obligations. What did Rheticus have to say of the new theory? Nothing. Yet it was clear to all what Rheticus's scientific interests were. For the student who transcribed the first lecture found in our manuscript described Rheticus as 'Joachim Heliopolitanus' or 'Joachim of the City of the Sun'.

The Provenance of the Lectures

Like so many other manuscripts in Heidelberg's old library, *Bibliotheca Palatina 1397* was essentially forgotten after it was transported to Rome and locked up in the *Bibliotheca Apostolica* following Heidelberg's military defeat in 1622. As the bindings of the manuscript - along with the name of the author, owner, and title - were burned to lighten the load for the trip to Rome,⁸⁶ our text had particularly little chance of becoming known. Ludwig Schuba first noted the possibility that our present text might contain lectures given by Rheticus in his catalogue of the Latin quadrivium manuscripts of the *Bibliotheca Palatina*.⁸⁷

Before I move on to specific questions about the text the reader may find the following overview helpful⁸⁸:

⁸⁵A first draft of this chapter was published as Kraai, J: 'The Newly-found Rheticus Lectures', *Beiträge zur Astronomiegeschichte*, Vol. I, 1998, p. 32-40.

⁸⁶ The first Catalogue of the Bibliotheca Palatina, the so-called *Alacci-Register* of 1623 (Bibl. Pal. Lat. 1949,1), contains the following entry for our text: "1205 Joachimi Heliopolitani quaestiones de Sphaera · 8 · C · 76". The numbers in the preceding entry refer to the old catalogue system. The second Catalogue, the *Inventarium Manuscriptorum Latinorum Bibliothecae Palatinae* (Bibl. Pal. Lat. 3) from the late seventeenth century (an exact date is difficult to determine in this case) has the following more extensive entry: "1397 1) Ioachimi Aeliopolitani quaestiones Sphaerae. 2) Alius tractatus anonymi de Spaera. 3) Ioannis de Sacrobosco Algorismus 4) Anonymi Algorismus". The entry then proceeds to give the incipits of the respective sections.

⁸⁷Ludwig Schuba, *Die Quadriviums-Handschriften der Codices Palatini Latini in der Vatikanischen Bibliothek*, Wiesbaden 1992, pg.164-65.

⁸⁸As in the overview of the manuscript discussed in chapter II ε, a transcription of those sections whose page numbers are given in *italics* may be found in the appendix. I've labeled the diverse 47'-50' 'Interlude' of which I also provide an English translation. A Latin Transcription of 110'-155' is given under the title 'Pliny Commentary', I also provide a partial English translation of this section under the title 'A Translation of Salient Passages of the Pliny Commentary'.

Bibliotheca Palatina 1397

<i>pages</i>	<i>work</i>	<i>scribe</i>
1 ^r -44 ^v	<i>Questiones sphaerae</i> . First Sacrobosco Commentary	A
45 ^r -46 ^r	Prologue to the Second Sacrobosco Commentary	B
46 ^v -47 ^r	blank	
47 ^v	On Easy and Difficult Works	B
48 ^r -49 ^r	<i>Epistolae petitorae sic & commendativae</i>	B
50 ^{r-v}	Notes on sin, faith, and good works scribbled on a page which was previously used in a Sacrobosco Commentary.	B
51 ^r -109 ^r	<i>Quaestiones in sphaeram materialem</i> , Wittenberg January 1540. Second Sacrobosco Commentary	B
110 ^r -155 ^r	<i>COMPENDIUM IN SECUNDUM LIBRUM PLINII</i> . Commentary on Plinius' second book of his <i>Historia Naturalis</i>	B
155 ^r	The final page is written by a different hand	C

The following texts, written significantly earlier, were appended to the manuscript⁸⁹

156 ^r -170 ^r	<i>Sacrobosco's Algorismus</i> , without the chapter <i>De radicum extractione</i>
170 ^v -172 ^v	blank
173 ^r -187 ^r	Commentary on Sacrobosco's <i>Algorismus</i>
187-189	blank

⁸⁹ These texts were written at a much earlier date. The *Commentary on Sacrobosco's Algorismus* was transcribed in Southern Germany in 1446; it ends: "*Et sic est finis in vigilia sancti Udalrici anno domini 1446*".

We find on the cover page of the first text: *Questions of the sphere by magister Joachim Aeliopolitanus*. ‘Aeliopolitanus’, literally ‘of the city of the sun’, is a student’s clever allusion to Rheticus’ stay in Frauenburg with Copernicus. This interpretation is corroborated by two factors: a) there is no other Joachim besides Rheticus immatriculated at the University of Wittenberg at this time,⁹⁰ and b) Although we would expect the spelling *he* for the Greek ‘*η*’ in Aeliopolitanus, i.e. Heliopolitanus, this translation of ‘*η*’ as *ae* was standard among the Humanists.⁹¹

QVESTIONES SPHERÆ
PER MAGISTRVM
IOACHINVM
NVM
AELIOPOLITANVM

The last page of this first text offers further testimony for Rheticus’ authorship of the text : “End of the questions on the Sphere, dictated by magister Joachim.”⁹² Then, with one word that appears to have been added before it was known that a second dictation would be added, we find ‘*uno*’ or ‘*once*’. A line is then drawn to signal the begin of a new section. We thereafter find, after a crossed out ‘*S*’, “a second dictation of the lecture on the sphere”⁹³ - both remarks apparently written by the same hand.

Ioachimus Aeliopolitanus

Ce λoo quæstionum
sphaeræ a Magistro
Ioachimo dictatae
§ TU Sphaeram secundo pra
lectam dictata

End of the First Commentary,
beginning of the second.

Given this, it would be a natural reaction to assume that both Sacrobosco Commentaries were delivered by the same author. The cautious reader however will object that the second Sacrobosco Lecture may well have been given by another person in Wittenberg. Yet a comparison of the two texts reveals that both indeed resulted from the same lecture. In order to understand how these texts could have the same content and be nevertheless of different lengths, one must first consider the ‘method of the *loci*’ in which

⁹⁰ Förstemann, K. E.: *Album Academiae Vitebergensis ab anno a. Chr. MDII usque ad MDLX*, Leipzig 1841.

⁹¹ This phenomenon can for example be seen in the manner in which the scribe of the first catalogue of the Bibliothecae Palatina in Rome wrote Aeliopolitanus.

⁹² 44^v; “τελoο quæstionum sphaeræ a Magistro Ioachimo dictata uno”.

⁹³ “In Sphaeram secundo praelectam dictata”. A more literal translation would be “On the lecture of the Sphere, dictated for a second time”. I have translated it as above as it is clear that we dealing here with notes by a different person of the same lecture, and not notes of a separate lecture.

Rheticus dictated them.

The ‘method of the *loci*’ was a didactical tool, cultivated by Melancthon, which Rheticus and several other students in Wittenberg employed. In this method each concept is explicated in its own *locus*, and the various concepts are ordered in terms of increasing complexity. For example, our two commentaries begin with the abstract *loci* sphere, centre, axis, pole, and then move on to discuss the antarctic and arctic poles of the earth.

One might expect that Rheticus would give his own definitions to these terms, and that he would organize them in an order he would find most convenient. Yet this is not the case. The *loci* are derived literally from *De Sphaera*, and follow the same conceptual order of that text.

Now the only difference between these two commentaries is that the first student was far less diligent than the second. A concordance of the two texts shows that the first student simply didn’t transcribe all of the *loci*. In fact, it seems that he skipped the last part of the lecture on the fourth chapter of Sacrobosco’s *De Sphaera* entirely. The text however of those *loci* which were transcribed by both students is exactly the same, this similarity includes the *locus* headings and the text which was selected from *De Sphaera* to answer the *locus*’ charge.

The significance of identifying both lectures as having been delivered by Rheticus is that we are able to date the second Sacrobosco Commentary. The title page of the Second Commentary, beginning with a poetic distich, reads:

I hope as long as I breath my sole hope is Christ;
to whom I commend, dedicate and subject myself.⁹⁴

⁹⁴ *spero dum spiro mea spes est unica christus; Cui me commendo dedico subicio* . Note that the first line is a hexameter and the second an imperfect pentameter as the ‘o’ in *dedico* would have to be spoken long (which it isn’t) for the pentameter to be perfect. Many thanks to Martin Hellman for recognizing the poetic nature of these two lines.

... Cujus in ...

Q
VAESTIONES
IN SPHAERA
MATEMATICAM

Questions concerning the
material sphere

In Wittenberg

H.H.L.⁹⁵

December 13, 1540.⁹⁶

Wittenberg,

H. H. L.

15 Calends. Januarij

The last page reads (neglecting
the final notes on Sacrobosco):

*... eclipsis non futuris natura...
... quod in tota terra
... univ[er]sali*

FINIS SPHÆ-
RAE MATH-
EMATICA-
LIS.

End of the material Sphere

Laus deo

Praise the Lord

*11 Cal. Januarij
1540*

December 18, 1540

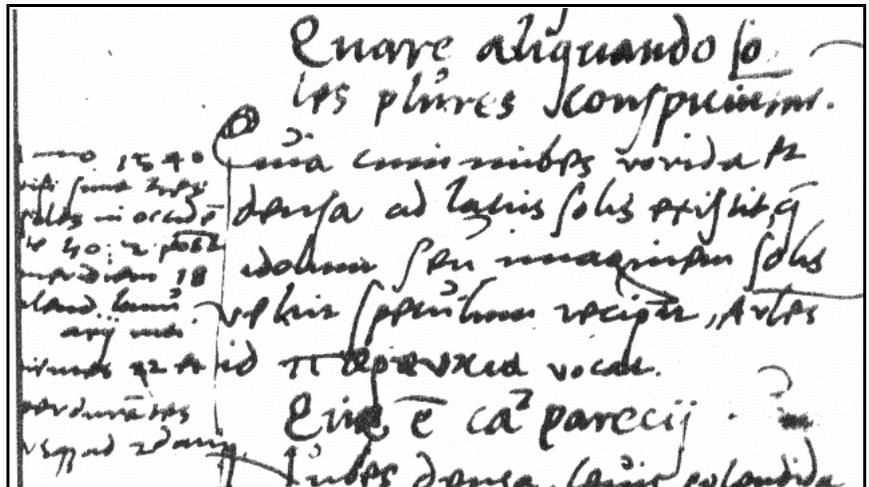
⁹⁵ This is our only reference to one of the students who wrote up Rheticus' lectures. H.H.L. can either refer to Hieronymus Haunold Lignicensis who was immatriculated in the winter-semester of 1538 (Förstemann, K.E.: *Album Academiae Vitebergensis...*, V.I. 173b, 8) or to Hieronymus Hesperg Lorensis who was immatriculated in the winter-semester of 1539 (ibid. V.I. 177b, 29). I have unfortunately been unable to find any further information on either person.

⁹⁶Note here and in the following dates given that the author uses the ancient custom of the *calends* which records the date by counting backward from the 1st day of the coming month.

Thus, the first text offers us an author (Rheticus) and the second a place and time (Wittenberg, December 1540).

There are two further reasons which make Rheticus' appearance in Wittenberg in late 1540 plausible: 1) We have three lecture announcements for 1540 wherein Rheticus proclaims that he will read Alfraganus, Ptolemy's *Almagest*, and Sacrobosco's *De Sphaera*.⁹⁷ We had previously supposed that these lectures simply hadn't taken place as we had no indication of Rheticus' return to Wittenberg. 2) Despite his unpleasant situation in Wittenberg, Rheticus was still obliged to fulfill his duties there. In particular, the school needed someone to teach the required introductory course on astronomy based on the Sacrobosco text. A witness to this pressure, albeit from a later date, is Duke Albrecht of Prussia's letter written to the University of Wittenberg recommending Rheticus' reinstatement as Professor in Wittenberg.⁹⁸ This pressure arose from the simple need of giving young students of the *artes liberales* an introductory astronomy course.

The Pliny Commentary. It also seems highly probable that Rheticus delivered the Plinius lecture found in our manuscript. Found on page 131 is a marginal note to a *locus* devoted to the phenomena of 'multiple suns' "Three suns were seen in the year 1540 in the west at 2 pm on the 11th of December, 22 minutes* lasting til the second hour*."⁹⁹ This places us directly in the time period



Three suns are seen in the west on December 11, 1540.

⁹⁷*Scriptorum publice propositorum a professoribus in Academia Witebergensi, ab anno 1540 ad annum 1553, tomus 1* (Wittenberg, 1560), C4^v-C5^v (Alfraganus), C7^r-C8^r (Ptolemy), E4^v-E5^r (Sacrobosco). I provide translations of these lecture announcements in the Appendix under *Lecture Announcements*.

⁹⁸An English translation of this letter may be found in E. Rosen, *Copernicus and the Scientific Revolution*, 1984, p.181-82.

⁹⁹"Anno 1540 visi sunt tres soles in occidente ho[ra] 2 post meridiem 18 Calend. Ianuarii minutes 22 et perdurantes usque ad 2dam." The text of the *locus* itself reads: "Why are many suns sometimes seen? Because when a dewy and dense cloud exists to the side of the sun it receives an 'idol' or image of the sun like a mirror. Aristotle calls this περιανκία (That is, 'those on the side', *Meteorology*, Book III, part 2.). What is the cause of the parhelion?" "Quare aliquando soles plures conspiciuntur? Quia cum nubes torida et densa ad latus solis existit, quae idolum seu imaginem solis velut speculum recipit, Aristoteles id περιανκία vocat. Quae est causa par[h]elii?"

of Rheticus' brief stint in Wittenberg. It would appear that this remark was not later brought to bear on the text, and is rather contemporaneous with the lecture, because no part of the entire manuscript contains any *post factum* remarks.

The method of the exposition also clearly matches the format found in the other lectures: The text is dividing into loci, these are then often dissected by examining the phenomena in question through Aristotle's efficient, material, formal and final causes. This particular bent for the four causes is peculiar to Rheticus' pedagogy. Further the content - as we shall shortly discuss in our section on the text itself - reveals key tenets of the philosophy of the 'astrological circle'.

The reader should now by all means object that the text could have also been delivered by either Paul Eber, Melanchthon, Jacob Milichius or Erasmus Reinhold. Eber, who would later lecture and write extensively on Pliny,¹⁰⁰ must be ruled out as he arrived in Wittenberg in 1541.¹⁰¹ Melanchthon could indeed have given the lecture, particularly when one considers the great similarity in Rheticus' and his astrological rhetoric. Yet why would Melanchthon bother with a text he was none too fond of¹⁰² when Rheticus was in town? Milichius had often taught Pliny's *Natural History*, and Rheticus had no doubt heard this lecture during his years as a student, yet - as we have already discussed - Milichius stopped lecturing on 'mathematics' in 1536, and moved to the study of medicine. Concluding his stint as professor of physics is a commentary on Pliny's second book. This book's tenets were so typical of the astrological circle that it was for many years ascribed to Melanchthon - along with Milichius' declamation *On the Dignity of Astrology* which was appended to the commentary in its first printing in 1538.¹⁰³ Milichius' commentary tries far more blatantly than Rheticus' to use Pliny's trivial blathering to trace God's Providence and demonstrate nature's use to man. Finally, Reinhold should be ruled out as he never passionately advanced the propaganda of the 'astrological circle'. And it was indeed for this reason that Melanchthon never endowed him with the

¹⁰⁰*De vita et scriptis C. Plinii*, Wittenberg, 1556.

¹⁰¹Eber would become the professor for 'physics and rhetoric' on Dec. 30 1543. Cf. Thüringer, W.: 'Paul Eber (1511-1596), Melanchthon's Physik und seine Stellung zu Copernicus', *Melanchthon in seinen Schülern: [Vorträge, gehalten anlässlich eines Arbeitsgespräches vom 21. bis 23. Juni 1995 in der Herzog-August-Bibliothek Wolfenbüttel]*, ed. Heinz Scheible, 1997, p. 285-320; p. 287-88.

¹⁰²Melanchthon apparently only taught the class once in 1521, and that only because the reader Aesticampianus died. He relates his reluctance toward teaching the text in a letter to Spalatin from the 13th of June 1520.

¹⁰³*Commentarii in librum secundum historiae mundi C. Plinii*, Wittenberg 1538. As for the work being ascribed to Melanchthon cf. the following title from 1582: *Editi commentarii Iacobi Milichii in secundum librum Plinii, cuius laboris maximam partem docti viri Philliop soliti ascribere*, Görlitz.

office of the introductory lecture into astronomy/astrology.

Ownership. To whom did our manuscript of elementary astronomical lectures belong? Three reasons suggest Rheticus himself as the most plausible owner: 1) Our current text collection does not appear to be that of a student as it seems implausible that a student would collect two commentaries. 2) That two Sacrobosco Lecture transcriptions were collected appears to result from the fact that the first was incomplete. Having a copy of his lecture would better enable Rheticus to prepare and could be used for various pedagogical purposes. We saw in our discussion of Rheticus' 'astrological manuscript' that a transcription of the Sacrobosco Lecture was also collected there. These two new transcriptions will have then served as that transcription's replacement which was no longer in Rheticus' possession. 3) Rheticus' later student Valentine Otto brought all of Rheticus' writings to Heidelberg, i.e. in the library where we find the text today, in order to publish Rheticus' *Opus Palatinum* following Rheticus' death in 1574.¹⁰⁴ If one accepts the idea that Rheticus collected transcriptions of his own lectures - as we found in the case of the astrological lectures of 1536-38 - then this provides further grounds for assuming Rheticus also authored the Pliny Commentary.

The Content of the Sacrobosco Lectures

Rheticus was regularly required to hold an introductory lecture on astronomy based on the classical astronomical text of the middle-ages *De Sphaera* by Johann de Sacrobosco.¹⁰⁵ Testifying to this fact is the first sentence of his lecture announcement for 1540: "I've once again been commanded [!] to read the little book concerning the sphere on account of the *adolescentes* who have yet to hear these fundamentals."¹⁰⁶

From a didactic point of view, Rheticus understood *De Sphaera* as a solid introduction or *Isagogue* to astronomy for beginning students. This is expressed in the Prologue to the Second Commentary¹⁰⁷:

Given in this Isagogue or introductory book to the mathematical disciplines are just and very apt writings in their method. For, as in the other arts, the elements and beginnings are laid down in advance so that the adolescents are gradually led as if

¹⁰⁴For more on Otto's role in inheriting Rheticus' library comp. Burmeister, *Georg Joachim Rhetikus. Eine Bibliography*, 1968, V.1, p.175-179.

¹⁰⁵ For Sacrobosco, see Thorndyke, L: *The Sphere of Sacrobosco and its Commentators*, Chicago 1949.

¹⁰⁶ "Iussus sum iterum enarrare libellum de Sphaera propter adolescentes, qui haec elementa nondum audierunt." *Scriptorum publice propositorum a professoribus...tomus I, E4^v*", p. 197.

¹⁰⁷ One finds a similar sentiment in the Sacrobosco lecture-announcement for 1540. *Scriptorum publice propositorum a professoribus...tomus I, E4^v-E5^r*. See *Lecture Announcements*, p. 197.

by degrees to other authors and a perfect doctrine of the art. It is up to the youth to make the beginning in such compendiums. This book aptly imparts the elements of that physical part which is directed toward the revolution of Heaven and the observations of the motions of the celestial bodies. In this regard our author deserves the highest praise, as he put it all together in a very correct and apt order,...¹⁰⁸

It is on account of this ‘apt order’ and didactic excellence that Rheticus varied so little from Sacrobosco’s text in the lectures of 1536 and 1540. The text itself is therefore of little use in interpreting Rheticus’ work, and I have for that reason not included my transcription of it in the appendix. A further reason for not departing from the text was that the real mathematical astronomy was to be taught *privatim*, whereas the ‘physical’ part of astronomy was taught publicly to the adolescents.¹⁰⁹

A discussion of the difference between the public lecture on physical astronomy and the private lecture on mathematical astronomy will help clarify the long-running dispute as to how one should interpret Rheticus’ praise of the *Almagest* as “the by far most beautiful work of all”.¹¹⁰ Some scholars have argued that Rheticus was only praising Ptolemy for his mathematical virtue, others accused Rheticus of treachery in turning his back on Copernicus, and still others suspected that Rheticus was coerced. This interpretational difficulty is really the same as that which we discussed II ζ: whether Rheticus viewed astronomy as a method of saving the phenomena or a real physical description of the universe.

We gain a valuable insight into how Rheticus conceived the mathematical truth of astronomy from his understanding of the meaning of ‘material’ in “Questions on the material sphere”. Rheticus makes it quite clear in the prologue and in the second and third *loci* of the Second Commentary what he means by ‘material’. ‘Material’ refers to that

¹⁰⁸ The ‘physical part’ should be read as analogous to Rheticus’ concept of ‘material’ which I address below. p.45^r (A Latin transcription and an English translation of this text may be found in the appendix under the title ‘Interlude’); “traditur in hoc libro Isagoge seu introductio ad disciplinas mathematicas iusta ac aptissima methodo conscripta, sicut enim in aliis artibus principio elementa & initia praeponunt [sic. praeponente] ut his ordine quodam veluti per gradus deducuntur adolescentes ad alios authores, & perfectam artis doctrinam. Adolescentia enim opus habet initio quibusdam talibus compendiis ita hic liber tradit aptissime elementa istius physicae partis qui circa revolutionem coeli & observationes motus corporum celestium versatur. atque eo maiorem laudem hic author meretur quod haec omnia iustissime atque aptissime ordine complexus est,...”. Further evidence that these lectures were given by Rheticus is seen in the fact that the above sentiment is expressed almost word for word in the 1540 *Lecture Announcement for the Sphere of Sacrobosco* (see my translation in *Lecture Announcements*, p.197).

¹⁰⁹ Considering the apparently very brief duration of Rheticus’ sojourn in Wittenberg, and the fact that Rheticus says in his *Lecture Announcement for Ptolemy* that it would only take place “with God’s help” (*Lecture Announcements*, p. 201), the private lecture most likely did not take place.

¹¹⁰ *Lecture Announcement for Ptolemy*, p. 201; “omnium humanorum operum longe pulcherimum esse”.

‘objectified or materialized universe’ which the student would find in the celestial globe depicting the ‘material’ orbs of the planets in the geocentric universe¹¹¹:

The author called this book ‘on the material sphere’ because it contains the physical discussion of the world, whose form is spherical, and so that the adolescents could more easily mentally grasp in their soul the physical world, he [the author] planned to teach that [the sphere] in the instrument as it has a picture of the celestial orbs and circles, seeing that the instrument is called the material sphere, and because this book is like an exposition of this instrument, he for this reason called the book ‘on the material sphere’.¹¹²

The physical/material world of the poles, the five climes, the zodiac, and the planets studied in *De Sphaera* is to be set apart from the mathematical world of Ptolemy and Copernicus. The first is meant for the young *adolescentes* of the *artes liberales*, the latter for a much smaller advanced group meeting *privatim*. The first thus presents a picture which may be readily grasped, mathematical truth on the other hand may only be ‘grasped’ in terms of the comprehension of the rhythms of celestial variations. ‘Physical’ astronomy is for beginners and doesn’t begin to scratch the surface of the divinely inspired mathematical astronomy.

The Pliny Commentary’s Contents. It is our great fortune that the extreme profusion of obscure details in Pliny’s second book force the lecturer to present the text in a more constructive manner. The commentary faithfully follows Pliny through the first xiv chapters of the second book, from the beginning metaphysical *loci* ‘What is God?’, ‘What is the World?’, ‘Is the World finite or infinite?’ to a discussion of the four elements and finally to the planets. This first part of Pliny’s book is capable of being presented in a concise and ‘Sacroboscan’ manner. Yet Rheticus immediately changes tact following the discussion of the planetary latitudes, because the random observations and claims with which Pliny fills the rest of the book must be given some sort of systematic order.

¹¹¹ Nevertheless, Wittenberg didn’t have an actual globe at this time!. We know that one was sought in 1543 (cf. the *Urkundenbuch der Universität Wittenberg*, Teil I (1502-1611), ed. W. Friedensburg, Magdeburg, 1926, p. 234-236). The student most likely used the picture of the geocentric universe which is found on the title page of Melanchthon’s edition of the *Libellus de Sphaera* (1531). Rheticus’ student Nicolaus Gugler copied this picture onto the front page of his lecture notes. A photocopy of this page may be found in: Burmeister, *Georg Joachim Rheticus, eine Bibliographie*, V. II, p.19.

¹¹² 46^r; “Inscripsit autem [the word ‘titulum’ is crossed out here] hunc librum Author de Sphaera materiali quia continet tractationem de mundo cuius figura est spherica & ut adolescentes complecti animo summam rei commodius possent, proposuit illa discenda in instrumento quod habet picturam orbium & circulorum coelestium quod instrumentum vocatur sphaera materialis & quae hic liber est veluti expositio huius instrumenti itaque eodem modo hunc librum de sphaera materiali inscripsit.”

Despite immediately declaring himself an opponent of astrology at the outset of the second book, Pliny readily acknowledges the ‘physical’ effects of the various colors of the planets. Rheticus moves aggressively to reject this commonly-held understanding in order to uphold his vision of astrology and the divine planets in the *loci* ‘Why does heaven have diverse colors when it is dark blue?’, ‘Heaven and the stars are seen, thus they are colored, is this color then objectively seen?’, and ‘Why do the stars have different colors?’. The notion that the planets are ‘colored’ upsets their metaphysical superiority, established by Aristotle as ‘pure being’ because ‘coloredness’ necessarily implies a ‘coming-to-be’ through the virtue of the primary qualities.¹¹³ ‘Coloredness’ rather results from the interaction of the planet’s light with the element of air:

I respond: there is a difference between being colored and being lucid. For light is seen even if it is not colored in heaven, thus no colors are in the objects themselves, nor do flashes of light or twinklings which are effects of the moving air. They are nevertheless not produced in one manner, for it depends on the nature of the body from which the twinkling results, and also upon the nature of the air itself, and the region of the air, and the rightness or obliquity of the rays. The color of heaven is thus dark blue, yet not inherent to the celestial body which exists as a luminous object. For the luminous body is seen through a dark and airy medium, color is a mixture of light and dark. [122]

This is an important clarification of the ‘astrological circle’ because it moves away from the astrology of the Middle-Ages which would employ the power of a planet’s color, say the red of Mars, to justify the astrological enterprise, and prepares the new astrology based on the rhythms of the celestial bodies.

Rheticus continues upon this course by rejecting Pliny’s claim that the three superior planets, in particular Jupiter, cause lightning and similar phenomena:

Plinius infers this reasoning,¹¹⁴ namely that the three superior planets cast fire upon the earth, and Jupiter above all, whom they later call lightning. Yet it is clear from the proceeding that this reasoning is false. We shall later speak of the matter of lightning, we wish to now show why lightning is assigned to Jupiter, namely, that same type of air also has camps from which it is carried in its fiery course by light winds [*auras*], in the same manner the poles begin by being held by the great Atlas, and he commands the frightened. The hearts of the just are tired and scared¹¹⁵. He wished to signify with these verses how He himself is the mighty God. Lightning

¹¹³“Colors result from the action of the primary qualities among themselves, thus, as none of these qualities exist as such in heaven - which are subject to change through alterations - it cannot be colored.”[fol. 122, p. 245]

¹¹⁴Plinius in II, 82 clearly states that this idea comes from other (unnamed) authorities.

¹¹⁵Though this sentiment is found throughout the *Old Testament*, no near matches to this quote are to be found.

is to be attributed to God, for He clearly never ceases and is idle, but rather makes punishments of these [lightning bolts], and he strikes down bad people on earth. [fol. 124, p. 246]

The final cause of lightning is also celestially inspired: lightning bolts are divine admonishments. Likewise the celestial bodies, in particular the sun, *effect* lightning bolts.¹¹⁶ The material and formal causes however result from terrestrial interactions (fol. 125, p. 247).

As we have noted, Aristotle's metaphysical division of the sub- and supralunar spheres was a powerful foundation upon which astrologers could establish the divine nature and influence of the planets. Transient celestial phenomena, particularly the comet, had therefore very little chance of being seen as supralunar. It is therefore very interesting to find a completely Aristotelian explanation of the comet (p. 246-250) from late 1540, because it would only be a few months later in April 1541 that Rheticus would wright Paul Eber with the new that he and Copernicus had discovered that comets were actually supralunar phenomena (see III ζ).

Now, as we discussed in II ζ, Rheticus was no great friend of the 'event astrology' which had been bitterly disgraced by the unmet expectations of the comets of 1531 and 1532.¹¹⁷ In the *Pliny Commentary*, Rheticus refuses to assign a celestial final cause to the comets. He instead sides with the *physici* who see no grand final cause of the comet, and rather a phenomenon which comes to be *per accidens*:

The final cause is the reason for which something occurs. It is however [127v] truly difficult to place the final cause [of the comet] in the planets. For something obviously exists as the final cause of them [the planets]. The natural scientists [*physici*] respond clearly: for they collect the final, material and effective causes, it is not possible for them to inquire into who set this great incendiary ablaze. The air dries out, therefore the final cause is the wet and dry constitution of the tempests which corrupts fruits. It therefore follows that the abundance of a year's crops depends on it. Likewise, because the matter of the comet is a compact and viscous exhalation which contains an abundance of poison, it produces a pestilent fume upon being lit which infects the air.¹¹⁸ (p. 248-249)

The text then goes on to discuss falling stars, the parhelion (whose

¹¹⁶The sun is the effective cause, and the stars which raise the material and prepare it to receive this kind of form through their qualities. [fol. 124^v, p. 246]

¹¹⁷Both of these comets are specifically referred to on fol. 127, p. 248.

¹¹⁸This *per accidens* is reinforced in the locus concerning the movement of the comet "I respond that it is moved, but only *per accidens*, for the superior part of the air is moved to the motion of the prime mover [128v] and as the Comet exists in this place it is moved by that violent course, just as the air is. Because however it is moved in another motion according to the direction of the signs, it occurs also *per accidens*. For it follows why it is of a given planet which excites and ignites this material, for it guides the comet with its rays like its slave." [p.250]

locus is reproduced above), tempests, evaporation, thunder, and wind in terms of the four Aristotelian causes. We find at the end of the discussion of wind a further reinforcement of the claim that the planets do not *materially* influence the sublunar sphere. Only after the ‘material astrology’ of the Middle-Ages is dismissed can a new astrology, based on influence through divine mathematical rhythms be established:

What is the opinion of the astrologers on the matter of winds?

These not only place the efficient and universal cause in the stars but also the material. For they say that the winds are excited as if by a cause by the solar rays, for they say that the sun acts upon and impels the air materially. Just as when someone vehemently strikes the air with a stick which then excites winds, so it is likewise necessary for harsh agitations of the rays to excite hissing and drafts which are called wind. Indeed as there is no air in heaven, and wind is nothing but an impulsion of air, it follows that this opinion drastically departs from the truth. Thus there is no power of the rays in the winds. It is true that the rays of the sun and Mercury excite by their fixed force smokes and soots in which winds thereafter arise. (p. 257)

Reception in Wittenberg. Rheticus appears to have returned to Wittenberg to quickly complete his teaching requirements and then immediately leave. The trip seems also to have been planned as the lecture announcements would have been printed in advance of the Winter Semester and well before Rheticus’ arrival in December. Yet even if Rheticus had planned to stay only for a brief period the amazingly brief period of six days for an entire lecture must raise our brows just a little.

Informed by the difficulties Rheticus faced in 1538 (cf. II η) and then in 1542 (III η), the brevity of Rheticus’ sojourn appears motivated by the unpleasantness of his personal and professional situation in Wittenberg. In addition to the Lemnius fiasco of 1538, Rheticus now had to face Luther’s bellicose disapprobation of the heliocentric theory, of which he was now, through the *Narratio Prima*, a prime representative. Even the otherwise conciliatory Melanchthon felt called upon to passionately discount the new theory only shortly after Rheticus’ return in October 1541:

Many hold it for an excellent idea to praise such an absurd matter, like that sarmatic [Pollock] Astronomer, who moves the earth and lets the sun stand still.¹¹⁹

This ideological and political difficulty is expressed in the plain fact that no mention of heliocentrism is made in either the *Sacrobosco Commentary* or the *Pliny Commentary*. Yet - despite this silence - one mocking word found in our manuscript ‘Joachim of the City of the Sun’

¹¹⁹Melanchthon, *Opera*, vol. 4, letter no. 2534(October 16).

makes the ungratefulness of Rheticus' heliocentric confession apparent.¹²⁰

We conclude by noting that the Catholic Church did not take severe notice of heliocentrism until the scandal of Galileo. It has been shown that Galileo's precarious situation was in fact brought about in large part by personal conflicts, in particular his alienation of the Order of the Jesuits. We likewise find that the negative reception of heliocentrism more than sixty years earlier in Wittenberg was significantly prefaced and influenced by Rheticus' personal difficulties in Wittenberg.

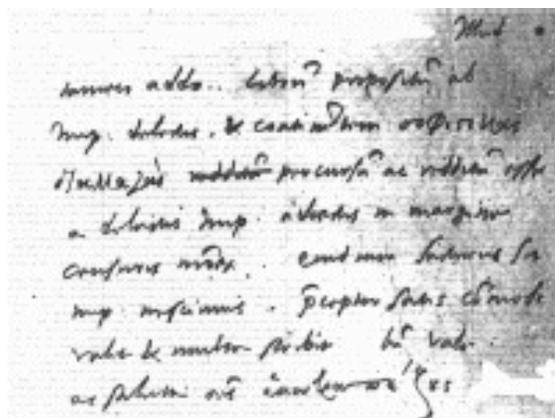
¹²⁰'Heliopolitanus' is ironically a remarkably accurate name for Rheticus when one considers his interest in the gnomon and his belief that the Egyptians had possessed the pristine science. 'Heliopolis' was the center of sun worship during the pre-Christian Egyptian civilization. The ruins of the city are 5 miles east of the Nile River at the apex of the Nile delta, and about 6 miles northeast of Cairo. It was originally the center of worship of the god Tem, deity of the setting sun, later regarded as a form of the sun god Ra. In Egyptian theological literature, the city was known as Per-Ra ('City of Ra'), of which the Greek name is a translation. In the Bible, Heliopolis is referred to as On, Aven, and Beth-Shemesh. Although its history goes as far back as about 2900 BC, the city reached its greatest development during the New Kingdom, beginning about 1570 BC, when Ra, later called Amon-Ra, came to be regarded as the chief god of the Egyptian pantheon. Under the pharaoh Ramses II during the 13th century BC, the temple of Heliopolis reached the height of its influence, with almost 13,000 priests and slaves serving in it. Most of the religious literature of ancient Egypt was written by the priests of Heliopolis, who were renowned for their learning, and the temple was the repository for royal records. The city declined under later dynasties, especially after the founding of Alexandria (332 BC), and the Ptolemies almost disregarded it. When Rome occupied Egypt, the obelisks of Heliopolis were removed, and the walls of its buildings were used as construction materials for other cities. (Paraphrased from *The Catholic Encyclopedia*)

ε. The Treatise on Holy Scripture and the Motion of the Earth

This treatise, recently discovered and edited by the Dutch historian of science Hooykaas¹²¹, reveals the broader theological context of early heliocentrism. We begin with a critical footnote to Hooykaas' discussion of the provenance of the treatise: The treatise was censured by an imperial commission for 'sophistical' reasoning. A discussion of the treatise itself follows which expands upon the background and justification of Rheticus' heliocentric Providence.

Provenance.

We knew of this tract before it had been found through a letter of Tiedemann Giese to Rheticus in 1543. In the letter, Giese indicates that the work was written entirely by Rheticus. Giese writes that he wishes that "your little work, in which you so aptly vindicated the motion of the earth from the dissenting passages of Holy Scripture" should be prefaced to *De Revolutionibus*.¹²² Our knowledge of both the context and provenance of the treatise is substantially enhanced when we consider the following passage from a letter Rheticus wrote P. Eber in June of 1541:



I

nevertheless

¹²¹Hooykaas, R.: *G.J. Rheticus' Treatise on Holy Scripture and the Motion of the Earth*, 1984.

¹²²Giese to Rheticus July 26, 1543; The Latin text and a German translation may be found in Burmeister (1968), vol. III, p.54-58.

add this... The book has been put forth, and was studied by the Emperor's delegates because it contains σοφιστικὰς διαλλαγὰς [sophistical exchanges]. The Emperor's delegates sent it back with censoring comments in the margins. What the Emperor shall now undertake we do not know. The praeceptor is doing well enough and writes a lot. Farewell and greet all ὁμωτραπέζους.¹²³

Burmeister, who of course did not know of the treatise's physical existence at that time, suspected that the book referred to might be *De Revolutionibus*.¹²⁴ Granted the chance of studying the treatise it becomes immediately evident that if any work ever contained σοφιστικὰς διαλλαγὰς it is the *Treatise on Holy Scripture and the Motion of the Earth*. That the treatise was censured by the Emperor's delegates explains why the treatise fell into obscurity for so many centuries.

It appears that the text was constructed with the direct intent of printing it alongside *De Revolutionibus* or the *Narratio prima* (conceivably also to the planned, but never completed, *Narratio secunda*). We find in the first sentence of the treatise the present tense in the description of the mathematical proof of heliocentrism (Mathematicè demonstratur). We also find several passages which suggest that the treatise was composed under the assumption that it would be reviewed. The deference of these passages contrasts starkly with the confident defense of the rest of the treatise.¹²⁵

Copernicus was clearly aware of the treatise as we find 'we don't know' followed by a direct reference to the praeceptor in the Eber letter quoted above. It is also reasonable to believe that Copernicus supplied Rheticus with the biblical references used in the *Treatise*, for Rheticus would not have had the time to collect the many biblical and apocryphal references to the motion of the sun or the earth. Copernicus on the other hand, as is

¹²³I.e. 'those of the same table' = 'friends'; Rheticus to Paul Eber June 2, 1542 (reprinted with the Latin text and German translation in Burmeister (1968), vol. III, p.26-28). Optimo viro magistro Paulo Ebero, amico suo carissimo, Witebergae in aedibus Philippi Melanthonis. ... Scriberem de multis rebus, sed impediatur et nuntius festinat. Ideo boni consules tenuitatem harum literarum. Scribam plura per dominum Christopherum Prusium, qui post festos dies pentecostes hinc movebit. Illud tamen addo: librum propositum ab imperatoris delectis & continentem σοφιστικὰς διαλλαγὰς percursum ac redditum esse a delectis imperatoris adiectis in margine censuris morum. Quid iam facturus sit imperator nescimus. Praeceptor satis commode valet et multa scribit. Bene vale ac saluta omnes ὁμωτραπέζους. Hermannum quin iube ad me scribere. Salutatur te Andreas. 2 Iunii Ioachimus.

¹²⁴Burmeister (1968), vol. III, p. 28. This however did not sit well with Rosen, who wrote a whole article attempting to disprove the reference (As far as I can tell this short essay has never been published. I received a copy of it from Burmeister. It is titled 'A New Rheticus Letter' and bears the marginal note 'Rec'd 1 Oct 69'). Rosen bases his thesis on the tenuous fact that the letter mentions a courier, and that there was no formal courier service in Frauenburg where Rheticus was staying in 1541. He concludes that the letter must have actually been written in 1538. Yet, as we have seen, Rheticus was clearly in Wittenberg in June of that year - why would he need to write a letter. Burmeister's 1541 and Rosen's 1538 are based on the fact that the letter, which bears only June 2 as a date, mentions that another letter will be sent after Pentacost, and that only these years would fit that description.

¹²⁵Cf. p. 16, 32 and 63.

evidenced by the collection of references to terrestrial movements in antiquity found in the preface to *De Revolutionibus*, had spent a lifetime trying to rediscover the lost heliocentric truth through philological study. That the treatise was censured also explains why biblical passages were not discussed in the preface to *De Revolutionibus*.

The Treatise

The first word of the treatise's question and the name given in the answer immediately highlight the two most important directions of the work for the reader:

*Mathematicè demonstratur, ad perpetuam rationem τῶν φαινομένων corporum coelestium obtinendam, terrae mobilitatem assumendam. Quid autem hac de re secundum Sacram Scripturam statuendam est? Divus Aurelius Augustinus librum qui imperfectus exstat in Genesin ad literam...*¹²⁶

Our task will be to understand the validity of a mathematical demonstration in a biblical context and how that relates to the doctrine of physical investigation expressed in Augustine's *A Literal Commentary of Genesis*. We will begin with the latter, to which the treatise devotes its first thirteen pages.

Augustine's doctrine of physical investigation.

The validation of physical investigation within a biblical context is a quixotic task. The main difficulty is explaining how physical investigation assists man's quest for salvation. Further, if God had desired for us to know these things, why aren't they described in Scripture? "Who better to describe the eye than that God who fashioned it. (p.12)" Is it not simply ridiculous to ascertain the nature of God's creations, such as the eye, without His word? Finally, given the above, is it not the height of folly to make a claim concerning nature which appears to be contradicted in Scripture?

Augustine provides Rheticus with the argumentation and authority to grapple with the final question. Rheticus must answer the remaining questions himself. Augustine begins his book with the following critical distinction between asserting truths and questioning in the natural world:

Concerning the hidden things of the natural world which we believe to have been created by God, the omnipotent craftsman, we are to proceed not in making declarations of truth (*non affirmando*), but in questioning, particularly in the books which authority commends to us. In these matters heedlessness in asserting uncertain and dubious statements of opinion hardly avoids the crime of sacrilege.

^{126c}*It is mathematically demonstrated that to obtain a perpetual ratio accounting for the phenomena of the celestial bodies the motion of the earth is to be assumed. But what is to be determined in this matter according to Holy Scripture? Saint Augustine, in his incomplete book A Literal Commentary of Genesis,..."*

And even the doubt of questioning may not exceed the boundaries of the Catholic faith. [p.1-2]

Rheticus immediately notes the difficulty of this statement, “Are not pronouncements of truth (*affirmando*) the way to proceed in Scripture? (p.2)” He proceeds to address this contradiction by offering an ambitious interpretation of the meaning and scope of Scripture which serves to focus Augustine’s argument upon the matter at hand:

Because the knowledge of God has vanished daily from our minds since the fall of Adam, and because Christ said that it is the Will of the Father that it should not perish, God gave us His Word, so that we would be certain of his Will toward us, and always have before our eyes what He wishes us to accomplish, and how His anger toward us will be relaxed through His promised seed and how He will receive us into His grace. This is that which the Holy Ghost wished to reveal through the Word, and this is the aim [*finis*] of Scripture. [p.3]

Three operative instances of this highly debatable interpretation must be iterated:

1) The continual deprecation of our knowledge of God finds its symmetrical counterpart in Rheticus’ belief that our knowledge of science has steadily devolved from the perfect cognisance which God gave the ancient Egyptians.

2) Lacking this perfect knowledge of God, we depend on Scripture, as a crutch, to know our part in his plan. Rheticus attempts to establish this as the *exclusive* aim of Scripture. Therefore all matters of Scripture which do not pertain to our salvation do not pertain to the purpose of Scripture and shall not be interpreted literally. Aristotle’s contention that the world is eternal, for example, must be vigorously rejected as it violates our knowledge that God created the universe (p.7). All Scriptural accounts however which address a ‘description of nature or kind of physics’, which do not pertain to our salvation, are a kind of scenic backdrop adapted to the common speech of the people (p.8).¹²⁷ Thus the answer to the question ‘Are not pronouncements of truth the way to proceed in Scripture?’ is that we are to blindly affirm those passages which pertain to our salvation, but be in a position to question those passages which concern the natural world.

Rheticus’ manner of interpreting scripture agrees with Augustine’s, but their justification of this scriptural hermeneutic differs dramatically. Rheticus offers the above theological justification, and it will prove useful to his subsequent expansion of Augustine’s argument. Augustine’s justification on the hand is completely a pragmatic matter.

¹²⁷Cf. “So that it [Scripture] may intelligibly accommodate itself to the understanding of the people, and doesn’t conform to the wisdom of the world [*saeculi*].” p.8.

Saint Augustine also wants that we never allow ourselves to be so pleased by our own opinion on natural matters which we believe to have elicited from Holy Scripture, that, even after the truth has taught us otherwise, we are ashamed to step back, and rather fight for our opinion as if it were a statement of Holy Scripture. He thus beautifully teaches that those who are overcome by the truth must say: divine Scripture does not contain this, human ignorance rather imagined it. [p.10]

3) The particular presence of the Holy Ghost is to be noted. Rheticus will establish a counterpart role for Him in the natural world later in the text.

The principle that only those biblical matters which are necessary to our salvation are to be confirmed in our hearts, and not questioned, is not simply a rhetorical strategy to circumvent those passages of Scripture which seem to proclaim the immobility of the earth. The substance of Augustine's principle gracefully conforms to Rheticus' evolving concept of physics: the knowledge of physical or "sublunar phenomena" is necessarily of an uncertain nature.

This doubt is forcefully applied to the hypothesis of the earth's motion. *The hypotheses of the earth's motion is not an assertion of truth.*

Ecclesiastes says: *He made all good things in their proper time and gave the world over to their disputing, so that man cannot discover the work which God has fashioned from beginning to end.*¹²⁸ We hold this excellent opinion before us. Thus no one should accuse us of asserting, as if we were unaware of our own feebleness, the motion of the earth as a truth. For what is more human than to fall and be deceived.

Augustine's *A Literal Commentary of Genesis* seems a reliable resource for Rheticus' project. It even contains a reference to 'brothers' who ask if the earth may indeed move (p.17). Galileo uses Augustine's work to the exact same end in his *Letter to the Duchess*. Yet Augustine did not finish the work. And, as in many other matters, he later changed his mind concerning his approach to Scripture. Both in the Renaissance and today this literal commentary is regarded as an immature early work characteristic of Augustine's struggle with the Manichaeans. Nevertheless, Rheticus' case may have won greater favor had he simply let the burden of reconciling the motion of the earth and Scripture rest on Augustine's shoulders and not pressed his case any further.

Extension of the Augustinian hermeneutic. Rheticus introduces three extensions upon the Augustinian argument in a brief statement following his discussion of Augustine, as if it were a natural extension of his thought:

¹²⁸Ecclesiastes 3:11.

As it is clearer that the Sun¹²⁹ that God did not leave little to our industry to excite the arts and disciplines necessary to life, and those matters which pertain to the cultivation and noble exercise of the mind, we should follow nature's thread in which first principles, ratio and everyday experience lead us. And because God wants to be known in nature, there can be no doubt that this our study is truly pleasing to Him. He therefore rouses the anima of great men to investigate that nature He created. He advances and governs their studies. [p.12-13]

All three of these extensions are found throughout Rheticus' earlier work: 1) The idea that God's creation actively encourages our cultivation of the arts which investigate it. 2) That God wants to be known (*illustrari*) through the nature he created. 3) That He guides great men in that study. These tenets serve to establish an extra-scriptural path of theological investigation in the natural world. They express the research programme of the astrological school without explicitly mentioning astrology. Opposing this viewpoint, Luther and other theologians had asked the circle 'why is the study of nature pious and what is its Scriptural justification?'. We will find that Rheticus not only tries to vindicate the motion of the earth in Scripture, but that he will ambitiously try to use that vindication as a validation of the astrological research programme.

The most substantial digression from Augustine occurs when Rheticus attempts to explain away those passages which seem to support the immobility of the earth and reinterprets several other passages to the benefit of the heliocentric theory. Does he thereby fall victim to what Augustine had admonished against: finding one's own opinions about the natural world in Scripture and fighting for them.

He begins with the question Augustine's brothers had asked: 'Scripture speaks of a *firmament*, how can it be the *firmament* if it moves?' (p. 17). For the claim that the heavens are actually immobile Rheticus is able to adduce several passages which speak of the firmament as God's seat, and therefore immobile (p.16-18). From this assumption, Rheticus leaps to an association between the *fundamenta* which God has laid with certain *measures* and the diverse centers of Copernican astronomy:

Thus assuming this, that the heavens are immobile, to satisfy the apparent motions of the stars, several motions are to be attributed to the earth. And for this reason there are diverse centers [each motion requires a circle to describe it], which the Lord appears to have wished known, saying to Job: Where were you when I placed the foundations [*fundamenta*] of the earth? Show me if you have understanding. Who placed their measures, if you know, or who has stretched the line above it? [p.18]

This path of biblical interpretation is continued on p.21 where 'the

¹²⁹One could read this as a word play alliterating 'it is clearer in the Sun'.

pillars of the earth' are likened to the mathematical centers of Copernican astronomy:

Job however appears to testify to the motion of the earth in another place when he says: 'Who moves the earth from its place and the pillars are shaken'. This may be understood thus 'who leads the earth around from one place to another under heaven, in its annual motion, around the center of its great circle, just as the globe of the moon in its monthly motion, and its columns are shaken'. So that it would be said figuratively, as if you were to say: 'their foundations or centers observe their motion and are removed from their positions whilst the earth completes its many periods. They are therefore as if shaken on account of the mixed motion of the foundations.

