Georg Joachim Rheticus

Narratio prima

or First Account of the Books
On the Revolutions
by Nicolaus Copernicus

With an introduction by
Jarosław Włodarczyk

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WUW

Foreword

It is with great pleasure that we can present a facsimile edition of the *Narratio Prima* by Georg Joachim Rheticus. This book, an abstract and resumé of Nicolaus Copernicus' *De Revoltionibus*, was written when both these scholars were staying at Lubawa Castle in the summer of 1539. Their host was a friend of Copernicus, Tiedemann Giese, the Bishop of Culm. Published three years before the work of Copernicus, the *Narratio Prima* recounts, in a clear and concise manner, the heliocentric theory of the great Polish scholar. We have also prepared the first-ever translation of Rheticus' book for Polish readers, published in its own separate volume.

Several years ago, I had an interesting discussion with Professor Jarosław Włodarczyk from the Institute for the History of Science at the Polish Academy of Sciences about the significance of the time Nicolaus Copernicus spent in the land of Lubawa. It is this charming land, shaped by a melting glacier, that the Nicolaus Copernicus Foundation, whose works I am honoured to oversee, has chosen for its seat. It is also here that the Nicolaus Copernicus Foundation has constructed its two astronomical observatories, in Truszczyny and Kurzętnik.

It was at Lubawa Castle that Nicolaus Copernicus, persuaded by his friends Giese and Rheticus, decided to publish his work. This canonical book was later to become one of the milestones of modern science. Moreover, it

is in Lubawa that Rheticus, amazed by the groundbreaking theory exposed by his teacher in *De Revolutionibus*, wrote his own book. The *Narratio Prima* had had two editions before Copernicus' book was published, and it is from the former that scholars first became acquainted with theories from the Frombork canon.

I am deeply grateful to Professor Jarosław Włodarczyk for his encouragement and inspiration in publishing Rheticus' book. Professor Włodarczyk has also written the introduction to the present edition.

The highest editorial and publishing standards have been ensured by the University of Warsaw Press.

The present book is being published with funds provided by the European Agricultural Fund for Rural Development – Europe Investing in Rural Areas. My success in the difficult application procedure was thanks to the aid of Michał Markowski and Karol Draśpa from the 'Land of Lubawa' Local Initiative Group and Mikołaj Miros from the Marshal Office in Olsztyn.

I am also grateful to the local government of the Varmia and Masuria Voivodeship, to Marek Brzezin, Marshal of the Varmia and Masuria Voivodeship, and to Zdzisław Fadrowski, the Director of the Department of Culture and Education.

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I would also like to thank the local authorities of Lubawa and Mayor Maciej Radtke for their continued support in the realisation and promotion of this project. The traditions related to Nicolaus Copernicus are exceptionally vivid in Lubawa.

The promotion of this project was also aided by entrepreneurs. The Board of Directors of PGE Dystrybucja S.A. has supported our activities for years. My special gratitude goes to its presidents, Marek Goluch and Grzegorz Dolecki, as well as to the company's press officer, Monika Stanisławek. My sincere thanks go to Medcom Ltd. and its president, Jerzy Linka.

I would also like to thank Gabriel Chojak, president of Dekorglass S.A., a company based in Działdowo. The bottles manufactured by Decorglass are

truly the finest in the world. Marek Liberacki, the owner of LIBRO, a manufacturing company specialising in high-quality furniture, also supports all our activities, which includes the publication of this book. I would also like to express my gratitude to the president of the WAM Hotel Group, Robert Małłek. I encourage everybody to visit this company's hotels in Toruń and Kraków, cities related to Nicolaus Copernicus.

Patronage of the publication has been overseen by the *Urania – Postępy Astronomy* bi-monthly. I hereby thank Dr. Maciej Mikołajewski, the editor-in-chief of this periodical, one of the world's oldest periodicals dedicated to astronomy, for supporting our activities.

Finally, I would like to thank my mother, Weronika, for her initiative that led to the creation of the foundation and for inspiring me with tales of Nicolaus Copernicus in my childhood.

Robert Szaj
General Director
The Nicolaus Copernicus Foundation

Introduction

There are few, if at all, examples of scientific books which successfully preceded the publication of a groundbreaking work, announcing it with considerable success which can be additionally measured by, for instance, the number of successive editions. There are no traces of such a vanguard enterprise announcing the *Almagest* by Ptolemy who in the middle of the 2nd century, in Alexandria, presented to the world his *opus magnum* of Hellenistic mathematical astronomy. Similarly unaided was Johannes Kepler's *Astronomia nova*, propagating the idea of elliptic orbits. In 1687, Isaac Newton published the *Principia*, a work that was fundamental for contemporary celestial mechanics, and yet without any earlier *lite* version. Typically, it is the explicit acknowledgement of the scientific significance of a given work which triggers elucidating commentaries, synopses and summaries aimed at readers of varying competence. It is also in this respect that the history of this book appears extraordinary, or in fact, unique.

De revolutionibus by Nicolaus Copernicus is one of the most famous scientific works of all time. The book was published by a Nuremberg printer, Johannes Petreius, in spring 1543. Paradoxically enough, however, *De revolutionibus* was not the first to introduce heliocentric astronomy to Latin Europe. For the three preceding years the geocentric world model had already been challenged by the *Narratio prima*. The book entitled the *First Account of the Books «On the Revolutions» by Nicolaus Copernicus* appeared in 1540

in Danzig (Gdańsk), and was reprinted in Basel the following year. Interestingly enough, even though the book was not free from certain personal bias originating with its author, Georg Joachim Rheticus, a well-educated and by then already sophisticated young scholar, it was nonetheless written under Copernicus' watchful eye during Rheticus' stay in Varmia and the Lubawa Land. Consequently, we can assume that the text received the full approval of Copernicus himself. Furthermore, the *First Account* was compiled at the time when Copernicus was preparing for print the final version of his own work which alone testifies to the significance of Rheticus' book for the history of science.

The Basel edition of *Narratio prima* was not alone to follow the original publication. Until the early 1620s, there were five editions of the book altogether, whereas *De revolutionibus* was printed only three times in the relevant period. Subsequently, Rheticus' book was translated into vernacular languages. The first such attempt was made by Jan Baranowski, head of the Warsaw Astronomical Observatory, who in 1854 published the bilingual edition of various texts both authored and related to Copernicus.[1] However, Baranowski's translation did not comprise the whole of *Narratio prima* and was devoid of any kind of commentary. This combined with Baranowski's now strongly archaic language and some departures from Rheticus' narrative make it a respectful and yet rather useless relic of the past. Additionally, taking into consideration the remarkable progress in Copernicus studies which has been made in the last two centuries, it appears all but unnecessary to explain the idea of a modern critical edition of the new Polish translation. Such a book appeared in 2015.[2]

The Nicolaus Copernicus Foundation decided to take this opportunity to recall the memory of Rheticus' work also among the English-speaking readership. However, given the fact that the English translation of *Narratio prima* has been available on the market for a long time,[3] and it was impossible to combine it with a new extensive commentary comprising more than 350 footnotes, the Foundation decided to publish a facsimile edition (based on the first Danzig

edition of Rheticus' book) along with the English version of the Polish intro-
duction to the above mentioned translation of 2015. The introduction aims
to present the historical context of the *Narratio prima*, to discuss its content as
compared to Copernicus' work, and to assess the share of the *First Account* in
the reception of the heliocentric theory. These aims may appear both modest
and ambitious. Certainly the task would not be possible without the assistance
of the many studies of the historians of science from around the world that are
available today. Some of these studies are mentioned in the notes.[4]

Finally, in Copernicus' phrasing: "And lest I appear […] to promise more
about the usefulness of this volume than I can fulfil, I now turn to the work
itself."[5]

Youthful Audacity

Georg Joachim Rheticus was born on February 16, 1514 in Feldkirch.[6] His
parents, Georg Iserin and Thomasina de Porris, came to this Alpine town
from Lombardy. Rheticus' father held the post of town physician until 1528
when he was found guilty of fraud and theft, and subsequently executed.
The family had to return to the mother's maiden name which Rheticus used
along with its German version – von Lauchen (in both versions meaning
"of the lakes"). Finally, following the habit of other Renaissance humanists,
he coined a toponym for himself – Rheticus – which he derived from the
ancient name of the country where he was born, i.e. Latin Rhaetia.