This scriptural exegesis will not have impressed the emperor's delegates. As a piece aimed at persuading it is horribly written. The treatise does however have its own internal harmony. Rheticus does not aim to contradict the Augustinian argument he himself has presented, *he intends to point beyond it*. We shall attempt to show in the following that Rheticus sees Augustine's argument as applying to the discernment of physical phenomena. A completely different standard attends however to that which is *mathematice demonstratur*.

The mathematical argument. Let us return to the question of the 'foundations of the earth'. Rheticus identifies these with the centers of the four Copernican circles, i.e. the daily motion of the earth around its center, the earth's annual path around the sun (the 'great orb'), the magical *circulus parvulus* (see III β), and the center of the sun. These four circles constitute in Rheticus' mind no coincidental connexion for the sake of saving heliocentrism in light of Scripture. They are rather mathematically true because they represent a 'perfect Pythagorean quaternary'. That is, $1+2+3+4=$ the perfect 10.¹³⁰

Consequently one will rightly call the center the foundation of the sphere, seeing that all parts of the sphere are supported by it, and if it is given, the entire sphere will be given at the same time. Thus, assuming the mobility of the earth, its foundations or bases shall be: its own center, the center of the great orb, the center of the little circle and the center of the sun. The number of the foundations of the earth is thus a quaternary which the Pythagoreans call perfect and commend with other praises, just as Holy Scripture also does.

This numerological identification of heliocentrism was, at least to Rheticus' thought, no sophistical abuse of ancient sources for the sake of making a point. Indeed, Rheticus was completely fascinated by the Pythagorean '10' long before he knew of Copernicus. This was a further reason for Rheticus to believe that Copernicus' work represented a true

¹³⁰*Op. cit.*, p. 34.

divine mathematics. We recall the already quoted passage from his *Preface to Arithmetic* from 1538:

The Pythagoreans spoke figuratively in arithmetical words, and they translated these to Physics, and to moral Philosophy: For Pythagoras defined God in the following manner: God takes his departure above the next number after the highest number. He wants to show in this manner that God is one and nevertheless the highest being. For he understands ten as the highest number, next to ten is nine: the departure above nine is unity: in this way do they wrap up all of philosophy in numbers...¹³¹

Rheticus then spends considerable energy (p.34-44) dismissing the notion that the ‘waters’ are the foundations of the earth. That is, the Bible speaks of the earth being established upon the waters. The waters for that reason seem to be foundations. This exegesis of a rather obscure point serves a greater purpose in Rheticus’ overall rhetoric. Rheticus sees scripture accommodating itself to the understanding of the common speech of the Old World on this point: “One land mass, floating on the waters like an apple” (p.38). But the discovery of the New World demonstrated the power of Augustine’s hermeneutic and the potential for human discovery:

Ptolemy believed there to be waters where the navigations of the Portuguese discovered fertile regions. The Psalmist therefore, accommodating his speech to the opinion and understanding of the people, sang of lands founded upon the waters. [p.38]

The discoveries of Portuguese seamen demonstrate, along with the discovery of the earth’s motion, the manner in which the Bible speaks. They differ dramatically however insofar as the New World is a discovery of the senses and not related to God’s greater Providence. Rheticus therefore returns us to the mathematical nature of the heliocentric discovery and its relationship to Providence at the end of this section on the waters:

Yet whatever interpretation is taken up, it will be sufficiently clear that the waters are not to be understood to be the foundations of the earth. It therefore follows from the above that they [the foundations of the earth] are the centers. It is thus correctly stated in Job that the earth is suspended above nothing.¹³² For what else is a center if not a point, and what is a point if not a certain relation to that which it is applied?¹³³

What role do these circles play in God’s Providence? We found in our

¹³¹*Preface to Arithmetic*, p. 12-13.

¹³²*Job* 26:7.

¹³³*Op. cit.*, p. 44.

discussion of the *Narratio prima* that the magical relationship of the cycle of 1717 to that of 3434 years led Rheticus to an insight into God's Providence which he appears to have then held on to. That prognostication however reflects only the effects of one of the four circles, the *circulus parvulus*. With our discovery in the treatise of the numerological interpretation of the other three circles, we immediately recognize the beginnings of a completely new astrological system based on the Copernican circles. Rheticus found a key textual support for the role of the circle which the earth follows on its daily path in Paul of Burgos'¹³⁴ interpretation of Genesis, a commentary he had used in 1538¹³⁵:

In Nicholas of Lyra's first chapter of Genesis 'and the Holy Ghost was carried over the waters'¹³⁶ is interpreted according to the true Hebrew: 'And the Spirit of God, that is the Holy Ghost, nurtured the waters with warmth [fovebat aquas]'.¹³⁷ For He is the vivificator of everything from its inception, as it is written in the Psalm: 'Send forth your Spirit and they shall be created, and you shalt renew the face of the earth'¹³⁸. This then, as the vivification is most correctly attributed to the first and daily motion, infers that, in the commencement of the creation of natural things, mention is made of this first motion as if it were the life of natural things, This motion is to be attributed to God in the person of the Holy Ghost, whose office it is, as just stated, to vivify.¹³⁹

The earth's daily motion is thus attributed to the Holy Ghost. Rheticus proclaims thereby a theological justification for the Copernican circle about earth's center or foundation. Insofar as the Holy Ghost is the *vivificator*, he can also be seen as effecting the earth's annual motion around the sun. Assuming this, Rheticus quickly moves to attribute the annual motion to the Holy Ghost:

¹³⁴Rheticus writes Nicholas of Lyra in the following because he was the prime author of the *Biblia Latina cum postillis* (Nuremberg, 1493) and the reason for its fame and authority, yet it was the *Additiones Puali episcopi Burgensis*, contained therein, from which Rheticus quotes.

¹³⁵*Annotata in astrologiam*, p. 160.

¹³⁶*Genesis* 1:2.

¹³⁷I.e. "Et spiritus Dei ferebatur super aquas" and "Spiritus Dei fovebat aquas". We read in the *Additiones Puali episcopi Burgensis*: "Fovebatur should not be understood as something of passive in the Spirit of the Lord, nor is the word *meraphet*, which is given in the Hebrew, a passive word, but rather purely active, signifying that the Spirit of the Lord, signifying that the Spirit of the Lord broods [fovebat] and gives life to the waters to the likeness of a nesting hen." Latin original reproduced in Hooykaas, *op. cit.*, p. 77.

¹³⁸*Psalms* 103:30.

¹³⁹*Op. cit.*, p. 22-23.

For if the Holy Ghost, in addition to the offices attributed to Him in the Evangelium, namely to be the Paraclete¹⁴⁰, to vivify the hearts of believers, etc,¹⁴¹ also fosters [*fovet*], moves, vivifies, creates nature, and renews the face of the earth, then, as Scripture testifies, the governance living on earth is clearly to be attributed to him.¹⁴²

Whence, as it has been established that the earth is moved in a singular divine conservation of its motions, He shall administer the entire lower world, to speak in the manner of the Philosophers, and He maintains the changing of the seasons. [p.23-24]

The next sentence solves a critical conceptual problem for Rheticus. He needs to bind the numerological significance of the four circles and the Prophecy of Elijah back into an astrological framework:

And He effects our participation in all the virtues which God has given the Sun, the Moon and the rest of the stars. We are subject to the series of all of heaven's stars through the annual motion. The Sun and all of heaven's attire rise and set for us through the daily motion.

The above description of the change of seasons arising on account of the earth's motion around the sun makes sense to post-Newtonians. For we see the earth's axis as fixed in its annual orbit. Unfortunately for Rheticus, Copernicus assumed an extra circle, upon which the earth slowly turned on its axis, to account for the change of the seasons. Rheticus refers to this as the motion of the 'oblique circle' or the 'motion of declination' in the following paragraph. Thus, in Copernican astronomy, the annual motion of the earth around the sun doesn't necessarily effect the change of the seasons. Rheticus however apparently sees no threat to his four ends of the earth in Copernicus' circle-inflation:

Aristotle said that the life of animate maintains itself through the motion in the oblique circle.¹⁴³ For we have spring, summer, autumn and winter, and all things are created, and the face of the earth is renewed in its season through the motion of declination. The motion of declination seems also to find a confirmation elsewhere in the Psalms, for David says after a long enumeration of the works of God 'You have made [25] all the ends of the earth, summer and spring, You have formed

¹⁴⁰ παράκλητος- A defender, advocate, helper.

¹⁴¹ Romans 5:5.

¹⁴² I Peter. 3:18; 2 Corinthians 1:22; John 6:63.

¹⁴³ *De generatione et corruptione* 336b-337a; 336b 37: "God, therefore, following the course which still remained open, perfected the universe by making coming-to-be a perpetual process; for in this way 'being' would acquire the greatest possible coherence, because the continual coming-to-be of coming-to-be is the nearest approach to eternal being." (Loeb Translation). Aristotle is very clear that neither the 'primary motion', encompassing 24 hours, nor the annual motion is the cause of coming-to-be and passing-away. (336a 33).

them'.¹⁴⁴ For if you understand 'the ends of the earth' to be explained by the apposition of 'summer and spring', the movement of declination will emerge. Because this movement is the efficient cause of the change of the seasons whose given limits are designated as if on the earth.¹⁴⁵

The Holy Ghost thus has the function of the 'efficient cause' in God's Providence. He governs the life-cycles of all living creatures by means of the four Copernican circles. It is here, above all, that we understand what mathematical truth means to Rheticus. Rheticus clearly says that we don't know what these effects are 'physically'. We only know their nature. Scripture apparently hints at the functions of the Copernican circles, and God reveals them further through mathematics:

We perceive the Holy Ghost to exist from the effects, yet we do not know what these are. Scripture shows their nature. We see the Sun, stars and everything above rise and set in a certain rhythm [*ratio*], repeating pristine courses. We perceive the infinite advantages with which God endows us as if through His instruments. But as to what the Sun is and other such questions, one says that it is a lighted torch, another an ignited stone, others believe it to be lucent water¹⁴⁶. Aristotle, in order not to say nothings, calls heaven and the stars the fifth essence. But to say that it is not less certain that the Sun does not rise than that it rises, that everything is equally uncertain, is for madmen. As to whether the Sun rises for us through the earth's motion or if the Sun has its own motion, *ratio* and Mathematics conclude the former, *sensus* the latter. For this thanks is to be given to God, for He imparts the knowledge and use of the effects of nature to us, which he created above all for man.¹⁴⁷

If it is helpful to perceive the Holy Ghost in Rheticus' system as the 'efficient cause', God the Father is the material, formal and final cause. It is His light from the Sun which conditions the essences of the planets and thereby makes them astrologically potent. The Holy Ghost then guides this light through the Copernican circles to effect God's Providence. Rheticus completes this vision with his identification, already made in the *Narratio Prima*, of God and the Sun. The fruit of this identification will be that the light of the Sun shall serve as the formal cause. His light from the Sun conditions the essences of the planets and thereby their astrological potency. The Holy Ghost guides the effects of this light through the Copernican circles

¹⁴⁴*Psalms* 73:17.

¹⁴⁵*Op. cit.*, p. 23-25.

¹⁴⁶Cf. Lucretius, *De rerum natura* Book V, 592-614.

¹⁴⁷*Op. cit.*, p. 30-31.

We reveal the Sun to be the author of the light in nature and the administrator of God in nature...Further, we do not deny manifest experience, that we have the day, spring, summer and the other seasons of the year through the benefaction of the Sun. But when we say this, that we receive these things from the Sun, just as the Moon receives its light through its changing relationship to the Sun, we do so in order that it may become known to the erudite through the authority of Urania [the muse of astronomy], to whom the lover of truth must defer.(p.56)”

Rheticus’ here craftily combines two passages of Scripture to justify this identification of God with the Sun, and the Providential power of its light. The first quote is deviously altered to suit Rheticus’ interpretation, it should read ‘in them (the celestial bodies) he set a tabernacle for the sun’.

‘He put his tabernacle in the Sun’¹⁴⁸, from where He illuminates the entire nature he founded, ‘and sends forth light, and it hastens, He calls it again, and it fearfully obeys’.¹⁴⁹

‘Physics’ is for Rheticus the science of the corruptible world. As such it is necessarily uncertain. ‘Physics or a description of nature’ is also uncertain in the Bible, because certain knowledge of physics is not necessary to our salvation. Knowledge of astronomy on the other hand is demanded of great men by God. Yet Copernican theory requires that the earth is a planet, that all planets have defects (ie. are corruptible), and all are subject *only* to circular motions. The first of these requirements presents itself as a physical problem. As in all things physical, Rheticus sees it as equivocal in its perspectival nature: “But I do not see how could we determine whether or not there are alterations in the Moon and the other heavenly bodies. For if somebody were to live on the Moon, I don’t think he would be able to judge anything about the alterations on the earth.”¹⁵⁰ The mathematical problem however is certain. “We may therefore correctly insist, because we are compelled by mathematical reasoning [*mathematica ratione cogente*], that the whole earth moves in a circle”(p.45).

¹⁴⁸*Psalms* 19:4-6. The beginning of Psalm 19 is one of the most astrologically potent passages in all of Scripture. All standard translations agree however that the text should read “In them [the celestial bodies] he set a tabernacle for the sun”; the *Vulgate* reads “soli posuit tabernaculum in eis”. “1: The heavens declare the glory of God; and the firmament sheweth his handywork. 2: Day unto day uttereth speech, and night unto night sheweth knowledge. 3: There is no speech nor language, where their voice is not heard. 4: Their line is gone out through all the earth, and their words to the end of the world. In them hath he set a tabernacle for the sun, 5: Which is as a bridegroom coming out of his chamber, and rejoiceth as a strong man to run a race. 6: His going forth is from the end of the heaven, and his circuit unto the ends of it: and there is nothing hid from the heat thereof.”

¹⁴⁹p.56.; *Baruch* 3:33; a further significant textual support for Rheticus’ astrological vision is also taken from the apocryphal *Baruch* (6:59;quoted on p. 54-55): “For sun, moon, and stars, being bright and sent to do their offices, are obedient.”

¹⁵⁰*Op. cit.*, p. 51.

Physics remains dirty and uncertain¹⁵¹, but its purview is extended beyond the sublunar sphere. In spite of this however, the heavens clearly remain as the celestial ambassadors of God's Providence. They, and now the earth is also included, do so however not by virtue of their fifth essence or celestial substance, but solely on the basis of the mathematical rhythms which God, through the Holy Ghost, imparts to them.

This understanding is illustrated in one of the classical 'physical' problems of Copernican theory. It is for Rheticus however clearly an astronomical difficulty. Namely, why aren't loose bodies flung from the earth as a result of its motion? Copernicus escapes this problem by appealing to the ancient doctrine of 'like attracts like', that is, 'earth' does not fly from 'earth' because the mutual attraction *completely* overwhelms the force of the motion.¹⁵² Rheticus however takes the argument one step further and says that any given part of a planet is carried in its God-given *place* and *form*.¹⁵³ It appears from a modern perspective that Rheticus explains away an entirely salient problem with another unknown.¹⁵⁴ Rheticus' method however proceeds from the divine and moves to the increasingly less certain. As such, even if he had been aware of the concept of inertia, the idea of an accidental force from without determining the perfect movement of the celestial bodies would have seemed preposterous indeed.

We now conclude with the most critical question: Is the mobility of the earth a 'physical' or an astronomical problem? We answer, insofar as we approach it as a 'description of nature', it is physical and therefore uncertain. Scripture for this reason does not speak to it and knowledge of it is not necessary to our salvation. It is a secondary problem. Indeed, Rheticus clearly states that, seen physically, the geocentric and heliocentric systems are perfectly interchangeable.¹⁵⁵ Insofar however as the problem is viewed mathematically, it represents direct testimony of God's Providence, and God gives us clues to it in Scripture. The mobility of the earth is thus mathematically true, and not the right question put physically.

It seems that it is to be concluded however, as was touched upon earlier, that we can have exact knowledge of those matters Holy Writ which are necessary to our salvation. Of the nature of things and other matters treated by the philosophers on

¹⁵¹The plain uncertainty of physics is clearly expressed on p. 31.

¹⁵²*De revolutionibus* I, 9.

¹⁵³*Op. cit.*, p. 46.

¹⁵⁴Note that the specific nature which Copernicus sees determining 'like attracting like' is the essence "endowed to the parts [of a given planet] à divina providentia" (*De revolutionibus* I, 9.).

¹⁵⁵*Op. cit.*, p. 57.

the other hand we know only that which GOD has conceded to human reason.¹⁵⁶ And as GOD wishes that we occupy ourselves more with the divine than the corruptible nature, of which we people know little or nothing (in which matter the judgement of Socrates is to be followed¹⁵⁷), we see the world conserved in the most beautiful order. Whence the reasoning is gathered that there is one first cause conserving all this, namely God.¹⁵⁸

¹⁵⁶This notion that God allows us to know certain matters is repeated on p. 64.

¹⁵⁷Rheticus here identifies the mind with the celestial and the body with the sublunar sphere. Cf. *Phaedo* 65D - 67A,

¹⁵⁸*Op. cit.*, p. 29.

ζ. The Supralunar Comet

The discovery that comets are in fact supralunar entities has long been attributed to Tycho Brahe. Yet in a letter from Rheticus' confidant Paul Eber to Melanchthon we learn that Copernicus and Rheticus had considered the matter long before Brahe:

Magister Rheticus wrote from Prussia, as he is expecting the completion of the work of his praeceptor he will not be able to return in the coming months, but rather in autumn. They have already discovered in those lands that Comets do not arise in the region of the elements, but rather in that of the ether above the lunar sphere. ...

April 15, 1541.¹⁵⁹

This passage testifies to the fact that Rheticus collaborated with Copernicus during his stay in Ermland and that *De Revolutionibus* was simply not yet ready for publication. The common interpretation is that the work was completed *decades* before Rheticus arrived there.

The Aristotelian notion that the comets are sublunar is necessitated by their and the sublunar sphere's corruptibility. Yet Rheticus and Copernicus clearly see the purview of 'physics' being extended beyond the sublunar sphere. As such, Aristotle's definition of the comet no longer pertains.

¹⁵⁹CR. Book 8, no. 2194, col. 174. "M.[agister] Ioachimus scripsit ex Prussia, se expectantem absolutionem operis sui praeceptoris ad proximas nundinas redire non posse. Sed adfuturum ad autumnales. Compererunt iam in illis terris, Cometas non gigni in elementari sed in aetherea regione supra lunariam sphaeram. ... Die παρασκευής, 1541"

η. Leaving Wittenberg

A closer look at the background of Rheticus' third and final departure from Wittenberg provides us with some significant insights into the difficulties Rheticus and his work faced. Rheticus' position in Wittenberg had already been so badly compromised by the Lemnius scandal of 1538 that only a strong letter of recommendation from Duke Albrecht would allow his reinstatement as professor of mathematics.¹⁶⁰ His presence however was clearly unwelcome, even with this strong political force behind him.

Rheticus returned to Wittenberg in September 1541 for the Winter Semester, as he had promised P. Eber in the letter quoted in the preceding chapter. He immediately began serving as the dean there by virtue of his letter from the Duke. At least according to all outward appearances, he did his best to fulfill his formal duties.¹⁶¹

It had previously been assumed that Rheticus left Wittenberg for Nuremberg in mid-May after his tenure as Dean had concluded to attend to the printing of *De Revolutionibus*. But this is only true in part. Rheticus returned to his favourite refuge also because his situation in Wittenberg was unpleasant. Had the printing been his sole intention he would have stayed for the duration of the task. He instead soon left to visit home in June of 1542.

Rheticus learned shortly prior to his departure that the position of Balthazar Klein, the professor of mathematics in Leipzig, had been severely challenged, and that a new professor might be sought.¹⁶² We read in a letter from Melanchthon to Camerarius on May 11, 1542:

Then our Mathematician Joachim, as he understood how to retain me, demanded

¹⁶⁰Written immediately prior to his return (Sept. 1, 1541). A translation of this eulogy of Rheticus may be found in Rosen: *Copernicus and the Scientific Revolution*, 1984, p. 181-2.

¹⁶¹The records of these various administrative acts are discussed in Burmeister, *Georg Joachim Rheticus, eine Biographie*, V. I, p. 67-72. Among these are two commencement addresses of which I offer a translation in the Appendix: *The Oration on Astronomy and Geography* (Feb. 9, 1542) and the *Oration on Physics* (April 20, 1542). Rheticus would publish these two addresses as *Orationes duae* in late 1542.

¹⁶²This is documented in B. Stübel: *Urkundenbuch der Universität Leipzig von 1409-1555*, 1879, p. 544, no. 417, In a letter to Duke Moritz, who appears to have tried to protect Prof. Klein: "We should however not conceal from Your Excellency that we think little of Magister Balthazar's mathematics... We have for the good of Your Excellency's university and our students, through the counsel of Magister Phillip Melanchthon, called [gerufen] Georg Joachim Rheticus.... Leipzig 1542" (no exact date given).

[*flagitavit*] to see the letter. Even though he is of great use to us, and does not freely leave us, nevertheless, because we were informed that there were deliberations in Leipzig [*apud vos*] on how to conduct the mathematics lecture, he wishes to hear what has been decided. He doesn't ask out of ambition, nor does he desire to cause you or the other friends trouble. We shall however, without controversy, not bring this business up again to you should the matter have already cooled off.¹⁶³

Melanchthon would continue to support Rheticus throughout his bid to become the professor of mathematics in Leipzig. Though clearly believing that Rheticus was perhaps the most qualified mathematics professor in Germany, Melanchthon had apparently already reconciled himself to the fact that Rheticus had no future in Wittenberg. This is seen in the fact that Melanchthon immediately began grooming Erasmus Flock¹⁶⁴ following Rheticus' departure for Nuremberg (before it was even clear that Rheticus would have a position in Leipzig), despite describing Flock as “mediocriter instructus doctrina”.¹⁶⁵ Melanchthon describes Rheticus on the other hand in a manner reminiscent of the ‘doctrine of great men’: “born to investigate mathematics”¹⁶⁶ and “incited by a certain Enthusiasm to this branch of philosophy”¹⁶⁷. Rheticus continued to not be an option for Wittenberg even after it was clear that Erasmus Flock wasn't qualified. In August, Melanchthon would begin pursuing Rheticus' old student Hieronymus Schreiber.¹⁶⁸

Melanchthon suggests to Camerarius, who held the sway of the appointment in Leipzig, that Rheticus had encountered problems on account of his homosexuality. He disguises this in their characteristic allegorical code with an expression we still use today, the ‘Platonic Relationship’.

¹⁶³CR, Book 9, no. 2489, col. 815.

¹⁶⁴Flock came to Wittenberg in 1537. He left for Nuremberg in 1543 after having achieved the title of *doctor medicinae*. Yet, being immersed in the culture of mathematics there, he did not give up his interest in astronomy and published an epitome of the *Almagest* in 1550, and a poetic prophecy in 1559. † Jul, 21 1568. J. B. Dopplmayr: *Historische Nachricht von den Nuernbergischen Mathematicis...*, Nuremberg 1730, p. 64. Flock also wrote an *Oratio de Aristotele*, Wittenberg 1544, and *Von dem jüngsten vnnnd achten Cometen, deren so von dem Jar 1531 an, bissauff das yetzig lauffend 1558 Jar, erschinen sein, im Augustmonat gesehen*, Nuremberg 1558.

¹⁶⁵Melanchthon to Camerarius July 25, 1542, CR, Book IX, no. 2526, col. 848.

¹⁶⁶Melanchthon to Erasmus Eber July 7, 1542, CR, Book IX, no. 2514, col. 839.

¹⁶⁷Melanchthon to Camerarius July 25, 1542, CR, Book IX, no. 2526, col. 847.

¹⁶⁸Seen in a letter from Melanchthon to the influential Nuremberg figure Theodore Veit on August 10. Schreiber was from Nuremberg and was staying there at the time. Of Schreiber's works I have only found *De Morbo Et Obitu Valerii Cordi: Epistola Hieronymi Schreiberi Norimbergensis* which was printed in *Valerii Cordi Simesusij, Stirpium descriptionis liber Quintus*, Argentorati 1563.

Yet I have often told him that I wish a little more of the Socratic philosophy [from him], which shall perhaps come to pass when he becomes the head of a family. For I understand as much from him.¹⁶⁹

Attendant to the problems caused by his sexual orientation were those of his association with the divergent poet culture which he would continue to partake in despite the grief it had caused him and Melanchthon in 1538. This culture is excellently reflected in the farce *On the XII signs of the Zodiac and the Beer of Breslau* which Rheticus wrote with the poet laureat Caspar Bruschius and Andreas Aurifaber circa 1542.¹⁷⁰ The poem also excellently illustrates Rheticus' approach to astrology.

On the XII signs of the Zodiac and the Beer of Breslau. Rheticus' poem has never been translated or discussed at any length. Past scholars have dismissed it as unaesthetic and judged it unworthy of further attention.¹⁷¹ This oblivion is shared by the entire genre of humanistic poetry to which it belonged - even though its popularity flourished on both sides of the religious divide in its own era. Perhaps our problem consists in our inability to swallow the lude style and its violent sexual imagery. This brash style however was hardly a humanist invention, it followed an ancient example and Ovid in particular.

A leading exponent of this new genre helped Rheticus put his poem into verse. Kaspar Brusch (1518-1557) achieved notoriety early with his *Progymnasta, written by the Author in his Eighteenth Year* (1538) and became a central member of this group of young poets living in Protestant Germany. The future *poeta laureatus* published Rheticus' poem in his *Sylvarum* in 1544.¹⁷² The remaining members of the group Georg Sabinus (1508-1560)¹⁷³, Simon Lemnius (1511-1550)¹⁷⁴, Michael Toxites (1514-

¹⁶⁹Melanchthon to Camerarius July 25, 1542, CR, Book IX, no. 2526, col. 847.

¹⁷⁰The poem was printed in a collection of Bruschius' works in Leipzig in 1544 (*Sylvarvm Gasparis Brvschii Slaccenvaldensis Liber: in Lipsensi Schola scriptus & aeditus. Anno Christi, M.D.XLIII*, Leipzig 1544).

¹⁷¹"The poem isn't exactly aesthetically pleasing." K.H. Burmeister, *Georg Joachim Rheticus*, 1968, vol. I, p. 88; "This poem is really not very aesthetic. One can confidently consign it to the category of gross humanism - and then forget it as quickly as possible." J. Hoppman, *Astrologie der Reformationszeit*, 1998, p. 130.

¹⁷²*Sylvarum Gasparis Bruschi Slaccenvaldensis Liber: in Lipsensi Schola scriptus & aeditus. Anno Christi, M.D.XLIII*, Leipzig 1544.

¹⁷³Son in law of Melanchthon. Sabinus was the eldest of the group, the most successful, and in many ways its leader.

¹⁷⁴Rheticus' most problematic association. Lemnius fled Wittenberg in 1538 after publishing two scandalous books of epigramms which poked fun at important Protestant figures. He was then supported by important Catholic figures in his further attacks on Luther and his inner circle. Cf. J. Kraai, *Rheticus' Heliocentric Providence*, dissertation Heidelberg, 2001, p. 71-77.

1581)¹⁷⁵, Johannes Stigel (1515-1562), Melchior Acontius (1515-1569) and Mathias Flacius (1520-1575) were all associated with Wittenberg and Rheticus in some way. The group only survived under the protection and guidance of Phillip Melanchthon. Rheticus' association with the young poets seems especially natural as Melanchthon was also Rheticus' ardent supporter.

The premise of Rheticus' poem is simple and elegant. The patroness of the harvest of grains, and hence beer, Ceres, is identified and rhymed with the first sign of the Zodiac, Aries. The path of the particularly strong beer of Breslau, to which Ceres personally attends, through the human body is then compared to the chain of events Aries sets into motion. We begin with the rowdiness and belligerence inspired by the war signs Aries, Taurus and Gemini. Yet our drinkers cannot persist indefinitely in such a manner and must be checked. This is achieved through the stern authority of the Crab, the Lion and the Virgin. Here however, at the middle of the Zodiac, things begin to fall apart when the Balance has a spat with his wife Arachne the weaver. Scorpion can't stand such whining nor the tribute which Bacchus and his kin receive. He engages in open revolt!

Matters take a surreal turn for our drinkers in Sagittarius. An ox - where does he come from? - struggles like a tired drinker to make it to his bed, striking his head against the doorposts. Then an adopted pig appears in Capricorn whose bodily contents take an unfortunate direction after she finally prostrates herself on the sought after couch. The drinkers' final action clearly lies with the water signs Aquarius and Pisces.

Beer, in particular the beer of Breslau, was a common source of inspiration for Germany's young humanists. Johannes Mathias Wacker (1550-1619) would later write *Concerning the Beer of Breslau*.¹⁷⁶ As in Rheticus' poem, the beer is said to be brewed 'with the little dog'. The attribution of the potency of a particular city's beer to the peculiar powers of a certain animal was not uncommon. Rheticus' friend Johannes Stigel wrote an elegy entitled *The Sheep of Halle* whose beginning lines read:

Waves crash over the city from the blue depths of the Salle
 who takes her name from the *salt* sources of the Halle.
 There the fawning Ceres is changed into a sheep,
 Who would believe that it happens as I sing it?
 The soft seeds are mixed with the resplendent corn,
 the liquid humour of pure water tempers the mixture.
 A lumpy mass arises; the kneader whirls this into a subject dignified,

¹⁷⁵See the excellent biography by C. Schmidt, *Michael Schütz genannt Toxites: Leben eines Humanisten und Arztes aus dem 16. Jahrhundert*, 1888. Toxites was later crowned poeta laureatus.

¹⁷⁶Printed in *Amphitheatrum Sapientiae Socraticae*, 1619, p. 728. Wacker was an advisor to the Bishop of Breslau. The map of Thomas More's Utopia is dedicated to him.

and then he makes little cakes with an experienced hand.
 These then rise with the permeating vapour as if by purpose driven,
 as the sweet water swells a spongy coat arises.
 And as they attain the shape of the prostrate sheep
 the little darlings take their name from the sheep of Halle.¹⁷⁷

Yet Rheticus' intentions in composing his poem go beyond a simple fanciful elegy of the peculiar effects of the beer of Breslau. Rheticus was interested in refounding astrology as the concrete mathematical science he believed it had been in Egyptian Antiquity. As such, Copernicus' new mathematical description of the universe opened a vast chance for reclaiming those ancient truths. In particular, if a mathematical astrology could be built upon the heliocentric model then Copernicus must have rediscovered an ancient truth. For Rheticus a true mathematical science of the stars stood in stark contrast to the newfangled loose associative images of the European astrology of the Middle Ages. It is this astrology, still pervasive in the sixteenth century, that Rheticus mocks in the poem. It is a facile astrology whose associations grip the imagination with its strange demons and premonitions. In Rheticus' eyes this is a science of obscure truths - much like the truths experienced by our drinkers of the beer of Breslau! Rheticus expresses this condemnation of the new astrologers in the final lines of the poem. The impetuosity of the new astrologers quest for an easy system and their inebriation is seen in their desire to trump the sun - the center of the universe.

Yet it wasn't Rheticus' sexuality alone which got him into trouble in Wittenberg. Indeed, when we compare his experiences in Leipzig, he was able to live quite comfortably there. And even after he was directly accused of raping a young boy in 1551 the faculty stood firm and united in his defense. We rather find that his lifestyle and associates aggravated the poor reception of heliocentrism in Wittenberg - to such an extent that he feared imprisonment if he were to return to Wittenberg in 1542.

This is seen in an enigmatic passage found in a letter from Melancthon to Camerarius which is to be dated to early November 1542. Rheticus had long since returned to his native Voralberg from Nuremberg in late September,¹⁷⁸ and was awaiting the decision in Leipzig. The passage uses

¹⁷⁷The Latin original of Stigel's poem may be found in Caspar Dornavius' *Amphitheatrum Sapientiae Socraticae*, 1619, p. 727. A full translation of this poem may be found on p.285.

¹⁷⁸Burmeister(1968), vol. I, p. 79, conjectures that Rheticus returned to Nuremberg in August. Yet a dedication from Rheticus to Gasser found in an edition of George Hartmann's *Perspectiva Communis* (Nuremberg, 1542), which I coincidentally discovered in the *Bibliotheca Palatina*, and then in Burmeister's notes compiled after the publication of his book, shows that Rheticus was still in Voralberg in late September: "D.[ominus] Ioachimus Rheticus Achilli P.[irmin]

an allegory which Rheticus himself had used in the exact same sense: the revolt of the brothers Otus and Ephialtes against Olympus is seen as an allegory of impious men trying to take hold of the universe scientifically. As in most letters from Melanchthon to Camerarius, critical passages were written in an allegorical Greek to conceal their meaning because their correspondence was often intercepted by a Catholic party:

The question of Rheticus' stipend and work should be dealt with plainly and explicitly. ἐκεῖ¹⁷⁹ γὰρ καὶ κείνος [= καὶ ἐκεῖνος] ὠροσκοποῦντα τὸν αἰχμάλατον τοῦ ὤτου καὶ τοῦ ἐφιάλτου. All of these are intertwined in him when with us.¹⁸⁰

The Greek section of this passage is difficult, I render it: “There are from him [Rheticus] there [in Wittenberg] predictions forecasting the captivity of Otus and Ephialtes.” The key I believe to understanding this difficult passage lies in the prominent position Rheticus had given the tale of Otus and Ephialtes. Rheticus first mentions it in his early lecture *In alfraganum annotata* (1537) in his citation of *De Mundo* which is spuriously attributed to Aristotle. This passage is significant because it is really only here, and not in the original Homeric sources,¹⁸¹ that the tale assume the character of an allegory of science:

It was not possible by means of the body to reach the heavenly region or to leave the earth and explore that heavenly place, in the manner once attempted by the foolish Aloadae: so the soul, by means of philosophy, taking the mind as its guide, has crossed the frontier, and made the journey out of its own land by a path that does not tire the traveler.¹⁸²

G.[assaro] L.[indaviensi] suo Brigantii [i.e. Bregenz] donabat 18 Septembri 1542” *Biblio. Pal. 1529e*.

¹⁷⁹ἔχει stands in the transcription given by Bretschneider in CR, yet I believe this to be a mistaken reading as it makes little sense.

¹⁸⁰CR, Book IX, no. 2574, col. 896; “Cum Rhetico proderit plane et explicare de stipendio et operis agi. ἔχει γὰρ καὶ κείνος ὠροσκοποῦντα τὸν αἰχμάλατον τοῦ ὤτου καὶ τοῦ ἐφιάλτου. Omnia ei apud nos integra sunt.”

¹⁸¹Homer *Odyssey*, 11.305: “After her I saw Iphimedeia wife of Aloeus who boasted the embrace of Poseidon. She bore two sons Otus and Ephialtes, but both were short lived. They were the finest children that were ever born in this world, and the best looking, Orion only excepted; for at nine years old they were nine fathoms high, and measured nine cubits round the chest. They threatened to make war with the gods in Olympus, and tried to set Mount Ossa on the top of Mount Olympus, and Mount Pelion on the top of Ossa, that they might scale heaven itself, and they would have done it too if they had been grown up, but Apollo, son of Leto, killed both of them, before they had got so much as a sign of hair upon their cheeks or chin.” (Trans. Samuel Butler) Also *Iliad*, 5.382: “Ares had to suffer when Otos and Ephialtes, children of Aloeus, bound him in cruel bonds, so that he lay thirteen months imprisoned in a vessel of bronze. Ares would have then perished had not fair Eeriboia, stepmother to the sons of Aloeus, told Hermes, who stole him away when he was already well-nigh worn out by the severity of his bondage.” (Trans. Samuel Butler)

¹⁸²Preface to *On the World*, trans. by D. J. Furley. *Annotata in Alfraganum* (fol. 61^v, p. 36).

This interpretation of the Aloadae or Gygantes elegantly describes in an allegory that difference between the ‘dirty’ corporeal physics and the divine mathematics we have tried to draw out in the last section. ‘Aristotle’ continues:

So those who have earnestly described to us the nature of a single place, or the plan of a single city, or the size of a river, or the beauty of a mountain, as some have done before now - some of them tell us of Ossa, some of Nyssa...- all these might well be pitied for their meanness of spirit, since they are overawed by commonplaces and pride themselves on insignificant things. The reason is that they are blind to nobler things.

The figures of Otus and Ephialtes are employed again in his *Oration on Astronomy and Geography* given on Feb. 9, 1541 to express the arrogance of those who would transgress the boundaries of piety in their scientific pursuits:

The Physicus predicts rain if southerly or warm west winds blow, if northerly winds then fair weather. Isn’t divination so much more useful which confirms souls on providence so that they don’t dream that the world came into existence coincidentally? It was with great cause that God gave us this testimony of himself. For when we have learnt that God is the ruler of all we understand that He is to be obeyed, we recognize His order and that it is to be instituted in our minds and in political society and the Divine punishments of those who disturb this order, which certain Gygantes would not seek to evade as when they risk to fortify themselves on Pelio in Ossa.¹⁸³

Given this interpretation which Rheticus give Otus and Ephialtes, it would appear that Melanchthon is relaying to Camerarius Rheticus’ fears of captivity. Melanchthon is apparently also familiar with the tale as an allegory for science, and he appears to share Rheticus’ concern, as he indicates in the final sentence of the above quote that Rheticus has the tendency of Otus and Ephialtes when in Wittenberg.

Rheticus believed himself to be Otus and Ephialtes in the eyes of the Wittenberg public. Yet not in his own eyes. For the Gygantes were foolish and believed to be able to capture heaven ‘physically’ instead of trying to grasp it in their souls through mathematics. But the mathematically ignorant public naturally understood heliocentrism - and any given theory for that matter - ‘materially’. Thus without understanding that it is actually the reality of the divine mathematical variations of the heavens which are posited - and not some sort of physical scheme - the public will have seen Rheticus as disrespectfully, and foolishly, trying to claim the heavens like the Aloadae.

¹⁸³This is a reference to the Aloadae (Ottus and Ephialtes), mythical Giants who tried to reach heaven by piling Pelion on Ossa.

Θ. Conclusion

The most vital and difficult aspect of this study has been our grappling with the concept of ‘mathematical realism’. Everything from Rheticus’ first approaches to astrology to the nature of his cooperation with Copernicus appears to hinge on the development of this novel philosophical position and its nuances. A discussion of the origins and nature of Rheticus’ mathematical realism will therefore, due to its centrality, give a structure to the elusive swarm of footnoted detail the reader has been plagued thus far.

Mathematical realism is a unique approach to natural philosophy which defies our modern categories. Most folks today like to draw a line in the sand and say that one is either an ‘instrumentalist’ or a ‘realist’. That is, you either believe a mathematical depiction of nature to be a fiction for the sake of saving the phenomena or that mathematical models actually say something true about the ‘reality’ of nature. Pythagoras’ ‘all is number’ is dismissed as being entirely incomprehensible, Plato’s geometrical figures which apparently stand both ontologically and temporally before the ‘world’ are left to philologists, and Aristotle’s mathematical truth *qua mathematica* seems ‘instrumentalistic’. One therefore not surprisingly finds a dichotomy between an ‘instrumentalistic’ and a ‘realistic’ interpretation of Rheticus’ work. It is fitting, given the nature of these difficulties, that we begin with a historical account of the origins of Rheticus’ mathematical realism, and then move to a more abstract discussion of the position itself.

Rheticus’ mathematical realism. Rheticus developed the position of what I have termed mathematical realism through his appreciation of Melanchthon’s thinking, his struggles with the methods and philosophical foundation of astrology, and finally his encounter with Copernicus.

Melanchthon’s astrology was the most dynamic component of his intellectual life. The boldness of Melanchthon’s astral Providence is particularly glaring when one compares it with the diplomatic masterpieces of his other more conventional theological writings, where he was especially successful in his humanistic ability to let the issues of contention bask in the innocuous glow of his trained rhetoric. Yet Melanchthon was no great reconciler when it came to astrology. Not only was he at grave odds with Luther on the subject, but he went further and advanced an enterprising new astrological theology. Melanchthon did indeed see Luther as a divinely

inspired interpreter of God's Will, yet only an interpreter of that *half* of God's manifestation unto us found in Scripture. Melanchthon amazingly claims that the reformatory battle-cry of *sola scriptura* is incomplete. For God wants us to know Him not only through the Book of the Word, but also through the Book of Nature.

Many astrologers and theologians of the Middle-Ages had made similar claims as to the efficacy of the stars. Yet they did this whilst also admitting of several other supernatural messengers and authorities like angels, the doctrine of the church, saints and terrestrial augury. It was in this closet of divine paraphernalia that the church gladly kept astrology, occasionally pulling it out for a further redundant demonstration of God's power. Yet Melanchthon was faced with the far more daunting task of professing God's astral message to a radical group who claimed Scripture alone as the basis of their knowledge and belief in God.

The first difficulty in this totally hopeless endeavor of persuasion was to anchor the justification of astrology in a monotheistic framework, and to move away from the polytheistic astrology of antiquity in which the astrology of the Middle Ages was still grounded. That is, instead of seeing fate effected by the *competing* influences of the various planets, of which each had their particular God, the planets had to now surrender their respective wills and virtues to one almighty God. This new astrological God was easily identified with Aristotle's 'prime mover'. Only He had the ability to focus all of the powers of the planets into one coherent and necessary Providence. Gone were the days where the conflicts among the fickle and often arbitrary desires of the individual Gods made astrology an uncertain science by its very nature. A coherent and necessary Providence now demanded a coherent and necessary science.

This was the impetus behind Melanchthon's drive toward a new mathematization of astrology. Indeed, astrology had always needed math, but only for the purpose of calculating planetary positions. This new mathematization was based on the profound idea that if the planets no longer had wills of their own and no longer moved of their own accord, but were rather moved by God, only a mathematical scheme *underlying* the rhythms of the planetary motions could account for God's necessary Providence.

This was an amazingly provocative vision. Even more daring was the fact that Melanchthon put this forward before he had the slightest clue as to what sort of mathematical scheme might provide the necessary substance for an idea he could only rhetorically embellish. Not being sufficiently trained in mathematics himself, he charged the enthusiastic young Rheticus with this task and gave him the office of inculcating this new vision on the next generation of Wittenberg scholars.

Rheticus faced several difficulties in trying to develop this new astrology. It was above all entirely unclear what sort of mechanism might

provide the substance to fulfill Melanchthon's vision. Second, how is it that the celestial rhythms of the planets effect God's Providence in our sublunar sphere?

We find a first attempt at addressing these problems in Rheticus' astrological manuscript. This initial undertaking was characterized by an attempt to reduce all astrology to natal astrology by eliminating the event astrology which had been discredited by several faulty predictions, particularly those for the comet of 1531, and the Jupiter-Saturn conjunctions of 1484 (the controversy over Luther's birth date) and 1524 (deluge predictions). By focusing on natal astrology, Rheticus was able to suggest that God's Providence was effected on earth through the constellations that determined the paths which those born under them had to follow. Rheticus also eliminated the factor of chance in what would have been an infinite calculus of horoscopes by claiming that great men, born under great constellations, are the true bearers of God's Providence. They effect the decisive events in the march of history and are the prophets of God's biblical word and astral Providence.

Yet Rheticus' reluctance to confidently proclaim this novel method and justification of astrology betray his own uncertainty. He concentrated on the opinion of others, and tried to find vestiges of the most ancient authorities. To what grand erudition this philological expedition led him is exhibited in the doxographical surveys *In astrologiam annotata* and *Tractatus integer de nativitatibus*.

This astrological philosophy undoubtedly found the favor of Melanchthon. Above all, it supported and furthered his ethical and pedagogical programme of advancing the knowledge of God's astral Providence: if each of us were to know, through our horoscope, the path which God had laid before us, we would be content with our lot and there would be no cause for the civil unrest evidenced in the Peasant's War and the irreconcilability of the Anabaptists.

This conception may indeed have pleased Melanchthon, yet did it really fulfill the scope of the vision of a coherent and necessary monotheistic astrology? For if we make the horoscope the basis of astrology we reify the competing planetary influences that determine it. The traditional horoscope presupposes conflicting divine influences. Only a new mechanism, issuing from one mind, will be able to form the basis of a monotheistic astrology. And it was precisely this which Copernicus offered Rheticus.

There were several moments in Rheticus' early thought which led him to warmly embrace Copernicus and his ideas, e.g. his belief that the sun-worshipping Egyptians possessed the original pristine God-given science, that this knowledge of the sun had been passed down to Archimedes, and the notion that Copernicus was a 'great man' destined to discern God's Providence in the Book of Nature. Yet the truly decisive factor was the fact

that Copernicus presented a new mathematical system that seemed to unlock the mathematical mechanisms which God used to effect His Providence. That the motion of Copernicus' *circulus parvulus* mirrored the Eliatic Prophecy - which had garnered so much interest in Wittenberg - must have seemed like a revelation. That Rheticus intended to further develop this astrological philosophy is seen in the functions he ascribes to all four Copernican circles in the *Treatise on Holy Scripture and the Motion of the Earth*.

Given this specific background of Rheticus' astrological inquiry, I find it doubtful that Copernicus himself could have concocted this system. Copernicus may well have been an astrologer, yet he came from an older generation which felt little pressure to alter its astrological methods and philosophy. Rheticus on the other hand thought of himself as a muse explicating the deeper sense of one of God's 'great men'. This astrological vision of Rheticus' was indeed in large part responsible for the fact that an account of heliocentrism was published at all. And, to offer a speculation, it was because Copernicus feared that Rheticus would further propagate his life's work in the light of this heretical scheme that he brought the otherwise clandestine *De revolutionibus* out of its intended secrecy. Rheticus' name was for this reason not mentioned in the preface to *De revolutionibus*.

Rheticus' mathematical realism was developed through the inspiration of Melancthon's vision, his difficulties with the method and justification of astrology, and his confrontation with a mathematical scheme in Copernicus' work that would provide a new foundation for astrology. The first offered him a view of astrology whose basis was not the individual planetary virtues, but rather the Plan of a sole God Who determined the course of the corruptible earth *absolutely*. Yet Rheticus went further and dismissed the event astrology so beloved by Melancthon's generation and the Middle-Ages. This opened the way to an astrological conception not based on the punctual *accidentia* brought about by the strife amongst the planets, but rather founded on the linear development of God's governance through the stars. Finally, the discovery of the rhythms of the four Copernican circles offered the mechanism needed to fulfill the linear vision of an absolute astral Providence.

This discussion of the origins of Rheticus' mathematical realism presents us with a unique beast which we may only occasionally gawk at in our visits to the zoo of the history of philosophy. A whole breed of mathematical realists would be far more helpful, we could then examine their common characteristics and come to an understanding of their essential tenets. We therefore quite fortunately find a famous exponent with whom we may compare Rheticus in the young Kepler.

Kepler's mathematical Realism. Rheticus' mathematical realism never found an opportunity for public expression. The main reason for this was that

Rheticus later felt that the discussion of heliocentrism ‘abroad’ was not productive.¹⁸⁴ Secondly, the pedophile scandal of 1551 and Rheticus’ subsequent self-exile left him in a position where only his apparently ‘neutral’ trigonometric work could find influence and acceptance.

Despite this lack of access to all of Rheticus’ works, Kepler was an avid student of Rheticus’ *Narratio Prima*, and appears to have studied it far more than *De Revolutionibus* itself. This is evidenced in his correspondence with his teacher Michael Mästlin (1550-1631) and several passages of his first work, the *Mysterium cosmographicum* (1596). Mästlin found the *Narratio Prima* so central to the work of Kepler that he reprinted it alongside the *Mysterium*. Although Kepler could really have only found Rheticus’ use of perfect numbers, his *circulus parvulus*, and his numerous references to the Pythagoreans as indicators of Rheticus’ mathematical realism, Kepler truly did develop a position very similar to Rheticus, which he then took to new heights.

Kepler’s early mathematical realism distinguishes itself from Rheticus’ in that the mathematical structures (the five regular geometric bodies which are inscribed in the orbs of the planets) that Kepler finds in the heavens are not sought as instruments of God’s communication of His Providence unto man. Kepler rather seeks to discover the mathematical foundation of the universe as God laid it out. That is, Kepler asked an ontological question. God posits mathematical structures which underlie the appearances. They are that which is truly real. Rheticus’ mathematical structures on the other hand are not real in the same sense. The Copernican circles are ‘theologically real’, they determine worldly events and are ambassadors of God’s omnipotence and His desire to be known by man. Further, Rheticus’ investigation always seeks the intentions of an astrological God, and never the ontological, because the ontological only has a ‘physical’ description at its foundation, not a divine message.

This difference between an ontological and a theological approach sheds significant light on the question of the physical truth of Copernican theory. For Rheticus, physical truth does not necessarily belong to God’s divine message; thus the question of the physical truth of the heliocentric theory is misplaced and secondary. Kepler on the other hand is primarily interested in the physical description, and sees precisely this as the fundamental testimony to God’s omnipotence. ‘Physical truth’ vs. ‘divine truth’ therefore does not become an issue for Kepler, and the physical truth of heliocentric theory is summarily accepted. This difference is nicely

¹⁸⁴Cf. *Preface to the Ephemerides of 1550*, p. 295: To which part I promise to give my own work, which should neither be unworthy of the excellence and greatness of Copernicus nor without particular use, so that it may appear to be both honorable to me and the good and erudite. I all the same don’t want Copernicus’ ideas to be inculcated abroad, either by myself or some other person, not so that an attempt is made to help his good name, nor correct the deficiencies, but rather it seems it would confuse the enterprise and the work if someone were to twist it.

evidenced in the fact that Kepler's teacher Mästlin believed Rheticus would have had no difficulty with the addition of 'material pictures', i.e. figures, to the *Narratio Prima*.¹⁸⁵

Kepler was an avid astrologer, yet he was not an astrologer like Rheticus, and this is due to his generation. The formative figures in Rheticus' early life, Gaurico, Carion, Schöner, Melanchthon and Camerarius were all innovative astrologers who believed that the astrology of antiquity could be reborn, and the poor astrology of the Middle-Ages rejected. They also all believed, following in particular the example of Carion's *Chronica*, that the entire march of history could be discerned in the stars.

Kepler was also strongly influenced by Melanchthon's astrology, yet in an entirely different way. Following Melanchthon's death, a strong backlash led by a new generation singularly devoted to Luther's word decried Melanchthon's deformation of the Lutheran purpose. Melanchthon was indeed guilty of this crime, and the astrological crown of his thought was promptly decapitated from Lutheran doctrine and history. This violent rejection of Melanchthon's astrological theology led inevitably to astrology's return to the dark closet of secrecy where it could no longer innovate in the spirit of the 'astrological circle'. The closet thereafter really only opened in royal courts and popular calenders where it was again its secrecy which shone like a beacon of divine authority. It was precisely in these venues that Kepler practiced astrology. This historical difference is the main reason why Kepler did not combine the justification of astronomical methods with those of a divine astrology through which God speaks with us as Rheticus had done. And although Kepler did try in his later work to innovate the 'aspects' of the planets and their various mathematical cases of occurrence, these aspects had no bearing on the mathematical structure of the universe itself.

Kepler and his teacher appropriately deem Kepler's mathematical realism as the method of *a priori* reasoning. Mästlin describes this method best in his preface to the *Mysterium cosmographicum*. He begins by invoking Plato's imagery of Geometry and Arithmetic carrying those desiring of enlightenment up to the heavens like wings (Mästlin doubtlessly obtained this image either from Melanchthon's *Preface to the Sphere of Sacrobosco* (discussed in II α) or Rheticus' *Preface to Arithmetic*) he then continues:

Even though these [the wings] are arduous and to be admired, our mathematician here, magister Johannes Kepler, nevertheless teaches us to fly much higher than the 'oars' of these wings. Truly great are those things which the masters of astronomy have discovered, yet they have all, until now, discussed astronomy backwards [*à tergo*], and they taught to investigate

¹⁸⁵*Gesammelte Werke*, p. 85, l. 32-34, "etiam schemata demonstrationum, quae Rheticus haud dubio apposuerat, sed in typis excusis exemplaribus, nescio qua incogitantia, ommissa fuerant, addere."

motions as well as magnitudes and distances from solar observations. Yet to gain access to the geometrical norms, findings of motions, and numerical quantities by measuring them *a priori*, or from the front, or rather without observations, this never occurred to the most experienced masters of the art, not even in a dream. Yet our very adroit Kepler now proposes a certain and finite number and order of the orbs or celestial spheres by means of geometrical invention. And what is more, a certain mutual proportion of magnitudes and likewise of motions. He then shows that the Creator, God, fabricated, extended, disposed, adorned and ordered everything in the creation of the world after its beginning with the five regular geometrical bodies, everything very understandable to geometers, proportion and the mobile celestial spheres. And this opinion is not violently set forth by means of logical, nor superficial or dubious, or spinster like, much less foreign, concocted conjectures, but rather proves itself by the most genuine and proper reasonings take from the Nature of things as well as from Geometry which cannot be contradicted. The greatest of these is the very elegant and clever harmony of the interval (*diastema*) of the five regular bodies, agreeing (*consonans*) with the concord (*concentus*) of the calculus of Astronomy from known observations.¹⁸⁶

Now the closest thing to this *a priori* reasoning we now know is the thought experiment. Yet what here occurs is no thought experiment. Kepler begins with the notion that nature can be known without observation. He deduces the mathematical structure of the universe from geometrical precepts. This method rests upon the belief that God is a geometer and that He alone posits the perfect geometrical structures. Rheticus' approach is very similar, yet the justification of the method is different, Rheticus deduces the mathematical structures based on the belief that God uses them to communicate with us and determine the march of history.

Although Kepler always retained his strong inclination towards *a priori* reasoning, he would later pursue it with far less rigor than in his early work. This was due to two significant changes in the conditions of his future research which demanded at least a certain degree of the old *à tergo* or backward empirical approach: 1) his access to the new Tycho Brahe observations and 2) the telescope. It was these two factors along with the general trend toward empirical investigation which closed the door of mathematical realism for those doing serious research.

Mathematical realism did however clearly play an influential and productive role in the astronomy of the sixteenth century. Although we have no document which philosophically explains Copernicus' love affair with the circle, the prime motivation of his entire work was the belief that the planets

¹⁸⁶*Op. cit.*, p. 82, l. 15-31.

must move in circles, and that Ptolemy's equant was therefore mistaken. Rheticus based his belief in heliocentrism on the mathematical properties he believed to find in it. And Kepler's most famous law $T^2 \sim R^3$ was the result of a relentless manipulation of data founded on the belief that some sort of rhythmic variation was present.

Despite the altered conditions which forced scientific research to follow a road based on empirical evidence, various vestiges of mathematical realism continued to echo throughout history. Schelling convinced Ritter, along with the later Goethe and Hegel of the virtues of *a priori* reasoning and founded *Naturphilosophie* in so doing. Their philosophy was very much a backlash against the empirical tradition. Though no longer necessarily mathematical, the Romantic philosophers believed to find through introspection the same type of perfectitude which Copernicus, Rheticus and Kepler saw in the geometrical figures. Kepler was their champion. His *a priori* method was contrasted with that of the arch-enemy, Newton. Finally, we continue to hear of the odd concept of *simplicity*. Though noone can really explain why, the simplicity of a given theory is used as a criterion truth. Yet aren't only geometrical figures and all things *a priori* simple?

IV. Original Works

Inquiry: Do the Laws Condemn Astrological Predictions? read by George Joachim Reticus, on the 17th of April 1536¹⁸⁷

I always strived to do the best I could in all things, so that not only that which was expected of me but also that my character might be proven to you. Nothing more disagreeable could happen to me than if I were to find myself lacking in decency and modesty. I therefore ask you, because public custom demands that I speak in this place, to judge me according to my present duty and not as if I were confident in my own powers, when I assume this role in this pomp and circumstance. And insofar as I hope that you will approve of my present obligation on account of your humanity and prudence, I also ask that you hear the oration with a calm spirit. For I know that my speech lacks the lustre and splendor which this place demands; partly because my nature, which cannot attain to such a flowery form of speaking, is reluctant, and partly because I couldn't exercise the art of speaking as I was impeded by other studies. Yet I shall try to quickly release you from this tedium. Now, in accordance with the ancient tradition, I shall dispute a certain question, namely, what is to be understood of a law in C[odex Justinian]¹⁸⁸ which doesn't only condemn mathematicians, but also throws them into exile¹⁸⁹, and further commands that they be executed.¹⁹⁰ There can be no doubt as to what the law says on divination or prediction. For it approves of the teaching of certain parts of mathematics, namely, Arithmetic

¹⁸⁷Found under the title *Quaestio: an leges damnent praedictiones astrologicas? recitata a Georgio Ioachimo Rhetico*, d. 17. April. 1536. in *Corpus Reformatorum*, V. X, 712-715. This small speech was published in 1557 and 1558 in Wittenberg under the title *Quaestiones de rebus cognitione dignissimis, explicatae in publicis congressibus in Academia Vvitebergensi. Item utiles aliquot commonefactiones de Statutorum: Scriptae plaeraeque. A phillipo melanphone et excusae in officina haeredum georgii rhav. Vvitebergae*. Each student completing his magister was required to defend a thesis. This is our first known work by Reticus.

¹⁸⁸Part of the *Corpus iuris civilis*, the section which condemns Astrology is IX, 17, 18.

¹⁸⁹Codex IX, 17, 18, paragraph 3.

¹⁹⁰Codex IX, 17, 18, paragraph 1.

and Geometry.¹⁹¹ This brings us to the question: *does the law condemn astrological predictions?* Even though this is taken from a foreign profession, that is, from the books of lawyers, it is nevertheless sufficiently clear, that this [question] pertains to us and all students of philosophy. For it behooves us to know the dignity of our arts, and because the law pertains to mores, it is clear that everyone has to know and correctly understand it [the law].

Now, just as it is proper for lawyers to defer to this law, nothing prevents us from deferring to our arts rather than some edict. For we don't have to defend our possession against the opinion of certain interpreters. Aristotle says that the arts will be happy if the skilled judge in their respective arts, and the lawyers teach this judgement. The skillful are to be consulted in each art.¹⁹² I therefore hope that they [the lawyers] will freely leave these matters to the philosophers, so that the lawyers might not condemn a part of philosophy. That is my position.

The laws of the codex do not condemn Astrological predictions, only those which do not have causes or physical reasoning. Ptolemy calls these *ἀνατιολογηται*.¹⁹³ Such are the predictions of augurs, and much of this sort is mixed up by Astrologers, so that they divine through temporal interrogation, when they promise carnage, or claim to be able to indicate the authors of crime. In like manner, a priest is damned by the law in the ordinances who faked being able to ascertain crimes with the help of an Astrolabe. I think that such superstitious predictions, which the philosophers themselves disapprove of, are to be condemned by those laws. These [the philosophers] condemn those predictions which are unable to produce Astrological predictions. By Astrological I mean those which have Physical causes and reasonings. We may show this in the following manner:

It is pious and useful - not superstitious - to observe the ordinations of God in nature. For those [predictions] are superstitious which do not have physical causes and the ordinations of God.

Astrological observations are observations of physical causes which are ordinations of God. The predictions of medical doctors are observations of causes and effects. The speed of the pulse in the arteries signifies a vehement heat and the motion of the heart. For the motion of the heart drives the spirits of the arteries. In like manner, the Astrologer will ascertain that the Sun has the power of heating, the Moon that of moistening. He therefore predicts that the Moon effects more humid temperaments in the air and in the bodies of animals. And that from the first qualities secondary ones will arise.

¹⁹¹Codex IX, 17, 18, paragraph 2 “Artem geometriae discere atque exercere publice interest. Ars autem mathematica damnabilis interdicta est omnino.”

¹⁹²I have been unable to find this reference.

¹⁹³Literally, ‘not guilty of logos.’

Such an observation therefore is pious and useful in our lives when it arises from Physical causes which are divine ordinations.

This reasoning teaches plainly enough that it is not possible to simply condemn Astrological divination as a whole. If they simply condemn predictions, they deny that light is hot, cold, humid or dry. What could be more absurd? At that point when they concede that light is hot, cold, humid or dry, it must be admitted that similar qualities are to be found in the air and in the bodies of animals. If these are the effects, why should the observation be condemned, when the order of causes and effects is a divine ordination? All predict in this fashion, if the pulse languishes, the heart is languid. For the cause is judged from the effect. This is how Hippocrates judges the cause of a foetus' abortion: the womb dries up, because the foetus lacks nutrition.¹⁹⁴ Here he argues the effect from the cause. If someone were ignorant of the reasoning of these predictions he would judge that these would likewise be magical. I therefore say that Astrological predictions are of a Physical nature. For these are also observations of causes and effects.

Yet many object, and these treat the astrologers abusively enough. They recall that they are often mistaken in their predictions. They point out that their precepts and judgements are often at odds with one another. And they put forth examples of famous men who held this doctrine in contempt. They add likewise that if anything is attributed to the stars, the decisions of free will are taken away. A certain Astrologer predicted to King Henry the Seventh of England that he would die within the year. The King required his presence and asked if he was an Astrologer. He, hoping to find himself in good graces [with the King], declared himself in this art. The King then asked if he could predict when Easter would fall in the holidays. As this [Astrologer] didn't know what to say, the King said "Do you think I am more capable of divination? For I predict that you will land in the dungeon in the coming days." And so he was miserably thrown in the dungeon, and thereafter discharged with abuse. Tyrants argue in this manner, not philosophers. I now defer my inquiry to the philosophers who may explicate this [inquiry], if there is opportunity.

¹⁹⁴This is not to be found in Hippocrates' works. The idea however that the qualities of hot and dry are concurrent with a lack of nutrition may be found in the *Aphorisms*, sect. V, no. 62.

A Preface to Arithmetic¹

I began by explaining to you why I started teaching publicly, so that no one might think that I impudently make an appearance in this theater on the basis of my own determination. For I am by nature very timid, and I cherish those arts which love hidden recesses and don't find applause among the common people. Further, when I see not only the great richness of science, but also a work accomplished through dexterity and felicity of mind, especially in these subtle arts of tradition, I am truly more conscious of my own feebleness. I didn't seek this place, and I opposed our teachers for a long time as they encouraged me to publicly teach the elements of these arts which I have practiced in no remarkable manner, particularly at that time when the other mathematical lecture ceased through the passing of the most learned man Johannes Volmar. And indeed those [teachers] asked that I do this not only by reason of our friendship, but also for the good of the youth, for it is of great use to constantly inculcate and exercise those elements in lectures. Thus the authority of the preceptors and their noble disposition in the literary endeavor was victorious. For I saw that they send me to this task not as some sort of private study, for they have their eye on young men, and insofar as they can, they invite them to these arts which are the true beginnings of philosophy.

I didn't want to be of no use to young men and the state in my work. They drove me for this reason to promise to undertake this test (*periculum*). I thus ask you not to think that I came to this level of public office through arrogance or a confidence in my own abilities. I would be eased if I also perceive your attendance and diligence in responding to the noble will of the preceptors who imposed this persona upon me for your benefit. It will therefore be up to your prudence and humanity to consider my work of value. For I hope to be able to satisfy you in my teaching of these precepts. However, if you should however desire something in my speech or in my actions, I beseech you to tell me. For I know that I am held fast by shame and fear, and am truly not suited for dramatic presentation. Yet they [the students] loathe these arts on account of these discomforts, and break off their studies. A professor is of a very delicate and morose mind if he is indeed a master of

¹This short speech was first published under the title *In arithmetice Praefatio Georgii Ioachimi Rhetici* along with another short speech by Rheticus former teacher Milichius, (Wittenberg 1536). Both were given at a commencement address in 1536. It was again published in the *Selectarum Declamationum* of Phillip Melanchthon as *De utilitate arithmetices*, (Strassbourg, 1544).

such an art. However, even though I appropriate nothing to myself, I shall nevertheless teach these precepts with great faith and diligence so that I might hope they are recognized and understood.

I disclosed the reason for my public appearance so that, as I hope, it would free me from the suspicion of arrogance in the eyes of good men and students. I shall now speak of my plan, or rather of the opinion of our preceptors. They charged me with teaching the elements of Arithmetic and Geometry, and because the nature of these arts demands it, I shall begin with Arithmetic. How I wish my authority and eloquence might prove so strong that I could excite and kindle the interest of young men for the arts. For what can a teacher wish for more than to have listeners who glow and burn in their love for learning? But because our preceptors urge the students daily to learn these arts, and the utility of these is manifest, I hope there to be many, gifted with free minds, who are sufficiently incited to culture these studies.

The Greeks tell the tale of Pallas who began to play a new pipe Mercury had given him as he walked to a river. However, even as he was caressed by the sound, he saw his face absurdly deformed in the waters, with puffed up cheeks, and he threw the pipe away forthwith. The satyrs, who ran to this new sound, followed the thrown pipe immediately: and so did the pipe, disdained by Pallas, begin to delight the Satyrs.² We allow in this manner truly unfree minds to take pleasure in other rustic arts, or rather to move about certain fragments of the arts, be it for reason of profit or to win over popular opinion. Yet honest minds love nothing more ardently than the truth, and as they are inspired by this desire they seek out the entire doctrine of all nature, of religion, of the motions and effects of the heavens, of the causes of mutation, not only that of living things, but also that of cities and empires³, of the fountains of honest office, and of other things of this sort. If we are possessed by an admiration and love of this perfect doctrine then we must surely be thankful for these comprehensive elements on numbers and measures which open the door to other parts of philosophy, notwithstanding the fact that they have great dignity and utility in themselves.

For just look how extensively the use of Arithmetic has proven itself in Economics. Aristotle writes that in the state of Thracia there were a number of people who could not count up to four⁴: I ask you, do you think that such circumstances are advantageous to government, not to speak of the larger market, or of the veins of metals, but rather of some small economy? Do we suppose that reasonings only a little more intricate can be developed

²I have been unable to identify the source of this tale.

³This is our first reference in Rheticus' work to a theory of the rise and fall of empires, which was to later become critical in his thought. Cf. Section III β.

⁴I have been unable to identify this reference.

and unfolded from such beginnings? By no means. Yet all are similar to those Thracians in great and obscure reasonings. I preside over those who are destitute of this art. For not only in the marketplace, with metals, and in coining money, but this art is also necessary in the calculation of many other public and private matters. Those versed in the matters of state should know the calculations of the treasury. Questions often arise in the course of decision making which require erudite computation. It is therefore not enough to know numbers as a benefit to nature, rather it is the art of addition without which no other difficult computation can be explained. Socrates discussed this in Plato's *Laws* also brings this forth so that the citizens would know to learn Arithmetic.⁵ But why is it proper to speak of a known matter at such length? For there is no one who does not appreciate the great use of Arithmetic in all parts of life, excepting those more rude Thracians who did not know how to count beyond four. Further, these vulgar applications should invite all young men equally to learn and exercise this art: for many cases arise when arithmetic can be of great use to specific individuals. It was moreover greatly cultured by the Romans so that free persons learned Arithmetic along with their first letters.

For you will remember the verse of Horace:

Roman youths learn to divide an
entirety into one-hundred parts through long calculations,
the son of Albinus says: if one takes away a twelfth
from five twelfths, what remains?⁶

The utility of Geometry is manifold, not only in building houses or in measuring containers, but also for the political man in his finding the distances between places in a cosmography. Yet I shall now leave these vulgar utilities.

Those who are versed in studies and seek a perfect doctrine will put forward the following utility for themselves: that there is no other entrance to celestial doctrine than Arithmetic and Geometry. And indeed Arithmetic is of such a power in celestial doctrine that almost the entire celestial doctrine is accessible to a mediocre mathematician. He can certainly follow the greater part of doctrine without difficulty. See now with what small labor you will be able to create works of great value. There is nothing more easy than learning the species, as they are called, of the art of numbering. After these are but satisfactorily understood almost every part of astronomy will be immediately grasped without the slightest difficulty.

Plato creates the souls in the *Phaedrus*, of which one he says is

⁵*Laws*, 809c, 817e, 819b.

⁶Horace: *De arte poetica*, 324-328.

winged, the other, he says has lost his wings.⁷ The winged flies in the heavens, enjoying the company and discussion of God and the beautiful spectacle of the courses of the heavenly bodies, and contemplating the causes of the mutations in the inferior nature, in the air, in the bodies of living things, in the studies and the mores of men, and the various falls of empires and cities. These spirits fly through all of heaven, captured by the beauty of divine things, and the admiration of their order, and the pleasantness of learning and virtue. They desire the enjoyment of this passion and do not burden their souls with obscene desires which perturb the harmony of virtue in the soul, and which project a darkness which prevents the heavens from being observed. Those souls who have lost their wings however, roam the soil, and seek impure desires from terrestrial things, and do not observe that most beautiful light of heavenly objects. Even though Plato understands the heroic wings as the impetus of minds, that same impetus does not carry the souls off the ground. It is rather a task for the arts, through these the souls are raised to the impetus. The arts are therefore the wings of the human soul, Arithmetic and Geometry. If one is provided with a non-sordid mind he will be able to grasp this and will easily enter into heaven, and freely move about in the union of the heavens, and enjoy himself in that light and wisdom.

Those therefore who are endowed with uncontaminated minds, and who also highly admire noble things, and who wish to reflect upon divine matters in their thinking, they give themselves those wings, Arithmetic and Geometry. Taken up to heaven through the power of these, to wander with their eyes through the natural universe, to see the spaces and limits of the greatest bodies, to see the fatal congresses of the stars, and finally the causes of the greatest things which come about in this life of men, turn your minds to this if you can. I think that rich minds can be seized by such a great benefaction, and that they can be incited to learn and love these arts. For I know that the great dignity and utility of doctrine of heavenly objects is persuasion enough for you, and that you, as it is proper, abhor with your ears and souls the ravings of Epicurus who derided Astronomy and dreamed that the Sun was vapor lit up through motion in the morning to later extinguish: and so are stars clouds which have been coincidentally set on fire. To affirm tales is not worthy of man, and certainly not a philosopher. There has never been such a barbarism than not to believe that the stars are certain and permanent works of God, carried by certain laws, by reason of some great use. It is therefore an affront to God to make up such a confusion of things, that the Sun is vapor coincidentally inflamed, and is carried in a coincidental manner, as Lucretius says:

⁷*Phaedrus*, 246a ff. This parable is to be found, in almost identical form, in Melanchthon's introduction to the *Sphere of Sacrobosco*, published in Wittenberg in 1538 and countless times after that as *Libellvs Ioannis De Sacro Bvsto, de Anni ratione, seu ut vocatur vulgo, Computus Ecclesiasticus / Cum Praefatione Philippi Melanchthonis*.

Wherever food invites and calls,
feeding their flaming bodies
All throughout the sky⁸

Yet we entrust more to the authority of the most learned men who refute these ravings with strong arguments, as well as to the divine oracles in holy scripture from which it is impious to dissent. These clearly testify that the Sun, Moon and other stars are all certain and permanent works of God, and holy scripture adds the reason of the great advantage of the founding of the heavenly luminaries: They are signs and distinguish the seasons and years.⁹ This description, even if brief, nevertheless comprehends great things and shows the study of Astronomy to be good. For, so that I may omit the remaining issues, if the Sun was founded to create and govern the year, it is necessary to observe the course of the Sun. Without the observation of its motion there is no way to determine the seasons and years. It is thus not obscure that the observation of the heavenly motions was approbated and foreseen by God. Nor should we regard these to be trivial reasons, because divine authority urges us to this doctrine. For besides the great benefits it confers on everyday life, this most beautiful order of movements also admonishes us that this nature did not arise coincidentally, but came into existence through an eternal mind, and that it is governed. And it confirms in our souls the honest opinions of God and providence. Therefore, of the philosophers only the Epicureans were ἄθεοι¹⁰, as they did not want to view this illustrious testimony of God, the certain laws of motion and the amazing harmony. It is thus proper for good minds to love this most honest doctrine, and, insofar as it is possible, to take up the inquisition of some part of the work of such things. And those will easily perceive a great deal who are but slightly learned in Arithmetic.

I thus return to Arithmetic, for I had began to speak of it in particular. Upon recalling its benefits however, which indeed are not at all obscure, I thought it necessary to add a little on its ease. I know that young men are deterred from these arts by the opinion of its difficulty. Yet what pertains to the beginnings of Arithmetic, as they are customarily taught in lectures, and are used daily, those persons would be in great error if they believed that these [beginnings] were wholly difficult. Art arises from the nature of the

⁸ *De Rerum natura* 1100-1104, Rheticus' "Quo cibus vocat atque invitat euntem Flammea per coelum pascentem coropora passim" differs slightly from the standard "quo cuiusque cibus vocat atque invitat euntis, flammea per caelum pascentis corpora passim" found in *De rerum natura: libri 6 / recogn., brevique adnot. crit. instr. Cyrillus Bailey.* - ed. 2. Oxonii : Typogr.Clarendon, 1967.

⁹*Genesis* 14.

¹⁰That is 'godless.'

human mind itself and has the most certain demonstrations. This is the reason why the beginnings can neither be obscure nor difficult. Further, the first precepts are so easy that even children can follow them, because the entire matter arises by nature. Whence, although the precepts of multiplication and division require a little more diligence, the causes may nevertheless be grasped quickly by attentive students. This art requires exercise and use, as all other arts. For it is very true what Anaxagoras says:

“Work is the cause of wisdom¹¹”, meaning that the arts cannot be correctly understood without exercise and experience. Wherefore it is always something of difficulty. You recall that there is no art where there is no difficulty. It is truly an error if you believe that the exercise of the pen is easier than the beginnings of Arithmetic. The lectures are not founded and constituted so as to cede to sluggish free-time to please inept desires. They require industry, care and a painful struggle of the soul. But I do not deny that much sought by arithmeticians are also observations which sink further to the level of the inexperienced: for all arts grow with movement. Yet I speak of those beginnings which are customarily brought down to you and which bring use. Young men should therefore toss away the opinion of difficulty, and with a great heart and with a certain hope come to learn this art. For if they do this, the elegance of the matter will thereafter detain them, and they will judge the difficulty of these matters to be less serious.

I have expounded upon the benefits which are to be especially sought in Arithmetic, I also spoke on the ease. The remaining uses however are more obscure and I shall not say much of these. It is certainly true that the other arts are more easily comprehended once Arithmetic is understood. For among the first arts Arithmetic teaches to judge, and to distribute the one and the many, it shows the order of things, and admonishes that the confused is to be unfolded and set apart. These are the beginnings of reasonings in man. The first understandable things are for that reason numbers. I believe that is what Pythagoras thought when he defined mind as number: for he meant that the soul is rational. It discerns and seeks order. These are the very characteristics and first functions of the mind. He aptly defined mind to be number for this reason, namely, because it numbers. This is the reason why the Ancient Greeks taught Arithmetic directly after Grammar, thirdly they taught Dialectic, and fourthly Geometry. For they realized that dialectic takes its beginnings from Arithmetic, and that the exercise of multiplication and division prepares the mind excellently for syllogisms. Likewise the power of demonstration can be more easily understood after Arithmetic has been studied, because it has such clear demonstrations. Moreover, many passages arise within the authors which cannot be understood without this art. The

¹¹I have been unable to find this sentiment in either the known fragments of Anaxagoras or in comments attributed to him by ancient authors.

Pythagoreans spoke figuratively in arithmetical words, and they translated these to Physics, and to moral Philosophy. Pythagoras defined God in the following manner: God takes his departure above the next number after the highest number. He wants to show in this manner that God is one and nevertheless the highest being. For he understands ten as the highest number, next to ten is nine: the departure above nine is unity: in this way do they wrap up all of philosophy in numbers.

Even if it is better to strictly teach the arts and not wrap everything up in figures and puzzles, it is nevertheless the case that other philosophers who wished to teach philosophy in particular gave examples from Arithmetic. It is a disgrace not to understand these. As Plato says,¹² the republic is changed through celestial causes, these effect certain changes in cities and empires, he says: in the same way does nature stay in tune as when $4/3$ is joint to $3/2$, that is when $\delta\iota\grave{\alpha}\ \tau\epsilon\sigma\sigma\acute{\alpha}\rho\omega\nu$ ¹³ is added to $\delta\iota\grave{\alpha}\ \pi\acute{\epsilon}\nu\tau\epsilon$ ¹⁴, that is when the harmony is completed $\delta\iota\grave{\alpha}\ \pi\alpha\sigma[\eta]\acute{\omega}\nu$.¹⁵ Thus does the period of empires proceed, republics fall and are changed. And he puts forth this cause because when the planes of a cube are completed to solids, nature cannot proceed any further and many dissimilar numbers are created. And so do ignoble citizens who control the state arise from greater men. They overturn the republic gradually to the end of the period. No word is here to be understood without Arithmetic.

These benefits are of a lesser nature, those are greater which I discussed earlier. Because this art is necessary in many other of life's duties it is truly the case that there can be no entry to that highest part of Philosophy which discusses the heavenly bodies without this art. This is the great and grave reason which should ignite the interest of noble natures for this art, because those who seek the entire doctrine, which is worthy of great men, should fight with all of the powers of the mind so that they might bind that part on the motions and effects of the celestial bodies to the other common disciplines. The man who holds all of philosophy in his soul and understands the hidden causes of the many mutations in nature and in the life of man, and the fountains of virtue and of honest office, we will say that he is truly happy just as the most wise Vergil said: "Happy is he who can recognize the causes of things."¹⁶

¹²*Republic*, Book VIII 546a ff.

¹³That is, '4:3.'

¹⁴That is, '3:2.'

¹⁵That is, 'of the whole'.

¹⁶*Georgicon*, book 2, line 490.

Happy is he who can recognize the causes of things¹⁷

¹⁷*Georgicon*, book 2, line 490.

ANNOTATA IN SPHE
ram procli a M^o Ioa
chimo Mathematicae
professore

Quae sunt consideranda
in singulis circulis coelestibus

In consideratione cuiuslibet circuli caelestis diligenter perpendendum · Primo quando imaginatione describitur in coelo et ubi sint eius poli, qualis sit, maior an minor, Intrinsecus an extrinsecus, aequidistans, obliquus, an per polos ductus, quo studiosi definitionem seu ideam potius cuiuslibet circuli animo concipiant Deinde elevandi oculi in ipsum coelum et sidus cuiuslibet circuli notandus, adiuvantibus instrumentis astronomicis, armillis dioptra, Quadrantibus et stellis fixis. Tertio, quod cuiuslibet circuli officium, non tam ex ipsis libris, quam ab ipso caelo petendum, quare et quomodo quilibet iuventus, quis ipsius in arte usque ad quaslibet apparentias observandas et salvandas conducat, quae eius et ad nos ut [40v] ad alios alios circulos Item stellis fixas habitudo

De circulo septentrionali

Maximus est circulus suntque earum perpetue apparentium

Solstitialis

Tropicus θερινος Τροπικος

In 12^{am} iuni sol intrat in principium ☀ olim 14 die Iohannis baptistae Utilitas huius circuli quod cum sol est sub hoc circulo tum maximus est dies ut ostendit quantitatem maximi diei

Solstitialis tropicus

Describitur hic circulus a puncto maxime declinationis motu primi mobilis, quod dicitur conversionis @ Cum hoc pervenit sol est maximus dies in spera obliqua solstitium aestivalis

Initium discessus solis decementi dierum

quaelibet stella in globo describit circulum paralellum

In spera recta omnes paralleli in partes aequales [41] les secantur, quia polibus intentibus in horizonte ipse transit per eos

De aequatore

Aequinoctialis distribuitur a sole ut a puncto aequidistante si videlicet ducatur linea a centro mundi usque ad firmamentum et centrum solis si esset in arietae vel in alio signo tum describerit inibi* aequinoctialem

Imaginanandus hic circulus in coelo per zonam orionis ut per stella in capite aquarii

1 Officium huius circuli dividere totum hoc universum in duo aequalia et ideo inquit proclus esse maximus @ Ideo etiam Authore spher[a]e primo de hoc circulo tradiditur

2 Cum sol in eo existit efficit aequinoctiam et circumvoluitur regulariter @

De brumali

Describitur hic circulus quando sol existit in primo puncto capricorni tum motu primi mobilis describit talem περιρεριαν quae dicitur dicitur¹ circulus brumalis ut solstitium hiemalis [41v]

De occultatione @

De habitudine equidistantium ad * se invicem et stellas fixas pro diverso poli elevatione, et primo περι επιφανειασ και κρυ[π]τεασ των πεντε παραλληλιον κύκλον id est de apparitione et occultatione aequidistantium id est quid de eis supra Horizonte in aliis atque aliis terrae tractibus conspiciantur qui intra eum existat et occultetur.

¹Double in Text.

De magnitudine

Secundo περι Μεγέθους πεντε παραλληλων κυκλον id est de magnitudine aequidistantium circularum ut cum ex predictis intelligent studiosi quomodo tropici et aequator in oculos incurrunt etiam perspicient qualiter arcticus pro diversa poli elevatione maiore ut minorem portionem caeli semper conspicuam determinet Antartico ex altera parte correspondent caeli parte occultata includente Et ex his qualis doctrina hoc astronimici de ortu et occasu poetico potest, quaeque aequidis[42] aequistantium ad stellas fixas sit habitudo Tertio sequitur Περι Τάξεος των πεντε παραλληλων κυκλον id est de ordine quinque aequidistantium circularum quo melius predicta considerarentur et studiosi aequidistantium eorum ad se invicem habitudinem proponderent

De potestate

Quarto sequitur περι δυναμειωσ των παραλληλων κυκλον id est quando pro varia eorum ad nos habitudine potestates seu officia inter se permutent In sphaera recta omnes dies sunt aequales

De intervallo

Quinto et postremo sit περι διαστάσεος των παραλληλων κυκλον id est de distantia et intervallo aequidistantium quo studiosi etiam recto computo aequidistantium ad se invicem tum adversum zenith habitudinem inquirere distant [42v]

Ab horizonte ad tropicum ☿ 14 A tropico ☿ ad aequinoctialem 24

Ab aequinoctialem ad tropicum ☿ ad zenith 28

A zenith ad polum 38

A polo ad horizontem 52

Usus

1 Ad observandas altitudines horum circularum in meridiano quae instrumentis postea conprobari possunt et haec est magna utilitas

2 Ut sciamus quantum distarent stellae hic ab aequinoctiali et solstitiali orientes et occidentes

Distantias stellarum principalium ab aequinoctiali facile inveniuntur in ephemeridibus, quae distant tum ab aequinoctiali quando est elevatio

aequinoctialis super horizontem versus septentrionem illae erunt in peripheria circuli arcticis, quae plus erunt perpetue apparitionis quae minus orientur et occident

Stellae habentes declinationem aequalem latitudinem [43] loci transibunt per zenith

De coluris

Describuntur per polos mundi deinde possumus imaginari pro dextrum pedem geminarum qui dicitur appollo et sinistrum pedem canis maioris Etiam per dextrum humerum andromedae

Usus solstitiorum

1 designat zodiacum in partes medietates ascendentes et* descendentes secundo continet maximas declinationes 3 ostendit solstitia puncta 4 sustinet polos zodiaci

Regula

Omnes stellae quae habent 38 graduum declinationem septentrionalem inclusive orientur et occidunt Maiorem autem qui continentur in circulo arctico sunt perpetue apparitionis Rursus omnes stellae qui habent 38 graduum declinationem meridionalem inclusive orientur et occidunt; quae aut maiorem sunt perpetue occultationis Notandum pro illa qui hic dicuntur de 38 gra: intelligenda sunt de omni elevatione aequinoctialis super horizontem

Aequinoctiorum

Distinguit zodiacus in duas partes medietates septentrionalem et meridionalem transit per communes intersectiones aequinoctialis et eclipticae ubi fiunt aequinoctia

1 prosunt ad distinguendum Zodiacum in quatuor quadrantes caducunt ad locum de ascensionibus intelligendum omnes parallellos in quadrantes secant

De Zodiaco

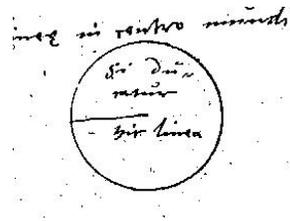
Primo huius circuli circumferentia ecliptica vocatur
 Greci vocant δια Μεσα των Ζωδιων Κυκλον
 Zodiacus dividitur secundum longitudinem et* latitudinem Secundum
 longitudinem in 12 signa
 In latitudinem est 12 graduum 16 graduum
 per hunc circulum possumus videre singulis diebus in quo loco sit sola -----
 Utilitas [44]

Utilitates

- 1 Ut ostendi possit solis locus in circulo et planetarum loca in Zodiaco
- 2 Ut omnes rationes variarum vicissitudinum temporum aliarum mutationum
 in hac inferiori natura colligi possit.
 Quomodo est inventus, experientia et diligenti consideratione
 instrumentorum

De horizonte

Horizon est circulus, superius hemispermum ab inferiori distinguens
 describitur hic circulus, transeat linea a zenith perpendiculariter per
 centrum mundi deinde linea ad angulos rectos applicetur huic lineae in centro
 mundi



[44v] Est circulus maior et immobilis
 Deinde est etiam extrinsecus obliquus ut per polos ductus ·
 Secunda divisio dividitur in sensilem et rationalem²
 Longitudo loci est arcus aequinoctialis interceptus inter meridianum primum
 et meridianum sui loci
 Latitudo est arcus meridiani interceptus inter zenith et aequinoctialem

²M: Insule fortunate sunt in occidente apud columnas herculis

Utilitas

Primo possum computare et considerare elevationem poli et declinationem solarum

Inde etiam ortus et occasus poetici et astronomici cum suis utilitatibus³.

Eclipsas solares visas et non visas praefari

Quo locus habet longiorem latitudinem loci eo est orientalis quo brevior eo est occidentalis praefari [44v+⁴] praefari, ortus lineae @ quantitates dierum

Erigere figuras caeli

Ortus poetici

Cognoscere qui[quae] stellae sint perpetuae apparitionis aut occultationis quae sunt occidentales et orientales cum aliis atque aliis partibus aequinoctiales

Variatio umbrarum, maior solis elevatio reddit breviorum umbrarum minor reddit longiorum

De meridianis circulis

1 Descriptio huius circuli id est meridiani

Describitur hic circulus per polos mundi ac zenith et Nadir

Hic circulus est extrinsecus procedendo versus orientem et occidentem subinde alius atque alius fit meridianus

Educatur linea ex centro mundi usque ad polum mundi et imaginatione a polo per [44v++] zenith ad alterum polum nadir radiens ad punctum unde digressa est describitur meridianus

Secundo possumus imaginari axim mundi per filium compassi Item stilos omnem Gnomonum in horologiis horizontalibus, meridionalibus, orientabilibus et occidentalibus

Habitudo meridiani omnis meridianus horizontem ad angulos rectos intersecat ita etiam omnes parallelos Existente polo zodiaci in plana superficie meridiani tum etiam ad angulos rectos intersecat

Ad nos  transit per nostrum zenith illud vides in compasso

³M: Utilitates ortus et occasus astronomici

⁴M: The numbering was left out for this page.

De circulo lacteo ma nilius ca: 9 li: 1⁵

Alter in adversum positas⁶ succedit ad arctos
 et poculum⁷ a boreae gyro⁸ sua filia reducit
 Transitque universae⁹ per sydera casiopeae¹⁰ inde per obliquum
 descendens tangit olorem¹¹ Aestivosque
 secat fines aquilamque¹² supinam Temporaque¹³
 aequantem gyrum zonamque ferentem solis equos
 inter caudam¹⁴ qua scorpius ardet¹⁵ Extremamque
 sagitarii¹⁶ laevam¹⁷ atque sagittam Inde suos sinuat
 flexus [45]
 flexus per crura pedesque Centauri alterius
 rursus ascendere coelum¹⁸ Incipit¹⁹, Argivamque²⁰

⁵The following text is a poor copy of lines 684 to 702 of Manilius' 'Astronomical Poem'. I've noted in the following footnotes where our text diverges from that of Manilius. The Edition by George P. Goold [1985] was used.

⁶positus

⁷paulum

⁸gyro

⁹inversae

¹⁰Cassiepieae

¹¹Olorem

¹²Aquilamque

¹³Temporaque

¹⁴,

¹⁵,

¹⁶Sagitarii

¹⁷laevam

¹⁸caelum

¹⁹incipit

²⁰Argivumque

ratem per applustria²¹ summa Et²² medium mundi gyrrum²³ Geminosque per imum²⁴ signa secat
subit²⁵ Heniochum teque²⁶ unde profectus Cassiopeia²⁷ petens
super ipsum perseam²⁸ transit orbemque ex illa coeptum concludit in illa.

Trisque secat medios gyros²⁹ et signa ferentem
partibus e binis quotiens praeceditur ipse
Nec querendus³⁰ erit visus incurrit in ipsos
sponte sua seque spse docet cogitque notari

Poetae finxerunt hanc esse rationam huius circuli totum caelum³¹
composuisse ex duabus hemispheris et ex illis partibus esse *
Lacteus circulus neque est meteoron quia est perpetuum nullum autem
meteoron est perpetuum sed studiosi cogitent quod tum sit dispositio
octavae sphaerae
Stella est densior pars sui orbis in qua est multum luminis coactum [45v]

De Zonis Tabullus h: 4 ele: 1

Et quinque in partes totus disponitur orbis
Atque duae gelido vastantur frigore semper

²¹aplustria

²²et

²³gyrum

²⁴ima

²⁵,

²⁶,

²⁷Cassiepia

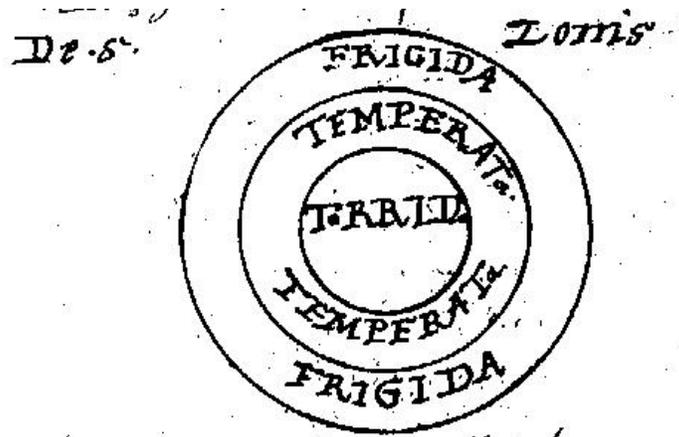
²⁸Persea

²⁹gyros

³⁰quaerendus

³¹Above caelum is written: speram

Illic et densa tellus absconditur umbra
 Et nulla incepto labitur unda liquore
 Sed ducata riget densam in glaciem nequequam*
 Quippe ibi non unquam litam super ingerit ortus
 At media est phebī semper subiecta calori
 Seu prop[r]ior terris aestiuum fertur in orbem
 Seu celer hibernas properat decurrere luces
 Non ergo praesso tellus consurgit aratro
 Nec frugem segetes praebent nec pabula terrae
 Non illic calit arva deus, bachius *
 Nulla nec exustas habitant animalia partes
 Fertilis hanc interposita est interque rigentes
 Nostraque et huic adversa solo pars altera *
 Quas similis utrinque tenens vicina rodi
 Temperat alter et alterius vires negat aer
 Huic placidus nobis per tempora labitur annus
 Hic et collo iugo didicit submittere taurus.
 Et [46] Et lenta excelsos vitis conscendere ramos
 Tondeturque seges maturos anima partus
 Et seratellus pontus confinditur aere
 Quin etiam seructis exurgunt oppida inuris.



Differ
 Zona
 plaga

Zonae
 caelo, plagae vero in terra

unt
 e et
 e

sunt in

De signis caelestibus

Stella est densior pars sui orbis in qua est multum luminis coactum

Efficiens causa stellae est sol a quo accipit lumen

Formalis causa est esse rotundas quod etiam satis probat ptolomeus

Hic oritur questio utrum videamus centra stellarum [46v]

Res: quod non sed tum per refractionem et formam refractam in aerem et stellae non scintillant sed tantum videntur ita scintillare ut cum multum scindillant videntur astare magni venti

finalis causa est movere nos hanc totam universam mundi machinam divinitus gubernari ac conservari

Stella in ore maioris canis est omnium aliarum stellarum fixarum maxima et cum sol ad illam stellam pervenerit est maximus aestus quia illa stella auget calorem et dicuntur isti dies caniculares ab illa stella

De ortu et occasu stellarum

Appendix

Brevem³² tractationem de ortu et occasu stellarum secundum poetas instituere Absoluta elementari tractatione de circulis caelestibus et proposita nomenclatura magnum caeli sequitur ut his quidam de ortu et occasu stellarum etiam apparitione et occultatione earum subiungamus³³ Quo studiosi al[ic]iantur ad astronomiam doctrinam maxime homines naturae convenientem [47]tem amplectendam cum viderint quantum suavitatem et utilitatem vel hic unicus locus qui dicitur de ortu poetico in communi vita habeat sine cuius notitia vix ullam authore aut poetam rei rustice vel etiam histographum probe aut recte per omnia intellexeris unde luce clarus quoque perspicient studiosi quando omnes artes liberales tanquam aurea catena cohereant Ad habendum in omnes bonos authores perpetuum et rectissimum commentarium quem nobis recte ceu finem omnium nostrorum studiorum constituere debemus

Nichil³⁴ autem aliud est doctrina ortus et occasus stellarum secundum poetas³⁵ quam communalis et civilis quaedam observatio seu consideratio assensionum descensionum item apparitionum et occultationum stellarum,

³²M: propono

³³M: Qua naturae ratio illud instituit

³⁴Rare form of "nihil".

³⁵M: Quid est doctrina de ortu et occasu stellarum

pro diversa earum habitudine ad horizontem et solem ad discernendam anni tempora et tempestates praediscendas quae res in Reip: necessaria est tum economiae agriculturae iuxta illud virgi:[lis] in primo geor:[gica] [“]Nec frustra signorum obitus speculamur et ortus [47v] Temporibusque parem diversis quatuor annum Hinc tempestates dubio praedicere caelo possumus, hinc messisque diem tempusque serendi Et quando infidunt³⁶ remis impellere marmor conveniat quando armas³⁷ deducere classis Aut tempestivam silvis evertere pinum[”]³⁸ Caeterum doctrina de ortu et occasu stellarum secundum poetas et duplex qualis quae fere est haec doctrina seu consideratio ortuum quam definimus et particularis quam non incommode mathematicam appellaveris cum enim pastores, agricolae et naute[ae] primum sibi stellas in caelo notassent earumque ortus, occasus, apparitiones, occultationes omnia vertissent poetae et alii docti viri haec ab illis accepta excoluerunt et illustrarunt quae tandem mathematici exactiori cura ad rectam rationem redigerunt, quod ut intelligant studiosi sumamus exemplum sit aliquis Agricola qui cognoscat imagines caeli et in initio veris, ut in initia Martii observet post occasum [48]casum solis stellas orientes et occidentes hic Wittenbergae, talis dicet cum arcturo in oriente ascendere coronam Ariathnes, Alas virginis craterem, malum et priorem partem navis in occasu occidentibus alis gallinae seu tigni dextra ala pegasi cauda unius ex piscibus Zodiaci et ventre caeli atque curvatura erithami* Eruditus autem aliquis harum magnum cum arcturo ortus dicet vocari Acronicus et poetas tali harum ortu initium veris describere ut pateat, Haec est qualis doctrina huius loci qua commentatores et interpretes authorum fere utuntur Mathematicus autem haec diligentia, et perfectius persequitur summa enim diligentia inquit ex doctrina assensionum in quo gradu aelipticae oriatur et occidat quaelibet stella proposita et quae ex aliis stellis cum ea in ortu et occasu simul ad horizontem perveniat in eadem regione Unde consideratio loco solis in Zodiaco tempore aliquo [48v] dato non solum primum innotescit quae stellae cum sole oriantur eoque oriente occidunt³⁹ Secundo quae eo in horizonte occidentali constituto simul condescendant, et e regione oriantur Tertio denique facile est ratiocinari quomodo et qua ratione propter accessum solis ad gradum Ecliptice condescendente stellae occultentur iterum propter discessum de subradiis apparent, verum etiam praestantiora quidam quae ad summam huius doctrinae pertinent Ut post in

³⁶Greenough gives ‘infidum’.

³⁷Greenough gives ‘armatas’.

³⁸Vergil’s *Georgica* 1.252-1256; *The Greater Poems of Virgil*, James Bradstreet Greenough ; George Lyman Kittredge, 1976.

³⁹ M: Occasu cosmice

8 almagesti Quatripartito qui suae loco discent studiosi.