Rheticus' European travels began in 1528 when at the age of 14 he was
admitted to school in Zurich. His tutor there was Oswald Myconius (1488–
1552), friend of Ulrich Zwingli. During his four-year stay in Zurich, Rheticus
also befriended Conrad Gesner (1516–65), subsequently a renowned natural-
ist and author of the monumental work *Historiae animalium*. In 1532, Rheticus
became a student at the university in Wittenberg. This choice was supported
by Achilles Pirmin Gasser (1505–77), a physician and astronomer in Feldkirch,
who would also exert some influence over Rheticus' subsequent life.[7]

At that time, Wittenberg, the seat of a young university, was a vibrant Reformation centre and Luther's Bible was printed during Rheticus' studies in Wittenberg. However, it was his relationship with Philip Melanchton (1497–1560) that had the greatest impact on the shaping of Rheticus as a young scholar, as well as his highly significant encounter with Nicolaus Copernicus (1473–1543). Much has already been said about the influence of *Praeceptor Germaniae* on universities and all levels of the reformed educational system. In Melanchton's vision, classical humanist education was to go hand in hand with the new philosophy of nature, the latter strongly supported by mathematics. According to Melanchton, the mathematical abilities of the human mind were the reflection of the Divine mind and an invitation to discover God's ideas in the order of nature. Such a programme was an obvious source of Rheticus' humanist erudition which was so well exemplified in his description of heliocentric astronomy, i.e. in the *Narratio prima*. However, the *First Account* would never have been completed had Rheticus not been "born", in Melanchton's words from his letter as of July 7, 1542, "to study mathematics".[8]

In 1536, Rheticus obtained the degree of master of liberal arts. This achievement is documented by the earliest extant text by Rheticus, a transcript of a dispute concerning the legality of astrological prophesies.[9] The starting point of this dispute was the well-known criticism of astrology in Justinian's *Corpus iuris civilis* where mathematicians were not only castigated but also threatened with banishment or even death.[10] First, Rheticus argued that the problem of the influence of heavenly bodies should be solved on philosophical and not on legal grounds. Secondly, he explained that reliable prognostications of astrologers derive from physical reasons (the actual celestial influences) which are governed by Divine Providence, and therefore, such prognostications should be considered religiously correct and useful. Such defense remained in line with the ideas of Melanchton who thought astrology was part of the physical world and a manifestation of the pres-

ence of Divine Providence, and who wished to complete the reform of this discipline by combining the efforts of astronomers and mathematicians.[11]

Melanchton offered his recent graduate, *magister artium*, the position of second professor of mathematics at the university of Wittenberg (the first chair of mathematics, vacant after the death in 1536 of Johannes Volmar, lecturer in astronomy and mathematics and Rheticus' tutor, was given to Erasmus Reinhold [1511–53]). Upon this occasion Rheticus gave a lecture where he encouraged the study of arithmetic.[12] While enumerating the benefits of arithmetic, Rheticus also pointed to the possibility of investigating the motions of heavenly bodies – "the most excellent part of Philosophy".[13] Making a recourse to Plato's *Republic* (546 A–D), Rheticus claimed: "Plato states that the republic changes due to some celestial causes which impel cyclical changes of cities and empires […]"[14]. This testifies to Rheticus' continuously crystallizing views on the place of astrology and astronomy in the physical world, and therefore, in the world's history. Characteristically enough, Rheticus, a Wittenberg mathematician, did not abandon these views when he embraced heliocentric astronomy.

When did Rheticus learn about Nicolaus Copernicus? In Johannes Petreius' letter sent to Rheticus in August 1540 one can find a suggestion that it was Johannes Schöner (1477–1547) from Nuremberg who became his source of information:

> … our Schoener, by virtue of his extraordinary kindness, was not only delighted by your talent, but also generously imparted what he believed would be beneficial to you in this system of learning [of the celestial motions]. This desire for learning next drew you to the farthest corner of Europe, to a distinguished gentleman [Copernicus] whose system, by which he observed the motions of the heavenly bodies, you related to us in a splendid description.[15]

Such a course of events would explain why the outline of Copernicus' astronomy in the *Narratio prima* was written in the form of a letter addressed to "the illustrious Johannes Schöner".

However, in the dedicatory letter which precedes Rheticus' *Orationes duae* (*Two Speeches*) published in Nuremberg in 1542, and therefore at the time when the decision to print *De revolutionibus* had already been made, he offered another version of the story:

> Finally, hearing the great fame of Dr. Nicolaus Copernicus in the far north, even though the University of Wittenberg had appointed me professor in those disciplines, I knew I should have no rest until I myself learned something of his teaching. And indeed I regret neither the expense, nor the long journey, nor any of the other hardships. Rather, I feel I have reaped a great reward. For by means of a certain youthful audacity I was able to spur this eminent man on to communicate to the whole world his theories regarding that subject earlier than might have been. And all learned minds will join in my assessment of these theories as soon as the books we now have in press in Nuremberg are published. [16]

What follows is that Rheticus could already learn about Copernicus' work in Wittenberg.

After Rheticus had been lecturing for two years on the fundamentals of mathematics, astronomy and astrology, in the autumn of 1538, he set out on his journey across Germany. Although the aim of his trip was to meet other astronomers and mathematicians, the immediate decision to leave the city could have been motivated by the scandal caused by the publication in the previous summer, in Wittenberg, of a collection of epigrams authored by Simon Lemnius, Rheticus' countryman and friend. Although the poems offered portrayals of approximately one hundred apparently fictitious characters, they outraged some influential persons, including Martin Luther himself. Lemnius was forced to leave Wittenberg.

In October, Rheticus left Wittenberg too. First he set out for Nuremberg to meet the aforementioned Schöner at whose place he stayed. Schöner, then a fairly famous astronomer and astrologer, was a friend of Melanchton who certainly had equipped his young protégé with a relevant letter of rec-

ommendation. In Nuremberg, Rheticus also became acquainted with Georg Hartmann (1489–1564) who later presented him with the manuscripts of two mathematical treaties by Johannes Werner (1468–1522). It is possibly thanks to the latter's writings that the scholars in Nuremberg first heard about Copernicus' astronomical competence. Accordingly, in 1524, Copernicus criticized Werner's views on the precession in the *Epistola Nicolai Copernici contra Wernerum* (*Letter Against Werner*; the study was in the form of a letter addressed to Bernard Wapowski). Rheticus' friendship, however, with Hartmann proved so lasting that the Wittenberg edition of the trigonometric part of Copernicus' work, edited by Rheticus in 1542 and entitled *De lateribus et angulis triangulorum* (*On the Sides and Angles of Triangles*), was dedicated to no other man but Hartmann himself. Setting apart the discussion of the significance and applications of geometry, Rheticus' introduction also included some interesting biographical information and a few personal remarks. He wrote:

> I have heard that while in Rome you befriended the author's brother [Andreas Copernicus]. However being a scholar you have enough reason to love the author for his brilliant mind and excellent knowledge of astronomy and other disciplines in which he could compete with the greatest authorities of antiquity. […] I believe I could not be happier in this world than to become friends with so great a man and scholar.[17]

According to the letter of recommendation written by Melanchton on October 15, 1538 to Joachim Camerarius (1500–74), professor of Greek in Tübingen, Rheticus was also to visit Ingolstadt, the hometown of Peter Apianus (1495–1552)[18]. We do not know if Rheticus actually met with this renowned cartographer and astronomer but his stay in Tübingen proved truly rewarding as Rheticus' friendship with Camerarius lasted many years.

In the spring of 1539 Rheticus also visited Feldkirch, his hometown. He met with his old friend Gasser and presented him with some scientific trea-

tises recently published by Petreius. These included the astrological treatises by Ptolemy – the *Tetrabiblos* (the Greek text was edited by Camerarius, whereas the Latin translation by Melanchton did not appear till 1553) and the *Centiloquium* – the collection of astrological aphorisms ascribed to Ptolemy, the treatise by Johannes Schöner (*Opusculum astrologicum*) as well as Werner's study on the precession (*De motu octavae sphaere tractatus duo*) which met with Copernicus' exceptionally harsh criticism. Can this bequest, originating with Petreius's printing shop, be indicative of yet another bequest which Rheticus made upon his arrival at Frombork? Whatever the case was the dedication extant in the *Centiloquium* suggests that the books reached Gasser in April.

The numerous scholarly encounters made during his trip possibly strengthen Rheticus' assumption that he found himself in the very mainstream of the contemporaneous search for new scientific ideas. Astronomy and mathematics in Nuremberg were strongly influenced by Johannes Regiomontanus (1436–76) who settled in this town and worked with Bernard Walther (1430–1504) to set up an astronomical observatory and a printing house, thus initiating the wide-scale publication of astronomical and mathematical works.

Prior to this, along with the famous Viennese astronomer Georg Peurbach (1423–61), Regiomontanus was engaged in the reform of geocentric astronomy and, following the former's death, he completed the summary of Ptolemy's *Almagest* – the *Epitome in Almagestum Ptolemaei* (Venice 1496) which was later also used by Copernicus. Significantly enough, the *Epitome* was more than an abbreviated version of the ancient treatise as it included a comprehensive explanation of ancient mathematical procedures, the description of intruments and observational methods and was additionally appended with materials abstracted from the works of Islamic astronomers. The *Epitome* was a supplement to the modern presentation of geocentric astronomy which Peurbach included in his *Theorice novae planetarum* (*New Theories*
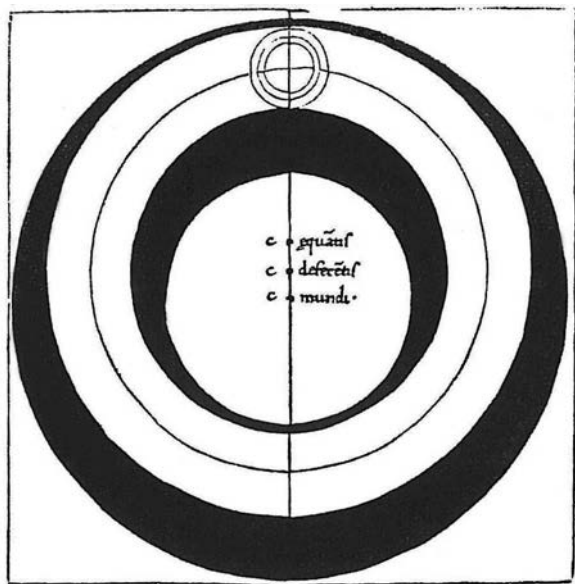
Figure 1. The model of material spheres which sustain a planet according to Peur-
bach's *Theorice novae planetarum*. The epicycle sphere is placed in the deferent
sphere. There are three designated centres: equant which in Ptolemy's astronomy
was the point of reference for the uniform revolution of the epicycle, the deferent
centre and the centre of the Earth. Courtesy of the Ludwik and Aleksander Birkenma-
jer Institute for the History of Science at the Polish Academy of Sciences in Warsaw.

of the Planets), the book published by Regiomontanus in Nuremberg around
1472. This exceptionally popular reference book presented detailed models
of Ptolemy's planetary spheres. However, it also clearly exposed a certain
feature of Ptolemy's system which had been long criticized, not least at the
Academy of Cracow, and which contradicted the central axiom of Aristotle's
celestial physics because the reference point for uniform circular motion
differed both from the centre of the Earth and from the deferent centre.

Regiomontanus was also concerned with enhancing the predictive po-
tential of the astronomical theory as represented in its widely accessible

version mainly via Ptolemaic *Alfonsine Tables*. In 1464, he wrote to an Italian astronomer:

> At last in the case of the Moon, a difference so great and so frequent occurs that even ordinary people begin to tear at this divine science of the stars with a sharp tooth. For my part I observed an eclipse in the year 1461 that was in December, the end of which in the heaven preceded the computed end by a full hour … I have also observed other eclipses differing greatly from computation in duration and the size of the eclipsed part, concerning which the proper place for speaking at greater length will be elsewhere.[19]

Regimontanus' observational programme was continued in Nuremberg by Walther, whereas his publishing programme – by Schöner who printed both Regimontanus' manuscripts as well as his own astrological studies. Interestingly enough, Copernicus used Walther's observations of Mercury in *De revolutionibus* but he ascribed them to Schöner. We know neither the time nor the manner of passing this data, and therefore the reason for the misattribution.

Rheticus also witnessed the dynamic growth of cartography. This progress was spurred partially by Schöner who made globes, and therefore strove to obtain the most recent data (for example, his globe made in 1523 showed the route of Ferdinand Magellan's voyage round the world which had been completed only a year earlier). Hartmann was also interested in geography and he was perhaps the first European scholar to describe the phenomenon of magnetic inclination. Apianus had a reputation of an excellent cartographer too. All these scholars received *The Call* of Sebastian Münster (1489–1552) who in 1528 asked for the supplying of regional maps which could become a basis for a bigger atlas. His request met with a positive response and in 1544 Münster's *Cosmographia* appeared. One of the contributors helping Münster to complete his impressive work was Gasser, who compiled the map of the Allgäu region.

Prior to his next trip, this time to Frombork, Rheticus was certainly familiar with a number of scientific developments such as, for example, the growth

of mathematical studies, the reform of ancient astronomy, the attempt to make astrology a testimony of sorts of the physical presence of Divine Providence in nature, the progress in cartography and the development of the publishing market of scientific books. He was certainly eager to learn about Copernicus' new astronomical theories but the experience he had gained within a remarkably short time would teach him to also consider other aims he could achieve. One of these aims could be the map of the visited land, an intention which seems to be confirmed by Rheticus' choice of a travel companion. Rheticus set out for Varmia with Heinrich Zell (1518–64), a recently matriculated student of the university in Wittenberg who came from a printers' family in Cologne and who had already worked with Münster on his map of Europe published in 1536.

To Become Friends with so Great a Man and Scholar

On his way to Copernicus, Rheticus stopped at Poznań on May 14, 1539, a fact he himself acknowledges in the opening sentence of the *Narratio prima*. Thus, he reached Frombork in the second half of May. In turn, in the closing chapter of the *Narratio* entitled "In Praise of Prussia" he writes: "This done in our seat of Muses in Varmia, nine days prior to the calends of October A.D. 1539". Consequently the *First Account* was compiled between the end of May and September 23, 1539 which is in less than a few weeks. Rheticus himself admits:

> … I have been able to devote scarcely ten weeks to mastering the astronomical work of the learned man to whom I have repaired; for I had a slight illness and, on the honorable invitation of the Most Reverend Tiedemann Giese, bishop of Kulm [Chełm], I went with my teacher to Löbau [Lubawa] and there rested from my studies for several weeks.[20]

The summer spent in the residence of Bishop Tiedemann Giese (1480–1550), Copernicus' friend, must have been decisive for the concept and shape of

the *Narratio prima*. We know that Copernius was Giese's guest during the first half of September.[21] We can only presume that Rheticus could have accompanied him all that time.

Whatever was the case, Rheticus worked then particularly intensely and made his acquaintance with some new people. His "In Praise of Prussia" includes a broad acknowledgement of the role of Giese in making Copernicus agree to the publication of *De revolutionibus* (Copernicus in his dedicatory letter is far more laconic in this respect). The second patron which Rheticus mentions is Johann von Werden (1495–1554), the burgomaster of Danzig and the banker of both the Polish King Sigismund I and of Duke Albert of Prussia. This hint, combined with some other known connections of Giese and Copernicus with Danzig, explains all but too well where and why the *First Account* was published.

The *Narratio prima* is a small book and unlike *De revolutionibus* it does not contain any drawings. This could be the reason why Rheticus decided to print the *First Account* in the first permanent printing house in Danzig, established in 1538 by Franciscius Rhode who had settled in the city a year earlier. Understandably enough, his decision could have been motivated by the proximity of Danzig and possibly some personal connections of Copernicus and Giese. These connections could have helped to secure some financial support as in 1540 the Senate of Danzig donated 31 marks to an unnamed mathematician who praised the city in his writings.[22] There is no certainty if this refers to Rheticus but there was very little competition at that time. There was only one other book on a related subject printed in Danzig in 1540, also in Rhode's printing office: a German astrological pamphlet (*practica*) for 1541, dedicated to the authorities of Danzig and authored by Andreas Aurifaber (1514–59).

Rheticus had already met Aurifaber during his studies in Wittenberg. Aurifaber came to Danzig the same year Rheticus met Copernicus. Similarly to Rheticus, Aurifaber was the protégé of Melanchton and came to Danzig

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Figure 2. Andreas Aurifaber, *Practica auff das Jar M.D.XLI...*, Danzig 1540. The front page with the stamp of Rhode's printing office. This copy probably belonged to the author himself as it contains a note: *Sum Andreae Aurifabri M. 1541*. Landesbibliothek Coburg, shelf mark Mo A 12#14.