Arcturus oritur Wittenbergae cum 28 <g: virginis Ergo sole existente 28 virginis tunc arcturus oritur ortu cosmico

Porro quia priores tres utilitates mathematicae tractationis ortum secundum poetas sufficiunt ad bonas interpretandas aliis omissis easdem quarum in presentiarum satis erit explicabimus attributis rectis [49] rectis vocabulis quibus tales ortus nominatur deinde eadem ad usum applicabimus addito uno atque altero exemplo in quibus usus praeceptoris apparebit

Tempore

ptolo:

D				nostro tempore	☉
Mar:	21-22	10	11		∩
Appri:	21-22	10	11		●
Maii	22-23	11	12	II	
Junius	23	12			☉
Juli	24-25	13	14		☉
Augusti	25		14		☉
Septem:	24-25	13	14	II	
Octo:	25		14		☉
Novemb:	23-24	12	13	⇒	
Decemb:	23		12		☉
Janu:	21	10		☉	
febru:	20		9		☉

Quibus rebus tota elementalis
tractatio ortus poetici consistat

explicare?

Elementalis doctrina ortus poetici est tractatio de ortu et occasu stellarum et praecepta, cum [49v] qualis et civilis observationis ortuum tum particularis seu mathematicae continens, quem maxime usum habent in communi vita ad discernenda anni tempora et auctores intelligendas

Huius tractationis sunt duae partes prima ut intelligant studiosi quot sint ortuum genera et quid sit oriri cosmice, Achronice et heliace Deinde ut proposito aliquo quae ortus seu occasus alicuius stellae statim perspiciant de quo tempore anni dicatur et e contra proposito tempore correspondentes ortus stellarum assignare possumus Item ostente tempore ortus seu occasus stellae determinare ipsum genus ortus @

De generibus ortuum

Ex novem generibus ortuum apud ptolomeum li: 8 ca: 4 pulcherrime et eruditissime desumpserunt veteres tria ortuum genera ad elementalem et primam institutionem sufficientia quos iam vocamus ortus seu occasus [50]occasus cosmicus, Acronicos seu corrupto vocabulo chronicos et heliacos Et cosmice⁴⁰ quaedam stellae oriri dicuntur quae in centro solis ad horizontem orientalem perveniunt, simulque cum eo supra horizontem elevantur Occidere⁴¹ autem quae eodem momento dum sol oritur in parte occidentali infra horizontem delabuntur Hoc genus ortus et occasus latini matutinum vocant⁴² Ratio quod mane sole oriente observetur Caeterum sole in horizonte occidentali constituto stellae ex parte orientis supra Horizontem ascendentes ortu Acronico⁴³ seu vespertino intelliguntur oriri stellae cum sole descendentes sub horizontem similiter occasu acronico seu vespertino occidentibus

Verum stellas⁴⁴ esse in occasu heliaco dicimus, cum vesperi ut mane propter

⁴⁰M: cosmice oriri quid

⁴¹M: Cosmice occidere

⁴²M: latine matutinum vocant

⁴³M: Ortus Acronicus

⁴⁴M: De helioco occasu qui dicitur et solaris

coniunctionem horizontalem⁴⁵ cum sole * oriri autem heliace cum a tali coniunctione liberantur Ut mane vel vesperi prout convenit iterum conspiciantur Exempli gratia scio recto compervenit ita ut non possint propter radios solis conspici [50v] puto ut potest ex tabulis directionum Arcturum hic wittenbergae ascendere cum 28 gradu virginis⁴⁶ descendere autem cum 2 capricorni⁴⁷. Ergo sole existente in 28 G ♃ Arcturus hic wittenbergae oritur cosmice⁴⁸, simul enim cum sole ascendit, et quia arcturus descendit cum 2 G ♃, patet⁴⁹, sole in 2 ☾ collocato⁵⁰ Arcturus occidere cosmice Sole⁵¹ autem in 28 ♃ commorante Vesperi oriri achronice et sole occupante 2 ♃ Arcturus vesperi occidente achronice.

Denique cum clarum * sit stellae tardiores⁵² sole occidere occasu heliaco Vespertino et oriri heliaco matutino post sole occidente ad 2 G ♃ Arcturus vesperi occultari et discendente a 28 G · ♃, oriri heliace, Quando autem incipiat oriri aut occidere heliace ignoratur quia non habentur arcus visionis stellarum fixarum quemadmodum planetarum ut rectos articulos temporis praefinire possumus quibus incipiat occultari radiis solaribus, quibus post occultationem appareant et orientur heliace sed satis est generalem huius rei existimationem habere ut diximus, adde quod stellae coorientes cum signis recte ascendentibus cuius post horizontalem cum sole coniunctor* apparent, quam stellae coorientes cum signis obliquae ascendentibus et econtra illae tardius occultantur istae vero citius Caeteris praesuppositis paribus ut magnitudinibus latitudinibus @ atque haec de tribus generibus ortuum verum studiosi ista melius aliquot auctorum exemplis ut paulo post faciemus, intelligent, si prius etiam aliud quod ad elementalem ortus tractationem pertinet in hoc exemplo ostenderimus

1 Ex commune aliquo ortus proposito Tempus anni quo talis, ortus contigerit, determinare

⁴⁵M: En duae stellae vel duo signa simul ad horizontem

⁴⁶M: ♃

⁴⁷M: ♃

⁴⁸M: Exemplum cosmice ortus et occasus

⁴⁹M: ♃

⁵⁰M: ☾

⁵¹M: Exemplum Achronici ortus ac occasus

⁵²M: ut probat ptolomeus

2 Et extra tempore proposito genus ortus ostendere

3 Item tempore et in commune alicuius ortus mentione facta de quo dicatur ortu explicare

Quid hoc loco proponatur, exemplo facilius intelligent studiosi quam multis praeceptis et matheum esse legendum et exempla recte propositionem⁵³

Deinde sciendum regem captum esse in vere in festo dum matheae * die 24 sub sole existente in 15 χ ergo 13 diebus post captivitatem constet Mar: arcturus oriebatur Acronice [51v] ipsa praecepta exemplis interspersa tanquam in illustriori loco collato melius in oculos incurrunt et fidaelius memoris inherent proinde totum hoc negotium proprio nostro exemplo declarabimus dicat aliquis Anno 1525 cum hic Wittembergae Arcturus oriretur heliace, Rex galliae a cesarienis captus est queritur quo mensae et quo tempore anni captus sit scio arcturus hic Wittenbergae oriri cosmice cum 28 G ∞ et post aliquot dies oriri heliace intro ergo in ephimerides et quaero quo die anni sol in intraverit in 28 ∞ et invenio eum occupasse 28 G ∞ 12 die septembris pono aut sole distante ab hoc loco 12 Gra: oriri arcturus heliace ut est verisimile ergo in festo divi mathie dixero regem captum esse sole in 7 ut et 8 gra: ☾ existente

Econtra quaerat aliquis quo ortu circa festum mathiae arcturus oririt et respondebit ut post de ortu heliaco. Item [52] Item dicat aliquis hic Wittembergae circa festum divi mathiae oritur Arcturus, queritur de quo ortu loquatur intro in ephimerides et video illo die solem esse in 8 gradu ☾ et quia suo arcturus cosmice oriri cum 28 ∞ respondeo intelligendum esse de ortu heliaco

Ex his patet cardinem totius huius tractationis elementalis ortuum secundum poetas duabus rebus exsistere principio in hoc ut sciatur cum quo gradu eclipticae quaelibet stella proposita oriendo et occidendo ad horizontem proveniat. Secundo vero ut sumus recti quem gradum aeclipticae sol singulis diebus occupet Quantum ad primum attinet si ad nostram aetatem omnia commune ortus et occasus alicuius stellae propositae considerare volueris prima cum quo gradu Eclipticae in quocumque signo oriantur et occidat desumes ex globo astronomico ut quod tertius est invenies ex doctrina priorum 14 propositionum tabularum directionum verificata [52v] longitudine stellae ad nostram aetatem, ut docetur in tabulis alfonsi et resolutis secundo autem in ephimeridibus nostrae aetatis statim primo intuitu conspicitur in quo gradu aeclipticae sol singulis diebus anni movetur Quod si autem ad poetarum tempora ut hesiodi qui vixit fere 2000 annos ante nativitatem domini, aut virgilii et ovidii qui augusti tempore floruerunt, ortus et occasus stellarum computare volueris primo rectificatis stellis fixis ad tempora tui poetae, et accepta competendi

⁵³M: Nota hic pro divi[n]o mathia divinum explicant

declinatione eclipticae tabulis primi mobilis scies voti tempes Cum autem haec res difficilior et laboriosior sit incipientibus, exaravi studiosis pro hoc negotio tabellulam ortus et occasus nonnullarum stella: fixa: et potissimum earum quarum mentio fit in primo et secundo fastorum, ut haberent quoque exempli quod imittentur etsi similiter in computan [53] putandis ortibus et occasibus stellarum fixarum exerreant, sumpsit autem simpliciter longitudes et latitudes stellarum fixarum ut habentur in ptolo: et ad finitorem Romanum et alexandrium ex tabulis directionum ortus et occasus computavi Negligens sitque omnimodam et superstitiosam prescisionem cum satis in hac quali doctrina versari circa prope verum porro quod secundum est quem gradum Eclipticae sol singulis diebus anni tempore Hesiodi aut alterius poetae tenuerit facile ex tabulis blanchini redderis certior

Porro por augusti tempore simpliciter intrabis in ephimerides nostrae aetatis cum die proposito et a gradus solis e directa diei positus 11 gradus subtrahas residuum ostendet gra: eclipticae quem sol tempore augusti occupavit, hoc fit propter anticipationem equinoctii Econtra dato gradu eclipticae, quem sol occupavit tem[53v]pore augusti Ut scias diem correspondentem inquiras gradum aeclipticae in collumna solis ephemeridis nostrae aetatis · Deinde diei a directo sole reperto si 10 aut 11 * adiunxeris habebis quesitum

Aliquot auctorum exempla ex praedictis declarare

Traditis necessariis praeceptis de ortu et occasu poetico et qua ratione omnes diversitates ortuum et occasum discerni possint sequitur ut studiosi sibi catalogum ortuum et occasuum stellarum fixarum ex optimis quibusque auctoribus graecis et latinis congerat illosque ortus iuxta praecepta judicent Hoc et commodius et facilius assequantur studiosi Uno atque altero exemplo Viam ipsis ostendemus, et primo de ortu Arcturi ex pli: et colu:⁵⁴ principio autem considerandum quo genere ortus stella sui temporibus anni oriatur deinde ad singula ortuum [54] ortuum genera sua exempla accomadanda Proinde cum ex tabula ortuum et occasum stellarum ad tempora ptolo: pateat arcturus Alexan: per ortum esse cum 22 ♃ occidisse autem cum 13 ♃ sequitur quod ibidem sole in 22 ♃ existente Arcturus sit per ortus cosmice die 16 ut 17 septe: quod est 15 ut 16 calendarum octobris Porro sole proveniente ad 13 ♃ occidebat cosmice 5 ut 6 maii sicut 3 ut pridie nonas maii patet itaque locus Colu: li: 1 cap: 2 cum inquit decima quinto calen: octob: Arcturus exoritur

⁵⁴This is a reference to Columella (ca. 4 B.C.-A.D. 65) whose works on agriculture *De re rustica* and *De arboribus* which were commonly read in the middle ages and renaissance.

Huc refertur illud pli: li: ca: 47 Arcturi sidus quod exoritur 11 diebus ante aequinoctium autumnus sui illud colu: li: 10 circa finem ad gravis Arcturi sub sydere parturit arbos De occasu cosmico inquit pli: li: 18 ca: 27 Octavo Idus maii Arcturus matutino occidit Idem eodem li: ca: 29 dicit conceptus virium, otiarum incipit ex ortu vergiliarum ad sextum idus maii exhorrent eum frigidum Arcturi sidus, postridie occidens

Quod autem in huiusmodi exemplis dies non ubique nostris diebus per computationem invertis respondent, fit quia plinius et unam alii plerique nulla ratione temporum et horizontem habita ortus ex veteribus authoribus sive discrimine desumpta scitant, verum prudens scolasticus facile traditus praeceptis aductus se ex talibus locis explicabit

Plinius li: 18 dicit mense februario die 22 Arcturum oriri ex ortu vespertino hinc consentit columella, inquiens nono calen: Martii arcturus prima nocte oritur quaeritur quomodo possit intelligi de ortu Acronico cum sole existente in 22 ☾ vesperi sol perortus Nempe 14 Martii Respondente hoc loco non intelligendum quod de stella arcturi dicatur [55] dicatur sed de boote cuius principium illo tempore Romae cum principio [∞] oriebatur Ergo sole in principio ☾ existente recte dicitur quod arcturus hoc est bootes oriatur Acronice. Huc pertinet illud hesiodi li: 2 * 60 post solstitium hibernos dies iupiter perferit tunc stella Arcturus relinquens sacrum⁵⁵ flumen oceani primum apparens tota oritur summa nocte

Exemplum autem occasus acronici ponit pli: li: 18 ca: 31 dicens quarto nonas novembris arcturus occidit vesperi

De corde leonis ☾

Patet cor ☾ alexandrie tempore ptolo: ascendisse cum 4 ☾ occidisse autem cum 5 ☾ his cognitis sit propositum auctorum loca de orbitibus huius sideris explicare pli: li: 18 ca: 28 Tertio Calenda: augusti regia in pectore ☾ stella matutino caesari immergitur columella 4 calen: August: ☾ in pectore clare stellae exoriuntur Hoc tempore⁵⁶ [55v] sol erat in 4 et 5 G: ☾ Ergo plus et columella sunt intelligendi de ortu cosmico Notandum hoc loco cum stellae fuerint [in margin: Regula] in aequiptica aut parum ab ea elongatae harum quoque variari ortus in diversis horizontibus Ovid li: 1 fastorum dicit cor ☾ occidere 24 * februarii Quemadmodum et plin: inquit octavo calend: februarias stella regia in pectore ☾ occidit matutino sol erat hoc tempore in

⁵⁵M: ortu Acronico

⁵⁶M: Explicatio

4 et 5 ☾ et cor ☽ occidebat mane paululum ante ortum solis ergo cosmico occasu, si autem hii loci intelligantur de 20 stella cum ad praecisionem cum veritate consentiant

De pleiadibus

Ad elevationem alexandriae borealis terminus antecedentis lateris vergiliarum qui numero est 38 oriebatur cum 26 ♃ occidebat autem cum 3 ♄ et stella 33 exterior ac parva vergiliarum a septentrione oriebatur [56] oriebatur cum 27 ♃ et occidebat cum 5 ♄ verum romae illa oriebatur cum 24 ♃ et occidebat cum 4 ♄ Haec autem cum 23 ♃ ascendebat et cum 6 ♄ descendebat infra horizontem, proinde loca Authorum facile explicari poterunt Ovidius li: 4 fastorum de 2 D Aprilis Nox ubi transierit caelum rubescere primo coeperitur et tactae rore quaerentur aves Pleiades incipiens humeros relevare paternos qui 7 diei 6 tum esse solent hoc tempore sol erat in 12 fere ♃ Ergo cum ipse oriuntur cum 24 Arietis dicendum pleiades oriri cosmice id est paulo post solem ortum autem heliacum pleiadum his verbis describit Ovid li: 5 fastorum pleiades aspicias omnes totumque sororum, Agmen, ubi ante idus nox erit via sidus id est die 14 maii sole in 22 ♄ [56v]

☽ decreta persingulis

caeli stationes · Leopold⁵⁷ ·

In ascendente ☽ · * sub limitatem et fortunam secundum ☿ · suam cum

· ♀ is.

In · 2^a · augmentum substantiarum et fortunam maximum*

In · 3^a · acquisitionem profectus, appetitionem fidei et mentalem semper morum.

In · 4^{ta} · proficuum si est in signis igneis, vel aereis in terreis et aqueis sententiam et dic econtra

In · 5^{ta} · augmentationem filiorum, et liberationem ab omnibus adversis

In · 6 · fortitudinem infirmitatum, augmentationem servorum, et mutationem vestiarum.

In · 7 · societatem mulierum.

⁵⁷Leopold of Austria (active ca. 1271), judging from the contents this might have been taken from the very rare and unstudied *Liber regum de significationibus planetarum in 12 domiciliis* which was first brought to print in 1564 in Prague, The Hague and Cologne.

- In · 8 · fortitudinem vitae, paucitatem maeroris
 In · 9 · fidem secundum · ♀^{is} · qui cum eo sint boni et mali
 In · 10 · interrogationem de Deo altissime, et de re bona invisibili, et *
 sublimitatem reverentiam et fortunam in magisteriis
 In · 11 · nullum opus est in eo et  similiter
 In · 12 · augmentationem malorum et paucitatem fortunarum

 decreta persingulas caeli
 stationes. Leopold.

- In · 1^a ·  · eradicationem tribulationem, rerum diminutionem.
 In · 2^a · pauperitatem. et casum a solis a quibus non credit.
 In · 3^a · destructionem fratrem.
 In · 4^{ta} · penuriam et inquisitionem rerum absque profectum
 In · 5^{ta} · expulsionem filiorum et descensum horribilium in eos. vetustatem
 nescium et indigentiam filiorum.
 In · 6 · infirmitatem * servorum et ancillarum et debilitatem vestiarum.
 In · 7 · destructionem * fortitudinem inimicorum.
 In · 8 · mortem et reliquias mortuorum et perditionem
 In · 9 · fortitudinem mutationes, et paucitatem fidei
 In · 10 · depositionem pericula peregrinationem sine casum.
 In · 11 · nihil.
 In 12 · paucitatem malorum. Secundum haec dic et noli dubitare. Leopoldus
 · Author ·

ANNOTATA IN Alfraganum¹

Definitio Astronomiae²

Astronomia est doctrina divinitus hominibus tradita qua per Geometriam et Arithmeticam inquiri et declarat motus coeli et corporum caelestium, Unde ex consequenti omnes diversitates et vicissitudines apparentiarum propter stellarum motus, earumque ad se invicem et nos varias habitudines contingentium [salvat vocabulum artis significat Eius dings Rettung sein unnd uber dessen]³ salvat.⁴

Causae

Efficiens Causa est Deus, Deinde ratio vel mens humana, Deus enim excitavit ingenia praestantissimorum virorum ut se conferrent ad considerationem et inquisitionem naturae.⁵

Efficiens Instrumentale est Geometria et Arithmetica⁶

¹This lecture was surely inspired by the first printed Latin edition of Alfraganus' *Elementa Astronomica* in 1537. Johann Petreius, the same man who would later publish Copernicus' *De Revolutionibus*, published this text of Alfraganus' in two separate books, both in 1537: a) *Brevis ac per vtilis compilatio Alfragani Astronomorum peritissimi, totum id continens, quod ad rudimenta Astronomica est opportunum* and b) *Continentur in hoc libro: Rudimenta astronomica ... Item Albategnivi Astronomus ... De motu stellarum, ... Item Oratio introductoria in omnes scientias Mathematicas Ioannis de Regiomonte, ... Eiusdem utilissima introductio in elementa Euclidis Item Epistola Philippi Melanthonis nuncupatoria, ad Senatum Noribergensem.*

²P. 61, p. 60v is blank.

³“ ‘salvat’ is a terminus technicus which means the salvation of a thing and above it.”

⁴Note that this definition is almost exactly identical to that prefaced to the Sacrobosco lecture. This cross-reference is critical in establishing the provenance of the Sacrobosco lecture (see text p. 33).

⁵This is the first place where Rheticus mentions his ‘theory of illumination’. See text p. 46.

⁶That Geometry and Arithmetic are the wings which God has given us so that we might fly up and observe the heavenly motions is a recurring theme in Rheticus' - and Melanchthon's - writings. See Rheticus *A Preface to Arithmetic*, and Melanchthon's preface to Sacrobosco's *De Sphaera (Libellus Ioannis De Sacro Bvsto, de Anni ratione, seu ut vocatur*

Materia subiectum simplex huius doctrinae Aetherea regio, composita inquisitio motus primi mobilis.

Forma est ipsa methodus astronomiae sibi ubique consentiens.⁷ [61v]

Prior pars praefationis Aristotelis ad Al-
andrum περι κοσμου⁸

S[a]epe mihi divina quaedam et eximia res res philosophia visa est, Alexander, praecipue in ea parte in qua se in sublimes tollens ad contemplandam rerum naturam veritatem inquisivit cumque aliqui deterriti altitudine ac magnitudine rei omiserint hoc negotium⁹, ipsa non formidans illa dignas iudicavit res pulcherrimas in quibus elaboraret, earumque cognitionem duxit sibi maxime cognatam et convenientem esse, Nam cum coelum adire corpore et relicta terra locum illum prope contemplari non sit possibile sicuti olim Stolidi Aloadae¹⁰ facere conati sunt, omnia per philosophiam mente duce eo transcendit, et peregrinata est viamque invenit qua non defatigat et loca procul distantia cogitatione adiit, quia facile res cognatas cognoscere et divino mentis oculo res divinas aspicere et vaticinari hominibus poterat, idque fecit ut quantum possibile esset hominibus praestantissima dona liberaliter impartiret. - -

Ex [62]

Ex his patet quod non solum mens humana sit efficiens Astronomiae, si mens divinitus exuscitata, quae tanquam numen quoddam hominibus hac pulcherrimas et vere divinas disciplinas largita sit. hoc numen fuit hyparrho in ptholomeo, Peu[e]rbachio¹¹ @ -

vulgo, Computus Ecclesiasticus / Cum Praefatione Philippi Melanthonis., Wittenberg 1538.)

⁷Note that the method of approaching each subject with the four Aristotelian causes is also followed in the Plinius lecture. Rheticus use of this method is further proof of his profound interest in Aristotle, and helps us identify the provenance of the Plinius lecture.

⁸The following text [Sepe...Impartieret] was taken literally from the first paragraphs of *On the World*, which is now generally regarded as spurious.

⁹M: Sic quidam argumentatur quae supra nos nihil ad nos @ facilius tum est has artes contemni quam eas assequi.

¹⁰The Aloadae (Ottus and Ephialtes), mythical Giants who tried to reach heaven by piling Pelion on Ossa. Taken from the English trans. of *On the World* by D.J. Furley, 1955.

¹¹A further instance of Rheticus' 'theory of illumination' (see text p. 46).

Causa instrumentalis
Arithmetica et Geometria.

Arithmetica enim numerare docens qua possumus praedicere ☉ hoc tempore perventurum Eclipses, ortus et occasus stellarum. @ Geometria causas suppeditat

Materia circa quam

Subiectum simplex, aetherea regio, sicut physicae corpus naturale
Subiectum compositum, inquisitio motus caeli corporum caelestium et a primi mobilis id est stellarum fixarum et erraticarum, unde causae et rationes omnium apparentiarum caelestium pateant

Forma est ipsum esse

Astronomiae est ipsa methodus sibi ubique consentiens [62v]

I Doctrina primi mobilis

Secundo. Secundorum mobilium doctrinam de Sole, ☽ de reliquis planetis et octava sphaera,

Τὸ δῖοτι ptolomeus et qui eum sequuntur tradunt Το Τὸ ὄτι continet libellus de Sacrobusto, Author Theoricarum et hic tum alfraganus.

Το Τὸ ὄτι

doctrinale
simplex narratio
Sphericus libellus
Ioannis de sa
crobusto
Gromius*
Theorici

hinc ac
cedit cal
culatio

Instrumentale id est
globus astronomicus
Astrolabium sapheae
Quadrantes ariani
Aequatoria
Armillae,
Regulae Ptolomei

Causa finalis

Primo dicendum que nam res moverit Deum ut traderet hominibus astronomiam id est quod voluit in natura illustrari et cognosci. Paulus ad Ro: quantum de deo sciri potest manifestum est illis, Deus enim illis manifestavit invisibilia eius ex opificio mundi per ea quae facta sunt intellectu conspiciuntur, nempe sempiterna eius virtus et divinitas^{12, 13}.

Phi: [63]

Philip[pi] Melanch[thonis]

Sydera dum claro spectas labentia caelo
 Et signas oculis lucina nota tuis
 Vere aliquam mentem rebus qui cuncta guberent
 Et qui nostra videt facta praeesse scias.

Haec est principalis dei causa id est quae moverit eum ut aliquam doctrinam de his maximis rebus inter homines volverit.

Quae res moverit homines ad harum rerum inquisitionem?

I. Deus est impulsiva causa

II. Nam cupimus scire.

III. Propter dei inquisitionem.

Est denique finis ipsius astronomiae notitia, quemadmodum hominis ipsa actio virtutis.

Alfraganus ad Scipionem in somnis

¹²M: Hac pertinet illa sententia Iovis omnia plena.

¹³The *Vulgate* reads “1:19 quia quod notum est Dei manifestum est in illis Deus enim illis manifestavit 1:20 invisibilia enim ipsius a creatura mundi per ea quae facta sunt intellecta conspiciuntur sempiterna quoque eius virtus et divinitas ut sint inexcusabiles 1:21 quia cum cognovissent Deum non sicut Deum glorificaverunt aut gratias egerunt sed evanuerunt in cogitationibus suis et obscuratum est insipiens cor eorum” This passage was critical in Rheticus’ justifying the pursuit of astronomy as an understanding of the *invisibilia*, cf. also Rheticus’ *Treatise on Holy Scripture and the Motion of the Earth*, p.6, and p. 44ff. of my expository text.

Neque sermonibus vulgi te dederis nec proemiis humanis spem posueris rerum tuarum. tuis de illecebris, oportet ipsa virtus trahat ad verum decus.¹⁴

Habet etiam suas utilitates easque maximas.

Primo in civili vitae consuetudine In religione id est celebranda festa @
politia - His enim omnibus opus recta anni distributione. [63v]

Secunda utilitas

In studiis · Auctores intelligere poetas historigraphos · et ad omne genus
studiorum alacrior aliquis redditur · et in artibus liberalibus · - -

Septem sunt artes liberales
unde versus de officiis

Gra[mmatica] loquitur Dia[lectica] vera docet, Rhe[torica] verba colorat
Mu[sica] cavit, Ar[ithmetica] numerat, Geo[metria] ponderat As[tronomia]
colit astra

Tertia utilitas

Astronomia est fundamentum Astrologiae Ergo omnes utilitates Astrologiae
id est alterius physicae partis ad astronomiam quoque pertinet.

Publice & privatim conducit.

Publice

Privatim

¹⁴This is a poor reproduction of Cicero's *Somnium Scipionis*, 6.25. The original reads "neque te sermonibus vulgi dederis nec in praemiis humanis spem posueris rerum tuarum; suis te oportet inlecebris ipsa virtus trahat ad verum decus." (Loeb edition).

I. de satione fabarum

II. de plantatione

III. de calendario

I. Ad valitudinem¹⁵

II. ad mores¹⁶

III. ad vitantos eventus in
nostro corpore

Festa duplica mobilia et immobilia, mobilia, ut Jacob. immobilia ut pascha
Ponter.

Triplices sunt menses id est Lunares, Solares, et usuales.@ -

Septem Planetae

Luna, Hermes, Cipris [Cyprus]¹⁷, Sol, Mars, Iovis, Et pater huius
In p[64]

In prima differentiam

Alfragani

Diversa annorum genera

Tria annorum genera apud diversas nationes comperiuntur¹⁸. Annis Lunaribus
olim¹⁹ utebantur Romani ex institutione Numae pompilii ut testatur [P]Linus
11^{cam} aetate iis utuntur Arabes et Thurcae. C[a]eterum postea²⁰ iulius Casar
annum solarem constituit opera Sosigenis summi mathematici, atque tali

¹⁵The type of ‘health’ presented here in I. has to be distinguished from that ‘health’ which arises from a knowledge of medical astrology as presented in III. I. refers to the idea that through a knowledge of what our fate and role are we shall prosper and be healthy.

¹⁶Melanchthon and Rheticus frequently and passionately stated that a knowledge of the providence which God has set forth in the stars contributes to the mores of men as they shall then be more at peace and less uncertain (see sections II α , δ and ζ of my expository text).

¹⁷The island of Cyper was known for its worship of Venus.

¹⁸M: Tria annorum genera

¹⁹M: Primum genus

²⁰M: Secundus genus

anno adhuc Romanum imperium utitur. Tertium genus est mixtum quiddam²¹ ex solari et lunari anno, hoc usi sunt olim hebrei, et Greci, et nostro seculo ecclesia in ordinandis festis mobilibus hoc anno fere utitur.

Est autem annus \supset aris²² tempus continens \cdot 12 Lunationes aequales, hoc est spatium temporis quo Luna \cdot coniunctione media vel motu medio \cdot 12 duodecies soli coniungitur²³ Sed ex sententia Ptolomei una lunatio est \cdot 29 diebus \cdot 31 M \cdot 50 S \cdot 8 \cdot T \cdot \cdot Annus itaque Lunar²⁴ neglectis tertiis et quartis erit 354 \cdot diebus 22 M \cdot id est $1/5$ et $1/6$ diei naturalis ut inquit alphraganus. Annus [64v] Annus \odot aris²⁵ est tempus quo \odot vero motu totum Zodiacum perambulat, videlicet spatium 365 dierum, 5 horarum 49 Mi: 16 Secundorum et cum in civili consuetudine summa praecisa negligatur, Annus Solaris est in communi usu spatium 365 dierum et 6 horarum. Annum mixtum²⁶ autem vocare placuit eum quo usi sunt greci, antequam Romano imperio subiicerentur, hi enim numerabant menses a Luna eratque eis annus communis 12 Lunationum id est 354 dierum, sed quod intercalationes efficiebant ut singulis 19 annis, quibus utebantur 19 anni corresponderent aliquando nempe 13 Lunationes pro anno computando ut patet in Theodorao Gaza, qui has temporum rationes apud graecos observatas diligentissime explicat.

Mensis est triplex [Mensis triplex] id est usualis Lunar Solaris, Usualis qua utimur in calendariis []. Solaris duplex²⁷, medius et verus quo \odot unum signum conficit. Lunar²⁸ iterum est triplex primum per * rationes Ap[p]aritionis. Consecutanionis. [65]

Apud diversas gentes

²¹M: Tertium genus

²²M: Quid sit annus \supset aris?

²³M: Zodiacum perambulat si hoc non probat* à lector eius*

²⁴M: Annus \supset ari habent dies

²⁵M: Quid sit annus \odot aris?

²⁶M: Annus mixtus

²⁷M: Quotuplex \odot aris

²⁸M: Quotuplex iterum \supset aris?

diversa annorum initia

Arabes cum annis Lunaribus²⁹, utantur vaga habebunt annorum initia, Iam in vere annum inchoabunt, deinde in bruma, postea in authumno, denique in solstitio, prout ipsa fert computatio, Qui autem³⁰ solari anno utuntur, vel lunares ad solares reducant, a tempore quo ☉ aliquod cardinale punctum intrat, Annum auspicantur³¹ Aegyptiari ab intratu ☉ in √ Attici a³² solstitio, Asiatici ab³³ aequinoctio autumnali, Romani a³⁴ bruma, Sciendum etiam quemadmodum ecclesia numerat suos annos solares ab nativitate domini, Illa Arabes et Turcas³⁵ suos annos Lunares numerare, a die lationis legis Machameticae, qui fuit anno domini 621 dierum, ut patet in computo maiori

Diversa mensium genera

Tria sunt³⁶ mensium genera, menses solares, Lunares, et iuliles seu usuales Mensis ☉ aris³⁷ est duodecima pars anni solaris, videlicet spatium 30 dierum 12 horarum [65v]rarum · 29 Min: 6 Sec: · et hic mensis dicitur mensis solaris medius, quia hoc temporis spatio ☉ medio suo motu 12 Eclipticae partem perambulat. Mensis autem solaris verus³⁸ est spatium temporis quo ☉ secundum verum motum 1 signum peragrat. Hi menses sunt

²⁹M: Qui ☽ ari utuntur quo inchoant Annus

³⁰M: Qui ☉ ari anno utuntur quomodo inchoant annus

³¹M: Aegyptiari quomodo annum auspicari

³²M: Attici

³³M: Asiatici

³⁴M: Romani

³⁵M: Romani Quomodo Arabes et Turcae suos numerant ☽ ari

³⁶M: Mensis tria

³⁷M: Mensis ☉ aris medius

³⁸M: Mensis ☉ aris verus quid

inaequales quia linea veri motus in Zodiaco inaequaliter movetur. Menses \supset ares sunt³⁹ in triplici differentia vel enim sunt peragrorii, vel coniuunctionales vel apparitionis \odot . · peragrorii mensis⁴⁰ · qui et περιδοικωσ dicitur est spacium temporis quo \supset secundum medium motum ab uno eodemque puncto eclipticae ad idem redit et est 27 dierum 7 Ho: 43 M · 7 · S · Επεριοδοικωσ secundum verum motum \supset parum ab hoc tempore discedit ut patet istis diligentibus considerationibus. Ceterum mensis⁴¹ coniuunctionalis est spacium temporis quo \supset . \odot assequitur. Si fit relatio ad medios motus dicitur hic mensis lunatio aequalis est est⁴² dierum et partium, Dierum ut supra

Si autem [66] Si autem fit relatio ad veros motus varia accidit mensium diversitas, ita et mediam et veram coniuunctionem aliquibus etiam horae intercedant plures vel pauciores pro diversis positionibus Luminarium in suis circulis, ut patet in tabulis eclipsium.

Mensis apparitionis est spacium⁴³ temporis quo \supset post coniuunctionem veram cum \odot liberata de sub radiis \odot vesperi supra horizontem conspicua toto Zodiaco peragrato · iterum redit ad apparitionem post coniuunctionem veram peractam, hoc mensi olim, Numam pompilium usum esse⁴⁴ [Quis usus mense] in celebrandis festis, et de hoc indet alfraganus loqui. Alii definiunt mensem apparitionis esse tempus⁴⁵ ab apparitione post modum occultatum rediens ad coniuunctionem et hoc tempus generaliter loquendo est fere 26 dierum. qui autem cupiant utram speciem profecte determinare, legant 41 caput Albategnii⁴⁶.

³⁹M: Menses \supset ares triplices.——

⁴⁰M: Peragrorius

⁴¹M: 3 Coniuunctionalis

⁴²Double in original

⁴³M: Mensis apparitionis

⁴⁴M: Quis usus mense

⁴⁵M: Alia Definitio mensis apparitionis

⁴⁶Al-Battânî (858-929). This and the following references to Albategnius were most likely gleaned from the 1537 edition of Alfraganus which contained Albategnius' *De Motu Stellarum* and *De scientia astrorum* (full title given in footnote one).

Usualis Mensis⁴⁷ Porro menses usualis seu civilis vocamus eos quibus communiter gentes in Kalendariis utuntur hi autem vel congruunt mensibus alicuius Lunaris, ut Arbaum, et ceteris Lunaribus * fere consentiunt, nostri autem Solaribus non congruunt saltem civili institutione * numero dierum ut sunt menses germani* quibus nostra aetate utitur eclesia Nomina mensium studiosi petant ex Albategnii.

Varia intercalationis ratio

Qui utuntur anno solare quarto quoque anno [66v] unum diem intercalant id est inserunt calendario. constabit itaque annus coniunctionis 365 diebus, intercalaris autem seu bisextilis 366 diebus hoc tempore elapso ☉ iterum eisdem diebus ad eadem Zodiaci loca rediret si quantitas anni usualis praecise responderet tempori, quo ☉ Zodiacum perambulat, quod cum non fiat si aliquantulum singulis annis plus iusto intercaletur ut ex praedictis patet, sequitur in 334 annis intratus ☉ in principia⁴⁸ signorum per unum diem quemadmodum declarat Ioa: stefflerus⁴⁹ in suo calendario romano⁵⁰ propositione 38 Arabes autem⁵¹ annum communem pro 354 diebus computant id est 6 mensibus perfectis et 6 imperfectis Intercalarem⁵² autem pro 355 diebus, unde uno die addito septem mensibus perfectis et 5 imperfectis, annus intercalaris constabit. Ceterum quoties cunque minuta dierum collecta in annis rationibus superant 30 Mi: pro eis computat unum diem annumque intercalarem constituunt, Trigesime autem proprio⁵³ anno lunationes aequales ad eadem principia [67]cipia redeunt, ut patet Si qui autem haec copiosius tractata cupiunt legere, consulant [Cap. 15 fo. 168] computem maiorem Campani atque haec ad primam differentiam Alfragani sufficiant reliqua per se sunt manifesta.

⁴⁷M: The following section (Porro...Albategnii) was apparently written after Gugler had already wrote the title of the next chapter (Varia calculationis ratio), as it is written in the margin. It is unfortunately not possible to decipher it in a satisfactory manner.

⁴⁸M: Quot annis intratus ☉ in principio signorum anticipetur?

⁴⁹M: Iohann Stöffler

⁵⁰Stöffler's *Calendarium romanum magnum* was first published in 1518 and enjoyed several subsequent editions.

⁵¹M: Arabes quomodo coniunctionum computant

⁵²M: Quomodo intercalarem

⁵³M: Quando ☽ ationes aequales ad eadem principia redeunt.—

IN SECUNDAM
differentiam
Alfragani

In hac et sequentibus 4 differentiis⁵⁴ tradit generales sententias primi libri Ptolomei de habitudine terrae et caeli ad se invicem, et duplici caeli motu breviter declarat. a sexta usque ad⁵⁵ duodeciam differentiam principales locos 2 libri tradit, atque ita doctrinam primi mobilis absolvit. Reliquis autem et succedentibus differentiis, totum τὸ ὅτι universale secundorum mobilium compendiosissime persequitur, et optima quaeque XL Reliquorum liberorum ptolomei 18 saltem differentiis complectitur, Haec ut studiosi ordinem et generalem distributionem huius libelli teneant, qui quidem omnibus seculis a doctissimis quibusque summa in admiratione fuit.—

Porro [67v] Porro haec differentia quod⁵⁶ caelum sit sphaerum duobus argumentis praebat Alfraganus quorum haec est summa Argumentum Stellae orientes et occidentes item perpetuo apparentes moventur circulariter. Ergo caelum movetur circulariter & est figurae sphaericae, antecedens est manifestum, Consequentia valet, quia stellae moventur ad motum sui orbis cui sunt infixae, et Circularis motus proprie est solis figurae sphaericae ut patet in secundo de caelo et mundo.

Uno* id est 25 id est tam ad se invicem quam ad nos eandem habent habitudinem.

In volubilitate id est in velocitate motus. Ut capricornus Puto legendum ut ursus, quia parum ad rem facit Alpharkadam id est duas stellae lucidiores in ursa minori. ---

In circulo minus id est circa unum aliquod punctum, hoc est circa polum Quicquid vero est quae plus distat a polo mundi

Aliud argumentum

Si caelum esse extensum vel planum tunc aliquae partes caeli esse nobis proprioeres aliquae [68] remotiores, Item stellae alibi minores alibi maiores conspicerentur.

Sed manifestum est caelum undique aequaliter à nobis distare, stellasque in omnibus caeli partibus aequali magnitudine conspici Ergo caelum non est

⁵⁴M: Argumentum 4 sequentium differentiarum

⁵⁵M: Argumentum differentium a sexta usque ad

⁵⁶M: Summa huius Secundae differentiae

extensum si sphericum, Consequentia valet, Caelum enim non esse extensum patet à destructione consequentis ad destructionem antecedentis · quod autem sit sphericum sequitur ex definitione sphaerae Poterat tamen minor⁵⁷ per instantiam in dubium vocare siquidem in oriente vel occidente nonnunquam maiores conspiciuntur quam alibi ut in medio caeli. hanc obiectionem diluit ex principio obliquus ut patet in textu. Ceterum sunt et alia multa argumenta de caeli rotunditate, apud aristotelem de caelo et mundo et apud Ptolomeum in almagesto. Quae omnia in tres locos ab authore sphaerae contrahuntur, id est in argumentis a similitudine, commoditate et necessitate, probet idem et ptolomeus hoc argumento pulcherrime. Aparentiae caelestes solum circularibus et sphericis instrumentis reipsa vel [63v]vel potentia observari possunt, Ergo caelum est figurae sphaericae. Verum haec et alia huiusmodi studiosi ex suis authoribus petant Nobis enim erat satis narrationis seriem et authoris sententiam breviter in singulis differentiis explicuisse.

Et iterum maior constans ex antecedente et consequente.

Sed nihil horum Minor constat ex destructione antecedentis ad destructionem consequentis.

In Circulo hemispherii id est in horizonte

Quid autem omittit conclusionem quia in principio posuit. Sed tantum respondet ad obiectionem Minoris. -----

Apendix

Argumenta de caeli rotunditate, quo omnia argumenta tam apud aristotelem et Ptolomeum, quam apud amnes alios philosophos et mathematicos commode includuntur. Caelum habet omnes proprietates sphaerae seu orbis mobilis circa suos polos, neque quicquam in contrarium re ipsa sed per experientiam vel rationem adduci posset. Ergo Caelum et sphaera seu orbis mobilis Consequentia valet ex regula Cui convenit definitio convenit et definitum⁵⁸. Antecedens primo confirmo ipsa experientia, ut enim sicut proposito globo [69] globo astronomico et alero polorum supra horizontem elevato, patet stellas orientes et occidentes item perpetuo supra horizontem manentes circulariter circumferri, Orientes quidem et occidentes, in omnibus caeli locis eandem retinere habitudinem ad se invicem et ad Centrum globi, nunquam occidentes describere circulos circa polum maiores et minores pro varietate distantiae a polo ita in ipso caelo omnia nostris globis correspondent, neque ulla dissimilitudo apparat clarum et itaque caelum habet proprietates sphaerae

⁵⁷M: Occupatio

⁵⁸Rheticus would often employ this thought, cf. *Narratio Prima* (Gedani 1540, fol. H IIr) “D. Praeceptoris mei hypotheses τοῖς φαίνομένοις consentire videbis, ut etiam inter se tanquam bona definitio cum definito converti possint.” We also find the thought several times in the following *differentia* of this lecture. It’s origin is Aristotle’s *Topica*, VII, 2, 152b 40 and *ibid.* 5, 154b 1.

mobilis, haec res primo coegit homines statuere caelum esse rotundum, cum prius in Geometricis essent exercitati, Accessit deinde ratio idem comprobans multis aliis experimentis per instrumenta factis, ratiocinans etiam sphericam figuram convenientissimam esse caelo, vel propter velocitatem et diversitatem motus vel quia haec figura est prima, perfectissima capacissima, maximeque aeternitati apta Denique confutans ineptorum philosophorum et Epicureorum somnia quod omnino sit alterius figurae quam sphaericae, irrefragabiliter constituit. IN [69v]

IN TERTIAN[M] DIFFE rentiam⁵⁹

Hac differentia probat alfraganus unico argumento ex terra et aqua unum globum constitutum. Manifestum⁶⁰ corpus ex terra et aqua constitutum unica superficie perfecta rotunda sphaerica contineri Ergo hoc corpus est sphaera seu globus consequentia valet ex definitione sphaerae. Antecedens probat⁶¹ author Orientales citius habent diem meridiem et noctem mediam quam occidentales omnesque stellae et apparentiae citius conspiciuntur ab Orientalibus quam occidentalibus sub uno et eodem paralelo constitutis Estque haec diversitas proportionalis ad caelum ergo superficies terrae secundum longitudinem est rotunda. Porro pro processu a meridie ad septentrionem, polus proportionabiliter elevatur, mutanturque ortus et occasus syderum ut ratio concludit contingendum in corpore spherico. patet itaque et superficiem terrae a meridie ad septentrionem id est secundum latitudinem esse rotunda ex his sequitur superficiem terrae esse perfectae rotunditatis, quare et corpus ex aqua et terra [70] terra constitutum est globus seu sphaera.

IN QUARTAM DIF ferentiam

⁵⁹M: Quatuor Elementa Aer, ignis, aqua et Tellus sunt semina rerum

⁶⁰M: Argumenta quo probant terra esse sphaerica

⁶¹M: Probat antecedens

Hac differentia alfragnus⁶² duo proponit, primo⁶³ globum ex terra et aqua constitutum in medio universi contineri. Secundo⁶⁴ eundem esse centrum universi et respectu firmamenti puncti vicem obtinere. Utrumque autem hoc uno quasi argumento⁶⁵ probat Quam rationem habent ad se invicem globus et sphaera seu orbis quorum centrum sunt unita, item ipsum centrum sphere ad suam superficiem eam tenet globus ex terra et aqua constitutus ad caelum. Ergo globi terrestris centrum est centrum est unitum cum centro universi, ipse globus in medio consistit atque respectu firmamento puncti vicem obtinet Consequentia valet ex eo cui competit definitio huic competit etiam definitum. Antecedens probatur hoc modo immisso globulo in spheram seu orbem, patet huius globuli superficiem undique aequaliter a concava superficie orbis distare. Item proportionabiliter partes globuli correspondere partibus superficiei [70v]superficiei concavae orbis, cum econtra eductisque ex centro universi duabus lineis ad id constituentibus angulum contineri similes arcus circuli magni. Item omnes superficies planas intersecantes orbem et contingentes globulum aequales portiones de orbe abscindere. Centrum autem sphaerae, ita se habet ad spheram primo ut omnes superficies planae transientes per centrum sphaerae, et intersecantes eum intersecant in duas partes · aequales · utrumque tandem talis intersectio fiat. Secundo ut sit collatum ad superficiem tanquam punctum Denique ut sit immobile atque medium circa quod motus quiescat ut probat Aristoteles *περι οὐρανοῦ*. Sed primum proprietatem seu rationem, quam habet globulus orbi, ut dictum im[m]issus ad orbis concavam superficiem, constat globus terrae ad caelum habere ut patet ex his quae in 2 differentia dicta sunt, Et quia in omnibus terrae plagis stellae eiusdem conspiciuntur magnitudinis. Altera proprietas ex 3 innotescit . Tertiam experientiam comprobatur ubique enim [71] enim aequalem portionem conspiciamus, nempe medietatem caeli · Quare et prima proprietas centri constat. Secunda etsi ex praecedenti conatur, tamen etiam collatione globi terrae attribuntur. Constat · ut infra declarabitur, minimam stellam visu notabilem maiorem esse tota terra. Sed stella est punctum respectu firmamenti multo ergo magis terra est punctum ad firmamentum collata. Probant hoc omnes caelestes apparentiae. item centra instrumentorum, quae referunt centrum mundi Tertia, posito quod terrestris globus sit centrum in confesso erit philosophice loquendo, ut etiam ab auctore sphaerae probatur Clarum est itaque globum terrestrem ad caelum eandem habere rationem quam globus orbi missus et ad suum orbem quod

⁶²M: Argumentum huius differentiae.

⁶³M: Primo loco

⁶⁴M: secundo

⁶⁵M: Quod argumentum probat?

erat determinandum.

In Quintam differentiam

Hactenus de habitudine caeli et terrae ad se invicem, et cum probatum sit caelum moveri circulariter, ostendit breviter in hac differentia duplices caeli motus observari [71v]observari, Primi id est mobilis, et secundorum mobilium. Considerabunt autem diligenter studiosi quomodo istos motus describat, et invenient nullum in eo verbum frustra positum, Primo ponit absolutam descriptionem motus, dicendo ad quas mundi partes fiat super quibus polis. Deinde etiam effectus talis motis declarat, primo motu fierem diem et noctem item ut stellae in circulis paralelis moveantur · hic describit aequinoctialem, et eius officium indicat, quod sit mensura primi mobilis, Item unde nomen aequinoctialis sortitus sit · Secundo autem motu ostendit pulcherrime à ☉ describi Zodiacum et dilucide declarat quod sit Zodiacus, quomodo dividitur secundum longitudinem, quomodo in caelo iaceat, quod punctum vernale, autumnale, quae signa septentrionalia, quae australia, hic addit subtilior descriptionem coluri solstitiorum, iuxta 12 · 12 13 Secundi libri Theodosii. Hoc posito definit puncta solstitialia, et quod ac quanta ☉ maxima declinatio [72]declinatio, Postremo breviter concludit, et propositionem principalem huius differentiae repetit, atque si primam partem suae compilationis rudimentorum astronomiae absolvit NON tantum tamen quod in conclusione clarius admonet polos mundi esse immobiles Zodiaci autem primo motu circa mundi polos circum duci et quemadmodum in sphaera docetur ab eis circulos id polares dictos describi

Dicamusque etc.) Tria sunt consideranda anni motu primo, Terminus ad quem, Secundo, polos circa quos res volvitur, Tertio, velocitas motus, haec tria observantur in omnibus thëoricis.

Et motus secendus) Iam describit motum secundum id est planetarum qui fit sub Zodiaco.

Exeuntes id est distantes

Unius quantitatis id est per quartam circuli Unumquodque) Hic legendum puto, unumquemque ut intelligatur, circulum super suos circulos id est coluri.