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CLARISSIMO VIRO, D. IOAN-
ni Schonero, vt parenti suo colendo,
G. Ioachimus Rheticus
S. D.

RIDIE IDVS MAIAS
ad te Posnaniæ dedi literas, quibus
te de suscepta mea profectione in Prus-
siam certiorem feci: et significaturum
me quàm primum possem, famæ ne
& meæ expectationi responderet
euentus, promisi. Etsi autem vix iam
x Septimanas in perdiscendo opere
Astronomico ipsius D. Doctoris, ad
quem concessi, tribuere potui, cum propter aduersam ali-
quantulum valetudinem, tum quia honestissime à Reueren-
dissimo, D. Domino Tidemanno Gysio, Episcopo Culmen-
si vocatus, vnà cum D. Præceptore meo Lobauiam profe-
ctus aliquot septimanis à studijs quieui. Tamen vt promis-
sa den cp præstarem, & votis satisfacerem tuis, de his, quæ
didici, qua potero breuitate & perspicuitate, quid D. Præ-
ceptor meus sentiat, ostendam.

Principio aut statuas velim Doctiss: D. Schonere, hunc
virum, cuius opera nunc vtor, in omni doctrinarum gene-
re, & Astronomiæ peritia Regiomontano non esse minoré.
Libentius autem eum, cu Ptolemæo confero, non quòd mi-
norem Regiomontanum Ptolemæo æstimem, sed quia,
hanc felicitatem cum Ptolemæo præceptor meus commu-
nem habet, vt institutam Astronomiæ emendationem diui-
na adiuuante Clementia, absolueret, cum Regiomontanus,
heu crudelia fata, ante columnas suas positas, è vita migrarit.

D. Doctor, Præceptor meus, sex libros conscripsit, in
quibus, ad imitationem Ptolemæi singula Mathematicos, et
Geometrica Methodo docendo & demonstrando, totam
Astronomiam complexus est. Primus liber generalem
Mundi descriptionem, & fundamenta quibus omnium æ-
tatum obseruationes, & apparentias saluandas suscepturus
est, continet.   A ij   His

Figure 3. The front page of the *Narratio prima* as printed in Rhode's office (Danzig 1540). The Polish Academy of Sciences, The Gdańsk Library, shelf mark Sa 14 8º.

upon the request of the city authorities which looked for a proper candidate to become the rector of the Church of St. Mary's municipal school. He soon published his syllabus entitled the *Schola Dantiscana* (Danzig 1539) in Rhode's printing office. The Latin part of the small book was composed with the same font as the *Narratio prima* and featured the same initial letter showing St. Matthew the Apostle with a sword, a book and two dragons.

Apart from Rheticus' *First Account*, Aurifaber's *practica* is the earliest printed text propagating Copernicus' theory, though in a somewhat different manner and in agreement with the nature of such publications which do not allow for theoretical inquires.[23] The author just states in the dedicatory letter that to enhance the correctness of his prognostications he used Copernicus' tables. It is highly probable that he obtained the tables from Rheticus although we do not know in what form: whether it was the version known from *De revolutionibus* and rather difficult to use for prognostication purposes or, perhaps, more typical tables whose existence seems to be hinted at in the *Narratio prima*. One can also assume that it was Rheticus, personally or through his *Account*, who encouraged Aurifaber to reach for the tables calculated in a new way. And it is thanks to Aurifaber's letter of February 14, 1540 that we know when the printing of the *Narratio prima* started: Aurifaber sent to Melanchton the first part of the book which had already been completed.[24]

There was one other thing which Aurifaber's *practica* and Rheticus had in common: the belief in the link between heavenly phenomena and the history of the world. In his dedicatory letter Aurifaber affirmed:

> For it can be demonstrated with many telling examples that God since the beginning of the world has never let any land or city come into particularly difficult circumstances without the heavens beforehand giving warning. Such occurred in this land in the year 1454 when indeed a terrible comet was seen before this city, along with several others, was forced by tyranny to pass from the Teutonic Order to the praiseworthy Polish crown.[25]

The printing of the *Narratio prima* must have been finished by March 1540 when Gasser received a complete copy dispatched from Danzig by Rheticus.[26] In April the book on heliocentric astronomy reached Albert, Duke of Prussia. A copy was sent to him by Giese who drew the Duke's attention to the chapter entitled "In Praise of Prussia" and recommended Rheticus for the Duke's patronage. The young visitor from Wittenberg clearly sought the support of the princely court in Königsberg. Incidentally, it was already in his "Praise of Prussia" that Rheticus placed "Albrecht, duke of Prussia, margrave of Brandenburg, etc., patron of all the learned and renowned men of our time" at the top of the list of the most famous citizens of Prussia.[27] The second place was awarded to Copernicus, although without any further justification. Expressing his thanks to Giese, Albert admitted that he had already received another copy a few days earlier and that he knew that the book had been published by Rheticus with the assistance of Aurifaber.[28] Therefore we can assume that the first parcel was sent by the rector of the school in Danzig, i.e. by Aurifaber himself.

The above fragmentary information on the circulation of knowledge and books reveals an interesting network of mutual connections, of which some were already well-established and some only strengthened with time.

Rheticus recalled in the *Narratio prima* the arguments exchanged by Copernicus and Giese when they discussed the rationale for the publication of *De revolutionibus*. Based on the *First Account*, one can assume that when Rheticus finished writing his book, the decision about the publication had already been made (his own share in this decision was emphasized by Rheticus not in the *Narratio prima* but in the *Orationes duae*, the treaties published two years later and already referred to herein). The letter of Giese to Duke Albert attached to the copy of the *Narratio prima* already included the news about the planned publication of Copernicus' work. This intent finds confirmation in Copernicus' (non-extant) letter of July 1, 1540 to Andreas Osiander.[29] The fact that the publishers in Nuremberg were expecting some

new astronomical ideas from Frombork is confirmed by Petreius' dedicatory letter addressed to Rheticus in August of the same year (see above). This is what Petreius wrote: "Although he [Copernicus] does not follow the common system by which these arts are taught in the schools, nevertheless I consider it a glorious treasure if some day through your urging his observations will be imparted to us, as we hope will come to pass".[30]

Before Petreius' dreams came true, however, the *Narratio prima* was printed for the second time in Basel in 1541. The front page was embellished with a poem by Georg Vögelin (d. 1542)[31] composed of nine lines announcing the astonishing change of the status of the Earth. By way of a preface, the publication included Gasser's letter to Vögelin, written upon the occasion of the first edition of the *First Account*. Gasser complemented Copernicus' mathematical and astronomical competence and expressed approval of the new cosmic order. At the same time, he observed soberly: "The book certainly departs from the manner of teaching practiced so far. As a whole it may run contrary to the usual theories of the schools and may even sound (as the monks would say) heretical".[32]

The threat of heresy obviously troubled Copernicus and Rheticus, and was a hot issue in the relations between Frombork and Nuremberg which is well exemplified by the stance of Andreas Osiander (1498–1552), a theologian with some scientific inclinations and Petreius' friend. Rheticus probably met Osiander when he visited Schöner in Nuremberg. Earlier, Osiander significantly influenced Duke Albert's decision to become Protestant. Osiander could have been fascinated by the new model of the motions of heavenly bodies which Rheticus further elaborated by associating it with the history of humanity (the theme discussed in the chapter "The Kingdoms of the World Change with the Motion of the Eccentric" of the *First Account*). In a letter written on March 13, 1540 in reply to Rheticus' (non-extant) correspondence from Varmia, Osiander first briefly, but forcefully, deliberated over the world's cycles and the figures derived from Copernicus' astronomy

and supplied by Rheticus, and then he wrote: "… I ask you over and over again, just as you offer me your friendship, in the same way to exert your efforts so as to obtain the friendship of this man [Copernicus] for me too".[33] Soon afterwards Osiander received several copies of the *Narratio prima*.[34] This probably spurred him to dispatch on April 20, 1541 two letters – one to the master and one to his student, both men propagating heliocentric astronomy. The content of these letters was very similar, and the version sent to Rheticus included the following guidance:

> The peripatetics and theologians will be readily placated if they hear that there can be different hypotheses for the same apparent motion; that the present hypotheses are brought forward, not because they are in reality true, but because they regulate the computation of the apparent and combined motion as conveniently as may be.[35]