De co[72v]

De coluro Solsticiorum

Posito in sphaera coluro solstiorum Alphraganus ei duos attribuit proprietates, antequam maximam declinationem definiat Primo inquit, quod tam aequinoctialem quam Zodiacum in aequalia secet, Deinde quod haec

intersectio fiat in punctis maxime declinantibus. Primum probat hoc modo Omnes duo circuli magni intersecantes⁶⁶ se in sphaera quorum unus transit per polos Alterius, intersecabunt se in punctis diametraliter apositis, unusque alterum in duo aequalia dividat⁶⁷ · sed colurus solstitiorum et aequinoctialis circuli magni sese in sphaera intersecant, et unus transit per polos alterius. Ergo⁶⁸ colurus solstitiorum secabit aequinoctialem in duas partes aequales, Item Zodiacum cum per utriusque polum ducatur. Maior demonstra ex 26 3 libri de triangulis Iohannis de regiomonte, et 12 · 2 · theodosii. Minor ex hypotesi patet. Valet igitur consequentia et quod de Zodiaco infertur

Altera autem proprietas ita patet. Omnis [73] Omnis
 circulus magnus⁶⁹ transiens per polos duorum circulorum se invicem in sphaera secantium, dividit utriusque portiones in duo aequalia, in punctis quibus circuli dati intersecantes se maxime a se invicem declinant. In sphaera autem Colurus⁷⁰ solstitiorum circulus magnus transit per polos aequinoctialis et Zodiaci circulorum magnorum intersecantium se in principio ·  et  · Colurus itaque⁷¹ Solstitiorum intersecabit eclipticam in principio  et aequinoctialem in 90 et 270 · * punctis Sed maxime à se invicem declinantibus Item Utrisque ab istis punctis ad intersectiones aequinoctialis et Zodiaci erunt portiones aequales id est quartae. Ex his etiam intelliguntur verba Alfragani describentis colurum solstitiorum, cum inquit Nominaturque circulus *. quasi diceret hic circulus nominatur descriptus super polos aequinoctialis et Zodiaci. Abscindens quemlibet per aequalia siquidem uterque transit per polos ipsius · puncta enim aequinocti[73v] aequinoctialia sunt poli coluri solstitiorum videtur autem Enigmatische loquuntur · sicut tamen pulchre et recte · nisi enim poli ipsius coluri essent in communi intersectione aequinoctialis et eclipticae  nunquam transiret per polos ipsius coluri, polo eius in aequinoctiali existente. Reliqua sunt facilia ut patet ex summaria huius differentiae.

Sicut enim) Maior primi argumenti

Cum autem) Minor Secundi argumenti

Iamque patuit) Conclusio huius differentiae. -----

⁶⁶M: Ma.

⁶⁷M: Mi.

⁶⁸M: Concl.

⁶⁹M: Ma.

⁷⁰M: Mi.

⁷¹M: Concl.

Interim legit ma
gister Ioahim spheram
procli. finito
proclo incepit
iterum al
fraganum.

IN SEXTAM DIF
ferentiam an
notata

In Se [74]

In Sextam differentiam

Sequentes 6 differentiae coherent et το τὸ ὄτι eorum quae in secundo almagesti ptolomei traduntur. Primo autem ostendat quantum terra secundam longitudinem et latitudinem sit habitabilis · et breviter enumerat universaliorae accedenta habitantum spheram rectam et spheram obliquam. His addit primo mensuram terrae hoc est quod * sit globi terrae circumferentia diameter et planities quartae habitabilis Secundo divisionem climatum quanta cum cuiusque initii modi, finis quantitas maximi diei et elevatio poli quot miliariorum cuiuslibet quantitas secundum latitudinem neque deorum provinciae urbes et insignora per loca sint in singulis climatibus breviter annotat Porro particulariora accidentia utriusque sphaerae tractans docet rationem ortus et occasus Zodiaci in utroque sphaerae situ quaeque sint causae inaequalitatis dierum naturalium atque sic feliciter generali το τὸ ὄτι primi mobilis a secunda differentia usque [74v] ad finem undecimae absolvimus. Ceterum haec differentia commode in 2 partes distribuetur · primo enim totam $\text{H}\gamma\omicron\upsilon\mu\epsilon\nu\text{H}\nu^{72}$ determinat per aequinoctialem et meridianum transeuntem per finem et initium $\text{TH}\zeta\text{H}\gamma\omicron\upsilon\mu\epsilon\nu\text{H}\sigma$ Orbis id est aequinoctialis Noctis atque dyei id est artificialis
Puncto id est centro
In direrecto[dirrecto] id est *
Axem id est polum quia noster author utitur axi pro polo
Secundum longitudinem id est ab oriente ad occidens
Latitudo id est a meridie ad septentrionem Circulum hemispherii id est horizontem vel elevationem poli.
Super Zenith capitis id est Zenith capitis est polus mundi
Zenith id est punctus verticalis unius cuiusque regionis.

⁷²Pres. part. of ἐγέομαι, 'to lead'.

Est in circulo hemisphaerae id est in horizonte Indirecte ascendentes id est paralelos Et quia) transitio ad sequentia.

Secundo vero recitat quae sit habitudo aequinoctialis et omnium circularum aequidistantium [75]tium in utroque sphaerae situ unde omnia alia accidentia quasi dependent inde enim patet qua ratione in utroque sphearae situ omnes stellae oriuntur, occidunt, supra et infra terram moventur, quae causae tam variarum vicissitudinum in tempore eorum qui habitant spheram rectam aut aliam atque aliam speciem sphaerae ab obliquae quibus ☉ transeat per Zenith quibus non transeat per Zenith , si sit aut perpetuo meridionalis ut nobis, aut perpetuo septentrionalis ut antipodibus, quare alii dicantur amphisci heteroscii, * atque numerata huiusmodi accidentia quae partim et hac a nostro authore reiciantur atque ab authore sphaerae cap · 3 partim vero a Geographis et Cosmographis quorum hoc et proprium copiosissime et elegantissime describuntur ut suo loco videbunt studiosi. Porro quia ipse author satis dillucide quod instituit prosequitur nobis in hac differantia sufficit generalem ipsius distribuionis mon[75v] monstrasse et ostendisse genus ex quo omnia ac[c]edentia utriusque sphaerae didicantur*, reliqua facile studiosi assequentur gernerere orationis diligenter excusso.

Universa quoque) accidentia in sphaera recta 3. Cum definitione

Volubilitas circuli id est motus aequinoctialis

Eruntque circuli hemispheri * Alterum accidens * vadunt * id est paralelos

Circulus autem) Accidentia sphaerae obliquae et primo pavit definitionem.

Circulus quoque) id est Quomodo aequinoctialem et reliquos circulos paralelos hoizon obliquus intersecat -----

Circulum hemispherii id est horizontem

Circulos in dirrecto positos · id est paralelos

Estque ex hoc quod diximus) Que sit utilitas huius speculationis

Medietates id est duas partes aequales

Initio ☉ id est in circulo tropico

IN SEPTIMAM differentiam an notata

In praeece[76] In praecedenti differentia ostendit accidentia et proprietates utriusque sphaerae et cum quaelibet diversitas seu species obliquae sphaerae, praeter illas praedictas · communes et universales passiones etiam suas peculiare proprietates habent · instituit author hanc differentiam in qua omnes diversitates sphaerae obliquae in 6 species contrahit, quorum et nonnullas proprietates declarat quod autem nullam tractationem de diversitatibus sphaerae rectae instituit fit quod diversitates sphaerae rectae potius numero differunt quam specie · haec igitur differentia recte in 6 partes

distribuetur · ut prima species sit eorum quorum Zenith est inter aequinoctialem et tropicum ☉ hi sub aliquo paralelo à sole descripto qui duobus locis Zodiacum intersecat habitant ergo bis per eorum Zenith ☉ in anno transibit et dicuntur amphisci id est utraque umbram habentes.

Et quanquam eadem accidant iis quorum Zenith est inter aequinoctialem et tro[76v]picum ☿ tamen recte facit noster author quod de iis saltem dicit et quia similibus est simile iudicium et quia solum hanc quartam septentrionalem supra determinata dixit esse habitabilem Secunda Itaque species obliquae sphaerae est eorum quorum Zenith est in tropico ☉ et elevatio poli aequalis maximae ☉ declinationi, Tertia eorum quorum Zenith est inter tropicum ☉, et circulum polarem ab elevatione 24 gradum usque ad 66, ut

Quarta eorum quorum Zenith est in circulo septentrionali · Quinta eorum quorum Zenith est inter polarem et polum mundi · Sexta eorum qui sub polo septentrionali habitant. et cum omnia in ipso textu sint facilliam, maxime si conferantur ad 3 locum 3 cap: Iohannis de Sacrobusto longiore huius differentiae explicatione ammissa quae circa 5 · speciem difficiliora videtur inter praelabimur. - In lo[77]

In locis autem) Secunda species.

Porro cetera.) Tertia species.

Item elongabitur ortus aestivalis ab ortu aequinoctiali quemadmodum etiam ortus hyemalis ab eodem ortu aequinoctiali arcum autem horizontis interceptum inter aequinoctialis ortum, et ortum alicuius puncti aequinoctialis vocant latitudinem ortus, tali arcu adiuvente invenitur elevatio poli, quantitatis diei, ascensio signorum, * quemadmodum docetur in 2 libro almagesti.

Donec perveniant) Quarta species

Si autem voluerit) Quinta species

Alfraganus dicit quod positio Zenith inter circulum polarem, arcticum, et polum mundi, intercipiatur partio quaedam Zodiaci, utrinque aequidistans à principio ☉, supra horizontem, et ex opposito alia portio huic similis infra horizontem utrinque aequidistans principio ☿ [77v] quamdiu autem ☉ fuerit in partia supra terram intercepta tam diu erit dies artificialis sine nocte. et quamdiu in portione opposita tamdiu nox sine die.

Circulum hemispherii id est aequinoctialis

Primum Clima

	Initum	Medium	Finis
Miliaria	Horae 12 3/4	13	13 1/4
439 1/6	Elevatio 12 3/4	16 2/3	20 1/2

Subtraho initum fine et producto procedo sicut regulam detri* 65 1/2 in medio

Secundum Clima

	Initum	Medium	Finis
Miliaria	horae 13 1/4[du.]	13 1/2	13 3/4
396 4/9	Elevatio 20 1/2[du]	24 1/4	29 1/2

Tertium Clima

	Initum	Medium	Finis
349 3/4	horae 33 2/5[du]	-14	14 1/4
302 7/9	Elevatio 27 1/2[du]	-30 7/10	33 2/3

Quartum Clima

	Initum	Medium	Finis
255 horae			
212 1/2 Elevatio		14 1/2	14 3/4
		36 2/3	39
		[79]	

Quintum Clima

	Initum	Medium	Finem
horae		15	15 1/4
Ele: 39		41 1/5	43 1/2

Sextum Clima

	Medium	Finis
	15 1/2	15 3/5

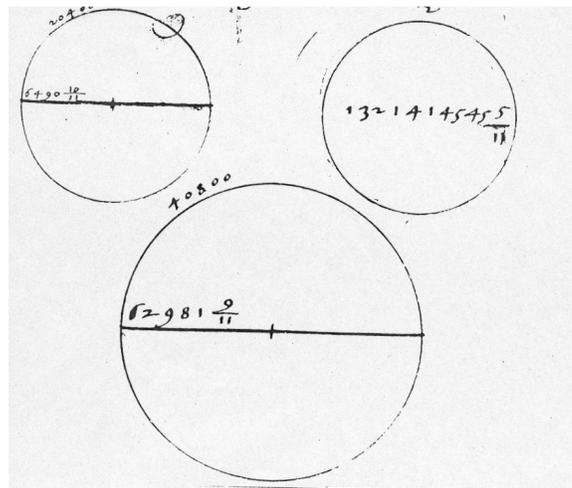
56

Ele: 43 1/2 45 2/5 47 1/14

Summa
2139 1/6

Septum Clima

Initum	Medium	Finis
47 1/4	16	16 1/4
Elevatio	48 2/3	50 1/2



IN NONAM DIF
ferentiam Alfragani
annotata

Medii diei id est meridiani

Primum Clima dicitur dia heroes in hoc climate sunt libia interior pars Aethiopiae sub aegipto pars Arabiae foelicis pars utriusque indiae intra et extra Ganniam fluvium Synarum regio * Secundum Clima dia fiene In hoc climate · Sunt pars utriusque Mauritanae et Tynganicae et Caesariensis, Getulia et deserta lybia pars africae minoris pars Numidiae Cyrenae et Marmaricae fere tota Aegyptus pars lybiae interioris. Arabicae felicis et Carmonia Gedrosiae et maior pars utriusque Indiae et regionis Synarum. -----
----Tertium Clima dia alexandrias vocatur in hoc climate sunt maior pars utriusque mauritaniae pars etiam affricae minoris et Numidiae et Cyrenae et

Marmaricae aliaqua etiam pars aegypti et Lybiae interiores [80] pars Cypri Insulae et Syriae tota fere Indea Arabia petrea Arabia deserta pars Babiloniae Susianae, Persidis carmaniae et Aria. Paropansi. Tota Trangiana, Aracosia et pars utriusque indiae et regionis Synarum.-----

Quartum Clima dia rhodon. In hoc est totum mare Mediterraneum cum suis insulis et regionibus ei collato calidus id est parte hispaniae quae dicitur bethicae et alia quae dicitur Car:

et parte utriusque maurithaniae numidia · affricae minoris marmaricae parte etiam illicadis* et Arthaniae* cum tota fere Sardinia Sycilia Epyro Achaia macedonia Eubonia Cum parte peloponense et Creta insula pars Asiae minoris Lypsiae* Gallaciae Capadociae utriusque armeniae id est maioris et minoris tota pamphilia et Cylicia Rodus et Cyprus Insulae pars Syriae mesopotamiae Arabice de[80v] deserta Babiloniae tota asyriae pars mediae sufiara* pars persidis* tota partia aria et paropamsis[paropamiscus] pars Hyrcaniae marchianae et Cyptae* quae est extra hymamn* montem pars Sericae regionis atque utriusque indiae.

Quintum Clima dia rames in ho[c] climata sunt tota fere hispania pars caltia* narbonensis Panoniae illicidis Dalmatia magna pars Italiae Daciae missiae* inferioris tota missia* superior tracia Geronesus pars macedoniae teleponesi Crete Pontus et Ithimia pars asiae minoris Gallacie Capadociae armeniae utriusque mediae Gyrraniae* tota fere margiana partriana pars Bodiana et utriusque scitie* Sarhorum* regio estque pars regionis seriae Sextum dia poristanies in hoc Climate sunt pars hispaniae Cararonensis quae dicitur pronuria* sancti Iacobi austriae napharra et Gasgonia tota fere gallia narbonensis et pars acitaniae* et [81] Galliae lugdinensis* pars germaniae et italiae Rhetia Vindelica Noricum panonia superiore et pars inferioris panoniae illicidis* utraque sarmatia Turcica Daria missia inferior pars asiae minoris tot Cholchis* hyberia Albania pars armeniae maioris mesopotamiae partriana utriusque Snyliae* et Sericae*

Septum Clima dia ripheon regiones huius Climatis sunt tota fere Gallia quatripartita magna Germonia pars capadociae* sarmacia asiae minoris et utriusque sylviae* atque fericae* regionis

IN DECIMAM

Differentiam an

notata

Haec differentia est plena eruditionis continet enim locum ex tota fere doctrina rerum caelestium dependit, nempe tractationem de ascensionibus signorum quam alii ut author sphaerae vocant doctrina de ortu et occasu secundum astronomos proponit autem hoc loco alfragnus generale [81v] saltem το τὸ ὄτι huius loci relinquens speciale iis qui tabulis propositis ascensionum signorum investigare docent ut Iohannes de regiomonte in tabulis directionum et tabulis primimobilis ** Porro haec differentia commode in 4 partes distribuitur. Principio enim definit quod sint circuli

dirrecti id est horizontes recti et circuli declivi id est horizontes obliqui et ostendit eclipticam inaequaliter oriri et occidere eo quod motu primi mobilis non super suos sicut super alios polos id est mundi circumvoluntur atque eam portionem aequinoctialis quae cum aliqua portione Zodiaci aut signo peroritur ascensionem signi vocari per tempora enim volubilitatis circuli aequinoctii diei intelliguntur gradus seu partes aequinoctialis penes quarum ascensum tempus mensuratur tempora autem). Quid est ascensio signi. Volubilitate id est motu

Hoc loco quoque sciendum dici signum in portionem eclipticae recte oriri, cum quo maior [82] maior portio aequinoctialis peroritur, obliquae cum quo minor, Item in tabulis ascensionum alicuius puncti eclipticae vocari arcum aequinoctialis · a puncto vernali usque ad punctum aequinoctialis cum dato puncto eclipticae coascendens, haec si consideratur ad horizonem rectum seu meridianum dicitur ascensio recta seu mediatio caeli, si ad obliquum dicitur ascensio obliqua. Secundo proponit · 4 · regulas de ascensionibus signorum in sphaera recta. **Prima.** Regula est in sphaera recta cum quartis eclipticae inchoatis à punctis aequinoctialibus et Solstitialibus coascendere praecisse quartas aequinoctialis conterminales, quia solum istae quartae aequalem et ad aequinoctialem et ad horizonem rectum habitudinem habent.

In Circulis autem) **Prima Regula** Secunda [82v] Secunda regula est partes inter medias istarum quartarum inaequaliter oriri determinatio huius regulae est quod quaelibet pars eclipticae quo magis ab aequinoctiali declinat eo etiam inaequabilius et ut proprie loquar rectius oritur Huc etiam pertinent ea quae dicit auctor sphere quod partes quartarum inchoantium à punctis aequinoctialibus tali ratione orientantur, ut cum qualibet talis alicuius quartae portione inchoatae à puncto aequinoctiali semper plus supra horizonem de ecliptica elevetur quam de aequinoctiali ita tamen ut in fine fiat coequatio. Econtra in quartis inchoatis à punctis Solstitialibus semper plus de aequinoctiali et minus de Zodiaco, facta tamen in fine coaequatione

Regula tertia est Arcus eclipticae aequales habentes declinationes aequales quoque habere ascensiones rectas siquidem aequales [83]quales inclinationes ad horizonem habent ex hac regula infertur ut est apud auctorem de sphaera Signa opposita habere aequales ascensiones rectas

Quarta Regula est · Cum qualibet medietate eclipticae in sphaera recta coascendere medietatem aequinoctialis conterminalem quae determinatur per circulum magnum transeuntem per polos mundi et intersecantem aequinoctialem et Zodiacum tanquam circulos magnos in medietates. Huius Regulae ratio patet Cum talis circuli plana superficies bis in die fiat eadem cum quolibet horizonte recta atque haec postrema regula est utilissima ut patebit. Eritque declinatio) **Tertia Regula.** Et similiter in utriusque) **Quarta Regula.**

In Circulo vero declivo @

Tertia pars huius differentiae est de Ascensionibus in sphaera obliqua. Sunt

autem 4 regulae, Quarum primam et quartam [83v] ponit Alfraganus · Prima regula cum immediati et praecedenti regula sphaerae rectae coherent quasi diceret cum in sphaera recta. cum singulis medietatibus Aecclipticae undicumque inchoatis medietates aequinoctiales conterminalis coascendant in sphaera obliqua duae solum[m]odo medietates ecclipticae sunt quae cum medietatibus aequinoctialis. sibi conterminalibus coascendunt videlicet medietates, quae incipiunt à duobus punctis aequinoctialibus siquidem principum  vel  propter communes istorum circularum inter se intersectiones cum eodem puncto aequinoctialis ad horizontem obliquum pervenit cum quo oriebatur in sphaera recta.

Secunda regula sit illa quam author de sphaera secundam facit quae desumpta est ex secunda alfragani quam nos quartam facimus in sphaera obliqua polo septentrionali elevato · partes ecclipticae [84] medietatis septentrionalis inchoatae à puncto vernali oriuntur oblique id est semper cum minori portione aequinoctialis maior Zodiaci perorta est · partes autem aeclipticae medietatis meridionalis inchoatae à puncto autumnali oriuntur recte id est semper cum maiori portione aequinoctialis minor portio Zodiaci perorta est haec Regula ad oculum patet in spherulis eamque author sphaerae declarat alia addita regula quod differentiae ascensionales auferantur ab ascensionibus rectis arcuum incipientium à puncto vernali medietatis septentrionalis et addantur ascensionibus rectis arcuum incipientium a puncto autumnali medietatis meridionalis. ----

Tertia Regula sit illa quae Iohanni de Sacrobusto et quarta id est decimanona propositio secundi Aepitomes qua inquit in Horizonte oblique quilibet duo arcus aequales a punctis aequinoctorum inchoati aequales [84v] habent ascensiones unde constat quoslibet 2 arcus ecclipticae aequales et aequaliter à punctis aequinoctorum distantes aequales habere ascensiones, patet quia tales arcus aequaliter ab aequinoctiali declinant et aequalem inclinationem ad horizontem habent sumuntur enim duo arcus aequales respectu eiusdem puncti aequinoctialis.

Quarta Regula continet habitudinem ascensionum sphaerae obliquae ad ascensiones sphaerae rectae estque determinatio praecedentis tertiae regulae in sphaera obliqua polo septentrionali elevato quilibet duo arcus in utroque latere aequidistantes a puncto vernali minuunt suas ascensiones ab ascensionibus sphaerae rectae a puncto autem autumnali augent in tantum in quantum arcus oppositi minuunt hinc deducitur signa seu partes aeclipticae in medietate ascendenti a puncto vernali inchoatas vel seorsum consideratas [85] oblique oriri in reliqua id est descendenti recte patet etiam aggregatum ex ascensionibus signorum oppositorum in sphaera obliqua aequale esse aggregato ex ascensionibus signorum appositorum in sphaera recta Similiter de aggregato signorum aequidistantium puncto solstitiali iudicandum.

τελος quaestionum
sphaerae a Magistro
Ioachimo dictata

In spheram secundo praelectam
dictata

[45; we read in the upper right hand corner: principium eruditionis] Traditur in hoc libro Isagoge seu introductio ad disciplinas mathematicas iusta ac aptissima methodo conscripta, sicut enim in aliis artibus principio elementa & initia praepone ut ab his ordine quodam veluti per gradus deducantur adolescentes ad alios authores, & perfectam artis doctrinam. Adolescentia enim opus habet initio quibusdam talibus compendiis ita hic liber tradit aptissime elementa istius physicae partis quae circa revolutionem coeli & observationes motus corporum celestium versatur. atque eo maiorem laudem hic author meretur quod haec omnia iustissimo atque aptissimo ordine complexus est, ita ut etiamsi non inesset [45v] tanta in ipsa verum cognitione utilitas, tamen haec methodus studiosos delectare posset, praeterea elegit ex longissimis aliorum commentariis certissimas demonstrationes certorum atque utilissimos locorum ut lectores habent scopum ad quem resisterent, neque istis vagis & confusaneis disputationibus turbarentur. proinde hic diligenter praestitit, quod in compendio fieri debet, summa enim huius artis iusto ordine, atque bona methodo, tradidit. Quemadmodum patebit lectori. Inscrispsit autem hunc librum Author de Sphaera materiali quia continet tractationem de mundo cuius figura [46] est spherica & ut adolescentes complecti animo summam rei commodius possent, proposuit illa discenda in instrumento quod habet picturam orbium & circulorum coelestium quod instrumentum vocatur sphaera materialis & quia hic liber est veluti expositio huius instrumenti itaque eodem modo hunc librum de sphaera materiali inscripsit. [46v; the following half-page is blank]

In re locum a facili nos petere aut rem factu valde facilem aut si magna res sit tunc eum virum esse ea praestantia tantum valere ingenio, virtute, opibus, gratia, & autoritate ut multo prorsus vel exiguo negotio possit praestare quod cupimus si tantum velit, Interdum cum difficultas apertior est quam et queat celeri dissimulari aut extenuari a ratione ait etiam cum oportet magnitudinem & difficultatem rei petitae exaggerate huc confugiendum est et dicat difficilia pulchra & digna esse conatibus atque industria & laude praestantium

fortiorumque virorum, tanto ampliorem accedere gloriam quanto maiori cura & labore aliquid expediatur ignavis & vilibus hominibus magis competere ut impendant operam cura faciliora quemadmodum Ovidius inquit,

In caussa facili cuivis licet esse diserto,
& minimae vires frangere quassa valent,
subruere est arces & stantia moenia virtus
quilibet [quamlibet in original] ignavi praecipitata premunt⁷³

Ad haec inuriam fieri eximiis heroibus si nugatia & cuilibet prompta rogemus atque ista tanta & dissimulata laudatio veluti urget & incitat eos ut pudeat recitare quod petitur.

[47^{r-v} blank] [48]

Epistolae petitoriae sic & commendativae[,]sic quia quamvis sicut deliberationes[,] argumenta sumunt ab honesto & vali** quae ubique plurimum momenti habent ea voluntas permoveatur ac incitetur animus [animum] ad studium rem aliquam suscipiendi & perficiendi diligenter susceptam propterea quod homines a iura sic sint facti ut iudicata a *** bona, honesta, salutaria, pulchra, laeta & praeclara, ament, appetant, prosequantur ac ea assequi aequis velisque contendant nec possint non iis sollicitari alliceri & pertrahi quocumque tandem ducant. Quoties igitur studemus quod movere mentes ac suadendo rem iuducere ut pareant ac acquiesunt nostris consiliis ut ultro sequantur quo cupiamus hac insistendum est via ut quam plurimam modi obiciamus et faciamus fidem magnum refert multum fructus, honoris, ingensque deus affere sit sic fanant qui admodum ostendimus. Contra vero si quid fugere, aversari homines volemus si onorari & deterreri prorsus ab incepto, a sententia, a re seu negotio quorumque ita obineatur oportet [48v] ut dicamus nisi desistat reperio futurum perniciosum, triste, miserum, allaturum insignia damna, ignominiam verum, famae honestique nobis iacturam, haec mala cum ante oculos statunt, & veluti solliitis computat articulis, quid utile, quid fructuosum, quid eximium, necesse est aminos flecti & rapi etiam eo quo vel inviti esset. Quare in argumentis petitoriis praecipue valet cum declaratur rem, quam quis petit honestam & dignam esse onus eo qui petit tum maxime eius persona qui rogatur studiose enim cavere debet ne videamur impudent petere, iniusta, iniqua & illicita, quemadmodum Cicero monet primam legem in Amicitia esse ne quid turpe, ipsi ab aliis rogemus nec rogati faciamus idem fieri convenit in loco utilitatis ne iudicetur aliquis rogare cum sibi quidem commodam sed gravem & pernitosam amico.⁷⁴ In primis rei petitur commoda si causa est eiusmodi ut idem patiatur, traduci

⁷³Ovid, *Tristia*, 3. II. 20-24.

⁷⁴*De amicitia*, XIII, 44 is much clearer: "Haec igitur prima lex amicitiae sancitur, ut ab amicis honesta petamus, amicorum causa honesta faciamus, ne exspectemus quidem, dum rogemur; studium semper adsit, cunctatio absit; consilium vero dare audeamus libere."

debent ad utilitatem rei publicae ostendendo ea praestari ad commum multorum usum & salutem non in unum virum sed in totam civitatem illum finem collocari & bene mereri amicum de reli[49]gione, de tota patria de pace & concordia publica, de literis, de legibus aliisque rebus praestantissimis quarum intersit ut impetres quod oras, Honestus autem potissimum pendet ex loco communi de liberalitate seu beneficentia homines hominum causa natos, non humanitatis solum sed propter Deum divinum esse mortalem iuvare mortale subvenire temnoribus promovere egregios conatus imbecillium item ex loco communi de Amicitia quod postulet verus amor ne amicus amico desit, cum eius opera opus habet, hic simul necessitas nostra ait aliorum est amplificanda necessitatem sicut honestatem quoque & utilitatem valde ponderant circumstantiae variae porro quemadmodum dederet rogare pugnancia cum officio boni viri & indigna humanitate atque virtutibus, ita nefas est contendere ab amicis, quod videatur effectum difficillimum aut omnino impossibile & aegre plerunque operam nostramque pollicemur vix adducimus ut quid ad nos recipiamus magna difficultate proposita impossibilia vero nullam admittunt omnino deliberationem ac quidem impudentiae datur bonos viros nimium gravare oportebit igitur praecipue *** [49v]

tres mercatores lucrati sunt 380 aureos quos ita dividitur ut quoties primus recepit - 7 - toties secundus recipit 3 & quoties item recipit secundus 8 toties tertius recipit 5. Hi quatuor numeri in tres reducendi sint hoc modo
His tres simul coniuncti divisorem constituunt

95	56	
95	24	380
95	15	

[50]

Nam 6 idus Aprilis libra chronice oritur id est vesperi sol enim tunc in Ariete. Orion autem chronice occidit id est una cum sole

Quae sunt pugnancia?

Quies seu cessatio

—
Ideo bona opera praecipuntur haec primum deus nihil agat nemi** neque nisi a per nos per quasi per instrumenta *** et *** Deinde — ne fides vestra esse quieta & — nullus perferret fructus sive *** **

Postquam agnitis ex lege peccatis sumus perterrefacti & sentimus nos propter transgressionem legis *** eternae damna nobis factos non desperandi est sed confugiendum est ad evangelium hoc est ad misericordiam & bonitatem Christi neque dubitandum enim Christi qui ideo vicit periculae

diaboli & omnia mala ut nobis nostra peccata vestra remissurum *** & salvaturum.

[Calculations]

[50v]

Quart — sphaera terta sunt Quia ascensiones illorum arcuum quos sol motu proprio singulis diebus confint sunt inaequales — sed illis ascensionibus responder — inaequale. Quid est dies naturalis. espacium termporis quod est inter duos ortus atis videlicet 24 horarum — Quod est dies artificialis est spacium temporis quod est inter ortum & occasum solis. Quid est hora est spacium temporis quo ascendunt 15 gradii aequonotialis circuli.

Si fides valet propter

adest terrii adest — ergo propria

**

polus occidente
necesse est esse
substantia

Cicero propter eloquentiam
hominibus est admirandi
ergo eloquentiam —
admirantur quam ----

Substantiam magis
sunt enim nescio
quo modo

End of the questions on the Sphere
read by Magister Joachim

Lecture on the Sphere
read for a second time

[45]

The beginning of erudition

An Isagogue or introduction to the mathematical disciplines is given in this book. Written in a just and apt manner, it sets forth the beginnings and elements, just like in the other arts, so that the adolescents will be led from these, by a given order, as by degrees, to other authors and a perfect doctrine of the art. For Adolescence must first gain entrance to such compendiums, thus this book aptly teaches the elements of that part of physics which concerns itself with the revolution of heaven and the observations of the motion of the celestial bodies. And in this regard does our author merit the highest praise, as he has put all this together in the most just and apt order, such that even if it indeed lacks [45v] great use in the science, the method may nevertheless please students. Furthermore, it selects the most certain demonstrations of the certain and most useful loci found in the very extensive commentaries of other authors, so that its readers might have a foundation upon which they may rest, and not be unsettled by these vague and confusing disputations. It thus excels in this regard, as a compendium should. For it teaches the gist of this art in a just order and with a good method. As will become clear to the reader.

The author named this book ‘On the Material Sphere’ however because it contains a treatment of the world whose figure [46] is spherical, and so that adolescents may easily grasp the heart of the matter in their souls. He intended to teach this matter in the instrument, called the ‘material sphere’ which has a picture of the orbs and celestial circles. And because this book is like an exposition of this instrument he thus named this book ‘On the Material Sphere’ in this manner. [the following half-page is blank]

[46v]

We seek an easy explanation, either an easy subject matter or, if it is a great matter, then this man through excellence he is capable of the task, in mind, virtue, deeds, agreeableness and authority, so that he can excel much further or with little trouble in that which we desire, if he wishes such. Sometimes, when the difficulty is manifest, and he wishes it to be ignored forthwith or

that it be extended by reason, he says so. For it is becoming of the magnitude and difficulty of the thing sought to take refuge in its enormity. As one says, the difficult, beautiful and worthy are for the attempts, industry and praise of the most excellent and strong men. The greater the cause and labor it demands the greater the glory it acquires. Lazy and vile people rather compete with one another and impeded the work with a lighter cause. As Ovid said:

Any given person can be eloquent in an easy matter
and one can easily crush that which is weak
virtue is to bring down arches and towering walls
Any sloth can push over that which has already fallen¹

This injury comes to great heroes if we ask for trifles, any given obvious thing, and such a dissimulated laudatio as this, as it urges and incites those persons so that that may be read which is asked for.

[47^{r-v} blank]

[48]

The sollicitory and thus also the commendatory letters, as they are like deliberations, take their arguments from the honored and strong which always carry great weight. The will is persuaded and the soul is incited to take up and perfect a given inclination. It is taken up diligently because men are naturally so created that they love, desire and follow good, honorable, sound, beautiful, pleasant and excellent judgements, and they grasp these and pursue them with tempered sails, nor can they not be roused, drawn, and driven to where they might lead. Thus, insofar as we study that which moves minds and induces them to commend a thing, they should heed and acquiesce to our counsels so they might further follow the path we desire. We must stick to this path; and because we present it in such a variety of ways we create great faith, it produces an abundance of fruit and honor. And as so much is to be given to God, they are to consecrate in the way we demonstrate. On the other hand, we wish men to flee and turn away from something if it is onerous an further deters from its inception, from an opinion, or a thing, or a business, and of which is thought of as such, so that we must say that if it does not desist I see future destructiveness, sorrow, misery, damning distinguishing marks shall be brought to bear, true ignominy, our reputation and honor ruined. When these evils stand before our eyes, and add up even with uneasy fingers, what is useful, what is fruitful, what is distinguished, it is necessary that souls are turned and lead to this, even if unwillingly. For which reason it is particularly important in sollicitory arguments that a matter be declared which is

¹Ovid, *Tristia*, 3. II. 20-24.

honorable and dignified to the listener, a burden to him who seeks it, for then this person will be especially asked. This should be studiously provided for so that we do not appear impudent to ask unjust, inequitable, illicit things. Cicero admonishes to this extent that the first law of friendship is that we do not ask for anything unseemly to the person. We also require this from others. Nor should we have to be asked when a question of use arises. It is not proper to ask someone for something when it is beneficial to one's self but grave and pernicious for the friend.² It is particularly proper when asking for something if the cause is such that it capable of being transposed to the good of the state, it is to be shown [to the person being asked] that this is of service to the common good of many and the health not of one man, but to the entire society. That that end be instituted and the friend well-deserved, on religion, the entire fatherland, on peace & public concord, on letters, on laws and other important matters on which it is of great importance that you accomplish what you say. A gentleman however judges best from the common locus on liberality and kindness, men are born on account of men, not only for humanity, but because God is divine the mortal helps the mortal, to succor the despised, to support the admirable attempts of imbeciles, likewise from the common locus concerning friendship which postulates that true love for a friend may not be lacking in a friend, as that is his duty, it also says in this place that our friendship is to be expanded to the friendship of others even as various circumstance weigh heavily upon honor and advantage. Further, in the manner in which it endangers to ask things contrary to the office of the good man & things indignant to humanity and the virtues, so is it loathsome to contend with friends because it would appear to be the worst result, entirely impossible and sick. And we promise that we will hardly claim the greater part of our work to be ours so that when we claim something it is publicly accepted with the greatest difficulty. Impossible matters however can be given absolutely no deliberation, and indeed anything of impudence given to good men will burden so much that it will therefore be particularly opposed.

[49v]

Three merchants make 380 gold coins which they divide in such a way that each time the first receives 7 the second receives 3 and every time the second receives 8 the third receives 5. These four numbers are to be reduced to three in the following manner.

These three joined together constitute the divisor.

²*De amicitia*, XIII, 44. The original differs somewhat: So let this be enacted as the first law of friendship--to seek what is honorable from our friends, to do what is honorable for them, and not even to wait until we are asked. Let zeal ever be present, and hesitation absent;

95	56	
95	24	380
95	15	

[50]

For on the 6th ide of April Libra rise chronically, that is because the sun is in Aries in the evening. Orion however sets chronically, that is one with the Sun.

What are the Opposites?

Rest or cessation

—

Good works are known in advance first of all because God doesn't do anything with anyone if not through us as through an instrument.

Further, so that our faith will not be quiet and will bring forth much fruit... [text illegible]

After we have understood from the law of sin we are shaken and recognize ourselves a being damned eternally for the transgression of the law, we are not to despair but to take refuge in the Evangelium, that is in the compassion and goodness of Christ - nor is Christ to be doubted - who conquers the dangers of the devil and all evils so that our sins will be rescinded and we shall be saved.

[50v]

[further excerpt from the sphere]

In the Year 1540

Lecture on the Sphere of Sacrobosco¹

I've once again been ordered to read the little book on the Sphere, on account of the young men who have yet to hear these elements. There are however many significant reason why these very known and familiar elements are so useful to the liberal arts.

For even though not all can dwell in the doctrine concerning the celestial motions, and the injustice of fortune or the large amount of business drives many away from these studies: it is nevertheless necessary for the liberal mind to know these first elements, so that, when observing the heavens, we are no longer ignorant of this our home which not only provides us with living quarters, but also nourishes us in its light and effects the very kind changes of the seasons.

Is it not barbaric to not at all know the path of the Sun is, in which intervals it effects the differences of the lengths of the days, where it comes towards us, from where it recedes, which regions of heaven distinguish for us the parts of the earth so that we can see the positions of the distances between places in our souls?

Kings and Princes must nevertheless pay heed to this doctrine in such occupations, as Caesar says about himself in Lucan:

Amidst the combat I always
dedicated myself to the superior regions of the stars and of heaven²

King Matthias of Pannonia And Maximilian were so erudite in this doctrine that they were able to bring forth masters of the art.

I know that also in our times the Emperor Carl, King Ferdinand, the King of France and the King of England not only take pleasure in this philosophy, but also grasp the greater part of it. Young men who have been endowed with a liberal nature should be moved by the judgements and examples of such princes so that they likewise seek out these so very sweet arts.

In Plutarch, as Circe bring back the human form to Ulysses' colleagues, Grylius asks to be turned back into a pig, stating that the life of pigs is much more pleasant than that of humans.

¹Given the title "In praelectionem sphaerae" in: Scriptorum publice propositorum a professoribus in Academia Witebergensi ab anno 1540 usque ad annum 1553 tomus I, Wittenberg 1560, pp. E4^v-E5^r.

²Author's translation (for purposes of a more literal translation). From: M. Annaei Lucani *Pharsalia*, Book X, lines 184-85. Rheticus also quotes this in his *Oration on Astronomy and Geography*.

So perhaps some will prefer luxury, the passions and other sordid matters to these great matters.

Yet I not only highly admonish good characters, but I even implore them to learn these elements, particularly because they are so easy, even if they have the task of discovering this for themselves. And even if it is laborious, the pleasure prevents it from becoming tedious, and the labor is compensated by its great utility.

Joachimus Rheticus
Rector

In the Year 1540

Lecture on Alfraganus¹

Johann Regiomontanus - who was endowed with a certain divine mental power - brought such a light to mathematicians that he can be counted among the class of the ancient great masters of the art. As he was brought to Italy by the Greek cardinal Bessarion, he stayed there awhile in Padua where he taught the little book of Alfraganus in the flourishing Academy and among learned men. For he saw that Ptolemy's prolix demonstrations were not always to be taught. The master rather wanted to address the needs of the students, and, because he didn't want to further teach the vulgar and feeble elements, he decided on a commentary of Alfraganus, judging it to be superior to Johann de Sacrobosco and similar books which contain the beginnings of Astronomy.

I prefaced this such so that the scholastics would be invited to the study of Alfraganus by the judgement and authority of Johann Regiomontanus. For I don't think that any greater testimony can be given for this author than by that man whom all learned men in Germany and Italy freely regard as the greatest in these arts, and who gave himself to the study of the Greek language so that he could study the founts of this doctrine and perfectly understand and explicate its authors.

The authority of Regiomontanus thus moves the students to love and diligently study Alfraganus. He is also useful to beginners as he sets forth the elements. As he does this we shall have occasion to repeat these matters which are taught in the little book of Sacrobosco. Other matters also turn up which will bring those forward who have already studied the elements, the more learned will also profit from them. And even though I measure my every step, and know myself to be a Tyrolian in these disciplines, I shall nevertheless complete it with God's help so that I can clearly explicate this commentary with my own mediocre abilities.

The greatest praise in these arts is perspicuity and simplicity. Thus the occupation with these accustoms minds to also love simplicity and perspicuity in other disciplines. The utility and sweetness of these matters incites listeners to understand this commentary. For it is clear that the doctrine of celestial movements is useful in many parts of life, as has often been said on other occasions. And those of not monstrous natures must

¹Scriptorum publice propositorum a professoribus in Academia Witebergensi ab anno 1540 usque ad annum 1553 tomus I, Wittenberg 1560, pp. C4^v-C5^v.

admit that nothing is sweeter and more pleasant than this philosophy. For as it brings us to the knowledge of God, and to view perpetual beings and the causes of change in nature, the cognizance of which the human mind vehemently desires, it brings forth amazing pleasures. Yet these matters are often addressed on other occasions.

Magister Joachim Rheticus

[Lecture on Ptolemy]¹

Peace is the greatest of all things which man was given to know, one peace is greater than innumerable triumphs.

Yet to use such a good men must polish and adorn the churches, educate the youth, improve the mores. Should this fail to happen however, and leisure invites pleasures, idleness and many vices, we should not wonder that wars arise. We thus beg God for peace, so that we might use it well, and those in power be more severe in the discipline of defense, the churches be polished, and that we cultivate letters and the necessary arts of life in very vigorous study.

We will more easily be able to attain peace from God if we do this. With what great worry we should beseech God becomes particularly clear in those places where the study of doctrine was destroyed by the Turkish wars, where it had once flourished at its greatest, in Egypt, Asia [minor] and Greece. Even that great Attic state which was the nurse of the arts collapsed to such a degree that the place where it once stood can now hardly be pointed out.

Thus, so that we may excite the study of the ingenious, we shall explain (with God's help) that writing of which I almost risk to say that it is by far the most beautiful of human works, Ptolemy's τὸν μέγαν σύνταξιν Which contains the complete doctrine on the celestial movements. All truly know the knowledge of this doctrine to be pleasant and sweet. For the human mind comes from heaven, it takes pleasure in the cognition of heavenly things as in the sight of the fatherland.

Yet there are many other reasons which commend us to this study. For as God affirms that the stars were made to be signs and measures of the year and the changes of the seasons, he certainly wants us to view the stars and observe their motions. For the ends of the year are constituted in vain without being observed. Consider further this: how great would the confusion of life be, if the ratio of the year was unknown, and if we were unable to understand in our souls and comprehend the time spans of past generations and the series of histories? What shadows of religions and great things would there be?

There are also other not unimportant uses in the significations of Physical things. For is it not absurd to believe that this amazing and certain variation of motions was instituted in vain by God?

This doctrine of motions is thus to be sought, which I shall diligently

¹Scriptorum publice propositorum a professoribus in Academia Witebergensi ab anno 1540 usque ad annum 1553 tomus I, Wittenberg 1560, pp.C7^r-C8^r. This lecture is given without title as "ALIA." A copy of this lecture announcement was also published separately in 1542. It was later to be published in E. Kästner's *Geschichte der Mathematik*, Vol. I, 1796, pp.706-707, who owned a private copy.

explain with my mediocre abilities, in this lecture of Ptolemy. God gave man shadow doctrines of the form of these matters, and he gave numbers and measures so that we could recognize the mind to be the creator of such a marvelous machine, and that he wants to be investigated and cultivated by us. I shall begin however with the explication of Ptolemy next Thursday.

Magister Joachim Rheticus

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[111]

Quid est Deus? Caput primum

Est una quaedam infinita aeterna & optima mens, prima causa, motus in hac tota rerum universitate

Quid est mundus?

Est compages (ut ait Aristoteles) caelestium atque inferiorum corporum apte distributorum, continens animantia, atque caeteras naturas, quae in singulis partibus procreantur et existunt

Quot sunt mundi?

Unus est enim mundus, et probatur hoc modo, Unus mundus capax est omnium corporum frustra ergo fierent plures mundi, nam frustra fit per plura, quod per pauciora fieri potest. Alia probatio, sicut est unus primus & aeternus motus, ita unus [111v] quoque est corpus, quod hoc motu aeterna movetur, et per consequens unus enim est mundus

Est ne mundus finitus vel infinitus?

Mundus est finitus¹, caelum hoc est figurae sphaericae, Ergo est finitus. Omnis nam superficies cuiuscunque figurae finem & terminum habet, alioqui non esset figura

¹M: Corpus finitum

Quae est forma mundi?

Est sphaerica et rotunda², perfectissima nam corporis est figura perfectissima omnium corporis, Mundus est perfectissimus atque absolutissimus Ergo mundi forma est sphaerica, nam sicut circulus figurarum planetarum prima ac perfectissima existit ita quoque sphaera solidarum [112]

Quid est motus mundi? caput 3³

Mundus est formae sphaericae, & inenarrabili celeritate in 24 horis circumagitur. Ergo eius motus quoque erit sphaericus, nam sphaericam corpus, motu sphaerico moveri necesse est.

Quis est sonus seu qualem efficiunt sonum astra sua circumvolutione?

Etsi minora corpora apud nos efficiunt sonum, non ideo probari potest caelum quoque sonitum edere, nam sonum quem edunt minora corpora apud nos causatur ex alritu et collisione duorum corporum astra neque colliduntur neque atternuntur, Ergo non edunt sonitus

Unde dicitur mundus? caput 4

Ab ornatu & elegancia, nam ut latini mundum ab ornatu ita graeci κόσμον ἀρ[112v]pellant, propterea quod nihil pulchrius excogitari potest ipsa corporum natura

Ex quibus constat mundus? caput 5

Ex aethere & elementis

Quot sunt corpora simplicia?

²M: Caput Secundum

³Ie. Chapter 5 of Pliny's second book.

5 · Caelum, ignis, aqua aër terra, Et sunt duplicia, scilicet Alia sunt quae nullam mixtionem sustinent ut caelum, Alia vero sunt que sua commixtione, diversas formas corporum producant, Et sunt quatuor elementa

Quid est caelum seu quid est materia caeli?

Principio constat caelum non constare ex elementis, non nam sustinet nec recipit contrarias elementorum qualitates, non mutuatur non alteratur, non incalescit non corrumpitur, sed una quadam continua agita[113]tione circumfertur, quod nullo modo circumferri posset, si ex elementis constaret Ergo necesse aliam quandam materiam caeli esse quam elementarem

Quae est ergo?

Qualis illa sit non satis explicari potest, nisi quod quodam dicunt, esse illius materiam partem aëris tenuissimam ac purissimam, quam alio nomine aetherea vocant.

Quid est ignis?

Est quatuor elementarum, primus est nam sua natura levissima atque supremum sibi locum legit in ante. Ut ait Ovidius lib. 1 Meta.⁴

Quae est natura seu complexio ignis

Calida & sicca. Est nam officium eius proprium ut in commixtione corporum calidum cum sicco naturaliter commisceatur [113v]

Quid est aër?

Est secundum ab igne, levior aliquantulum terra & aqua, onerosior autem igne ut ait Ovidius⁵ Eius vera natura est calida & humida officium vero

⁴Ov. Met. 1.26

⁵Op. cit.

rarificet et transibilia reddat

Quid est aqua?

Est tertium elementorum terram ita circumdans ut cum ea integrum globum conficiat

Quid est eius natura?

Frigida & humida, et naturaliter terram circumdit. Cuius officium est coniungere et cogere corpora coniungit enim sicca ne debebantur

Quid est terra?

Est quartum elementorum in medio universi mundi situm, quod aqua undique alluitur parva parte in inuncta relictis ad vita animantium [114] tuendam

Quae est eius natura?

frigida et sicca. cuius officium est ut retineat formas impressas

Quae est natura ignis?

Qualis illa sit non constat, nisi quod quidam dicunt, caelum et ignem eandem habere naturam, ideo ait Plinius Ignem ob id summum esse elementarum⁶, et cum caelo coniunctum, quod caelum cognatum sit, et stellae sint igniculi quidem, ut ait Virgilius quem Venus ait alias astrorum diligit ignes *** Aristoteles negat caeli materia elementarem esse ut diximus

Cur terra est immobilis in medio universi?

Quia se habet ad primam sphaeram, quam primum mobile vocamus, velut contrum Si ergo est centrum, necesse [144v] est illam in uno certo loco

⁶M: Ignis ideo supremum locum obtinet quia summum elementarum est purissima et levissima

firmam et fixam consistere

Quot sunt sphaerae?