Neither Copernicus nor Rheticus accepted his point of view. However, when in Nuremberg, Osiander replaced Rheticus as supervisor of the final stages of the publication of *De revolutionibus* and added an anonymous preface, *Ad lectorem*, where he repeated the same argument: "For these hypotheses need not be true nor even possible. On the contrary, if they provide a calculus consistent with the observations, that alone is enough".[36] Such a statement stood in sharp contrast with Copernicus' message which concluded his exposition of the heliocentric system with a lofty exclamation: "So vast, without any question, is the divine handiwork of the most excellent Almighty!".[37] Rheticus chose yet another path. He wrote a treatise where, as Giese wrote to him, he "successfully defended the movement of the Earth" against the accusation of the incompatibility with Holy Scripture.[38] Until recently, it has been assumed that this treatise – similarly to Rheticus' biography of Copernicus mentioned by Giese in the same letter – was lost. However, in the early 1970s, Reijer Hooykaas came across an anonymous work entitled the *Epistola de motu terra*, published jointly with another work

in 1651 in Utrecht. Hooykaas made a thorough analysis of this text, proving it was the apparently lost Rheticus treatise.[39] The arguments put forward by Hooykaas are very heterogeneous, and only two of them refer directly to the *Narratio prima*. First, the anonymous author of the *Epistola de motu terra* declares that he will not deal with astronomical matters as he has already dealt with them in a separate treatise (in the *First Account*?). Indeed, the text makes almost no recourse to any mathematical constructions or advanced astronomical knowledge. Secondly, even though Copernicus' name is never mentioned in the *Epistola*, the author refers to him as *praeceptor meus*, "my teacher" which is the address so frequently invoked in the *Narratio prima*.

By staying with Copernicus, Rheticus became acquainted not only with a new astronomical theory, but also with an interesting observational method. As he states in the *Narratio prima* "[f]or nearly 40 years in Italy and here in Frauenburg [Frombork], he [Copernicus] observed eclipses and the motion of the Sun".[40] While observing a solar eclipse, Copernicus would delineate its phase measured by the fraction of the diameter of the eclipsed disc. This was done twice in Rheticus' presence when there was a partial solar eclipse in Varmia on April 7, 1540 and on August 21, 1541. Copernicus measured the magnitude of these eclipses by using the image obtained from *camera obscura*.[41] This method was first described by Reinhold in the second edition of his commentary to the *Theoricae novae planetarum*, published in Wittenberg in 1542:

> When calculations indicate an approaching solar eclipse, climb to the attic of a tall building or to a not-too-lowly chamber or to a room on an upper-floor, the higher the better for the task. Your observation post should be, as far as possible, devoid of all light. Yet even if you close every opening and block every crack, the solar rays will surely find a fissure or hole of whatever shape through which to penetrate into the room. Failing that, make yourself a small opening for the rays. This done, you will notice that the spot of sunlight on the floor or on the brick wall opposite the opening, most amazingly, takes the

shape of the Sun, its face partly obscured by the Moon entering our field of vision. You can thus see with your own eyes what proportion of the 12 digits of the Sun's luminous face has been concealed … even if you watch the earth, rather than the sky. Such an ephemeral image will allow an apt observer to understand much more, make better estimates, etc.[42]

Reinhold obtained this account of Copernicus' work from Rheticus who could be his source of information either at the end of 1540 or the beginning of 1541 – when he briefly left Copernicus and returned to Wittenberg[43] – or in the autumn 1541 when he finally returned from Varmia. Whatever was the case, due to Reinhold's description, the method became very popular among astronomers of the second half of the 16th century. Additionally, in some other place of his commentary, Reinhold hinted that a certain excellent scholar from Prussia was preparing for publication the work which should reform astronomy.[44]

In 1541, contact between Rheticus and Copernicus and Duke Albert intensified. Upon the request of the Duke, Copernicus spent almost the whole of April, including Easter, in Königsberg where he treated the Duke's councillor.[45] In June, in connection with the same medical case, he corresponded with Jan Benedykt Solfa, the physician of the Polish king, and with the Duke. We do not know if Rheticus accompanied Copernicus in Königsberg, but certainly the earlier recommendation of Giese attached to the complimentary copy of the *Narratio prima*, the personal contacts with Copernicus, as well as Rheticus' connections in Wittenberg and Nuremberg facilitated his access to Duke Albert. In August 1541, Rheticus dedicated and sent to the Duke of Prussia his *Chorographia*, accompanied by a map of Prussia and the instrument for calculating the length of the day. [46]

Zell, who went to Varmia with Rheticus, proved very useful and assisted in the publication of the *Narratio prima* in Danzig. He compiled a list of Greek words and citations along with their Latin equivalents, as well as errata, all to be found at the end of the printed book. It can be assumed that another
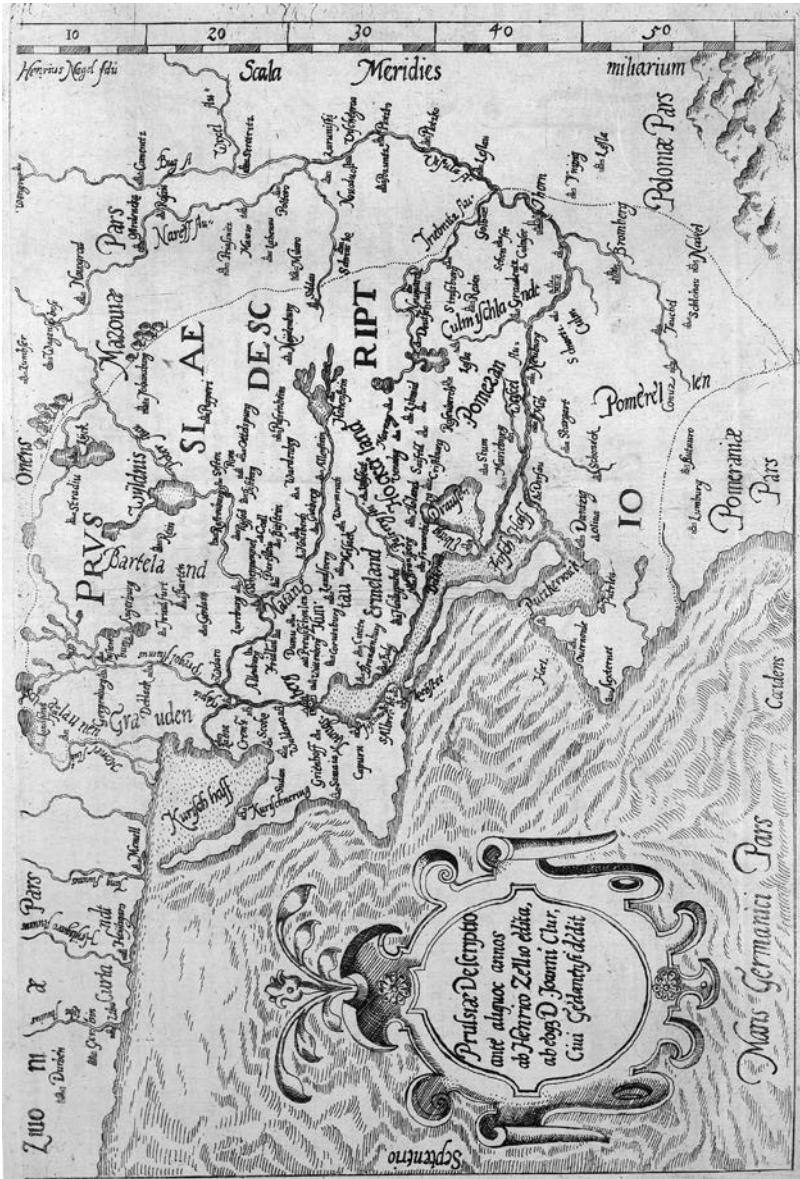
Figure 4. The map of Prussia made on the basis of the map by Heinrich Zell (Nurnberg 1542), 145 x 216 mm. C. Schütz, *Historia rerum Prussicarum...*, Zerbst 1592. The Malbork Castle Museum, shelf mark XVI, III 3906.

reason for Zell's accompanying Rheticus was the former's experience in map making. Significantly enough, it was only after they all had met that Rheticus and Zell learned about Copernicus' cartographic pursuits.[47] This proved to be yet another interest which they shared. Consequently, it seems justifiable to suspect that the map of Prussia sent by Rheticus to Duke Albert and the *Tabula Prussiae*[48] published by Zell in Nuremberg in 1542 were both a result of the joint effort of "some good gentlemen and friends".[49] Zell's map was later frequently reprinted, also by Münster, and modified depending on the required scale.

The *Chorographia*, extant only in manuscript, was already an independent work of Rheticus and was written in German.[50] The title stemmed from the differentiation found in the *Geography* by Ptolemy who thought geography was the art of making maps of the Earth, whereas chorography was the art of drawing maps of individual regions (and thus it was local geography, or as it is called nowadays – cartography).[51] In Rheticus' dedicatory letter, Duke Albert is described as a lover of this art, and Rheticus additionally emphasizes the close association of map making with astronomy:

> And thus, without the knowledge of the longitude and latitude of a given town, one cannot calculate for it the eclipses nor the motions of the Sun, Moon, planets and stars. In turn all these calculations are essential for chorography which proceeds on the basis of these figures.[52]

The text also suggests Rheticus' familiarity with local harbours. While upholding the use of maps and compasses, Rheticus somewhat wryly observes:

> Many sailors heading from Prussia to England and Portugal are not only ignorant of latitudes but they neglect also navigation maps and can hardly use their compasses. Instead they boast about their natural sailing talents. As long as things remain uncomplicated, they can cope with their tasks, but their talents often prove fleeting and they cannot catch them when in trouble, and then they run aground with people and goods on board.[53]

In his short treatise, Rheticus first described the three methods of drawing maps, setting aside the most advanced method which required calculating longitudes and latitudes and which he decided to leave to mathematicians. The three methods described for the Duke are based on calculating the distances between relevant places and measuring the angles either by using the finder (Rheticus described the construction of this instrument) or by relying on compass angles. The next part was devoted to discussing the two ways of determining the local meridian (there is only one way mentioned by Copernicus in *De revolutionibus*), whereas the last part focused on the magnet and its use in the naval compass. At this point, Rheticus admitted he had his own magnet which he used to determine the magnetic declination in Danzig and that he had learned about the experiments with the magnet from Petrus Peregrinus' treatise which had been shown to him by Gasser.[54]

Rheticus left Frombork in September 1541. His arrival at Wittenberg was preceded by two letters of Duke Albert, both dated as of 1 September. The first letter was addressed to Johann Friedrich I, Elector of Saxony, whereas the second one to the university. Using similar arguments, the Duke of Prussia insisted on exempting Rheticus from his academic duties until he finished supervising the publication of Copernicus' work but without diminishing his remuneration as a professor. In a letter sent later to Rheticus, the Duke thanked him for the treatise and for the instrument (which incidentally had proved difficult to operate) and asked to pass his complements to Luther and Melanchton.[55]

When Rheticus arrived in Frombork in May 1539 the manuscript of *De revolutionibus* was ready for publication though Copernius was still adding some final touches. Significantly enough, some of these modifications were the result of the visit of his guest from Wittenberg.

The question of how long Copernicus worked on *De revolutionibus* remains unanswered. First of all, we do not know when Copernicus started writing his treatise and how dynamic this process was. The astronomer never

revealed when exactly he discovered the heliocentric cosmology. The outline of the theory can be found in a short study extant in manuscript form and entitled *Nicolai Copernici de hypothesibus motuum coelestium a se constitutis commentariolus* (known under its abbreviated title *Commentariolus*). The study must have been written before 1514 when the catalogue of the library of Maciej of Miechów, a Cracow scholar, features an item described as "Six sheets with manuscript on the theory postulating that the Earth moves whereas the Sun remains motionless".[56] The *Commentariolus* includes a statement: "... I shall endeavor briefly to show how uniformity of the motions can be saved in a systematic way. However, I have thought it well, for the sake of brevity, to omit from this sketch mathematical demonstrations, reserving these for my larger work".[57] What follows is that Copernicus started writing his "larger work" around 1515 and such a view, supported by the analysis of the extant holograph[58] and of the paper on which it was written, was expressed by Ludwik Antoni Birkenmajer and Aleksander Birkenmajer who thereby postulated the so-called "long chronology" with the completion of Copernicus' treatise dated 1541.[59] While analysing the text with a view to establishing chronology, one takes into consideration the mutual relations among various elements of the heliocentric theory, the dependence of the fragments of Copernicus' work on the contemporary editions of important astronomical and mathematical works, and finally the astronomical observations he referred to. In turn, some specific features of the paper such as watermarks allow us to determine the approximate time of writing by comparing the paper to similar sheets in dated prints or manuscripts such as, for example, letters.[60]

Copernicus' holograph was written predominantly on four types of paper. The first type bears a watermark depicting a water snake (a sea horse) in a crown. Undoubtedly, it is the oldest part of the manuscript which comprises the initial chapters of Book I, the star catalogue from Book II, and the precession theory and the introduction to the solar theory from Book III.
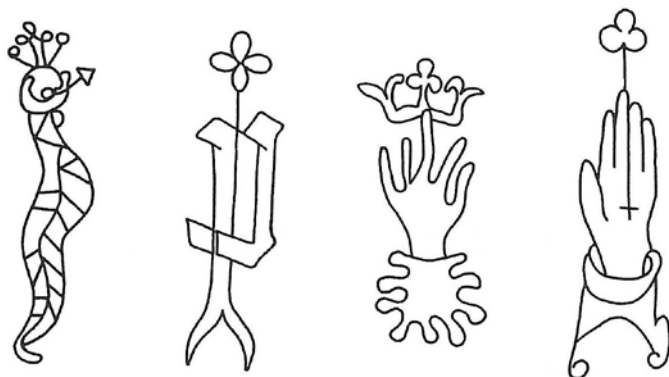
Figure 5. The redrawn watermarks of the four main types of paper used in Copernicus' holograph. Courtesy of the Ludwik and Aleksander Birkenmajer Institute for the History of Science at the Polish Academy of Sciences in Warsaw.

There are two reasons for the importance of this part of Copernicus' work for the reconstruction of the overall chronology. First, Copernicus makes a recourse to the theory of precession in all later books where he presents the theory of the motions of the Moon and the planets. Secondly, while determining the average rate of precession Copernicus relies on the observations of Spica in the constellation Virgo made in 1525 (*De rev*. III,2). Consequently, according to the alternative "short chronology", Copernicus began to write *De revolutionibus* after 1525.[61]

Almost one third of Copernicus' work is written on watermarked paper depicting the letter "P" and a flower. In this case what helps to date the material are the three extant letters to Bishop Jan Dantyszek (1485–1548) which were written by Copernicus on the same paper in 1537 and in 1539. This type of paper can be found mainly in Book V and Book VI. Book IV was written on the sheets bearing the watermark depicting a hand and a crown. The same paper was also used to replace some pages in Book III bearing a water snake. It can also be found in Book V and at the beginning of Book VI. Consequently, these parts of *The Revolutions* can be dated to the second

half of the 1530s. Additionally, there are some watermarked sheets featuring a hand and a three-leaf clover. Such sheets can be found in Book I and Book VI and they correspond to the aforementioned letter of Copernicus to Duke Albert written on such paper in June 1541.

Thus the completion of the holograph of *De revolutionibus*, whether it took several years or decades, did not proceed page by page. The oldest parts of the book were rewritten and replaced with some updated versions, this done by cutting out the old sheets and affixing the new ones in their place. One such case can be found in Book I in a passage on plain and spherical geometry. Rheticus brought to Frombork three volumes composed of five titles, three of which were printed by Petreius.[62] The latter included a trigonometric treatise by Regiomontanus entitled *De triangulis omnimodis* (*On All Types of Triangles*). Copernicus used this treatise to update his geometrical elucidations and rewrote these fragments on watermarked paper bearing a hand and a three-leaf clover which he subsequently substituted for some of the oldest parts of the holography originally written on the paper bearing a water-snake. Moreover, the trigonometric part of *The Revolutions* was published by Rheticus in 1542 in Wittenberg as a separate book entitled *De lateribus et angulis triangulorum*. Consequently, associating the date of this part of the holograph with the letter to Duke Albert fully coincides with the short period between Rheticus' visit to Frombork and the publication of *De lateribus*.

We do not know which of Copernicus' manuscripts were in Rheticus' possession when he left Frombork. The extant holograph of *De revolutionibus* probably remained in Varmia and was given to Rheticus, possibly by Giese, only after Copernicus' death. If Rheticus took with him the copy of *The Revolutions* prepared for Petreius, the version was closer to the final printed version than the holograph, which is evidenced by hundreds of differences between the Nuremberg edition and the holograph. Similarly, we do not know if while printing the trigonometric part of *De revolutionibus* in

Nuremberg, Rheticus relied on the updated version of the manuscript for Petreius or on yet another copy of it.