Veteres enim ordo posuerunt propterea quod hae in oculos incurrant scilicet sphaerae 7 planetarum, et caelum quod alio nomine primum mobile vocantur, diligentiores autem harum artium qui posuerant, viderunt nam stellas fixas duplici motu moveri, tam in latitudinem quam in longitudinem, et hae in primum orbem infixae sunt.

Quid autem tenendum de istis sphaeris?

Non debemus existimare tales machinas existere in caelo quales hic finguntur tum haec ratione ad docendum accommodata est.

caput 6 Quid sunt planetae & quot?

Sunt septem stellae propriis motibus incidentes, de quarum [115] numero incerta est sententia

Quid est ordo et nomina eorum?

Septem sunt orbis sese complectentes invicem atque coherentes a globo. Contiguus semper est saturni circulus positus, huic proximus jovis, post jovum martis, adhuc rursus Mercurii, secundum luciferi orbis est, ab eo est orbis solis et denique lunae

Quis est motus et qualis illorum orbium?

Summus orbis vehitur ab ortu in occasum, et quotidie circumvolvitur et secum rapit inferiores orbis, hi inter in proprio quodam motu ac tardiore contra vehitur ab occasu in ortum, atque idea errantia dicuntur sydera, etiamsi non errent, habent nam sui motus leges certissimas

Quotuplices sunt stellae [115v]

stellae bifariam dividuntur scilicet in stellas fixas et erraticas

Quae sunt fixae?

Quae certa et uniformi et regulari motu circumferuntur

Quae dicuntur errantes?

Quae diversis ac variis motibus circumferuntur, quae et planetae dicuntur a $\pi\omicron\lambda\omicron\nu\acute{\alpha}\omega\mu\alpha$ id est erro non nam regulari cursu mundi incedunt sed in contrariam partem abeunt, alique ratione circumferuntur quamquam stellae fixae itaque de illarum motu pauca dicuntur

Quis est motus stellarum fixarum?

Caelestes sphaerae circumferuntur motu uno ab oriente in occidentem qui motus proprius et regularis est primae et supremae sphaerae et omnium stellarum fixarum, quae suum cursum constituunt videlicet 24 horis hoc est die naturali [116]

Quis est motus erraticarum stellarum?

Huic plane contrarius, videlicet ab occidente in orientem, hoc motu diversa dierum spatia fiunt.

Quare non eodem ipsum spatio suum cursum perficiunt?

Quia etsi omnes planetae proprio motu ferantur scilicet ab occidente in orientem, tum qui sunt altiores, longiore tempore, qui terris sunt propinquiores breviori tempore constituunt suum cursum

SATURNUS

Saturnus qui a terra longissima discessit, in 30 annis ad brevissima sedis suae principia pervenit hoc est in 30 annis conficit suum cursum

Quare poëtae fixerunt ***?

Propter tarditatem motus, etiam mixtum baculo tarde in incedentem fingunt,
Et propter [116v] complexionis maliciam fingunt devorantem liberos.

IOVIS CURSUS

Iovis proximus cuius cursus aliquam brevior existit in 12 enim annis circumfertur

Quae est eius natura?

Iovis complexio est temperata itaque et salutaris humano generi

MARTI CURSUS

Tertium locum Martis sphaera continet, qui in 2 annis circumvolvitur

Quae est eius natura?

Complexio eius est colerica est ei excessime calida et sicca

SOLIS CURSUS

deinde sequitur Sol, qui 365 Zodiaci partes totidem fere diebus conficit, cum enim Zodiacus inter tot partes distributus sit, solque suo proprio cursus unum fere conficiat [117] sequitur totidem fere diei illum suum cursum conficere quo sunt partes in Zodiaco

*** vero ad huc 5 dies et 4^{tam} eius diei sunt namin anno 365
dies et 4^{tam} pars diei?

Sol non viam praecise unum gradum magnum uno die perficit, sed aliquod minus, videlicet spacium 29 [?] minutorum

Quo igitur pertinet quadrans qui ultra dies 5365 dies excitorit?

Additur quarto anno unus dies qui interea *** dicitur propter quadrantem qui excurrebat Quadrans nam diei continet 6 horas, et quater 6 sunt 24 hoc est dies naturalis

VENERIS CURSUS

Quantum locum Veneris sydus occupat, quod alterno meatu vafrinii [vafritia?] existit. hoc est iam prae[117v]currit iam subsequitur solem vocatur etiam φοσφορος lucifer

Quae est natura Veneris

Humida & temperata. Est nam genialis, perficit autem cursum suum 356 diebus neque a sole discedit longitudine 46 partibus

MERCURII CURSUS

Mercurius in 6a sphaera circumvolvitur conficit autem motum suum 340 diebus neque discedit longius a sole 22 gradibus

Quae est eius natura?

Versatilis est Mercurii natura hoc est pro configuratione aliarum aphaerarum iam in has, iam in illas qualitates conferri, excitat autem spiritus celeritatem ingenii

LUNAE CURSUS [118]

Septami sphaeram luna occupavit, conficit autem cursum suum in 27 diebus et in 3a diei parte, hoc est redit ad illum locum, in quo fuit coniuctatum sole

Quae est eius natura?

Humida, atque cursus brevissima, quia proxima terris existit et quia a solis radiis illustratur mirabiles quasdam vicissitudines tum in recipiendo lumine a sole, tum *** in cursu suo refert, fertur nam non semper aequalia terra distantia, sed iam humilis iam excessa existit, et ne id quidem suo modo.

Quomodo autem lumen a sole recipit seu accipit?

Certum est lunae corpus tale esse, quod optima sit recipere lumen, itaque radii solares incidentes in [118v] corpus lunae reflectuntur, quemadmodum in aqua radii solares resplendent

Quare non semper illuminatur?

Quia in coniunctione radii sua vi non potest tale opacum & obscurum corpus integrum penetrare, quod ex eclipsibus facile intelligere potest

Quid est eclipsis lunae?

Est diametralis interpositio terrae inter solem et lunamque nam cum terra sit corpus solidum et densum, radii solares id penetrare non possent, necesse est igitur ut umbram reddat.

Quare autem non in omnia coniunctione obscuratur?

Etiam si luna fere singulis mensibus soli opponatur tum non singulis mensibus [119] in umbram terrae incurrit, propter eius latitudinem quam habet ab eclipsis seu solis via proicitur, qui est diametralis. Ergo luna extra viam exitus in suo circulo non potest tegi ab umbra, quia ipsam non diametraliter attingit. Sunt autem in lunari circulo duo puncta quae nodi seu caput, seu cauda draconis appellantur, quae nullam sub ecliptica latitudinem habent, in qua puncta si luna suo cursu pervenerit tempore oppositionis necesse est fieri eclipsis lunae

Quid est eclipsis linea? aut quomodo fit?

Est interpositio lunae inter aspectum nostrum et corpus solare. lunae nam corpus est densum, per quod [199v] radii solares penetrare non possunt,

quemadmodum supra diximus, quae interpositio lumen prohibet ad nos usque descendere, non quod ipso lumine privetur, sed quod lumen ad nos perveniat

Sunt ne stellae fixae maiores luna?

Sunt, nam linea non conspici potest visi a sole per 14 partes discesserit, Reliquae autem stellae cernuntur, distantes a sole 7 partes, necesse est igitur illarum corpora longe maiora esse

ERRANTIUM MOTUS

Quid est apparitio et occultatio errantium syderum?

Occultatio est, quando incedent cum Sole id est quando teguntur radiis solaribus ne conspici possunt et haec dicitur occasus heliacus apparitio, postea vero a sole recedentes, vel sol ab ipsis discedens, tum ut verum conspici possent diameter oriri ortu matutino, huius ortum vocant heliacum

Quomodo differunt ortus ab apparitione?

Ortus fit respectu horizontis apparitio respectu solis · videlicet stella oriri dicitur quando supra horizontem elevatur Apparere dicitur, quando verum conspicitur quae antea erat tecta radiis solaribus.

Quae est latitudo Veneris?

Venus latitudinem Zodiaci percurrit duobus gradibus latitudo autem Zodiaci circuli ab ecliptica est 6 graduum, atque ita tota eius latitudo erit [120v] 12 graduum cum igitur venus hunc duobus gradibus excurrat, sequitur eius maximam latitudinem esse 8 graduum

lunae latitudo

Post venerem maximam latitudinem habet luna, quae quidem non excurrit

Zodiacum, send intra illius limites consistit, habet autem maximam latitudinem luna, in itranque partem 5 graduum

Mercurii latitudo?

Mercurii latitudo est ab ecliptica utranque parte 4 graduum, nam quando est in medio eclipticae, excedit 2 gradibus supra et 2 infra, Quando vero supra vel infra eclipticam est maxima eius latitudo in unaquartus parte 4 gradibus excur[121]rit soleque extendit

Solis latitudo

Sol fertur medio spacio inter duas partes Zodiaci, movetur etiam in ecliptica quae per medium Zodiacum incurrit utrinque reliquens 6 gradus de latitudine Zodiaci, igitur sol non habet latitudinem, sed tum declinationem

Quae est Martis latitudo?

Martis stella 4 medias partes conficit hoc est latitudo martis est 4 graduum a medio Zodiaci spacio hoc est ab ecliptica

Quae est iovis latitudo?

Iupiter in medio existens & supra movetur in latitudinem 2 gradibus

Saturni latitudo?

Saturnus in duas partes sicut sol

Nota sententiam Procli? [121v]

Sol per medium signiferum invehitur, nunquam magis in septentrionem austrum vergens, Venus plus caeteris planetis utroque versus secedere praehibetur post Venerem Luna utroque versus 5 Mercurius ad 4 Iupiter ad 2 & dimidium, Saturnus ad unam partem modo

Quare diversas habet colores cum caelum sit caeruleum?

Principio notandum quomodo generantur colores in corporibus deinde facile intelligitur an caelum coloratum esse possit sunt autem colores ex actione primarum qualitatum in se invicem, quia autem in caelo nullae eiusmodi qualitates sunt, quae et immutatione alterationibus sunt obnixae, coloratum esse non potest. [122]

Caelum & stellae videntur Ergo sunt coloratae Color nam
obiectum visa est?

Respondeo, differunt coloratum esse & lucidum, lumen nam videtur etsi non sit coloratum in caelo, itaque nulli insunt colores, sed non fulgores & splendores, qui per aërem diffidentes sese, non uno quidem modo afficiuntur, tum pro natura corporis, e quo splendor erit, tum etiam pro natura aëris ipsis, aeriaeque regionis, ac per rectitudine obliquitateque radiorum, caeli igitur color est ceruleus, non quidem inherens in corpore caelesti, quod luminosum existit, sed quia luminosum cernitur per medium tenebricosum & aërem gignitur mixtus color ex lucido & tenebriso. [122v]

Quare habent stellae versos colores?

Lumen non aequaliter diffiduntur, per haec corpora, alia nam plus, alia numquam de lumine recipiunt quae igitur plus, fiunt clariores, quae minus tanto obscuriores

Quae est natura viae qualitatis diei?

Principio sciendum est sphaeram dividi in rectam & obliquam. Recta autem vocatur, quae utrumque polum in horizonte habet. Obliqua quae alterum polorum habet supra alterum infra horizontem. In recte semper dies aequales noctibus, In obliqua semper sunt inaequales exceptis duobus diebus Causa autem istius inaequalitatis est ascensio Zodiaci circuli

Quomodo id fit?

Sol qui producit diem feritur [123] in Zodiaco perpetuo cursum. Zodiacus

autem est circulus obliquus. eius nam poli a poli distant, necesse est igitur illum obliqua oriri et occidere et per consequens etiam inaequaliter, non potest ergo esse mensura temporis. Tempus nam nihil aliud est quam mensura motus aequalis et regularis quia vero aequinoctialis circulus aequaliter oritur et occidit descriptus nam est super polis mundi, constituerunt velut certam et exactam regulam temporis. Semper nam in spatio horae 15 gradus de aequinoctiali circulo oriuntur et in 12 horis medietas aequinoctialis regulariter ascendit hoc est gradus 180 ascendunt si ergo plures 180 ascendunt [123v] necesse est diem esse productionem sex horis, si superant 30 gradus dies est 14 horarum si 45 dies 15 horarum et sic consequitur

Quodmodo fit quod in sphaera recta dies semper sunt aequales noctibus cum tamen Zodiacus etiam obliqua ascendit?

In hoc terrae tractu Zodiacus hanc convenientiam habet cum aequinoctiali ut semper cum 6 signis Zodiaci 180 gradus de aequinoctiali orientur, in sphaera autem obliqua res aliter se habet, isti nam duo circuli non eandem proportionem in ascensione retinent. Semper nam in die artificiali sive sit longa, sive sit brevis. medietas Zodiaci ascendit sed huic non semper 180 a radii aequinoctialis circuli respon[124]dent itaque Zodiaci signa dicuntur recte & obliquae ascendentia

Quae dicuntur recte ascendere?

Illi cum quibus plures gradus de aequinoctiali circulo ascendunt quam de Zodiaco Et sunt illa a fine usque a finem

Quae obliquae?

Cum quibus pauciores ascendunt de aequinoctiali circulo gradus

Quare Iovi fulmina attribuuntur?

Hanc rationem Plinius infert scilicet tres superiores planetae ignem ad terram iaculantur, et maxime Iupititer, quem postea fulmen appellant, Verum hanc rationem falsam esse ex superioribus constat, de qua re postea de fulmine dicetur haec tum [124v] est positam* cur Iovi fulmina assignentur ratio scilicet aëris ipse etiam campos tenet, inde per auras fulmeneo invehitur

curso, quo maximus Atlas incipiunt tenente poli, atque exterrita praesit -
Corda iurum pavor exanguis · Quibus versibus vult significare cum ipse
habeatur summus deus, deo ei attributa esse fulmina ne videlicet cessaret et
ociosus esset sed ut per illa poena de malis sumeret ex terra rem hominibus
incureret.

Quae est causa impressionum effectiva?

Causa effectiva est sol et stellae quae suis qualitibus levant materiam et
praeparent eam ad huiusmodi formam recipiendam

Quae est causa materialis? [125]

Est vapor et exhalatio nam vapor est fumus calidus et humidus, sublevatus
a terra & aqua · Exhalatio autem est fumus calidusae siccus sublevatus ex
terrestri materia.

Quae est formalis causa?

Est qualitas vaporis et aëris regio, quae in aliis locis aliter, atque aliter hos
vapores percoquit, et in diversas formas commutat

Quae est finalis?

Usus animantium & planetarum singularum μεδέορα* habent suam
utilitatem, aut manifestam aut occultam, quemadmodum audietur

Quid est Cometa?

Ex* exhalatio calido et sicca pinguis viscosa, virtute solis et aliorum astrorum
in [125v] superiorem aëris partem tracta, principio quidem rararum pauca
existens, sed subinde spissior facta quae postea caelestium corporum radiis,
percussa et incensa inflammatur

Unde habet nomen?

A coma, Cicero vocat crinitam, quod sparget flammam istar comae seu crinis

Causa efficiens

Vis astrorum, quae tenet hanc exhalationem illamque praeparat ad hoc incendium atque ad hanc formam recipiendum in primi Saturni et Martis vis efficax est in hac re, quae radiis suis huiusmodi exhalationes concoquunt vel ad incendium praeparant.

Quae est causa materialis?

[126]Est exhalatio sicca terrestris, viscosa, lenta compacta, densa et pene inflammabilis, ita attracta et disposita, ut non nullum de eo incendii simul absumi possit, sed semper habet subiectum dispositum exhalationem ascendentem ut aptum & conveniens nutrimentum

Causa formalis?

Est illa figura seu forma quam elata exhalatio et incensa contraxit, atque haec est coma seu flamma, quae ex incensa inflammatione porrigitur

Quot sunt species comitorum?

Aristoteles in duas species cometarum tradit. Primam quando exhalatio undique similis comarum modo in vertice [126v] hispida fluvia*, hoc est si supra aut circa illam in comae modum radii sparguntur alteram speciem pogoniam quendam barbatum, quando exhalatio oblonga fuerit et cui ex inferiore parte in speciem barbae longae promittitur iuba id est quae quasi trahere videtur ignem, Reliqui vero philosophi et astrologi pluras alias species tradunt singula tum his duabus includi possunt vel ad summum his tribus videlicet quando flamma in vertice velut capilles ut neque isti cometae appellantur proprie Ad quos pertinent lampadas seu faces hyppeas, seu *nubilatae ceratae*, seu cornutae, Ad tertium genus [127] pertinent quorum inflammae in modum barbae dependent, ut sunt acontiae sive cacula, item xyphiae sive enses et isti quos astrologi militem & animum Ascoviae vocant Ad hoc pertinent ambo cometae qui conspecti sunt anno 1531 et 1532 quorum hic fuere xiphias alter pogonias fuit. Ad tertium genus pertinent quorum flamma velut conglobatur, ut sunt disci & orbis, item Pithias seu dolia, item aeges, sive caprae plures, aliae species enumeruntur pro

diversitate et qualitate exhalationum

Quae est causa finalis?

Finalis causa est cui gratia aliquid fit est autem [127v] valde difficile finalem causam in planetis ponere. Scilicet cur fiant autem quis illorum finis existit, phisici plane respondent, colligunt nam finem & materia & effectum, non potest inquit fieri, quin hoc maximum incendium inflammet. Exicciet aërem finis igitur est sicca & arida tempestatum constitutio quae corrumpit fruges, unde annonae caritas inde sequitur, item quia cometae materia est exhalatio lenta & viscosa, quae plurimum veneni in se continet, quae incensa spargit fumum pestilentem quo aër inficiuntur

Quomodo astrologi finem querunt?

Nam tum considerantes ipsam materiam sed vim praeparatricem et effectricem materiae scilicet quis planeta aut eclipsis aut quae congressio stellarum hanc materiam praeparaverint, item quo loco figaturque formae, quis cursus aut motus, quis calor ita si est Saturnus igitur significet pestem, Si Martialis, bella, si Mercurialis seditionem, finem eventus huius rei, in qua detrimentum eius accidit

Quare cometae non sunt stellae tum etiam moveantur motu planetarum, nam motu primi mobilis moventur oriendo & occidendo, deinde sicut reliquae planetae?

Respondeo movetur quidem sed per accidens, superior nam pars aëris, movetur ad motum primi mobilis [128v] Cometa ergo in isto loco existens etiam illo violento cursu movetur⁷, quemadmodum aër Quod autem alio motu secundum signorum ordinem movetur, fit etiam per accidens, quia sequitur cur sunt [sit] istius planetae, qui hanc motum excitavit & incendit, ille nam suis radiis cometam ducit, velut mancipium suum

Quare alius celeriore cursu aliquem tardiora movetur?

Planetae etiam non uno motu moventur, nam quidam sunt celeriores, quidam

⁷M: fertur.

tardiores, itaque prout planeta est directus, retrogradus & stationarius, sic etiam cometa est, cui dominatur planeta

Datur rationem quare cometae non sunt [129] planetae?

Cometae apparent extra Zodiacum et ut plurimum in septentrione, planetae autem tum intra Zodiacum feruntur Ergo Cometae non sunt planetae secunda ratio Cometae non sunt certo notati loco, ergo, non stellae fixae, neque habent motum similem errantium syderum Ergo non sunt planetae 3tia ratio Omnium stellarum corpora sunt rotunda · Coma aut cometae inaequaliter circumfunditur · Ergo non est stella

Quid est Chasma seu flamma caeli?

Chasma vocant hiatum seu voraginem, quando eiusmodi aliqua species apparet perinde nam si universus aër arderet, aut velut ignis et iunctura caeli decideret [129v]

Quare aut quomodo id fit?

Quando exhalatio multa, levis, rara, et terrestris virtute astrorum attolitur, quae incensa mira celeritate ignem concipit, sed statim deflagrat, quemadmodum pulveres, bombardici, ex mero et sulphura cito flammam excipiunt, sed igni absumpta materia subito evanescit, pro diversitate autem situs varias formas et colores concipit

Qui sunt isti calores aut quales fiunt?

C[h]asmatum colores proprii sunt, pumiceus, purpureus hi enim colores · plerunque ex mixtura ignis, candidaque temperati solent

Quam induunt formam?

Si lumen per densum nubem decidit, tum fit recessus simili[130]lis, ossosae in orbem spelaecaenam*, nam interventus nubis facit, ut aliqua in igne videntur inesse profunditas si autem parva & densa fuerit, impressio pythias appellantur a signa dolii, atque haec etiam causa est cur chasmata diversis

coloribus conspiciantur.

Quae est causa efficiens Chasmatum?

Vis radiorum solarium et aliarum stellarum, quae attrahunt eiusmodi fumum.

Causa materialis?

Ipsa fumus attractus, ex quo fit hoc incendium

Causa finalis?

Quod plerunque magna vis ventorum haec incendia in aëre sequitur, quae postea siccitatem & sterilitatem efficiunt

Quomodo sit corona seu circulus circa solem, circa illas

fiunt circuli circa solem seu stellas hoc modo, radiis visivi* franguntur in nube, franguntur autem in orbe, lineae autem aequales ab eodem puncto ad idem punctum semper supra circuli linea franguntur.

Quae est causa effectiva?

Radius solaris, et refractione radiorum in orbem

Causa materialis?

Est nubes aequabilis, qui cuius partes sunt raras ac tenues qui sublata virtute solis ad infimam aëris regionem hanc dispositionem concipit

formalis causa

Refractione radii visivi* nam sicut ab aqua, ita etiam ab aëre caeteris quoque omnibus qui superficialem constant refrangentur aspectus. [131]

Quis est locus halonis?

Halones sunt in infima aëris regione visus autem propter imbecilletatem indicat ipsas proxime ad solem vel aliam stellam consistere

Quare sub luna saepius halones fiunt quam sub sole

Quia solis radii efficaciores sunt atque celerius aëris constitutionem dissolvunt.

Quare aliquando soles plures conspiciuntur?⁸

Quia cum nubes torida et densa ad latus solis existit, quae idolum seu imaginem solis velut speculum recipit, Aristoteles id πέρανκία vocat.⁹

Quae est causa par[h]elii?

Nubes densa, levis splendida plana, et posita ex obliquo solis quae nec supra nec infra nec prope solem existit, nec est regi[131v]one, sed semper circa solem ad latus eius

Causa formalis?

Refractio radii in nube quae sunt litudinem* et effegiem solis, tamquam in speculo existit.

Quae est finalis causa harum impressionum?

Ut significant pluviam et tempestatem, ut eodem modo de pluvibus Lunis iudicandum, eadem nam sunt causae uniuscuique impressionis

⁸M: 31

⁹ M: Anno 1540 visi sunt tres soles in occidente ho[ra] 2 post meridiem 18 Calend. Ianuarii minutes 22 et perdurantes usque ad 2dam.

Quomodo fit clipeus ardens aut quae sunt causae?

Impressionum omnia efficientes et materiales causae eadem sunt, formali tum differunt, diversae nam formae ignitarum impressionum existunt, fiunt autem clypei, quando vapor in medio densior in extremitatibus vero raro existit, quae inflammatus formam vel clypei vel dolii exprimit

Quare cadunt aliquando scyntillae vel cadunt stellae?

Quia quae exhalatio valde rara est, neque admodum continua tum nam singulae partes inflammantur seorsum, atque una post altera decidit.

Quid vocant veteres castorem et pollucem?

Id quod recentiores ignem praecedentiam et sequentem propterea quod saepe navigantibus aut terrae iter facientibus occurrit, illos praecedit et sequitur generatur autem hic ignis in infima aeris regione ex fumo pinguiori qui frigore aëres nocturni cogitur & densatur lucenditur autem [132v] concursu et conflictu duarum contrariarum qualitatum. Vapor nam calidus est, aër nocturnus frigidus, tantisper autem concurrunt donec agitatione vapor incenditur fingitur autem polis et antennis navium, propter eius gravitatem

Quare solitare sunt graves geminae vero saluterres? xxxviii

Nam video aliam esse causam, nisi quod geminae significant hoc incendio, absumi omnem tempestatum materiam solitariae autem significant hanc regionem materia illa refertam esse, ex qua tempestates solent excitari.

fiunt ne omnes tempestates necessario?

Non, quaedam nam sunt stata et certa quaedam vero fortuitae [133]

Quae sunt certae?

Ad quas effectus necessario sequitur, ut sunt anni commensationes et temporum vicissitudines, nam stas & certas causas habent ex cursu solis in

obliquo circulo. Reliquae vero tempestates non habent.

Quae sunt fortuitae?

Quibus effectus non necessario respondent, et fortuitas causas habent, prout temperantur & miscentur infirmae & supernae qualitates et materiae ut aestatem esse calidum est certa causa Sol enim tunc accedit ad signa septentrionalia, quia aliae vero magis sunt calidae tempestates & aliae minus, fit propter causas fortuitas.

Quae est causa effectiva?

Sydera & stellae nam pro diversis constitutionibus et configuratio[133v]nibus corporum coelestium ista fieri certum est, quaedam nam stellae peculiariter et praecipue humidus constitutiones tempestatum reddunt, ut sunt Luna & Venus in signis aqueis. Quaedam concitae ad pruinas, quaedam cogunt humores in pruina grandines & nivem: Ut Saturnus coniunctus stellis frigidis. aut in signis aqueis existens. Aliae flatus, ut Mercurius, aliae tepores ut Jupiter, Aliae vapores et rares, ut Venus, aliae vigores ut Saturnus

Quare tam diverse agunt?

De hac re Astrologi, item aliter physici loquuntur Astrologi dicunt stellis inesse specificam quandam naturae divinitus illis traditam quare id agant Quamadmodum herbis [134] & floribus et insunt etiam specificae naturae quare una id agat, alia non. Physici vero dicunt corpora caelestia hoc modum aërem efficere, quod luna suis radiis sublevet talem materiam aut agat in ea ut in nubem aquosam convertatur. Eodemque modo Mercurii stella suis radiis excitare solet, fumidam et fulginosam materiam ex qua deinde venti existunt.

Habent ne planetae tum has vices?

Minime, verum etiam stellae fixae seu adherentes caelo praesertim si istorum vires planetarum ascensiones aut configurationes excitarunt Ut si mars accesserit ad stellas fixas calidas aut coniectu radiorum tunc calidiores effectus largietur* [134v]

Quae vis et natura est caniculae? XI

Canicula sua natura est calida & Martialis. Itaque ortu suo cosmico magnum aestum excitat

Quid est nubes aut quomodo generatur?

Nubes est impressioni aëre generata ex vapore sublato, virtute solis et aliorum astrorum, qui cum destituntur calore, cuius opera effectus est, paulatim frigore loci cogitur ac densatur in nubem, quae cum rursus calore liquescit, revolvitur atque pro corporis dissimulatione decedit

Quare decedit?

Quia si vapor fuerit subtilior ac rarior, tunc guttatim et minutilis stellis decedit, et id appellatur pluvia seu stellae [135]

Quomodo differt pluvias ab imbre?

Superior est pluvia. Imbres vero fiunt et sunt quando vapor spissior fuerit.

Quid est nimbus?

Si magis spissas ac crassatus dissolvitur, fiunt numbi.

Quae sunt causae?

Ex his quae dixi eandem esse materiam effecturam, et materialem nubium, nebulae, pluviae, et nimbi, forma tam differunt pro qualitate materiae, finalem ex effectibus facile colligimus

Quomodo ex fumo qui ex aqua ascendit pluviae generatur?

fumus, quem ex aqua ascendere videmus tantisper evolat donec ad aliquod obstaculum impeerit. Ubi propter frigus coit in unum corpus, deinde vero iterum in aquam liquitur ac defluit, quemadmodum in [135v] aëre generatur

nubes

Quare et quomodo nubes circumvolvitur motu caeli?

Nubes circumferuntur et agitantur partim vi ventorum per efficacium radiorum solarium, qui ipsas ad motum sui corporis circumducunt, atque etiam in aëre suspensas retinent nec decidunt

Quae sunt causae tonitrii?

dixi materiam esse, et eandem omnium impressionum, causam effectivam, videlicet constitutionem calidiorum planetarum in signis igneis, hi enim praeparant et deinde sublevaret materiam, ex qua deinde tonitrua fiunt

Quae est causa materialis?

Est vapor compositus, hoc est exhalatio calida et sicca coniuncta cum vapore humido. [136]

Quae est causa formalis?

Quando huiusmodi vapor virtute caelesti perfectus usque ad superiorem partem mediae regionis aëris cum frigore loci vapor aquaeus condensatur atque in nubem spissam cogitur. Exhalatio vero quia est terrestris & sicca, non potest se ita dilatare, sed ab illo altero humido vapore undique circumdatur. Postremo extimulatus inverso frigore tum nubis circumdatio quam etiam loci circumagint in nube quarens exitum, qua agitatione verum contrarium instar stupae incenditur. Internque nubis, magnis ictibus excusa perumpit, fragor itaque ex hac concussionem excitatus vocatur tonitru, ignis vero ex fracta nube perumpens fulgentiam [136v]

Quid est ventus? xlv

Ventus nihil aliud est, quamque agitatio quaedam sicci corporis sublatis, virtute radiorum solarium usque ad medium aëris regionem

Causa efficiens ventorum quae?

Ventorum causa effectiva prima & principalis est vis radiorum solarium, quae ipsum in extrahenda materiam adiuvant 2^a est frigus mediae regionis aëris Antiperistatum¹⁰ pellens exhalationem calidam et siccam

Quae est causa materialis?

Est exhalatio non ut Seneca ait, esse aërem motum sive exhalatio ventum¹¹

Quae est causa formalis?

Est ipsum spirare et vehi obliqua

Quae est finalis?

Sua ventilatione purgare aërem

Quomodo generatur ventus? [137]

Virtute solis & aliorum astrorum sublevatur a terra exhalatio sicca, terrestris & ***, quae cum mediam aëris regionem contingit confestim fragore loci depellitur, quare vera exhalatio est calida et sicca rursus subvolat. deinde iterum frigore loci deicitur neque omnino deici potest propter eius calorem quem ipsam subinde levat et adversus frigus deducit. Ex hac autem agitatione cietur & comovetur aër, quae agitatio ventus vocatur

Proba ventos esse exhalationes

Quia alii ventus ciet pluvias, alii serenitatem efficiunt. Ergo satis apparet ex contraria, nec materia pluviae oriri dare rationem, Nec spirant venti in aestu aut magno frigore, quia in aestu consumi hic materia ventorum, & terra gelu constricta non [137v] potest exhalare vaporem. Ergo Materia ventorum est

¹⁰From *antiperistasis* 'to surround in order to compress'.

¹¹M: Virtruvius unde* aërem esse motum et perpulsam

exhalatio

Quae est sententia Aristotelis de materia ventorum?

Aristotelis sententia est quod venti ex arido siccoque terrae anhelitu, veluti ex materia generetur

Quae est sententia Astrologorum de materia ventorum?

Hi non tum efficientem causam & universalem in astra ponunt, verum etiam partialem. Dicunt nam illos a radiis solaribus excitari tanquam a causa, materiali solem nam dicunt in radiorum agere atque impellere aërem, atque quemadmodum si quis flagello aërem vehementius verberet flatuum excitabit, ita necesse est huiusmodi acerbis agitationes radiorum in aëre sibilum & flatum excitare qui ventus vocatur. Verum [138] cum caelo nullus sit aër, ventusque nihil aliud sit, quam aëris impulsio, sequitur hanc sententiam procul a veritate discedere. Ergo nulla radiorum vis est in ventis, verum est id quod radii solis & Mercurii sua in sita vi excitent halitus fumidos et fuliginosos, a quibus postea venti existunt

Quare tam inaequaliter in diversis loci sonant?

Quia abscinditur atque refringuntur a locis altioribus qui ipsorum flatus intercipiunt atque liberum transitum impediunt, quemadmodum nam vox aliter sonat per *** planum aliter per flexum ita quoque venti in his locis refranguntur, vocatur autem haec vocis reverberatio ἐχο id est resonantia [138v]

Quando aut quomodo id fit?

Quando in montium flectibus, aut in specubus aut in aliqua concava valle aër inaequaliter percussus, scinditur atque cum sonitu resilit

Quomodo differt ventus ab aura?

Ventus est flatus et perspicans flatus, qui non peculiariter aliquem tractum terrae verum terras in universum perflat. Aurae autem sunt lenes, et gelidi

quidam flatus excitari a corpore commoto ac agitato in isto loco, quod aërem commovet et ventilat perinde atque si quis flabro ventilaverit aëra

Quomodo fiunt aerae?

Excitantur in magnis aestibus in locis saltuosus aut ad [139] ripas aut in manu factis conceptualis, quae inclusa opacitate aeras suas habent

Quae causae aerae?

Quod assidue mundi motum citantur, et continuo syderum occursum orientur quemadmodum venti

Quot sunt genera ventorum?

Quatuor tum ventos veteres posuerunt ad cardines mundi a 4 mundi plagis per diametrum oppositis spirantes. Porro recensio res unicunque duos ventos addiderunt, quos omnes ex tabula adscriptum

Quae est natura ventorum?

Tametsi omnes venti pro materia sua calidi et sicci sunt, tamen pro diversitate locorum, nam regionum subinde alias qualitates recipiunt [139v]

Quae est natura ventorum orientalium?

Orientalis calidiores sunt ab occasu flantibus, quia sol diurnus supra illos fertur, hi serenitatem efficiunt scindunt nam nubes, praeterquam obducit caelum densioribus nubibus.

Quae est nam septentrionalium?

Septentrionales sunt frigiores propter longinquum aeris motum in sua reliquos flatus sternant et discussis nubibus, quae coalescere ceperant caelum mundum optumque reddunt.

Quare aliquando grandines et nives ferunt?

Quia si frigidi magis quam vehementes fuerunt, tunc prius nubes inducant quam repellere eas possunt, inde igitur aliquando grandines aut neves important [140]

Meridionalium natura quae?

Quia ab opposita mundi parte spirant plane contrarias qualitates habent. Sunt nam humidi et calidi et illorum flatus sunt debiles. Ex longinquo enim ad nos perflatum sicut etiam pluviosi, calore nam suo materiam adducant nobis quae qua facta in pluviam dissolvitur

Quare animantia minus eicirire dicuntur flante Austro?

Quod calore suo aperiat *** corpore caloremque naturalem et internum ad exteriora trahat, et per consequens appetitus fiunt debiliores. Contrarium fit spirante Borea.

Quid est repentinus flatus?

Repentinos flatus vocant ventos, qui non statis temporibus aut regulari cursu spirant [140v], sed aut quando partes in unum confluxere aut quando alioqui latius aut altius vagantur quam caeteri

Quot sunt horum flatuum species?

Quatuor Emephas, Typho, Turbo & praester

Emephas

Ventus est qui latine perculla vocantur, quando multum sicci species in nube elevatum fuerit (si tum densior fuerit) luctatur sursum evadere fumus nubi inclusus, sed nubes deprimat *** in terram, dum sic luctatur, agitur varie, atque haec agitatio vocatur Emephas

Typho

Latine turbo dicitur, quando fracta nube fumus emittitur, et [141] particulam aliquam nubis, a qua non potest se explicare · secum rapit · qui venti arbores et navigia comprehendentes fraguunt.

Turbo

Latine vortex dicitur, fit aut quando maiori hyatu nubis erupit cum frigore. Atque habet nomen a circumactu nubis in orbem, quando ex fracta nube eliditur, atque in angustias incidens tum convolvitur atque in orbem circumagitur

Praester

Turbo quando accenditur praester dicitur, Praester nam est flamma late volitans, et vulgo caelestis ignis dicitur.

Quomodo differunt isti flatus?

Constant eadem materia dicitur differunt tamen situ & qualitate [141v]

Quid est fulmen quae materia quae forma?

Supra dictum est eandem esse causam materialem omnium harum impressionum, scilicet tonitru fulguris, Emephae Typhonis & fulminum differunt tum formali causa et finali

Quae est formalis causa fulminis?

Quando vapor inclusus in nube agitatione incenditur, tunc erumpens humectatus, unde fit massa quaedam, quae iterum acta, in nubem inducantur, et denuo incenditur, qui vapor iaculatus fulmen vocatur

Quae est finalis causa fulminis?

Est sonitus quam in aere excitat, et metus animantium timentium

Quare ni aestate et hyeme fiunt vera fulmina?

Quia in hyeme plurimum [142] exhalationes calidae et frigidae, quae coacta in nubes extinguit quicquid calidae exhalationis sublatum fuerit. In aestate vero plurimum est calidae et sicca evaporationis, qui propter tenuitatem nullo modo potest densari in nubes, Mediis vero temporibus vere & Autumno fiunt ubra fulmina, quia horum temporum amplectiones tam siccam quam humidam materiam illi praebent.

Quare in media regione aestate fiunt fulmina?

Quia hic non tam magnus calor est, ut omnem materiam nubium assumere valeat. In hyeme tum nunquam fiunt propter frigoris abundantiam

Quot sunt species fulminorum?

Aristoteles tum tres species ponit, quem sequuntus est Plinius

Prima quae est? [142v]

Quaedam fulmina non urant sed dissipant, eum propter nimiam naturae siccitatem, fit autem haec dissipatio, a specie sicco, quae semper assequitur fulmina fertur hic magno impetu, qui impactus in corpora prosa convellit ac dissipat, illa semper aut species praecedit, aut sequitur fulmina

Quae est 2da species?

Est illarum tum quae infusunt non urant Aristoteles vocat $\phi\epsilon\lambda\omicron\rho\iota\varsigma$ [?] id est fumidum, hoc fulmen, propter subtilitatem non urit. citius nam penetrat quam ut possit adurere, veruntamen ana fuligine conspergit

Quae est 3tia species?

Cognata est cum secunda, et atque hac ab Aristotele ἄργεος [ἀργήος] vocatur id est clarum quod eadem penetrat per corpora rara, verum cum impege[143]rit in corpus solidus quod resistat, statim dissolvit illud

Quid est Iris? lx

Est refractionis radiorum solarium in nube torida soli opposita

Quomodo id accidit?

Si hoc modo fuerit disposita nubes aut noster visus medius inter nubem et solem existant, tum fit refractionis inter nubem et solem existant, tum fit refractionis radiorum in nube

Quae sunt causae?

Causa efficiens est sol materialis est nubes, formalis est visus et refractionis radiorum. significatio pluvia finalis, et quod non amplius futurum diluvium

Quare tum dividuus fit arcus non integer circulus

Tum forma nobis in causa est tum etiam radiorum in nubem projectio, nam radius [143v] in nubem causa immissus refrangitur atque in solem radius ex qua refractione non forma solis, ut in speculo, sed calor non imprimitur propter nubis varietatem, quae integram formam continere nequit.

Quod haec refractionis arcus formam referat?

Sol in puncto A oculus in B nubes in D per quo puncto lineam ducatur recta A B D signentur autem in nube tertia signa aequidistantia videlicet C T G quare et aequidistantia a duobus reliquis hoc est ab oculo et sole, a quibus ad haec aequidistantia puncta ducantur rectae lineae, ita ut fiant tertia maiores et tertia minores trianguli, tres autem maiores trianguli sunt inter se aequales per 4 et 8 quae latera & bases habent aequales, eodem modo tres minores per easdem *** [144] Ergo bases sunt aequales cumque centrum nobis tangunt sequitur quod linea tangens illarum trium linearum extremitate erit

semicirculus ut in hac figura patet [**einzuscannen]

Quomodo differt halo ab tride?

Etsi iris et halo refractione radiorum fiant, tum inter se differunt a forma et situ, halo enim integri formam circuli refert. Iris autem dividiati circuli formam, halo non fit circa solem. Iris autem tunc adverso sole.

Quae est causa nube qualitatis?

Sole existente vel in occasu vel in ortu, tum arcus fit maximus, quia hoc loco tridis [144v] centrum est punctum diametraliter centro solis et eius radio perpendiculari oppositum sole vero in alio hemispherii puncto existente ita radium perpendicularem proiciat ut centrum eius sub horizonte siti atque arcus semicirculi minor sit

Quae est ratio diversitatis colorum?

Colorum dissimilitudo fit propter inaequalitatem partium nubis. Aliae nam sunt solutae in aquam aliae adhuc consistunt radius autem non eodem modo frangitur in raro atque denso corpore, haec autem inaequalitas alternis umbram lucemque permiscit ac illum mirabilem colorum varietatem exprimit

Quot sunt colores arcus?

Tres tum sunt, aliorum nam colorum mutatio, et temperativa sensibilis et infimea est unde dicit Vergilius [145] Mille ducit varios, adverso sole colores
1 pumiceus 2 viridis 3 flavus

Quomodo fit pumiceus calor?

Quando res lucida in nigro aut per nigrum conspicitur

Viridis quomodo?

Viridis calor propter debiliorem reflectionem radiorum in ista nubis parte.

flavus quomodo aut quando?

Qui inter puniceum et viridem medius existit

Quid est pluvia, et quid ros et quomodo differunt? lxi

Pluvia et ros easdem habent causas, quemadmodum etiam nix et pruinae differunt tum secundum maius & minus, nam cum interdiu vapor sublevatur, quem calor evehens quasi perpondus ferat maius quam suis congruant viribus in altum sustollere [145v] utque itaque frigore noctis confringitur non procul a terra sublatus, atque rursus decidit, fuit vel ros vel pruina, ros quando in aquam vapor fuerit densatus pruina quando gelatur.

Quando fiunt?

Ambo non fiunt nisi serena nocte a ventis silente, nam cum caelum non fuerit serenum nihil attolli potest

Quid grando et nix?

Eodem modo generantur grando et nix grando nam nihil aliud est quam glacies concreta in aere et grandioribus aquae guttis, quae sua gravitate impulsae decidunt nix vero quando nubes congelascit, decidit autem nix hyeme tunc quod nubes non posset congelari nisi frigus dominaretur, grandines autem vere et autumno et aestate etiam fieri solent. Hieme [146] autem raro

Quid est nebula?

Nihil aliud est nisi nubes in aquam concretae superfluitas proinde serenos dies potius quam pluvios praetendit Iam iterum incidit locus de terra, verum de hac re supra dixisse sufficit

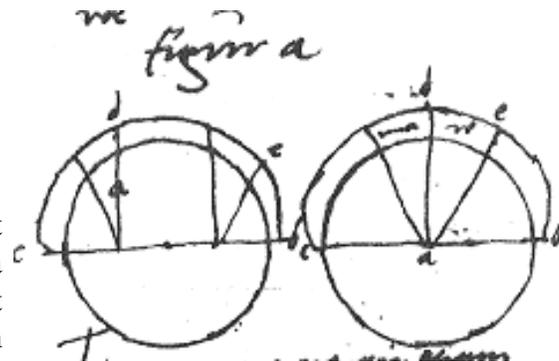
Quomodo autem inhabitur terra, an sint antipodes?

Sunt antipodes, si nam terra est rotunda ut probavimus supra, hinc etiam

possint esse antipodes, nam antipodes nihil aliud sunt nisi *** distantes a se invicem secundum longitudinem ut etiam longitudinem 180 gradibus maximi in caelo circuli. Quare igitur non decidunt Quia omne grave naturaliter tendit deorsum. Si autem ille deciderent [146v] non caderent deorsum, sed sursus versum caelum, nam hae differentiae propositionum non sunt respectu mei consideranda e sed caeli

Qui populi
invicem

Hispani sunt
indis, quia
non
locorum
possent.



sunt
antipodi?

antipodes
vero maior
operta aquis,
singulorum
antipodes esse

Quare aqua non decedit?

Quia aquae feruntur sua natura deorsum, omne nam grave deorsum tendit Secunda ratio Aquae in litoribus non sunt tam altae quam in medio mari propter connexitatem illorum. quod hoc modo colligitur Lineae ductae a centro terrae ad medium mare sunt longiores quam ductae ad littora unde linea a - b a centro [147] terrae ad proximum littum est breviter quam linea ac et aut a - de ad extremum mare a centro terrae

Ergo mare vergit etiam ad centrum, non quidem ad terrae centrum, sed ad proprium

Quomodo id inveniendum est?

Per propositionem 24 Euclidis lib. 3 scilicet super arcum convexae superficëus aquae describatur circulus, inde lineae ductae per rectos angulos concurrunt in centro aquo omnes lineae subductae sunt aequales et per [147v]consequens aqua est sphaerica ex definitione sphaericae, atque potest cadere pro eandem definitionem

Si aqua est rotunda necesse est eam undique contegere sicut
aer?

Etsi utraque sit rotunda tunc nec aqua nec terra integrum corpus constituunt, sed simul iunctae, unum corpus ambae, et perfecte sphaericum efficiunt, nam quantum edit tantum terra devoratur, inquam illius locum succedit, ita ut utriusque elementi una sphaerica superficies sit

Quare terra undique habitatur?

Quia cum terra divisa sit in partes seu Zonas, duae tum sunt temperatae ut possint habitari [148]

Prima Zona quae est?

Est polo arctico usque ad circulum arcticum, et haec est inhabitabilis propter unicum frigus

Secunda Zona quae est?

A circulo arctico usque ad tropicum cancri, quae temperata dicitur propter temperamentum frigoris et caloris

Tertia quae?

A tropico cancri usque ad tropicum capricorni, quae torrida dicitur et propter potentiam solis et radii rectitudinem inhabitabilis est.

Quarta quae?

Est iterum inhabitabilis et est inter tropicum capricorni et circulum antarcticum, ad quem nostri homines pervenire necquunt propter aestum interpositae torridae

Quinta quae? [148v]

Reliquam terrae partem occupat, et est etiam inhabitabilis propter nimium frigus

Quis est usus Zonarum?

Ut discernant partes habitabiles ab inhabitabiles atque etiam temporum inaequalitates illis Zonis discernuntur, nam quemadmodum partes habitabiles ab inhabitabiles discernunt ita etiam discrimina temporum constituunt

Quare?

Ex illorum nam ortum et occasum temporum discrimina mensurantur. Sed de inaequalitate dierum & noctium alias.

Quando dies est nobis longissimus?

Sol in cancro existente, et brevissimus in Capricorno

Quando sunt dies aequales noctibus? [149]

Quando sol in aequinoctialem venit, qui per medium ambitum signiferi incedit et utrumque aequalia spatia efficit. deinde vero proportionem aut breviores existunt, prout ab aequinoctiali vel in Boream vel in austrum, sol discedit usque ad suos limites id est tropicos ultra quos in latera mundi progredi nequit ut ex hac figura patet si nam circumferentia caeli A B C D super centro E si aut D B aequinoctialis F G tropicus cancerus H I tropicus Capricorni, locus habitationis septentrionalis in K cuius Horizon L M [149v] Ex hac figura patet diem longissimum esse sole existente in f g siquidem in arcum diurnorum f enim maximus existit sic ut tum brevissimus

Quare tam diversa sunt ingenua horum diversis locis?

Haec diversitas sumitur ex temperamento privatarum qualitatum quae lumine caelestia temperantur et foventur, nam quemadmodum astra non eodem modo omnibus oriuntur et occidunt, ita neque eodem modo omnibus in locis partes effectus sortiuntur

Quae est ratio nigreditus in aethiope?

Quia habent solem super verticam, ergo necesse est eorum corpora vapore vicini sydere terreri, eosque similes adustis gigni. Medici tum aliam rationem addunt, quam videlicet [150] in his locis viros calidissimos habent, in quibus genitale semen nimio calore adiutitur, unde sequitur quod corpora earum ex nimia adustione sanguinis nigrescantur

Quare terrestria membra ut ossa et dentes sunt alba?

Etiam propter calorem, qui omnino humidum ex illis membris educit, habent autem barbam atque capillum vibratum propter adiustionem, Crines nam sicci vibrantur sicut humidi planantur et extenduntur.

Quid est terrae motus?

Motum terrae vocant, quando concussa contremiscat, sit autem ex vaporatione calida et sicca in imis terrae partibus atque cavernis generata, quae cum virtute sua excitatur [150v] neque patet illi ulterior locus in quem exeat, retrofertur et in se rediit deinde nixa species reciprocans iactat obstantia et sive interclusa sive per angustum motu & sonum emitat

Unde oriantur haec?

Pales* exhalationes gigni in terra constat, terra nam per sese arida est, imbribus vero humectata ardoreque solis non calefacta plurimum speciem extra intraque gignit, qui cum aut eliduntur, per angusta voramina, aut cum vero feruntur propter copiam validissimam excitant molum**

Quae sunt causae?

Causa efficiens est calor solis et astrorum qui eiusmodi species producit et gignit Maritialis aut species crassus [151] Causa autem formalis, quando etiam spacia plena sunt, tunc quae supervenit species, priorem pervenit et elidit, qui alium quarens locum nec inveniens terram concutit

Quae sunt species terrae motus?