We also do not know about the arrangements made between Copernicus, Rheticus and the printing house as to the final composition of the book. One of these mysteries surrounds Bishop Dantyszek's poem which Copernicus had received from him shortly before Rheticus' departure from Frombork. The poem was an epigram addressed to the readers of Copernicus' work, and was possibly intended to be placed at the beginning of *De revolutionibus*.[63] This did not happen, however, and Dantyszek's poem precedes Copernicus' trigonometric treatise published by Rheticus in Wittenberg.[64] Interestingly enough, one of the copies of the first edition of *De revolutionibus*, which bears Rheticus' handwritten dedication to Aurifaber[65], features a Greek poem by Camerarius, also written by hand:

On the treatise concerning the Revolutions of Nicholas Copernicus
the Prussian.
The speakers here are a certain Stranger and a Philosopher.[66]

– What is this book? – A new one. – And what is new in it?
　　 – Much indeed! – And is anything good in it? – Every good thing is in it.
– Indeed, I see many diagrams of useful geometry
　　 And many tables of most admirable numbers.
– This work, then, repels from itself everyone untutored in geometry,
　　 As did your gate of yore, most excellent Plato,
And it is full of incalculable wisdom. – Is it still possible
　　 To ask one small question? – Indeed, speak, and you will hear all.
– Does this book give the design of the heavenly motions?
　　 Or the Winding paths of the much-divided Earth?
– Both, O Stranger. – And how so? Tell it clearly, I entreat you.
　　 – Come then, open it for yourself and see all.

– O Zeus! How great a wonder is that which I see! The Earth above
Is whirled in all directions in the arthereal sphere,
And the sun in the middle of the universe kindles the sacred fire.
Lying a captive in the prison of Zeus;
Everything is changed, and the Pleiades no longer set
Nor does Sirius move bringing to mortals the fiery heat.
– In truth, Stranger, every wise thing is a Wonder to the unwise
And from wonder learning comes to the mortals.
But do not merely Wonder, nor, as do the ignorant
Before you understand, speak evil of a good thing,
But, examine all things, repeatedly turning them over,
And ponder deeply what each of them means.
First read all things written by the Megarian [Euclid]
And whatever else the old man of Syracuse [Archimedes] found
And the labors of the Pelusian [Ptolemy], by which
He corrects not a few errors of the ancient astronomers;
Thus, Stranger, either learn something good from these if you can,
Or if you condemn it, produce something better.
But the work of Copernicus, sacred to the muses,
Will forever have its fame among men of understanding.

Was this poem also meant to precede *De revolutionibus*? Rheticus had already been friends with Camerarius for several years and it was due to the latter's support that Rheticus received the prestigious position of professor of higher mathematics at the university in Leipzig. He assumed this position in the winter term of 1542, a fact that significantly influenced the way Copernicus' work was printed.

Notwithstanding Duke Albert's letters requesting permission for Rheticus to supervise the print of *De revolutionibus*, the university in Wittenberg had other plans as regards their long absent professor. For the period from

October 1541 till April 1542 Rheticus was elected Dean of the Faculty of Liberal Arts, which entailed additional administrative duties. Rheticus used that time to deliver two lectures entitled the *Orationes due*, subsequently printed by Petreius. The first lecture focused on astronomy, whereas the second on physics. Both of them can be called manifestos of sorts, and both contained erudite references to some earlier authorities but without going into details. There was one exception however. While discussing the problem of calculating the length of the day and recalling the methods of ancient and medieval astronomers, Rheticus mentioned Copernicus' idea of tracing the motion of the Sun not against equinoxes but against the sphere of the stars. He did not, however, invoke Copernicus' name on this occasion.[67]

And yet Nuremberg was about to welcome the work which soon proved revolutionary for astronomy. It seems that Rheticus arrived in the city in May 1542. At that time his position had already been strengthened due to his being the author of the *First Account* dedicated to Schöner as well as the publisher of Copernicus' *De lateribus et angulis triangulorum*, a treatise dedicated to yet another excellent Nuremberg scholar, Hartmann. When in June Rheticus left Nuremberg to visit his homeland, Copernicus had just finished writing his dedicatory letter to Pope Paul III. Finally, it was this text, placed after Osiander's *Ad lectorem* and Cardinal Mikołaj Schönberg's letter to Copernicus as of 1536, that stood for the author's voice in the initial pages of *The Revolutions*. By this time the printing of *De revolutionibus* had already started as Johann Forster, the administrator of the parish of St. Laurence in Nuremberg, wrote in his letter from the end of June that the book of "a new and extraordinary astronomer" from Prussia should be composed of approximately 100 sheets of which two he had already seen a month earlier.[68]

The extent of Rheticus' involvement in the printing process remains unknown. Thanks to the erratum found in some of the Nuremberg copies we know that the printed sheets were read and a list was made of the identified errors.[69] In the already mentioned letter from June 1542, Forster reported

that the proofreading of Copernicus' work was done by a certain master from Wittenberg, and therefore, as it may seem, by Rheticus. But in the autumn Rheticus was already lecturing in Leipzig, a place three hundred kilometres away from Nuremberg. Is this the reason why the erratum is incomplete and ends on folio 146 recto, in the sixth chapter of Book V, leaving aside the last 50 folios of the book? And yet the headline of the erratum reads: "Since the printed work has once again been examined and compared to the autograph, you will take the trouble to correct the following".[70] Since the word 'autograph' (*autographum*) may be understood as a manuscript which remains with the author, one can but wonder if Copernicus himself prepared the erratum by proofreading the prints dispatched from Nuremberg. In this case the incompleteness of the erratum would result from Copernicus' deteriorating health. However, the word 'autograph' may also denote the manuscript held by the printer or by Rheticus, being an identical copy of the one left in Frombork. It should be emphasized here that the corrections listed in the erratum do not follow the extant holograph, and therefore the copy used for proofreading must have been a more advanced editorial version of the holograph.

Copernicus was struck by illness in December 1542, when his right side was paralysed, his memory became distorted and his consciousness started to fail. All these symptoms were described to Rheticus by Giese in a letter written two months after Copernicus' death.[71] Copernicus was attended primarily by Jerzy Donner (d.1544), the canon of Varmia, who had written to Melanchton as regards the rector of the Church of St. Mary's municipal school when he was still a town clerk in Danzig. Since Giese was not present at Copernicus' deathbed we do not know how precise his information is that Copernicus died on May 24, 1543 and that he saw his whole work printed only on that very day.

The printed copies of *De revolutionibus* reached Rheticus prior to Copernicus' death. The book was complete by March 1543,[72] and Rheticus' dedication in the volume presented to Aurifaber is dated April 20.[73] Inci-
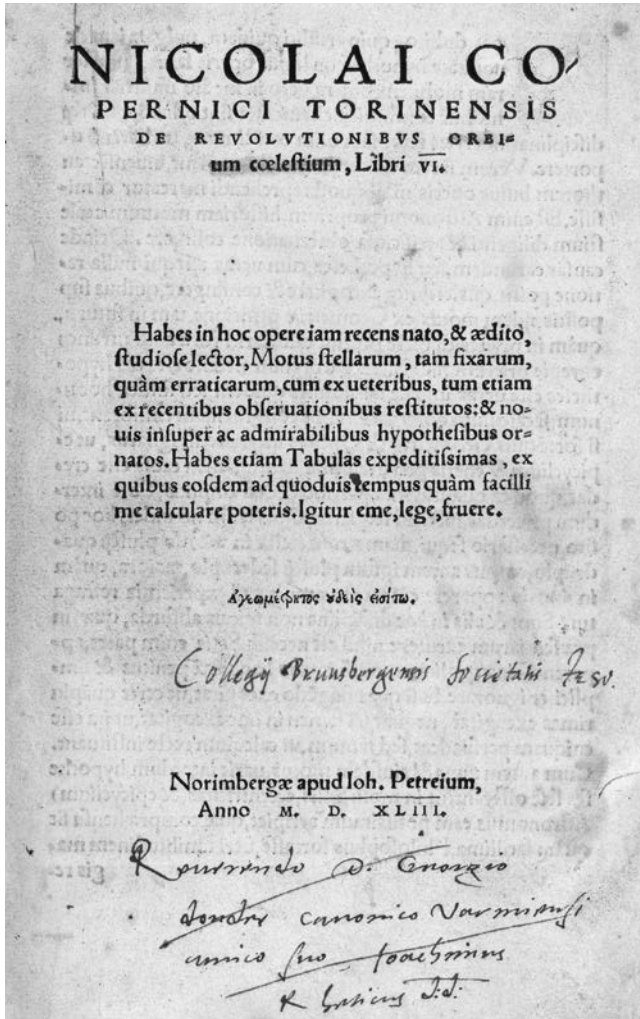
Figure 6. The front page of *De revolutionibus* (Nuremberg 1543) with the words *orbium coelestium* crossed out (in red) and the dedication: *Reverendo D. Georgio Donder canonico Varmiensi amico suo, Joachimus Rheticus d[ono] d[edit]* (To Reverend Georg Donner, Canon of Varmia, presented by his friend Joachim Rethicus). Uppsala universitetsbibliotek, shelf mark Cop 2.