Prima est ruina vel casus quam Seneca inclinationem vocat, quando in unum aliquod latus inclinatur terra atque nisi caeleriter ex altera parte occurat motus, qui restituat inclinata, ruinam sequitur necesse est Secunda est hiatus terra profundo hiatu debescit Tertia succussio seu pulsus, quando terra assingens intumescat alternique motu residet ut aliquando magna moles instar motis extra terram ageretur, aliquando vero terrae pars subsidet, ex [151v] qua aut flumaina aut ignes erumpunt, Quare est tremor quando terra in latum tremoris instar movetur

Quae sunt signa futura terrae motus?

Primum est commotio motis 2da aeris tranquillitas tertium crepitus fragores nam velut aedificiorum sonitus corrumentum exaudii solet Quartum, pavor avum Quintum est nebus tenuis et oblonga

DE AQUA POSTREMO ELEMENTO, ac primum de aestu maris

Quid est aestu maris?

Est motus maris quo fluit ac refluit, seu quando inundat campos et postea iterum refugit et relabitur

Quae est causa efficiens?

Huius maris motus tres sunt efficientes causae, quarum duae sunt physicae et materiales, tertia autem astrologica est.

Quae est prima

Prima cognata est cum causa terrae motis, quando videlicet plurima ventorum materia sub aquis collecta exitum quaerit, cumque nullus illis patet, tunc erumpit vi potendit materia, & quando materia hoc modo est egressa aquae iterum ad suum locum naturalem redeunt, atque hic motus inundana et recedentis maris aestus avocatur

Secunda quae est?

Est priori cognata, nam quando diu immobilis consistat tunc in illa densus quidam ac spissus vapor generatur, ex quo [152v]fiunt venti, qui eam hoc modo (ut dictum est) impellunt

Tertia quae est?

Haec precipua est vere effectiva videlicet corporum caelestium et praefectum illorum, quae habent aliquam cognationem cum aquis, quemadmodum luna quae ciet et movet, in his inferioribus corporibus humores, id quod in nostris corporibus quotidie experiuntur, humores enim humidaque membra leviter alterantur ex lunae mutationibus.

Quare non eodem fluunt et refluunt?

Quia non eodem loco, neque semper aequabili cursu ut lumine luna movetur igitur neque eodem modo neque eodem tempore aestus fluunt et refluunt

Ubi autem est effecatio [153]

Et a quo loco?

Lunae vires sicut reliquorum planetaum longe efficaciores sunt in angulos caeli, quem in aliis locis, igitur plurimum maria movet, quae vel ascendit vel descendit.

Quae est causa materialis?

Vapor densus qui lunae lumine attenuatur, ita* ut extra aquas erumpat illasque sua vi protrudit

Cur non consentint aestus in omnibus locis cum regulari motu lunae?

Quia est etiam dissimilis exortus syderum in diversis terrae tractibus, quae lunam sua virtute adiuvant iniciendo aestibus quod autem tam dissimiliter oriuntur sydera causa est obliquitas Zodiaci et motus proprius in suis sphaeris

Quae loca dicuntur aesturaria?

Ista videlicet in quibus mare fluit ac refluit

Quid est Syrtis?

Est sinus quidam in mari dicta a trahendo, quia trahit, atque figit navigia. Sunt autem duae celebres *, altera vocatur magna altera minor. vide Pompo: * Melan [Melanchthon]

Quare mare est salsum?

Causa efficiens est calor solis qui extrahit ex summo maris quicquid est dulcedinis.

Quae est formalis causa?

Ex fundo extrahit exhalationem crassam et humidam quae a sole adusta, iterum vel cum vapore vel cum pluvia in mare deorsum fertur ex qua commixtione mare salsu [154] efficitur, et haec sunt efficientes et formales causae, omne nam adustum salsum est, ut cinis

Quae est causa materialis?

Huiusmodi exhalatio quae hoc modo sublata et exhalata atque ambusta
rursum in mare delabitur

Quae est causa generationis fluviorum ex et annuum

Nam hi loci in quo vel propter specus et cavernas, vel propter raritatem
solis multus et copiosus species generatur quem proxime ad naturam
vaporis accedit, deinde vero loci frigore in aquam agitur, quae iecta
praebet originem fluviorum & annuum

Qui fit quod perpetuo cursit aqua ex uno fonte oriuntur?

Aër supra terram nunquam consistit sed fertur perpetuo aut [154v] agitur
vento, aut impulsus radiis solaribus unde et magis intervalla imbribus
fumes sub terra vero frigore aequale semper et uniformae essent, quod
praebet fluvio perennem et statum cursum

Qui fontes dicuntur Thermae?

Hi videlicet qui continent aquam ferventem, qui mixta hyeme et aestate
ferventissimi aquam ad plurimos usus largissimos praebent

Causa Thermarum quae?

Causa hae est, quod haec aqua illic per subterraneas meatus labitur ubi
sunt plurimae venae sulphuris incensae, quae ipsam hoc modo calificant,
idque ex signis apparet, haec nam aqua et odorem & saporem sulphuris
retinet et efficacissimum remedium habet [Normal Text stops here] [155]

et a quo loco?

O* omnem impetiginem scabiri

Cui fontes in aestate sunt frigidores quique in hymene?

Quomodo radii solis aestate sunt intenserit itaque super ficiem terrae
magis * faciunt unde et frigus per *

English Translation of Salient Passages of the 'Compendium of Pliny's Second Book'

Note the opinion of Proclus¹

The Sun is carried through the middle of the Zodiac, never being carried more to the north or the south. Venus is allowed to move in either direction more than any of the other planets - after Venus the Moon [may move] 5 [parts] in either direction, Mercury 4, Jupiter 2 and a half, Saturn only one part.²

Why does heaven have diverse colors when it is dark blue?

It is first to be noted how colors are generated in bodies, it will then be easily understood if heaven may also be colored. Colors result from the action of the primary qualities among themselves, thus, as none of these qualities exist as such in heaven - which are subject to change through alterations - it cannot be colored.

Heaven and the stars are seen, thus they are colored, is this color then objectively seen?

I respond: there is a difference between being colored and being lucid. For light is seen even if it is not colored in heaven, thus no colors are in the objects themselves, nor do flashes of light or twinklings which are effects of the moving air. They are nevertheless not produced in one manner, for it depends on the nature of the body from which the twinkling results, and also upon the nature of the air itself, and the region of the air, and the rightness or obliquity of the rays. The color of heaven is thus dark blue, yet not inherent to the celestial body which exists as a luminous object. For the luminous body is seen through a dark and airy medium, color is a mixture of light and dark. [122v]

¹This *locus* is preceded by a presentation of the planetary latitudes which Plinius gives in Book II, 66ff.

²I have been unable to find these values anywhere in Proclus' *Sphere*.

Why do the stars have different colors?

The light is not equally projected through these bodies, for some receive more some less light. Thus those which have more will be clearer, those which have less will be that much more obscure.

[124]

Why are lightning bolts attributed to Jupiter?³

Plinius infers this reasoning⁴, namely that the three superior planets cast fire upon the earth, and Jupiter above all, whom they later call lightning. Yet it is clear from the proceeding that this reasoning is false. We shall later speak of the matter of lightning, we wish to now show why lightning is assigned to Jupiter, namely that same type of air also has camps from which it is carried in its fiery course by light winds [*auras*], in the same manner the poles begin by being held by the great Atlas, and he commands the frightened
· The hearts of the just are tired and scared⁵ · He wished to signify with these verses how He himself is the mighty God. Lightning is to be attributed to God, for He clearly never ceases and is idle, but rather makes punishments of these [lightning bolts], and he strikes down bad people from the earth.

What is the effective cause of these impressions?

The sun is the effective cause, and the stars which raise the material and prepare it to receive this kind of form through their qualities.

What is the material cause?[125]

It is vapor and exhalation, for vapor is a hot and humid fume, risen from the earth and water · Exhalation however is a warm dry fume risen from terrestrial material.

³This theme is discussed in Book II, 82.

⁴Plinius in II, 82 clearly states that this idea comes from other (unnamed) authorities.

⁵Though this sentiment is found throughout the *Old Testament*, no near matches to this quote are to be found.

What is the formal cause?

It is the quality of the vapor and the region of air which heats these vapors differently in different places, and alters into diverse forms.

What is the final cause?

The use of living creatures & of particular plants, μεδέορα*⁶ have their utility, either manifest or occult, depending on how it is heard.

What is a Comet?

It is dry, hot, fat and viscous exhalation which is drawn into the superior part of the air by virtue of the sun and other stars [125v], indeed existing at first as a few bits of loose texture, but then made harder, it is finally - pierced and kindled by the rays of the heavenly bodies - ignited.

Whence does it have its name?

From *coma*, Cicero calls it *crinitam*, because it ejects its flame in the shape of a hair (*coma*) or long curly hair (*crinitus*).

The efficient cause

The power of the stars which and prepares the exhalation for the ignition and to receive the form. The power of Saturn and Mars is above all efficacious in this matter, which cook the exhalations and prepare them for ignition.

What is the material cause?

[126]It is the dry terrestrial exhalation, viscous, tenaciously compact, dense and extremely flammable. It is drawn together and disposed in such a way that parts of it may be engulfed in flames but simultaneously always

⁶Perhaps a false plural construction of μεδέων which really means 'ruler', but can also be taken as 'admonisher' which the passage seems to suggest.

have an ascendent exhalation so disposed for apt and convenient nourishment.

The formal cause?

It is that figure or form which the elongated and ignited exhalation contracted, and this is a *coma* or flame which arises from the ignited inflammation

How many species of comets are there?

Aristotle teaches two species of comets.⁷ The first is when the exhalation has hairs equally in all directions and only a rough stream at the vertex, that is when above or around it the rays are spread out like hairs. The other species is a bearded *pogonia*, it occurs when the exhalations becomes elongated and a mane extends from the inferior part in the shape of a long beard, that is that which appears to carry the fire. The other philosophers and astrologers however teach many other species. Now many of these may be included in these two or at the most three, namely when the flame at the vertex is like many hairs. For those cannot be properly called comets such as ‘torch meteors’ [*lampada*] or *faces hyppeas* or *nubilatae ceratae* or *cornutae*. To the third group belong those flames which hang down like beards, as are *acontiae* or *cacula*, likewise *xyphiae* or *enses* and those which astrologers call *militem* & the soul of Ascovia*. Both comets which were seen in the years 1531 and 1532 belong to this group, the first of these was *xyphia* the second was *pogonia*. To the third group belong those flames which roll up into a ball, such as discs and orbs, likewise *pithia* or *dolia*, and *aeges*, or many *caprae*. Other species are enumerated through the diversity and quality of the exhalations.

What is the final cause?

The final cause is the reason for which something occurs. It is however [127v] truly difficult to place the final cause in the planets. For something obviously exists as the final cause of them [the planets]. The natural scientists [*physici*] respond clearly: for they collect the final, material and effective causes, it is not possible for them to inquire into who set this great incendiary ablaze. The air dries out, therefore the final cause is the wet

⁷The following account is literally taken from *Meteorology*, Book I, part 7.

and dry constitution of the tempests which corrupts fruits. It therefore follows that the abundance of a year's crops depends on it. Likewise, because the matter of the comet is a compact and viscous exhalation which contains an abundance of poison, it produces a pestilent fume upon being lit which infects the air.

How do the astrologers seek the final cause?

They consider not just the matter itself but also the preparatory and effective power of the matter. Namely the planet or eclipse or group of stars which prepare this matter, also in which place the figure is formed, what is the course or motion, what the color is, thus if it is Saturn it signifies the pest, if Mars then war, if Mercury then sedition. The final cause of the occurrence of this thing in which its given detriment comes to pass.

Why are comets not stars, and do they move with the motion of planets, for they are moved by the rising and setting of the prime mover, are they therefore like the other planets?

I respond that it is moved, but only *per accidens*, for the superior part of the air is moved to the motion of the prime mover [128v] and as the Comet exists in this place it is moved by that violent course, just as the air is. Because however it is moved in another motion according to the direction of the signs, it occurs also *per accidens*. For it follows why it is of a given planet which excites and ignites this material, for it guides the comet with its rays like its slave.

Why does one move with a swifter course and another with a slower?

The planets are also not moved with one motion. For some are swifter, some slower. Further, just as the planet has with a direct, retrograde and stationary motion, so too does the comet - which is dominated by the planet.

Is there a reason why comets are not planets?

Comets appear outside the Zodiac, and many in the north. The planets however are carried inside the Zodiac. Thus Comets are not planets. Second

reason: Comets don't have a certain known place, thus they are not fixed stars, nor do they have a motion similar to that of the errant stars, thus they are not planets. Third reason: The bodies of all stars are round · a *coma* or comet is unequally circumscribed · thus it is not a star.

What is a *Chasma* or a flame of heaven?

They call *chasma* a *hiatus* or *vorago* when a species appears and blazes through the entire air, or like falls like a fire and joint of heaven [129v]

Why and how does this occur?

When a great, light, rare and terrestrial exhalation rises through the virtue of the stars, it catches fire after an amazingly quick ignition, yet it steadily burns up, like dust, the bombardiers quickly use up the flame of pure sulphur. Then, after the diminished fire matter suddenly disappears, its position takes on various forms and colors by virtue of its diversity.

What are these colors and what is their nature?

Colors of *chasms* are their own, lavalike, purple these are the colors · and many tend to be tempered by a mixture of fire and white.

What form do they induce?

If the light descends through a dense cloud it becomes similar to a backward motion, the color of bone in a cavelike orb. The intervention of the cloud effects that the fire is seen to have a certain depth. If however it is small and dense, the impression is called *pythias* after the shape of a large-mouthed jar, and this is also the reason why *chasma* are seen to have diverse colors.

What is the efficient cause of the *Chasma*?

The power of the rays of the sun and other stars which attract the fume in this manner.

The efficient cause?

The same attracted fume from which the ignition occurs.

The final cause?

Because the great power of the many winds follows these incendiaries in the air, they thereafter effect dryness and sterility.

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Why are many suns sometimes seen?⁸

Because when a dewy and dense cloud exists to the side of the sun it receives an 'idol' or image of the sun like a mirror. Aristotle calls this *πέρανκία*^{9,10}.

What is the cause of the parhelion?

A dense cloud, clearly twinkling and placed at an oblique angle in respect to the sun. It can exist not above nor below nor next to the sun, for that is not its region [131v], it is rather always beside the sun.

The formal cause?

The refraction of the ray in the cloud which is the image* and effigy of the sun, as if it existed in a mirror.

What is the final cause of these impressions?

So that they signify rains and tempests, and also to judge the full moons. These are the causes of such impressions.

⁸M: 31; the instigation of this discussion is to found in book II, 99.

⁹That is, 'those on the side', *Meteorology* Book III, part 2.

¹⁰M: Three suns were seen in the year 1540 in the west at 2 pm. on the 11th of December, 22 minutes* lasting til the second [hour?].

What did the ancients call Castor and Pollux?¹¹

It is what more recent authors have called the preceding and following fire because it often occurs to those traveling by sea or land that one leads and the other follows. But the fire is generated here in the inferior region of air from a more substantive fume which is formed and condensed in the frigid nocturnal air. It ignites however through the collision and conflict of two contrary substances - for vapor is hot and the nocturnal air frigid. These two collide such until the vapor is ignited through the agitation. This is felt by the poles and masts of the ships, on account of their weight.

Why do the Twins tend to be grave yet salutary? xxxviii

I believe their to be another cause - if it is not because the Twins signify that inflammation as all material of tempests is consumed. Yet alone they signify that matter - out of which tempests tend to be created - is referred to that place.

Do not all tempests occur out of necessity?

No, for some are certain and fixed while others occur by chance.

Which are certain?

Those whose creation is necessary, as are the monthly changes of the year and vicissitudes of the seasons. For these have certain and fixed causes which result from the course of the sun in an oblique circle. The other tempests however do not.

Which occur by chance?

Those which do not necessarily correspond to the effect, and those which have chance causes. Further the qualities and matter of the lower and

¹¹This and the following locus are inspired, but do not rigidly follow, Book II, 101.

higher [regions] are tempered and mixed. For example, that summer is hot is a certain cause, for the sun accedes to the northern signs. Yet those tempests which are sometimes more hot sometimes less occur on account of chance causes.

What is the effective cause?

The stars and planets [*sydera & stellae*]. For it is certain that these occur by virtue of the diverse constitutions and configurations [133v] of the heavenly bodies. For certain stars peculiarly and particularly bring forth humid constitutions of tempests, like the Moon and Venus in the water signs. Certain tempests are shaken to bring forth frosts, others condense humors into frost, hail and snow: just as Saturn is bound to the frigid stars and exists in the water signs. Others bring forth winds, like Mercury, others warmth, like Jupiter, others vapors and rare matters, like Venus, others vigorous forces, like Saturn.

Why do they act so differently?

The astrologers speak differently on this matter than the natural scientists. The astrologers say there is a specific given nature in the stars which God has endowed which cause them to act as they do. Similarly there is also a specific nature in the herbs and flowers which work in one but not in another. The natural scientists however say that the celestial bodies effect this through the air, as when the moon raises such matter by virtue of its rays or effects a tempest such that it is converted into a watery cloud. In the same way the star of Mercury tends to excite fumes and shiny material out of which winds then arise.

Don't planets then have these alterations?

Hardly, yet the fixed stars or adherents of heaven can also excite the ascensions and configurations of the planets through their powers, as in the case when Mars moves towards the hot fixed stars or stands in conjunction with their rays, for more heated effects are then brought forth. [134v]

What is the power and nature of the little dog stars?

The little dog is by its nature hot and martial. It therefore excites a

great heat when it rises cosmically.

What is a cloud and how is it generated?

A cloud is generated from the impression in the air from the vapor, risen by virtue of the sun and the other stars. When it is destitute of heat its office is done, it gradually takes on the frigidity of the place and condenses into a cloud, which then in turn liquefies by virtue of the heat, and it revolves and falls through the dissimulation of the body.

Why does it fall?

Because if the vapor becomes more subtle and rare then there is rain and it falls as minuscule stars, and this is called rains or stars. [135]

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[135]

How are rains generated from a fume which ascends from water?

The fume which we see ascending from water rises in such a manner until it fastens upon a certain obstacle. [Namely,] when it gathers into one body on account of the cold, it is then once again liquified into water and rains down, clouds are generated in the air [135v] in this manner.

Why and how is a cloud revolved by the motion of heaven?

The clouds are carried around and act in part through the power of the winds and through the efficacy of the solar rays, these [the winds] are lead around by the motion of their own body, and as they are suspended in the air, they are retained and do not fall down.

What are the causes of thunder?

I stated what the material is, and the effective cause of all impressions, namely the constitution of the hot planets in the fiery signs. For these prepare and raise the material out of which the thunder finally occurs.

What is the material cause?

It is the composite vapor, that is the hot and dry exhalation bound to the humid vapor.

What is the formal cause?

When vapor is brought up to the superior part of the middle region of air through the virtue of heaven and the watery vapor is condensed through the frigidity of the place the a dense cloud is formed. Because however the exhalation is terrestrial and dry it cannot expand itself, but is surrounded by that other humid vapor. After the surrounding cloud has been aggravated by the adverse cold then both parts desire to escape. In this agitation of the contraries it is ignited in the shape of a flax. And the inside of the cloud erupts after having sent of great bolts. For the rupture is excited by this concussion. It is called thunder, and the erupting fire from the ruptured cloud lightning. [136v]

What is wind? xlv

Wind is nothing other that a certain agitation of a dry body which has been raised to the middle region of air through the virtue of the solar rays.

What is the efficient cause of the winds?

The first and principal effective cause¹² of the winds is the power of the solar rays, these help to extract the material itself. Second¹³ is the cold of the middle region of air which so surrounds and compresses, pushing the hot and dry exhalation.

What is the material cause?

¹²M: *

¹³M: particularis

It is not the exhalation as Seneca maintains¹⁴, the air is moved or rather the exhalation is blown.¹⁵

What is the formal cause?

It is to blow the wind and for it to be obliquely carried.

What is the final cause?

To clean the air through its ventilation.

How is wind generated? [137]

The dry and terrestrial exhalation is raised by the virtue of the sun and other stars. When it reaches the middle region of air it is immediately pushed down by the frigidity of the place. The true exhalation which is hot and dry for this reason flies up again. It is then once again pushed away by the frigidity of the place, nor can it ever be completely pushed away on account of its heat which raises it repeatedly and leads it to the adverse cold. The air is shaken and moved by this agitation however. This agitation is called wind.

Proof that the winds are exhalations

Because some winds stir rains and others bring serene weather. It is thus sufficiently plain from the opposite that the matter of rains rise. Give the reason: Winds do not blow in summer or in great cold, the matter of the winds is thus consumed in summer and constricted by the freezing earth, the vapor cannot exhale. Thus the matter of winds is an exhalation.

What is Aristotle's opinion on the material of winds?

Aristotle's opinion is that the winds arise from an arid and dry exhalation [*anhelitus*] of the earth, as if it were generated by its matter.

¹⁴*Naturales quaestiones*, Book V, parag. 4.

¹⁵M: Vitruvius maintains that the air is moved and propelled [by moving trees, *De architectura*, book II, ch. 1.].

What is the opinion of the astrologers on the matter of winds?

These not only place the efficient and universal cause in the stars but also the material. For they say that the winds are excited as if by a cause by the solar rays, for they say that the sun acts upon and impels the air materially. Just as when someone vehemently strikes the air with a stick which then excites winds so it is likewise necessary for harsh agitations of the rays to excite hissing and drafts which are called wind. Indeed [138] as there is no air in heaven, and wind is nothing but an impulsion of air, it follows that this opinion drastically departs from the truth. Thus there is no power of the rays in the winds. It is true that the rays of the sun and Mercury excite by their fixed force smokes and soots in which winds thereafter arise.

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[149v]

What is the cause of becoming black in Ethiopia?

Because they always have the sun over their head it is therefore necessary that their bodies are tormented by the proximity to the star and that corresponding sunburns arise. Yet doctors have [150] added another reason: as there are obviously very hot men in these places in whom the semen is enhanced by the great heat. It follows from this that their bodies are blackened by the great sunburn of the blood [ie. genetic material].

Why are their terrestrial members like bones and their teeth white?

Also because of the heat which forces all humidity out of these members. They have a curly [vibratum] beard and curly hair because of the sunburn. For the hair is vibrated dry just as humid hair is planed and extended.

Oration on Astronomy and Geography¹

Held in Wittenberg

One reads in the ancient oracle of the Sibyll² of Athens that two pests, deception and a cowardice of leaders would come to that city. Yet if we consider the common life of man and the fall of empires, Sibylla prophesizes not only for Athens but for all cities and empires. Germania once also distinguished itself with its magnanimity and counsels through truth, candor and faith. Wars are now fought with techne, correct counsel is frustrated and that old love of military glory and fortitude is extinct. You therefore see that there is no defenses, not only in Germany, but also in the whole rest of Europe, in such a public danger. When considering this a great angst fills the soul for the Church and for our studies which devastation and destruction by Turkish barbarians particularly threaten. Although fatal punishments impend, as there are many signs, not only in the stars, but also in the mores of men, I nevertheless sustain myself in the hope that God will care for the Churches and that the Son of God will fight for us, as Daniel prophesied. It is for this reason that young men should not break off their studies from us, in desperation either for money or for their health. They are rather to be roused more ardently in this matter, so that even with the enemy among us the studies will be preserved, if the fates order it so. And because these gatherings of ours are part of the Church, in so much as we convene, in so much as we think of our studies, will pious wishes arrive, and we pray to God the Father of our savior Jesus Christ that the Church also defends honest studies, that it serves and governs us. I wanted to preface these comments because it especially befits us in these congresses that when we think of the studies we likewise remember the common dangers and add our prayers. For the saying of Christ also pertains to these congresses, when he says: when you are among one another, wherever you are, two or three convene in the

¹This speech was first printed in *Orationes duae, prima de Astronomia & Geographia, Altera de Physica, habitae Vuittebergae à Ioachimo Rhetico, professore Mathematicum*, in Nuremberg at the printing houses of Johannes Petreius in 1542. It was published a second time in *Selectarum declamationum Phillipi Melanthonis, quas conscripsit, & partim ipse in schola Vitebergensi recitavit, partim aliis recitandas exhibuit*, on pages 350-361 of the first volume in Strassburg in 1544. It was subsequently published in the numerous editions of Melanchthon's works.

²Rheticus also cites the Oracula Sibyllina in his prooemium to Werner's *De triangulis sphaericis*, p. 3. The Sibyll were considered to be divinely inspired seeresses in antiquity. Their history is long and disparate.

name of the same.³ As however the duty of office imposes upon me the necessity of speaking in this place, I thought it best to speak of that art which I profess, namely, the doctrine which teaches the laws of celestial movements, and that which shows the sizes, spaces, intervals and boundaries of regions. And even though I know that these divine arts are not blamed in this place of learning, nevertheless, because they are cultivated more tardily than is fitting, it is our duty, insofar as we can, to kindle and to excite the interest of young men by any means. I wish that we were supported in this matter by the princes in the same manner as the generosity of the Kings in Egypt invited minds to cultivate and illuminate these arts. And recently, three-hundred years ago, as Latin men did not indeed have a shadow of this doctrine, the Ingenious King Prince Frederic the Second⁴ took care that this doctrine was transfused from the monuments of the Arabs into the Latin language and restored by whatever means available in a great collection. And there exist many testimonies which show that very ancient kings supported these studies, such as Atlantis, Orion and Chiron. For this reason gracious posterity attributed their names to stars so as to signify that they received the doctrine on the celestial movements and the description of the year from them. And Caesar says of himself in Lucan

Amidst the combat I always
dedicated myself to the superior regions of the stars and of heaven⁵

Likewise, in recent times, it is well-known that King Carl V also understands the celestial doctrine almost as a master. He loves it so dearly that he takes a certain interval[of time] for himself to rest, not by relaxing his soul in games or passions, but rather in disputations on this sweet doctrine. I know that when he is sitting in a warm bath, as it is necessary for him to free his feet of care, that he sometimes skillfully composes horoscopes himself rather than be fooled. I know that he is very diligent in seeking the longitude and latitude of regions, in finding in the stars the location of regions so that he can direct the course to be sailed through an attentive study of the heavens. What is more honest in a great prince than to relax in such a desire when the soul is tired.

How I wish that others would imitate this so very honest example, and bring forth the rewards for the minds, because, if this happens, these arts will be conserved, and be better illuminated. Yet it often comes to my mind that

³*Matthew*, ch.18, verse 20.

⁴1194-1250, Kaiser from 1220.

⁵Author's translation (for purposes of a more literal translation). From: M. Annaei Lucani *Pharsalia*, Book X, lines 184-85. Rheticus also quotes this in his *Lecture Announcement for the Sphere of Sacrobosco*, p.1.

these[arts] grow old with heaven, and are gradually extinguished, and that their fall portends the end of the world. In the meantime however there are strong minds, born from the heavens, who think about their homeland when they observe it, and come to the conclusion that this most beautiful spectacle of celestial bodies and motions was not put forth in vain for man, and they inquire into the order of these admirable things, because it agrees well with the nature of man. They particularly offer great utilities to life, some of which I shall briefly, as the allotted time demands, expound upon. And insofar as I speak on the doctrine of motions and the boundaries of regions, with the aspect of divination omitted, it is because I don't seek strife. As however it is most correct in all things to be ordered by God, so in this deliberation on studies, when we contemplate heaven itself, the architect comes to mind. We think that this admirable order was not instituted in vain, nor that knowledge of these motions was given to mankind in vain. If one does not recognize this, how does he differ from that Cyclops who lived in a cave and did not look up into the heavens, nor fear that eternal divine will? If one however, so as to convene with the nature of man, thinks highly of the gifts of God, he will find that these laws of motion were instituted on account of their great utilities, and that doctrine was given to us. The utility of these motions is placed before all of our eyes. What is more agreeable to the conservation of living things than the change from night to day, what is more useful to the fecundness of the earth to produce fruits and nourish living things than the dissimilar tempests of spring, summer, autumn and winter? The diligence of the maker was so great in this that he not only placed before our eyes how the spaces of times of the sun and moon were to be measured through motions, but also added powers, so that the earth is warmed by a fecund heat at one time, is moistened at another, dries at yet another, and rests in choking cold at another. So that we would know that this was done by art he bound the risings and setting of the fixed stars, convening in given parts of the year, to the Sun. Hyades sets after the seeding spring, because, as Plinius says, the star is vehement and turbulent for the earth and sea. And it was so instituted because the earth needs water at this time.

Dry tempests are necessary for the harvest. Canis Minor therefore increases the heat at that time. And so do fixed risings and settings convene with the remaining parts of the year. These utilities are notable, which, as Xenophone says, attest to an architect, when he looks down so knowingly on our fate, he will truly love our kind, or, as he says himself, φιλάνθρωπον.⁶ Although this may perhaps be observed without doctrine, its order will nevertheless be more clearly seen as erudition increases. I therefore say of those utilities presented earlier that they are neglected by doctrine. Moses said

⁶I have been unable to locate this passage.

that the seasons, days and years are in signs.⁷ This oracle of heaven admonishes mankind to learn to observe the fixed turning-points of the year set forth by divine providence, and to consider the intervals of the years. This can never come to pass without erudition and a cognition of motions. God gave us therefore a shadow doctrine so that we could observe the equinoxes and the conversions of the sun. He gave a science of numbers and measures which elevates minds to the heavens so that we could recognize the fixed paths and ends of the luminaries as if before our eyes. Thus first the parents, then the more erudite and then the most ingenious always elaborated upon the observation of the circuit of the year so that they might conserve the fixed order of the seasons, whose benefit it is proper for us to be thankful for, and to praise the skill, diligence, assiduity and will as worthy of mankind. But there are many illustrious testimonies of skill and diligence, like that of the prediction of the eclipses and the description of the year, whose circuit, insofar as is possible, it exactly comprehends.

This[the description of the year] has been contested in many ways, the very oldest supposed the return of the Sun to a fixed star to be the true space of a year. Thereafter, as it was studied many ages later, the stars progressed, and a new path was sought. For this reason Meto of whom it is written that he lived in Athens, and I think was the grandfather of Empedocles, described the year as the return to the same point of the summer solstice.⁸ That is the reason why the beginning of the year in Athens was the summer solstice in which he better constituted the turning point. Then, after the age of Alexander, Hipparch preferred to observe the equinoxes rather than the Solstices. Because the variation of the declination to the equinoctial cannot be perceived for a few days around the solstices. Hipparch therefore defined the year to be the return of the year to the same point of the equinox. Ptolemy followed him, and by comparing his observations, he finally taught a more certain determination of the year than his predecessors, namely, 365 days, 6 hours, and less than 1/300 part of a day. This diligence did not yet satisfy posterity. For after Ptolemy Albatengius, in the year 743, clearly before this our age of almost 1600 years, found an emendation of Ptolemy necessary. Thereafter did most learned men again follow the first man with a certain correction, they preferred the year to be the return of the sun to a certain fixed star, as in this manner the circuit of the year appeared to be less unequal

⁷*Genesis*, ch. 1, verse 14. This reference played a critical role in Rheticus' '*Treatise on Holy Scripture and the Motion of the Earth*'.

⁸Meto was the father of Empedocles. I have not however been able to find a source which makes the claim Rheticus makes.

through long passages of time.⁹

I recounted these matters in this oration so that you might marvel at the diligence of great men who took it upon themselves to give us accurate calendars and an accurate description of the year. Consider how great this benefit already is. For if these masters hadn't conserved for us this series of ages, what shadows of religions and all of history, what total confusion of life would there be now? If we could not read the beginnings of the world in our souls backwards, if we didn't know which religions came first, which later: if the series of empires were unknown we wouldn't know the beginnings and propagation of the church. And God foresaw that we know such things, and he showed the year to contain twelve months, and constituted the beginnings in the equinox so that we would learn what the year is. These were the seeds of this doctrine for the first men. Wherefore, admonished by that voice in heaven, we lay out the utilities, and embrace, love and cultivate the gift of God. The related arts concerning celestial motions and Geography are doctrine and they cannot be separated. Who however is so wholly inexperienced in common life, so completely without sense for the common that he thinks that life can do without this which shows the locations of the regions, the intervals of nature?

No navigation and no journey of a longer distance can be undertaken or conducted by those ignorant of this art. How is it possible to judge on that in the prophetic writings, insofar as the church moved around, where which acts took place, if we don't have this skillful description of regions. The region is to be known in daily prayer in which the Son of God abided and was sacrificed, the place is to be understood in which the voice of heaven first sounded. For God wants to be invoked in such a manner that we at the same time know of the sacrifice of the son and of the promises. These prayers of the soul should place you in these places daily, so great is the idleness not to know where the locations of the earth are. Unlearned men also desire to view these in pictures. And if this art did not exist all people would think the earth to be something infinite, and would only know the spaces and intervals of those regions which would be at hand. Many grave errors in life can arise here. But how pleasing, how useful it is, when the mind embraces the whole circumference of the earth, and indeed is comprehended in a certain, easy and short method of computation. In which if you contemplated everything in thought as if before your eyes, you will be able to marvel also at its smallness, as it is 5400 of our miles. This is not possible without a doctrine of celestial movements containing exact descriptions like boundaries. I have already said how elegant and sweet this doctrine is, if I can express this in words. Yet this must be recognized in experience itself. One's own particular action, each to

⁹Rheticus here defends Copernicus' method of measuring the sidereal year. Of note is that Rheticus presents this as the 'original' method of the ancients, reflecting his belief in a once pristine God-given science - and that Copernicus has rediscovered part of this truth.

his own nature, is the most pleasant, and just as the one-eyed sing to the fish in the Nera¹⁰, so it is necessary for men to be effected by great desire when they view the entire nature of things, when they discover the proportions of numbers and sizes, when they understand the consensus and harmony of the celestial and inferior bodies, when they see that everything was created by a fixed law, so that they admonish us of the Architect. Because we are born to this consideration it is necessary that it not be desired by monstrous or distorted natures. Even though I said at the beginning that I would not speak of the matter of divination, I nevertheless add this, this same doctrine of the celestial movements is in and of itself μαντικη¹¹, and is the most excellent and most certain great divination governing life. For these laws of motion testify that the world did not arise by coincidence, but rather was founded by an eternal mind, and that mankind is the concern of this founder. As the laws of movements clearly show, it cannot be denied that this doctrine is truly μαντικη of the most supreme, for this knowledge of God and of Providence truly awakens souls to virtue. The Physicus predicts rain if southerly or warm west winds blow, if northerly winds then fair weather. Isn't divination so much more useful which confirms souls on providence so that they don't dream that the world came into existence coincidentally? It was with great cause that God gave us this testimony of himself. For when we have learnt that God is the ruler of all we understand that He is to be obeyed, we recognize His order and that it is to be instituted in our minds and in political society and the Divine punishments of those who disturb this order, which certain Gygantes would not seek to evade as when they risk to fortify themselves on Pelio in Ossa¹².

Finally the order of the celestial laws reminds us of many aspects of God and of mores testifying that the changes in nature were founded for the utility of mankind. Plato for this reason prudently said that he is so happy who explains this doctrine, it can govern mores, and be measured, just and useful to citizens.¹³ And I add the words of Plato so that the voice and authority of such a man awakens you to the love and study of these high arts. There is one vinculum of nature, the doctrine of numbers, figures and celestial movements, and if someone wants to teach another way, he invokes fortuna, as one commonly says. For without these no one can ever be happy in the body-politic. This is the way, this education, this discipline, be it easy

¹⁰I have been unable to identify this reference.

¹¹I.e. 'prognostication.'

¹²This is a reference to the Aloadae (Ottus and Ephialtes), mythical Giants who tried to reach heaven by piling Pelion on Ossa. They are referred to in the preface of Aristotles' *On the World* which Rheticus quotes in *Annotata in Alfraganum* 61^v.

¹³*Laws*, 820e ff.

or difficult. It is necessary to follow this path for it is not correct to neglect God who gave mankind knowledge of himself in these arts for which we should be thankful. These words are Plato's, recognize in them how wisely they are said, the welcome knowledge of God is heard in these arts, that is, of numbers, of order, and from the necessary cognition of the celestial bodies do we conclude that the world was founded by an eternal mind. Thus this same doctrine of which we speak is truly *μαντική*, even if we do not scrutinize other divinations, on the motions of the air, and of our bodies whose utility is not wholly null if they are bound within just ends.

Thus as the doctrine concerning the celestial motions is of great erudition, as it is useful for life in the distinction of the seasons and of regions, as it is the sweetest of the arts, as it confirms in mens' souls the honest opinion of God, and as there is the occasion to learn, I call on good natures that they devote themselves to these studies and that we, for the matter itself, and for the republic, should conserve honest arts useful to life.

Oration on Physics¹

Held in Wittenberg

Peace is the greatest of all things given to man to be known.

One peace is greater than innumerable triumphs says the poet. This is especially true among citizens. We therefore ask God for this perpetual peace, enough evil has already been brought about on account of the Churches. And to retain these small rests of letters, we should now give thanks to God, the father of the liberator our Jesus Christ, because he laid the tumultuous πανικόν² to rest which began in the vicinity. On this I shall say little, as we now wish for an eternal ἀμνησιαν³ of the entire matter. But in this danger of remembering do we cherish God with great piety and diligence so that he shows himself to the churches and to the studies which are necessary for human life. We will more easily obtain this if we don't fall in our free-time to luxury and obscene desires, but rather view the end to which purpose God gave peace to states, so that they may be educated, and the youth taught, and be governed through discipline, and that we demonstrate great assiduity in this our civilly clothed army. I shall now give an oration on Physical Doctrine so that you, in this place and in these gatherings, will be urged to encourage one another in the other arts and virtues. This and the first beginnings are taken from the mathematicians and everywhere borrows demonstrations from them. I therefore spoke on Mathematics not so long ago⁴ and often elsewhere.

¹This speech was first printed in *Orationes duae, prima de Astronomia & Geographia, Altera de Physica, habitae Vuittebergae à Ioachimo Rhetico, professore Mathematicum*, in Nuremberg at the printing houses of Johannes Petreius in 1542. It was published a second time in *Selectarum declamationum Phillipi Melanthonis, quas conscripsit, & partim ipse in schola Vitebergensi recitavit, partim aliis recitandas exhibuit*, on pages 341-349 of the first volume in Strassburg in 1544. It was subsequently published in the numerous editions of Melanchthon's works.

²I.e. 'Panic.'

³I.e. 'Oblivion.'

⁴A reference to his speech *In arithmetice praefatio*.

Perhaps however just as soldiers are incited not so much through words as through the nature, pain and magnitude of the cause, does Sallust proclaim:

As Words don't add anything to virtue
so do our trifling speeches not bring much to incite spirits⁵

I nevertheless think that it is useful for good minds to judge on the arts, they show the ends, they teach the student that that is to be directed less which is taken from the material itself. These same admonitions are indeed also conducive to exciting study. Nor do I think that the custom of princes isn't of any use which rouses the soldiers not only through speech but also through the trumpet.⁶ You have in this Academy, in this benefaction of God, most learned lecturers who explain Physics, and who invite eminent minds through the goodness of things, and who set inclinations in motion through their speech: I do not doubt that undistorted natures are kindled through their judgements and authority.

It is however presently the will of the entire college that the oration be held on the same argument which I announced would be discussed, so that you know that the opinions of everyone agree on this part of doctrine.

Of note is Vergil's verse in which it is said:

Happy is he who can recognize the causes of things⁷

And even if human nature is weak, and all diseases and fatal causes cannot be avoided by prudence or diligence, we nevertheless do not think that life instructed in so many arts is in vain, which indeed the divine has shown mankind.

Moreover, the nautical art is conquered by tempests, that however does not mean that the art of making ships and of rowing is in vain. Further, crops may perish in an inopportune summer or strangled in pouring rain: agriculture however is not for that reason to be laid aside. One can speak in the same manner about all the other arts. Medicine often helps life and rids it of pest-like sicknesses, even if the sickness is sometimes stronger than the learned art. It is this beginning of Medicine, Physical Doctrine, which should be taught to young men on account of its many uses, and of which I shall presently speak.

The doctrine of medical men embraces a substantial erudition and the

⁵Paraphrasing Sallust, *Bellum Catilinae*, 58, "Comperit ego habere, milites, verba virtutem non addere, neque ex ignavo strenuom neque fortem ex timido exercitum oratione imperatoris fieri."

⁶The explanatory margin given at this point in the text of 1544 sums up this somewhat confused thought with "to excite good minds like soldiers through speech and the trumpet."

⁷*Georgicon*, book 2, line 490.

health of human life. Yet not everyone can exercise this art, as Aristotle said, the polis establishes itself through the farmer and the medical man, the Republic needs many arts.⁸ These beginnings of Physics are therefore taught, not only for their cognition or pleasure, but because they serve many aspects of life. Even if everyone doesn't exercise the art of healing, nevertheless, all those who don't live according to barbaric custom need a certain common doctrine, which we call elements, on the seeds of bodies, on the temperaments, on the functions of the members and of the organs of man, on the causes of sickness, I add more, on the motions of heaven and the various effects which accompany their motions. I recall that there also was a doctrine of mothers in nurturing the health of families, and that it is necessary for it to be taught. For a certain domestic science to nurture health and to bring forth constitution is necessary for everyone. And it is fitting that the literate know the founts of these disputations, and even if these appear to be insignificant, many can nevertheless admonish the students. It was not the duty of Doctor Varro, but nevertheless, through reason and diligence he devoted himself to the multitude in the province infested by the pest, so did he save himself and his neighbors. He ordered that all windows should be closed except those in the north from whence blew more rigid winds.⁹ This plan was taken from schoolboy precepts, which in Physics, is taken from the differences of the winds, as all of you know.

Galen tells how King Antonius was accustomed to expelling the overload of a ventricle, that which was not yet digested in one day, by drinking a measure of wine which was laden with pepper. These are domestic matters, yet we cannot use them properly without an understanding of physics. For the causes were to be sought in Antonius, as to why he used almost inflammatory things. Upon closer examination he found that the undigested food arose by itself from the cold ventricle. I could say so much more of princes old and new who, even if they didn't practice medicine, nevertheless sought counsel in this Philosophy and in their constitutions and in those of others. Alexander's diligence was so great in this matter that he even knew the medicine which was spread from Chiron to Achilles, as we read in Homer¹⁰. I will not now speak on the complete arts of the doctors, I defer to this common and economic doctrine which we cannot lack if we do not want to live in the manner of animals any longer.

I also add examples from the Church. This same physical doctrine was peculiar to Noah, Abraham, the Prophets and the Apostels. For as they stand out among other men by reason of their authority, and were able to

⁸Aristotle, *Politics* 1328b,20, et passim.

⁹I've been unable to find the source of this statement.

¹⁰Homer, *Iliad* 11.830.

oblige many through benefactions, God wanted these persons to join the Medical art to the testimony of the evangelium, and he guided their hands in curing. Do not think yourselves as being unworthy to follow the endeavors of such men who, even as they sustained other difficult duties, nevertheless inquired into the working of the human body and into the temperaments and the cures of diseases. The one was perhaps more inclined than the other, yet all nevertheless knew the common Physics which is taught without letters. So therefore this first utility: that it is a part of this Medicine. Yet there are many other reasons why Physics should be taught to young men. For there remains a large part of Ethical disputations, because the causes of virtue are to be sought in the nature of man. Which is why a part of Physical doctrine is often used in civil business. And Plato says: Pericles distinguished himself from other orators because he had diligently listened to Anaxagoras on Physics¹¹, and an erudite Physics confirms honest opinions on God and on Providence. For we deduce from the doctrine of causes that there is an eternal mind, one, of immense power, wise and great, and as Plato says, the cause of the good in nature. It can do its part for discipline to confirm weak and languishing spirits with these arguments. I often bring together all reasonings of the Physicists on God so that I may more clearly refute the illusions of false opinions with which the Epicureans and Academics offend the eyes of men. We learn from Physics that an intelligent nature cannot arise from the irrational, or be born coincidentally. The human mind is an intelligent nature, and bears since birth an immutable capability of separating good and bad. It is therefore necessary that it arose from some more excellent and eternal mind. Who however doesn't see that a different consideration of the arguments is wholly useful? I rather assent to be ruled by the considerations of the voice of heaven, in which God more clearly shows Himself, His nature and His will. I therefore come to the doctrine of the Church. Even though I know that the Manicheans and many other fanatics brought about monstrous tumults in the Church of long ago with poorly constructed opinions of Physics¹², there can nevertheless be no doubt that an erudite and sincere physics is necessary for the church. If there are inept trouble-makers, the furor of men is to be cursed, not the art censured which those same disgraceful people lacked. And they are easily refuted when true demonstrations are brought forth. The examples also show the ancient interpreters could not do without Physics. That is why Nisenus wrote a long commentary on the parts

¹¹*Phaedrus*, 270a.

¹²The Manicheans light vs. dark theology involved an extensive cosmogony.

of man.¹³ And how much Physiology is in the others when they discuss the parts and offices of the soul. How often in grave theological controversies should one speak of causes, the variation of which is so eruditely taught in Physics.

Insofar as it concerns having a discrimination of the parts of the soul, as there is such a discord among these, the mind retains the impressed law of God, it demonstrates the benefaction of God, it teaches that punishment follows arrogance. But the other part of the soul, which they call Appetite, the seat of which is in the heart, is not moved by benefactions because it constantly loves God, nor does it shudder because it is admonished by the horrific examples of all ages so that it fears a wrathful and vindictive God. Each time we speak of the founts of the effects and of the seats: and the σοργάς should also be eruditely distinguished from the vicious motions. He will never be able to explicate this who is not accustomed to Physical doctrine, which is taught in the lectures. We find moreover that the ancient authors did not stick to the plebian in these matters, as in mud due to the ignorance of physics. How often are Church controversies driven by the question of prophecy. Here one professes something inexperienced in Physics insofar as it causes a stir like the opinions of the Stoics and Peripatetics which were uninformed. It is not only in these matters where I have proclaimed a use for Physics, we constantly run into Physical passages in the explication of celestial doctrine where a knowledge of these elements is a great help to the interpreter, just as a mediocre ability to paint is to the architect or to the sculptor. The ornament of the church is enormous, erudition, which comprehends not only the knowledge of words but also this certain variation of things. For a judgement cannot be formed without a certain consideration and collation of many things, nor does an oration have force or power if it does not arise from good things. The small verse is to be noted:

to know how to write well is the beginning and fount

A Physical doctrine is thus to be put together if we want an erudite church. And much is to be foreseen for us in this same matter. As unlearned minds cannot agree on the certain aims of doctrine, they easily err from the path, and it is harder to correct them, because they neither know nor observe the laws. It is necessary to follow these like a rule in teaching. Furthermore, they don't have the true Hypotheses. If we want to avoid these troubles then it is truly necessary to cultivate and polish these minds with true erudition. You know how great the furors of the Anabaptists are which indeed are clearly brought

¹³Cardinal Bessarion (1403-1472). I take this to be a reference to his *Tu sophotatu Kardinaleos Bessarionos ta heuriskomena panta: theologica, exegetica, polemica, partim jam edita, partim hucusque anecdota; accedunt ex virorum doctorum qui Graecas litteras in Italiainstaurarunt supellectili litteraria selecta quaedam*, Migne, 1888.

forth and propagated by so many illiterates. If however the light of erudition were to be extinguished in the church various deliriums would then arise as occurred previously. Moreover it behooves us to support the study of letters: Yet this concern reaches few, we must exert ourselves in this matter more vehemently so that we may uphold, insofar as we can, this honor of the church. This is peculiar to the militia of our order which God indeed shall support and furnish with rewards even if we are neglected by the centurions and much harshness is to be sown. Yet you know this to be the duty of virtue, to do right, to be there for others even if the common people are ungrateful. Are we not most clearly confirmed in the church where the more violent and cruel are hated in contrast to the well deserving, to whom the grace of Esaih and Jeremy is related to the highest and divine benefactions? We are incited by their examples to conserve the healthy doctrine for posterity and we come to the conclusion that God will not be wanting in his precession, nor will he allow celestial doctrine to be completely destroyed. We sustain and encourage ourselves with this hope in these tribulations which accompany our militia.

De XII. Signis Zodiaci ac Cerevisia Vratislaviensi apud Silesios quae dicitur Schoppo iocus doctissimi mathematici Georgii Joachimi Rhetici versu redditus a Bruschio in gratiam et Aurifabri.

The Twelve Signs of the Zodiac and the Silesian Beer of Breslau, called schöpps, a Farce by the learned mathematician George Joachim Rheticus, brought to verse by Brusch with the help of Aurifaber.¹

The rhyme scheme runs:

- -or- ˘˘| - - or - ˘˘| - -
 - - or - ˘˘| - - or - ˘˘| - || - - or - ˘˘| - ˘˘˘

where ‘-’ represents a long syllable and ‘˘’ a short syllable. As an example, the rhyme scheme of the first couplet is:

- ˘˘| - ˘˘| - -| - ˘˘| - ˘˘| - -
 - ˘˘| - ˘˘| - || - ˘˘| - ˘˘| -

¹*Sylvarum Gasparis Bruschii Slaccenvaldensis Liber: in Lipsensi Schola scriptus & aeditus. Anno Christi, M.D.XLIII, Leipzig 1544.*

I

Nobilis in veteri iacet urbs regione Quadorum,
 Sidere sub gelido, Parrhasis Ursa, tuo.
 Haec quia Sarmaticis paullo est vicinior oris,
 Forte Vratislavio à Principe nomen habet.
 Moenibus ac munita polos tangentibus altos,
 Nulli urbi cedit, Teutonis ora, tuae.
 Illic grata Ceres fieri solet, horrea postquam
 Ac lupulum purae miscuit humor aquae.
 Non est Saxoniae liquor aptior: omnibus horis
 Arctoo quae cum sidere sicca, sitit.
 Ista Ceres, Aries turba appellatur ab omni
 atque aptum a signo principe nomen habet.
 Nam velut ille trahens animalia plurima post se
 Zodiacum in supra conficit arce suum:
 Sic liquor humano solet ille in corpore totum
 Zodiacum recte constituisse suum.
 Nam velut ille lacessitus fecit undique cornu
 Monstrat & adversa praelia fronte minax:
 Primus & in toto signorum hoc ordine secum
 Accipit arbitrio caetera signa suo:
 Sic etiam illa Ceres hominis rapit omnia membra,
 Sauciat atque manus, sauciat atque pedes:
 Atque omnes sensus oculos perstringit & aures,
 Ne faciant munus pesque manusque suum.

II

Ac velut hunc sequitur metuendo corpore Taurus,
 Fronte hirsuta Hyades humida signa gerens:
 Sic quos illa Ceres nimis abluit intus, ubique
 In tauros etiam degenerare solent.
 Fronte petunt, veluti duplici fera bestia cornu;
 Et quos contingunt aspiciuntque viros.
 Atque Hyades veluti pluvias inducere largas,
 Quae sunt in Tauri sidera fronte, solent:
 Sic etiam tandem pluuias effundit & imbres,
 Quem taurum semel hic effecit ipse liquor.
 Cumque ita fronte petit quoscunque vir ebrius ille,
 Tum facile rixas excitat ille graues.
 Dum vocat hos asinos, alio illos nomine stultos,
 Atque alios aliis intonant usque modis.
 Donec & in barbam crinesque ipsi inuolat alter,
 Qui quoque non adeo sobrietate valet.
 Tum sic noster habet post tauri signa furentis

I

The renowned city lies in ancient Quadic lands^a
 under your cold star, Ursa Major.
 Close to the climes of the Pollocks
 She takes her name from strong prince Vratislav.
 Fortified ramparts bound to high towers
 She yields to no city, the border of the Teutons, yours^b.
 There the agreeable Ceres tends when the dew of pure water
 brews the little dog into the beer grains.
 There is not a better beer in Saxony: in all hours of the night
 beholden to the dry star doth it thirst.
 This Ceres, by all called wild Aries,
 takes her becoming name from that first sign.
 For just as he creates his Zodiac in its high arc
 by dragging many animals in his wake,
 So too will that liquor its own complete Zodiac
 in the human body create.
 And just as Aries charges with both horns when aroused^c
 and menacingly points to the onerous battles ahead,
 first in his order grand
 the other signs abide his command:
 So too does that Ceres lay waste to all the limbs of man,
 and wrecks the hands and wrecks the feet,
 she strangles all the senses, the eyes, the ears,
 hands and feet their office cannot complete.

II

And just as the bull follows him with body frightful,
 bearing the humid omens of the shaggy Hyades out in front,
 So too does that Ceres baptize men to their very core,
 and they degenerate everywhere into bulls.
 They charge! Just like wild beasts with two horns;
 And they meet men and stare them down.
 And just as the Hyades will bring forth profuse rains,
 being the omens at the head of the bull,
 So does this liquor finally pour forth rains and showers,
 yielding the bull in his full glory.
 It doesn't matter whom the drunken man charges,
 he easily unleashes a terrible brawl.
 He calls some asses, others fools by an appellation stronger,
 many ways do they have to thunder each other down without pause,
 until he tangles the accosted up to his beard and hair,^d
 nor does the victim particularly sober seem.
 Following the omens of the furious bull

III

Zodiacus geminos Tyndaridasque suos.

Dumque illi duo se per mutua vulnera laedunt;
Involvunt avidas crinibus usque manus;

Et nunc sese illuc, nunc huc in pulvere versant,
et verrunt totis vestibus omne solum:

IV

Dicere te poteris cancrum vidisse rubentum:

Namque ea retrograda est plurima imago ferae.

Hos ubi percipit & clamores atque tumultus,

Qui Cererem talem vendit in aede sua,

Advolat ille citus, vaginaque eripit ensem,

Corripit aut avida grandia scamna manu:

Hac dirimit lites, animo iubet esse benigno,

Irarumque iubet ponere quicquid adest:

Potores addit rixosos neutiquam amare

Se, sed concordi qui pietate bibant:

Se paci ac Cereri non irae odiisve malorum,

Vel sua Mavorti tecta sacrasse truci:

Hos altercantes qui sic compescuit ambos,

Hunc recte Libycam dixeris esse feram.

V

Haec ferventia erunt Nemecae signa Leonis;

Vicinus quibus Seirius esse solet.

Hunc aetate gravem tali & sermone timendum;

Iam metuit toto pectore uterque virum.

Ergo silent atque arrectis stant auribus ambo,

Et redit ad mensas ebria turba suas.

Pax fit ubique; domum complentque silentia totam:

III

Our Zodiac finds its Gemini and Tyndarids.^e

While these two injure one another with mutual wounds
 they entangle themselves with lustful hands up to their beards,
 now hither now thither, they beat one another to bits,
 And brush the entire ground clear in full attire.

IV

You will be able to say that you have seen Cancer red as blood,
 for his image contains many backward beasts.
 Where he perceives those cries and shouts,
 he praises strong Ceres in his house,
 He quickly hastens and rips his sword from his sheath
 violently seizing the grand thrones with eager hand.
 With this he frustrates the fight, he commands the soul to be calm,
 he orders that something fill the place of the rages.
 He adds that the roudy drinkers are not to make love,
 they should rather drink in concord and piety.
 His house is consecrated by peace and Ceres, not by rage
 nor the hatreds of the bad, nor by the savage Mars.
 He who restrains both quarellers
 You will thus rightly say to be an African beast.

V

The glowing omens will be those of the Nemean^f Lion
 near to which Sirius will tend.
 His weighty manhood and deep voice call forth dread,
 the entire breast of both men now pants with fear.
 Both fall silent and stand with ears attentive,
 and the bedrunken madness returns to their tables.
 Peace rings forth in every quarter and silence fills the house.

VI

Paxque haec Astreae virginis ora notat.
 Quae Saturni habitans pacatas tempore terras,
 Coelestes adiit sub Jove pulsa lares:
 Hospitis audita iam duricieque minisque
 Ac sermone gravi pergit uterque domum.
 Dumque per amplarum spatiat^{ur} strata viarum^g
 Alter, & augusti per spacia ampla fari,
 Nunc his nunc illis inclanans partibus aedes;
 Nunc has, nunc illas denotat esse suas.
 Si tot haberet & is, quot nutu denotat; esset,
 Roma vetus, Crasso ditior ille tuo.

VII

Hunc igitur Libram si dixeris esse bilancem,
 Iudicium poterit carpere nemo tuum.
 Hic longos ubi post cursus sua tecta subintrat,
 Ac recipit dominum regia parva suum.
 Ingreditur penetrare domus, titubansque subinde
 Fabula fit pueris risus & ille suis.
 Uxor Arachnaeas diducens sedula lanas,
 Hauserat insipidas sobria semper aquas.
 Vix etiam se pane domi bene paverat atro;
 Auxerat & parvae commoda parva domus.
 Haec ubi conspexit temulenti signa mariti,
 Vocibus hunc lacerat protinus illa suis.
 Ac tractat duris nimium sermonibus ipsum;
 Iam taurum, mox & clamat esse suem.
 Iam furem dicit, modo latronemque procumque
 Nuncque hos nunc illos increpat ore Deos.

VIII

Scorpius hac certe dominatur in ordinis arce,
 Ac, nisi me fallit mens mea, scepra tenet.
 Ille furoris ita impatiens, ut plenus Iacchi
 Ac Cereris donis atque utriusque Dei,
 Corripit ex digitis vetulae; quae proxima sedit,
 Lanificae fortem Palladiumque colum,
 Coniugis hanc mox impingit latrantis in ora,
 Concutiens faciem, concutiensque caput.

VI

And this peace distinguishes itself in the region of the virgin *Astraea*^h
 who lived in peaceful lands in the time of Saturn.
 But the Heavens swayed under Jupiter and she was beaten down to a household god.
 The rumours of the hostess are now hard and foreboding.
 But both proceed through the house amidst its grave speech,
 and whilst one walks through spacious cobbled roads,
 Does the other ambulate through the open space of the august mew
 yelling 'home'! to one place then 'home'! to another.
 Stalking these parts, then those as his very own.
 Were he to have everything and that which he claims at a nod
 then, old Rome, he would be more wealthy than your Crassus!

VII

Thus if you call the balance *Libra*
 no one will be able to doubt your judgment.
 Here, where after long journeys he steals into his abode,
 and the little court receives its master,
 he comes to the heart of the house, staggering and stammering
 he tells a tale to his boys and laughs.
 His wife *Arachne* assiduously spins wool,
 sober, she always drinks tasteless waters.
 And as he feasted well on bread in the dark house
 the small house and its little creature comforts grew.
 Perceiving these tokens of her drunken husband's presence
 she gives him an incessant tongue-lashing,
 and talks him down with her hard speeches.
 Once a bull, he now yells that he is a pig.
 He says he is a thief, that he is only a bandit and a wooer.
 His lips reproach now these gods, now those.

VIII

Scorpio reigns strong over this arc of the order,
 and, if my mind does not falter, he bears a sceptre.
 Bursting with fury and madness, the bounty
 of gifts *Bacchus*, *Ceres* and their friends receive!
 He seizes the strong distaff^f and the *Palladium*^j from the fingers
 of the old lady, the old weaver sitting nigh!
 He now slugs the woman with the ranting husband in the mouth,
 smashing the face, and smashing the head.

IX

Semimarisque colum hanc si dixeris esse sagittam
 Herois, puto te dicere vera nimis.
 Tandem ubi pertaesum est rixarum, ultricis & irae,
 Claudicat ad thalum bos penetrare sui.
 Dumque fores humiles erecta fronte subintrat,
 Incutit aduersis postibus ecce caput.
 Moxque iterum nunc huic lateri, nunc incidit illi;
 Ipsis parietibus praelia saeva movens.
 Et quamquam dudum caput omni parte laboret,
 Cogitur illud adhuc vulnera ferre tamen,
 Idque genus belli gemini post signa tyranni,

X

Zodiaco in nostro sic Capricornus erit.
 Aedem ubi se deinceps sponda propiore locauit,
 Mollibus & plumis sus adoptera iacet
 Epotos crudosque eructans ore liquores;
 Euomit & potus euomit atque cibus:

XI

Udus ita ingentes effundit Aquarius amnes;
 Zodiacus finem sic prope noster habet.
 Fluctibus ille suis toto & circumdatus omne

XII

Iam natat in mediis Piscis avarus aquis.
 Finis adest operi: fesso date vina Poetae;
 Ut solis madidus discat & ille viam.
 Id cupida versato manu noctesque diesque
 Tempore quisquis amat noscere signa breui:
 Sedulus & versato merum, versato Lyaeum^k,
 Nataque Eleusinas saepius udus aquas.
 Sic ipso fies Hyperione^l promptior olim,
 Ac celerem hac vinces commoditate Deum.
 Ille duodenis percurrit mensibus illud
 Immensum spacium, quod Iouis aula capit.
 Tu poteris quocumque die hos implere labores,
 Atque ita Zodiacum constituisse tuum.

IX

And if you say that the arrow of the hero
 is the distaff of the manhorse, I believe you speak very truly.
 Finally, when the brawls, the venging and the rage grow old
 the ox will stumble back to his innermost chamber.
 And as he steals through its humble doors with an erect back
 Lo! His head slams against the opposing posts.
 And now again! His head slams against this side, then that,
 engaging in fierce battles with his own walls.
 And although his head has labored long with every part of the home
 does he only now realize that it can indeed injure.
 And as the origin of the war, the Gemini, follows upon the omens of a tyrant,

X

 so does Capricorn now arise in our Zodiac.
 She brought herself to the house to be close to the couch,
 and the little adopted pig throws herself upon its soft feathers,
 spewing forth crude drinks and fluids,
 she vomits the drinks and she vomits the fare.

XI

Wet, Aquarius lets loose great streams,
 our Zodiac is nearing its end.
 Completely and utterly engulfed in his flowings,

XII

 covetous Pisces swims amidst the waters.
 The work has reached its end, give the tired poet wine!
 So that he too might learn the path of the sun wet.
 You likewise desire to learn the signs, the days and the nights
 in a short period of time with a keen lustful hand.
 Seated twisting in wine, twisting in Bacchus,
 Wet, Eleusian waters are often born.
 And so you shall now be more prepared for the Sun
 and you will conquer the swift God in this proportion:
 He runs through that immense space in twelve months
 which embraces the palace of Jupiter,
 You will be able to fulfill these labours on whatever day,
 And thus is thine Zodiac to be constituted.

- a. The Quadi were a Germanic tribe who settled on the Main in 57 B.C. They then moved to the Maehren which is the area referred to in the poem.
- b. 'Yours' seems purposefully ambiguous in the Latin. Simply dangling at the end of the pentameter it would mean 'Your German city', possible however is also 'she cedes to no city of yours'.
- c. The constellation of Aries was said to have horns 'Aries cum cornibus'.
- d. *Barba crinesque* means both 'beards and hair' as well as 'comets and falling stars'.
- e. The relation of the gemini, Castor and Pollux, to Tyndareus may be seen in Apollodorus, *Library and Epitome*, 3.10.7.: "But Zeus in the form of a swan consorted with Leda, and on the same night Tyndareus cohabited with her; and she bore Pollux and Helen to Zeus, and Castor and Clytaemnestra to Tyndareus." (trans. J.G. Frazer).
- f. Nemea was an open valley on the north borders of the Argolid, in the territory of Cleonae. It was the scene of Heracles' encounter with the lion, and of the Nemean Games.
- g. Both of the 'ia' diphthongs in this line must be pronounced short, suggesting a slurred drunkenness.
- h. Goddess of justice who left the earth in the iron age. She was placed among the stars under the name Virgo.
- i. A distaff is a cleft stick holding wool or flax wound for spinning by hand. In a metonymical sense, the distaff in our poem could also be read as 'the thread spun'.
- j. An ancient sacred image of Pallas (Athena), said to have been sent down from heaven by Zeus to Dardanus, the founder of Troy, or to his descendent Ilus. It was believed that the protection of the city depended on its safe custody. Greek legend told that Diomedes and Odysseus, at the instigation of Calchas or Helenus, carried off the Paladium and thus made the sack of Troy possible.
- k. Lyaeus has three interrelated meanings: 1) 'relaxer' or the 'deliverer from care', 2) wine, and 3) Bacchus.
- l. A Titan, husband of his sister Theia and father by her of the Sun, Moon, and the Dawn (Hes. *Theog.* 371ff., cf. 134f.). The name is often used as an epithet for the sun himself, as in *Odyssey* 12. 133.

On the Sheep of Halle

An Elegy by Johannes Stigel

The city is covered in waves from the blue depths of the Salle
it takes the name of salt from the founts of Halle.

There the fawning Ceres is changed into a sheep
Who would believe that it should happen just as I sing it.

The soft seeds of corn are mixed with the shining [waters]
The liquid humour of pure water tempers these [seeds].

A lumpy mass arises; the kneader whirls this into a subject dignified,
And then he manufactures clever little pies.

These then rise with the permeating vapour as if by purpose driven
So that the pliant water swells after the spongy coat has been expelled.

And because they are created in the form of the prostrate sheep grounded
the lamb gives these a name in this place.

You laugh at the material, reprehend the form, of the apex[apici]?
It shall not be served on your tables, neither these nor those.

Who are you, who gleefully pours of the unremitting Bachus
You do not let your gluttons easily go.

Put one such lamb before these your feasters
Do they say, oh my God! this sheep is detestable?

Likewise you heavenly gifts of the beautiful girl
My love, solitary, sweetly both the good and the bad.

So that you shall caressingly hold parting lovers
love potions harm, I do not wish to give you love potions here.

Place these treats above all else to your tables
He who wishes to leave you, will be nothing

The sweetest fruits of Lot to be had like a feast
They cannot be separated from the sweet meal.

So do each eat of the aforementioned lamb at the banquet
It sticks like warm pitch does to the hands.

And although he may widely travel through diverse lands with his body
He shall nevertheless not be able to leave the city with his mind.

This his mind remains, it sticks to every wall of the city
The absence calls back these bodies, whenever it so desires.

Dear me! what shall occur when I depart; if the mind
which doesn't well sustain the present is my travelling companion

Here the body fights; there the mind fights more furious
And the die of Mars makes both horrible

Yet I believe the mind shall win, it is certainly superior to the body
If it is good it can duly win.

The winged loves testify to its goodness
Ah! one does not badly sin who lovingly loves.

As I speak an all penetrating tremor attacks my joints
And I do not know whither greater the mind departs.

I do not want nor can I depart from the pleasing land,
It pains heavily to be away from these habitual places

The great colleagues of Odysseus testify to this
Only by force was the terrible confusion withdrawn.

If some strong Odysseus had not likewise dragged me out of there
the person I was would soon be all sheep.

Dean of the College of Liberal Arts

Joachim
Rheticus

On the coming Thursday, as it is fitting and pleasant, we bestow the degree of Magister in the liberal disciplines upon a few honest and learned scholastic men. We do not doubt however that all sane men favor the study of the true philosophy which is a grand adornment of life and the light of the other arts through which human life is governed. You often hear that these same disciplines which philosophy contains are selected gifts of God, given to Mankind on account of their vast utilities. For the heavenly gifts are not of a leisurely nor trifling nature. How clearly does the use of Arithmetic underscore this, whose eloquence is such that its significance can be seen in how many shadows of life and histories there would be if no other ends and the paths of the stars were unknown. It is further clear that the public doctrine in the churches needs the knowledge of speech, articulation, histories, the partition of causes, the description of man and the philosophical doctrine concerning the causes of virtues. If someone were to scorn these it would seem that he would not only lack prudence but also candor. We therefore ask all those erudite, honest and candid men whose mention we have made to convene to the pomp on that day in which the degree of Magister shall be bestowed in the traditional manner upon those whose names here follow.

(Preface to the Ephemeridae of 1550)

The Author to the Reader

Because we have followed the path which erudite antiquity traveled, it lead to the understanding of the most beautiful things. I strive above all to recall these methods and those writings to the schools. Yet this work could not appear more foreign to some (for many withdrew themselves for a sufficiently long time from these vestiges). For it was seen how Mathematicians work so that they can explain unknown terms in a vulgar tongue, and stabilize swaying structures so that they can be affirmed, and thereby demonstrate them, and what the words signify, and the manner in which we want to understand the things we teach. As however it is necessary for others to give different speeches on works of this kind, we have taken it upon ourselves to say some words at this time concerning the whole body of such descriptions. We however shall take up only those areas of mathematics which can no longer be ignored, and which are indeed grasped in the desire for understanding. For the others require their own speech. This is first of all therefore already entirely clear: That which is taken from the tables of star positions, which everyone commonly uses, is now terribly far from the truth. And so that it may might be more attentively noted, we last year published the positions of the fixed stars and planets for the first days of each month. We now edit the Ephemeridae, i.e. the daily indications of the stars, for the entire year, in which the errors of the vulgar calculations can be more clearly seen.

This art was nevertheless never perfect in Greece before Ptolemy, after a few centuries terrorized by war however, as these studies were cultivated less, they sunk to the same level as before Ptolemy, so that the truth was given up. Azophi, Mahumeta Aratensis, Thebith Saracem and then King Alphonsus of Spain tried to keep the ruin from sinking. The divinity was indeed awakened then, yet through the fault of the times, as the doctrine of antiquity was not grasped, even this incredibly great work had to lose its foundations. For which reason, after exactly forty years, a certain Guilhelmus of Saint Glodialdo risked adding notes to the Alfonsoian judgements with his own observations, which Prophatius the Jew was likewise to do shortly thereafter. Johannes Blanchinus, George Peurbach, Johann Regiomontanus the Frank, Bernardus Gualterus and Dominicus Maria followed their lead. All of these, because they saw that errors which were to be studied had invaded the beautiful art through a certain neglect, struggled in their study and work

so that they could amend and remove some of these [errors]. They say for example there is no doubt that Arzaelem, the author of the *Toledan Tables*, was a great man. He lived about 183 years before Alfonsus. From him we have 42 Solar observations for finding the Apogee of the Sun. From this it is clear how great the debate was in this endeavor. For, as is taught in our Astronomical commentaries, there are others in this science to be studied, and indeed even preferred. From the last generation however Mr. Nicolaus Copernicus, coming after all those we have named, who, as if it were his hand, moved the machines of the world. And as the doctrine of the arts and great disciplines taught his soul, having finally achieved leisure, the entire matter embraced in his divine mind, he perfected it with incredible diligence, to the admiration of all versed in these studies. He lived with Dominicus Maria of Bologna whose thought he plainly understood, and whom he assisted in his observations. He didn't however hold his mediocre investigations in the highest regard. Therefore, the stay did not damage these path-breaking investigations, neither through sloth nor through the wretchedness of fatigue. These investigations strived after much, and what they produce is as subtle as Peurbach's eclipse tables. You should notice however that these placed all their care in these matters so that they could scrutinize the positions of the stars as exactly as possible. They eagerly tried to express these positions in seconds - thirds, fourths and fifths of minutes, they meanwhile forgot integral parts, nor did they respect them, and in pursuing τὰ φαινόμενα hours, sometimes even days, went by. That which we find in Aesop's fables occurs in this activity: charged with bringing back a stray cow, the boy tries to capture certain small birds, he doesn't catch them, nor does gain possession of the cow. I recall how I was moved by the same juvenile curiosity, and desired to penetrate as if into the stars. I therefore now laugh at this investigation with the fine and great man Copernicus. For he, as they pleased the honest cupidity of my heart, used to urge me and scold me with a gentle arm that I also learn to take my hand from the tables. I said that if we were able to understand the matter in sixths, which are parts of ten, I would be able to adduce the truth and that my heart wouldn't be less exulted than Pythagoras when he rejoiced upon finding the ratio of the norms. Admiring me, and in order to strive for something more certain, he said: he demonstrated on this point that the goal was only to be reached with difficulty, as, among others, there are three strong arguments. Of these he said that the first was that one had to notice that many observations of the ancients were not sincere, but rather accommodated to that doctrine of motions which each of them had uniquely and particularly created. Thus attention and a singular industry are necessary so that those observations in which the opinion of the observer added or detracted nothing or at most a little can be distinguished from the corrupt. The second reason he said is that the positions of the fixed stars were not given in parts smaller than sixths, it is nevertheless clear that these are needed to grasp the positions of the planets, a little was

thus lost. It helps when the declination of the star is noted from the equinox, because the position of the star can already be ascertained more certainly from this point. He admonished with the third cause: we don't have authors like Ptolemy had following the Babylonians and Chaldeans, those lights of the art: Hipparchus, Timochares, Menelaus and others whose observations and precepts we can support ourselves with and consider. One could of course prefer to acquiesce in these matters and openly declare oneself to their truth rather than to show an acrimony of character in the dubious subtlety of ambiguous issues. Nevertheless this path is by far less certain, for even if almost all of your observations are wrong by $1/6$ or $1/5$ this mistake not only punishes you insofar as it is wrong, but more severely damages the undertaking itself for a long time as it can only proceed through mammoth labor, a great debate and a singular aim and industry. Indeed, according to a proverb of the Greeks, Mercury couldn't decide, because, he said, this his cause was neither observed, nor was it accepted by the others, for which he could either be supported or he could prove his case completely. Indeed, admonishing me often, subjecting me, teaching me, he encouraged me first of all to dedicate myself to the observation of the fixed stars, particularly those in the Zodiac, as the positions of the planets can be noted with these. The most learned Gemma Phrysius, the other Copernicus of our times, now also comes to the conclusion that this has to be done. I understand that he is laying the firm foundations of this art, and, as he is up to the task, I celebrate him in my soul. When I speak of Copernicus' works in such a manner and decide to defend certain imperfections of his in these matters and reprehend the character and the uncertain diligence of others, I don't want to be seen as acting in a way which would lame his drive and industry. I further also wish that the rich and powerful through expensive undertakings, and the learned and erudite of astronomy in their laborious communications, take up the care of this most beautiful matter so that even in our times the art can be completed. Indeed, even as Copernicus feared the unjust judgements of others and sharply questioned his own discoveries, he was encouraged by the honorable Mr. Tiedemann Giese, and he composed his work and allowed it to be published. Not so that others are halted in these discoveries and traditions, but rather so that they lead us, after all the heated contention, to progress much further. For if only our times could see this occurring, perceive the fruit of the good arts, of the generousness of Princes, and of the concords of the learned. For this work is truly not the elaboration of one or a few, but was done with help and cooperation. To which part I promise to give my own work, which neither unworthy of the excellence and greatness of Copernicus nor without particular use, so that it may appear to be both honorable to me and the good and erudite. I all the same don't want Copernicus' ideas to be inculcated abroad, either by myself or some other person, not so that an attempt is made to help his good name, nor correct the deficiencies, but rather it seems it would confuse the enterprise and the work if someone were to

twist it. This however is the same as that which the young slave Plautinus says: The work conducted in faith will experience the simple fortune that the elaboration may be considered and seen for what it is. And so great is this curious leisure that it brings its own comments to the discoveries and teachings of others: and to mix the diverse corrupts everything, just as cooks confuse many laws. I however did not want to distance myself from the Copernican doctrine in the construction of the Ephemeridae, not even by the width of a finger, as the saying goes, which was followed, as I admit, up to a point of complete refusal, and I know it to be thoroughly reached, and I give thanks that this my work could come to be to those who more feverishly study to understand these disciplines, as well as to those who are content with foreign values of the positions of the stars for προγνώσις, as if they wanted to assume the face of the heavens. For those[values] which have been made public are, according to our demonstration, not certain, erring by at least a half hour or even a full hour, which comes to pass as these minutes were used in determining the positions of other stars. Our thoughts on these and those issues however will be presented in another place, like in the books on the eclipses and designations ὑποθέσεων περὶ τῶν ἀνελιττουσῶν, and our tables of the unequal motions, if these are published in the coming days as I hope. Should they appear, I also hope that the students of this art will find nothing to be more desirable. For which reason we find it necessary to come to the following conclusion: We followed the Copernican doctrine throughout the entire exposition of the Ephemeridae. We even accommodated the description of the stars to his meridian which is at the mouths of the Wisła, whose longitude Ptolemy gives as 45, so that however these Ephemeridae might better congrue with our regions, I've reduced the positions of the Moon and of those which stand in relation to the Sun to the meridian of longitude 30 as Ptolemy found that the opening of the Elb river receding to the east had a longitude of 31. This is therefore the space of one hour, insofar as the time is given in συσχηματισμοῖς, and the hourly motion of the position of the moon is also given. But just as the arc of the great circle between Frauenburg and Leipzig is not greater than 5 and 1/3 and the ἔξαρμα of these is 54 and a third and 51 and almost 1/3 respectively, the interval between these meridians, according to the theory of triangles in a globe, is only 7 and 1/3. Indeed we do this insofar as we can, according to the old proverb: It was the duty of princes to assign work so that the surface of the terrestrial globe could be described, and it counsels us and posterity to do the same. I now come to that which I above deemed worthy of explication. And I shall first show the order I observed in the exposition of my Ephemeridae. Ptolemy, not the king in Egypt, but the king of the Astronomical science, said that Astronomy has two parts, one prior in place and dignity in which we find the motions and places of the Sun, Moon, and stars and their positions in relation to themselves and the earth. The second is adjunct to this one and secondary in which are the judgements and conjectures concerning the effects of the stars

and certain events. It was proper that the theories of both parts found their basis in daily tables. On which we shall say more when we publish, given Christ's favor, the Ephemeridae for 1552, for there will be more there concerning both parts. That however which pertains to the motions, places and positions of the stars is now exposed with my mediocre industry in the following manner: The numbered days of the months are given in the form of the religious celebrations, according to the custom of our times. To these are added, in a direct series, first, the indications of the places of the Sun and Moon and likewise the definition of the northern Lunar circle, that is $\pi\epsilon\rho\acute{\alpha}\varsigma$ $\beta\acute{o}\rho\epsilon\iota\omicron\nu$ along with an indication of the daily lunar latitude. Second, the places of the five wandering stars in the Zodiac. Third, the limits of the luminaries are designated by the four turning points or $\kappa\acute{\epsilon}\nu\tau\rho\alpha$. In these we find a certain occult power, that which is even seen in the ocean, winds and heat accommodating themselves to these moments. Fourthly, the places of the Sun and the five planets are described in relation to the Moon. Fifthly, these same planets are described in relation to the Sun. On the first page, after we give the occultations and emergences of the wandering stars for each day of the month, we give on the next page the same for particular fixed stars under the table $\sigma\upsilon\sigma\chi\eta\mu\acute{\alpha}\tau\iota\sigma\mu\omega\nu$. Further, just like the Ancient Romans so finely instituted that the beginning of the year and likewise that of the day began with the movement of the Sun towards us, the year beginning with the winter solstice at midnight when the lengths of the days increase and the Sun passing through the solstice of its lowest point; pushing away its shadows. this I say, just as the ancients observed the year in this way, is the path to follow. On account of this fact we denote the accession of the sun, which is the time before the meridian, with the letter a, the time of recession [*d*ecession] after the meridian with the letter d, as was the custom with Maronem. In whom one finds:

And the Sun duplicates its shadow when rising
and [at the same distance from the meridian] setting.

As these indications follow we should also explicate those which are prescribed at the beginning of the Ephemeridae. For as Ptolemy taught to observe the apogees and perigees for prediction (the apsides, these are the highs and lows, when the star is at its greatest and nearest distance to the earth respectively), and certainly the nodes and the designation of the end of the latitudes, these should also not be omitted. And indeed that definition of latitude, which is found in the moon at its northern end, because it changes daily, was therefore to be included in the exposition of the Ephemeridae, as already stated. What pertains to the nodes of the Moon however, these always appear at the limits of the circle, the angle on the right of the quadrant $\acute{\alpha}\nu\alpha\beta\iota\beta\acute{\alpha}\zeta\omega\nu$, to the left $\kappa\alpha\tau\alpha\beta\iota\beta\alpha\zeta\omega\nu$. Concerning these however, as their variation is not so great, it is enough that we have an indication which can be

seen at the beginning of the Ephemeridae, in which we also have the positions of the Moon, of Venus and of Mercury at ἀπόγειοι and περίγειοι so that the Moon and these Stars may be known during the day, as the apogees and perigees are always on the epicycle. The demonstration of the eclipses which we found to arise in this year follows. We decidedly placed this before everything else, as those which defend the truth of the Astronomical art above all else. Finally, so that nothing would be found wanting by those whose heart is set on προγνωσ[τ]ικα, a table was added to the Ephemeridae for the construction of horoscopes and of the Middle of heaven, aptly given in four ἐξαρματα namely, 45, 48, 51, 54. So that the use of this would be easier, we divided the equinoctial circle not by those known 360 parts or by seasons, but in νυχθημερι or spaces of 24 hours, and the hour in parts. Enough has been said on these matters for now. And there are many Canons and smaller works on the use of the Ephemeridae, and such matters are already taught publicly and privately.

(Preface to Werner's *De Triangulis Sphoericis*)

Proemium

To his serene Majesty Ferdinand King of
Hungary and Bohemia et al. and the protector of
the great disciplines and the arts, etc.

from Georg Joachim Rheticus on the books of the Nuremberg
mathematician Johann Werner, edited through his industry and
diligence.

Julius caesar developed and wrote histories which Thucidides called the thesaurus of princes, on the most important matters of great things, on how to establish a collapsed state anew, on defeating enemies, while he sustained the weight of the entire empire, between arms and the blast of horns. It appears that this was done not so as to give others the motivation and faculty of writing of their own deeds, but rather to take away the entire story from others.

Something else which lead to being a hero was that, as Alexander the Great basked in the success of his deeds, he cried to his statue that he had not done something great, something worthy of his spirit and mind, for he also wanted to excel in doctrine. He had attained his knowledge of physical matters from Aristotle, but had lead himself to observe the heavens.

He learned that in the Republic, as in the world, only one Sun can be carried. So true is that saying of Homer:

ὄκ ἀγαθὸν πολυκοιρανίη, εἰς κοίρανος ἔστο.

In the Heavens the Sun is Monarch, he on earth. He desired to understand for this reason the imperium of the Sun in the heavens. To recognize the ends of the year, and those of his own state, to institute a certain ratio of the year and the seasons through the risings and settings of the stars, by means of the Sun, the leader and prince. To accomplish this task he employed the great mathematician of his day Sosigenes, who, according to Proclus, wrote the books on the conversions.

What great change of empire from that form which Julius had conceived in his soul did the great benefits of Julius Caesar's Victory bring

to God, who protected him with his shield which fell to a miserable fate so that posterity would see that the Divinity had guarded the path, not through virtue, nor chance, nor Fortuna. And He thus also assisted Cyrus, so that he could institute a certain ratio of the year and restore the fallen doctrine of the motions and risings. This began under the Persian monarch, and the doctrine of motions began to take root for the first time. For the observations of the Babylonians appear to fall in this time period. The Mathematician Manilius gave thanks to the divine Augustus by placing a gold ball atop the Obelisk. Ptolemy flourished in the times of Anthony the pious. Between him and the Great grandfather of your Serene Majesty the Divine Frederic, that is 1300 years, did the one and other flourish hardly without significance, obviously Albategnius of Aracen and Azophi. Under your Great Grandfather did a light begin to rise in the Mathematical disciplines, in whose time George Peurbach and Johannes Regiomontanus first tried to develop Mathematics out of the Saracenian barbarism. Of these two George had a position with the illustrious Sigismund of Austria. Regiomontanus among the highest priests. After these came the famous minds Johannes Stabius and Andreas Stiborius who the Grandfather of your Royal Majesty, the Divine Maximilian, supported, nourished and brought forth, because he was uncommonly fascinated with these studies and understood them like a master.

As however the princes of Republics are occupied with grave cares and the burden of negotiations, they have no time to train themselves in Geometry. Those great men Stabius and Stiborius thought up various instruments and Astronomical Machines as thanks to the Grandfather of your Serene Majesty, with whom he traveled, fought wars, and wrote histories. He indeed not only observed the motion of the heavens and the risings and settings of the stars but also understood the causes of all these quickly and correctly as if upon a glance, without weary.

Further, as Stabius served under his Serene Majesty in the office of Mathematician and Historiographer, he did not have the leisure to adequately investigate these sublime matters. He saw that the mathematical doctrines of Johann Werner of Nuremberg was investigating were close to what they were doing. He pressed Werner to follow the same path, for which he found thanks with the Serene Majesty of the King as well as from many leading men who took pleasure in the mathematical disciplines after they had been moved by the authority of the King. Werner thus wrote six books on Meteorscopy, in which all of the rules of the doctrine of the prime conversion and those of the Geography were put together with such ease that each of the obliquations of the Sun were given in single days without the logistical drudgery or Geometrical sand games. He found the elevation of the pole of the world in various ways. He laid down the true locations of the stars in the celestial globe and easily predicted the risings and settings, the occultations and apparitions of all stars. He described all forms of Sciotherics or sun-dials for any given plane, even those brought forth randomly, of which some are more

exact by manner of their various placements at showing the hours in relation to the meridian, others in relation to sunrise and sunset. He discerns the parts of the day from a simple investigation of the sun and stars by means of various arguments. We understand [ie. through his work] the paths of the sun and the transit of the Zodiac through the horizon, the meridians and the circles drawn through the vertices of the horizons, as well as the sections of the same [ie. of the circles] with their horizontals from which we gather the defects of the Sun and the various labors of the Moon. In Geography we reason the position of specific locations on the globe of the earth through the three arcs of the great circles and the three angles of inclination.

Obviously the distance of two places above the pole is the itinerary of the same. The position of the one to that of the other in regards to the inclination of their meridian, and the inclination of both meridians in relation to that maximum which is drawn through the vertices of both positions; Whenever three are given six can always be derived through permutation and be made known, these are the *Meteorscopia*. When employed not only do the three remaining positions appear, but they also show the manner of the rising and setting of the stars and when they culminate. The longitudes and latitudes of the respective positions are then to be found.

In this doctrine which concerns the effects of the State of the Heavens, of the Sun, the Moon, the Planets, the fixed stars, and of those between these in the world, and the form it assumes in relation to us, that part which investigates the up and down movement of the Liberator or Apheta is the most difficult of all.

For this reason Albohazen ascribes this cause to the nodes of opening in his books on the subject. These nodes, in these books, are indubitably opened, but also the face of the entire heaven, through these *Meteorscopia* which we may easily describe at any given moment of time, from which we gather that the effects of heaven are ordained by God.

Following Werner's death George Hartmann, a Mathematician from Nuremberg excelling in doctrine and virtue, collected these books [ie. on the *Meteorscopia* and the spherical triangles] like dispersed tables from a shipwreck there in that city. He artfully brought these tables together which were dispersed and written as if on Sybillan pages, and gave them to me 15 years ago. There are many reasons as to why they laid forgotten in my possession for such a long period of time. The first and second *Meteorscopia* were edited by certain friends of his, for, as I have heard from George, they said that they had the responsibility and draft for the completion of the work. Yet I knew them to be the deceivers in the tale of Bellerophon well enough, who claimed to be the authors of the work, yet they [ie. Werner's books] are in our possession, which has the language in which the author demonstrated the work as is shown above. As we do not doubt whether they are the authors of the *meteorscopia*, we do not see any of the work as produced by them. The *Meteorscopia* are thus Werners, we have nothing more to say on the issue,

particularly as he produced two other *Meteorscopia* in the meantime which were clearly superior to those which went before them. For which reason these have been altered even in the language, ours however is eloquent, and it shall nourish all of posterity with its erudition.

Vergil would have rather had his *Aeneid* consumed in flames than not to have the final hand in its edition. As our Werner also would not, he conducted his research in such a manner that he could polish and perfect it, prevented by death. I did not want to present our mind in a foreign work. And I doubt whether the unpolishedness or imperfections would have been greatly improved, if I were to have edited it. Finally, the counsel of the divine Augustus won out over all other considerations. The *Aeneid* did not need to be refined, as Vergilius had opted for through his art and diligence, the divine Augustus nevertheless did not cheat all of posterity out of the labors of the divine Vergil. We see that many of the writings of the excellent Medicus Montanus, both spoken and written, were edited in the same spirit. We therefore do not doubt that we have not corrected the mathematical work of our fellow German in every detail nor absolutely, because although it is excellent, it will be polished by voluminous writings of many others in a grand apparatus. The holy Augustus commended the imperfection of Vergil's work to posterity, and was defended by means of his authority against the malign nature of the Zoilers. I therefore hope that your Serene Majesty will clemently receive these books and study them with pleasure written as they were for the Royal Grandfather of your Serene Majesty. Even though these books generally contain the precepts of Astronomy and Geography, they particularly treat those concerned with Spherical doctrine. I know that your Serene Majesty will take pleasure in these disciplines with his Kingly Virtue. And it will also please him that these books are propogated to posterity. We preface these six books on *Meteorscopia* with four on spherical triangles, the fifth brings the material together, but this was done by Hartmann's hand not Werner's. He noted which part of the doctrine he worked on, yet we decided not to try to perfect the unfinished beginnings of this great Name by a diverse hand. Further, Werner substantiated the path he took in these books by naturally producing the doctrines of Spherical triangles, not added by some artifice, for nothing should be redundant, nothing can be taken away from this work without destroying the entire work as nothing is redundant within it. He wanted to produce everything in numbers with the exception of the precepts which were taken from Theodosius and Menelaus. He sought to achieve this aim maturely in that which is finished, so that it would be easy for the more lightly educated, he surpasses all those who came before him in this form of writing. It was our plan however that the erudite who have the leisure to be versed in Geometry have at the very beginning a Thesaurus on the whole doctrine of spherical triangles. For as they will see the use of such a Thesaurus in the subsequent books, they should exercise themselves in these matters, and realize why the consideration of each spherical nature is worthy

of heaven, the sea, the earth and the natures contained in these. If I were to explicate this I would have to now bring forth the entire doctrine of Astronomy and Geography on the effects of the stars. But your Serene Royal Majesty, he far more correctly and deeply grasps and understands this in his soul with his Kingly virtue than could ever be described by us in speech.

Your Royal Serene Majesty, the most important matter of state is, as we hear, the conscription of an army to repel the incursions of the Turks. I pray to Christ, the Son of God that the heavens grant Your Royal Serene Majesty victory. He sits to the right of God the father and is called upon to break the enemies of the Christian name like the vase of a potter so that no shard remains in which a small fire might be carried.

We said that these inferior natures were governed by the astral order, yet the founder of the heavens who call the stars by name prescribes their measure their measure and end, where he wants, he places the course, and the effects he wants are moderated as when he stopped the course of the Sun in heaven for Joshua and recalled the sun for Sedechia. What however pertains to the stars I have no doubt that the Turkish empire faces eminent complete ruin, suddenly, not foreseen, approaching the influx of the Trigon of fire and languishing in the powers of the Trigon of Water. The anomalies of the orb of the fixed stars accede to the third end. How often one given thing attains the end, that it always comes to pass in the world and in the great mutations of empires is seen in the histories. And at that time, God the founder of nature lets his judgement fall. Displacing the powerful from their seats and exalting the humble, which also happened as Xerxes invaded Greece with an innumerable army.

Nicolaus Copernicus, the first Hipparchus of our times, can never be lauded enough. He discovered the ratio of the anomaly of the fixed stars, as we demonstrate at length in other places. As I was in Prussia for roughly three years the grand old man took me in and taught me so that I might strive to perfect this doctrine which he himself, weak in his increasing years and impeded by his coming death, was less able to complete. On those which are desired of the conversions of the fixed stars and planets we will discuss in another place.

There is much in Ptolemy's description of the true position of the orb of the fixed stars which is alien to the truth. Firstly, on account of his ignorance of the books: as such indices [ie. which Ptolemy used] were often copied an error is easily admitted into the numerical description. Secondly, as the observations were not even taken at tenths of a degree, that is by armilleries which are taken by the hand, they err by half a degree. Of what great importance it is to have a just description of the stellar orb we touched on briefly above concerning the doctrine of the effects of the stars. I risk maintaining that the entire part of Physics which concerns the effects of the stars is less able to defend itself among the other disciplines due to its subject matter, that which pertains to the planets and the parts tend to be many, not

to speak of that investigation which is peculiar to this art. It is for this reason that I believe there to be a great use for the art [ie. described in Werner's books]. The great men George Tanstetter and Andreas Perlachius have realized the same and without a doubt if they have the correct positions of the stars they prove themselves capable of good things in this art.

This investigation is thus of the highest importance and Mr. Copernicus took us into this province, a man whom I have not only cherished and observed as a teacher but also as a father whom I have always tried to please. After I had sufficiently prepared myself in Geometry and Arithmetic I chose Cracow as my place of observation, for Copernicus observed in Frauenberg, his place of observation, Cracow is equally distant from the occident under the same meridian. Here, with the help and hospitality of the great man Mr. Johannes Boner, I erected an obelisk of forty-five Roman feet. For in my judgement there has never been an instrument superior to the obelisk.

King Mitres commanded in a dream, was the first to construct Obelisks in Egypt, as Plinius explains. Galen also testifies that God wants us to consider His Geometry in nature. For as he did not attempt to adduce geometrical demonstrations in his anatomical books, he did not want to deter doctors of his generation from their study. Commanded in dreams by God, he constructed a geometrical demonstration of the make-up of the eye. Plinius testifies that the Obelisks were dedicated to the God of the Sun and that this is the Egyptian word for them. For the Sun is the King and Monarch of the State of Heaven, to whose rhythm and motions the other stars are moved. It is also the eye of the entire world, through whose light everything else is illuminated. So it is through the Obelisk alone that all the laws of the celestial state will be able to be understood exactly and written. Alone the obelisk can open the eyes of the masters of the art, and bring forth the light of the observations to be made of the motions of histories yet to be written and the apt demonstrations of the motions to be investigated, so that through this [instrument] the useful observations of motions are grasped in their full significance. Stiborius writes, and as a master of the art he admonishes all posterity, that the doctrine of motions is always to be supported with new observations, that we do not hang onto the established tables perpetually, but rather adjust them to heaven. The Obelisk is thus not a human invention, but was instituted by God the author, not in order to satisfy human curiosity, but to teach the Geometry of God to be found in the heavens and on earth. Armilleries, regulae, Astrolabes and Quadrants are human inventions, and are therefore subject to grave and laborious errors. The Obelisk was constructed as an admonishment of God, it easily excels over these other instruments in its exactitude. Furthermore, Plinius says that two Obelisks were so inscribed:

THE PHILOSOPHICAL WORKS OF THE EGYPTIONS

CONTAIN THE INTERPRETATION OF NATURE.

What else could be intended by this inscription that the fact that these machines were not instituted in vain and that they have the greatest uses. They are the works of the Philosophy of the Egyptians, not of the Philosophy of the Greeks or the Romans, but that of the Egyptians who were the parents of Geometry, Arithmetic and Astronomy from the Fathers up until Abraham, if we are to believe Joseph. It is from the Egyptians whence Plato brought Mathematics to Greece and Pythagoras the same to Italy. Plinius also reports that at the same time in which Pythagoras was in Egypt a 125 and $\frac{3}{4}$ foot Obelisk was placed there which the Holy Augustus later placed in the circus. Egyptians called them Obelisks because they are interpreters of nature and because it is greater than the interpretation of that same nature. Who however, when looking at this stone Colossus, would think that this colossus is the interpretation of nature or the interpreter of nature? I would believe no man who did not have knowledge of their Mathematics, the vestiges of which Aristippus saw upon reaching a shore following a shipwreck. He told his shipmates to remain calm and to take heart in seeing the vestiges of humans as he saw the Geometrical figures drawn throughout the sands of the beach. We shall therefore say more explicitly that the Obelisk is a work of Philosophy, demonstrating the order, mode and manner of grasping the positions of the Sun, the Moon, the planets and the rest of the stars. From whose condition the motion of the stars and all the laws of the celestial state are investigated. And Astronomy and Geography along with that part of Physics which concerns the effects of the stars are very necessary disciplines for human life, they need to be built, made secure and propagated. As Plinius testifies, the Holy Augustus used to read off the hours of the day from the Obelisk, a very beautiful use. But just like the cooperation of the most beautiful Rhine river with the whole sea, like that of the earth with heaven, such is that relation between Gnomics and the entire use of the Obelisk.

It is thus to be deeply regretted that the Turkish empire has taken such a Thesaurus, alone on account of ambition, from Egypt to Constantinople, to a place where it is of absolutely no use. If only the Roman Obelisk had stood unchanged through so many centuries and excelled with doctrine and the leading minds of Italy. For the reason for which he placed it, to give us Astronomy, in its celebration and to the use of all. God benignly concedes this life to the wishing and praying, among these to me, and he protects me through your Serene Majesty, so that posterity may hear what a thesaurus the Obelisk is. The Egyptian Kings did not spend gold and silver in vain for the great Obelisks, as they are sweet commemorations to us and give us such great thesauri. Until now many narrow and adverse fortunes plagued me. I nevertheless wanted, insofar as I could, to wake Astronomy, and to grasp medicine entirely. For if Your Serene Royal Majesty takes it upon himself to

protect me, and finds pleasure in these studies, and does not frown upon my work, this will give me unto the good of god, which is in God's hands for I do not doubt that your Serene Royal majesty will gladly accept this work, or rather I persuade myself.

Being committed to the aforesaid, I commend myself to Your Serene Royal Majesty.

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