AD LECTOREM DE HYPO-
THESIBVS HVIVS OPERIS.

ON dubito, quin eruditi quidam, uulgata iam de
nouitate hypotheseon huius operis fama, quòd ter
ram mobilem, Solem uero in medio uniuersi im-
mobile constituit, uehementer sint offensi, putétq́
disciplinas liberales recte iam olim constitutas, turbari nõ o-
portere. Verum si rem exacte perpendere uolent, inueniét au
thorem huius operis, nihil quod reprehendi mereatur cõmi-
sisse. Est enim Astronomi proprium, historiam motuum cœle
stium diligenti & artificiosa obseruatiõe colligere. Deinde
causas earundem, seu hypotheses, cum ueras assequi nulla ra-
tione possit, qualescunq́ excogitare & confingere, quibus sup
positis, ïjdem motus, ex Geometriæ principijs, tam in futurũ,
quàm in præteritũ recte possint calculari. Horũ autẽ utrinq́
egregie præstitit hic artifex. Neq́ enim necesse est, eas hypo-
theses esse ueras, imò ne uerisimiles quidem, sed sufficit hoc u-
num, si calculum obseruationibus congruentem exhibeant, ni
si forte quis Geometriæ & Optices usq́adeo sit ignarus, ut e-
picyclium Veneris pro uerisimili habeat, seu in causa esse cre-
dat, quod ea quadraginta partibus, & eo amplius, Solẽ inter-
dum præcedat, interdũ sequàtur. Quis enim nõ uidet, hoc po
sito, necessario sequi, diametrum stellæ in περιγείῳ plusq́ qua-
druplo, corpus autem ipsum plusq́ sedecuplo, maiora, quàm
in ἀπογείῳ apparere, cui tamen omnis æui experientia refraga
tur? Sunt & alia in hac disciplina non minus absurda, quæ in
præsentiarum excutere, nihil est necesse. Satis enim patet, ap-
parentiũ inæqualium motuũ causas, hanc artẽ penitus & sim-
pliciter ignorare. Et si quas fingẽdo excogitat, ut certe quãplu
rimas excogitat, nequaquã tamen in hoc excogitat, ut ita esse
cuiquam persuadeat, sed tantum ut calculum recte instituant.
Cum autem unus & eiusdem motus, uarie interdum hypothe
ses sese offerant (ut in motu Solis, eccentricitas, & epicyclium)
Astronomus eam potissimum arripiet, quæ compræhensu sit
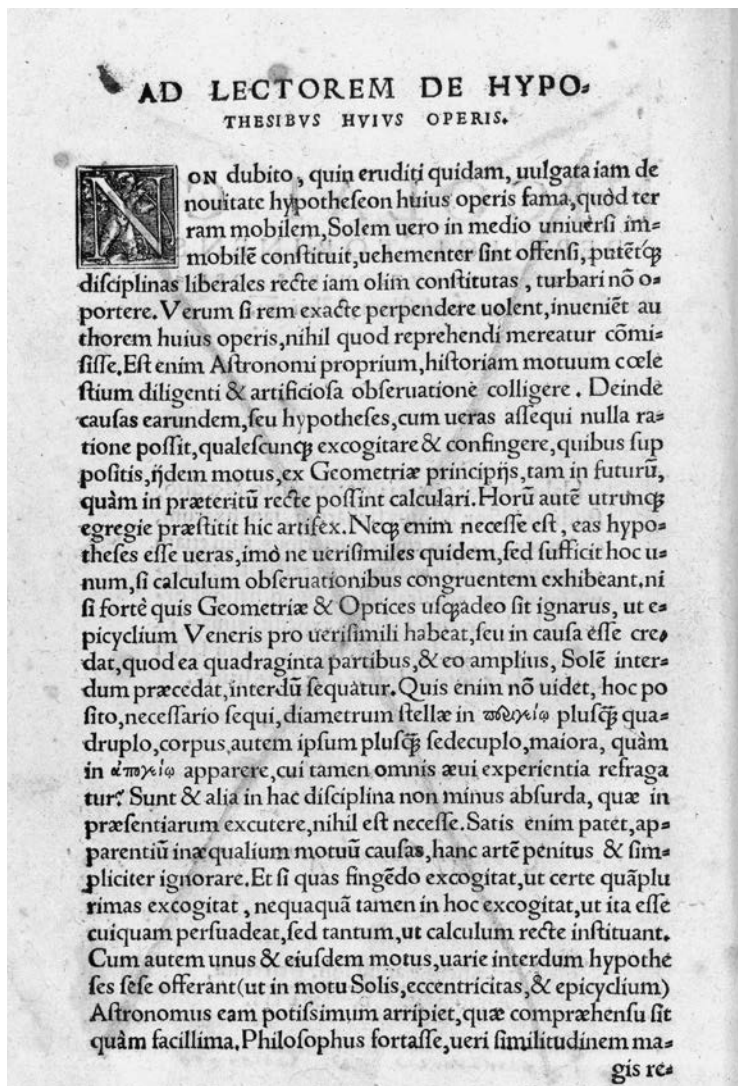quàm facillima. Philosophus fortasse, ueri similitudinem ma-
gis re-

Figure 7. The anonymous preface *Ad lectorem*, added by Andreas Osiander in *De revolutionibus* (Nuremberg 1543), crossed out (in red) in the copy presented to Georg Donner. Uppsala universitetsbibliotek, shelf mark Cop 2.

dentally, Aurifaber's copy is important evidence of Rheticus' reaction to the ultimate shape of the book whose printing he was to supervise. He used his red pen to cross out the second part of the title *De revolutionibus orbium coelestium* – both on the front page and in the table of contents (leaving *De revolutionibus* only) – and the anonymous *Ad lectorem* added by Osiander. Similar corrections can be found in the copies sent by Rheticus to Giese and to Donner. We do not know if Copernicus wished to or could respond in any way to the final form and content of his book.

Harmonious Souls, that is, Philosophical Natures

The *First Account* was written swiftly. While working on it, Rheticus, eagerly devoured the manuscript of *De revolutionibus* and, no doubt, conferred with Copernicus at the same time. If this indeed was the case, to what extent can this aspiring mathematician of Wittenberg be truly credited with the design and content of the *Narratio prima*? Did Copernicus give Rheticus a free hand and agree even to those passages which he would normally have rejected? Or did Rheticus give an account of those things which had been fully approved of by his tutor? Even though there is no answer to these important questions, they remain tantalizing and we are continuously intrigued by the construction of some passages of the *First Account*.

At the beginning of his account, Rheticus briefly summarizes the content of the six books of *De revolutionibus*. His summary corresponds both with the construction of the holograph and with the Nuremberg edition where in Book I geocentric astronomy is first rejected and then replaced by a new heliocentric cosmology. This is followed by Copernicus' geometry and, discussed already in Book II, the fundamentals of spherical astronomy and the catalogue of the stars. Thus Rheticus saw in Varmia the already arranged outline of the new theory. And yet, unlike Copernicus, he did not offer to his readers a revolutionary vision of the world from the very first pages of the *First Account* (he described Book I as containing "a general description

of the universe and the foundations by which he undertakes to save the appearances and the observations of all ages", not even mentioning the heliocentric theory). Additionally, Rheticus states bluntly: "So far as the first two books are concerned, I have thought it unnecessary to write anything […]" – even though, as he himself acknowledges in the previous sentence: "I have mastered the first three books, grasped the general idea of the fourth, and begun to conceive the hypotheses of the rest"! [74]

This strategy allows Rheticus to launch the presentation of Copernicus' achievements from the discussion of the precession of the equinoxes, the length of the tropical year, the solar theory and the introduction to the theory of the motions of the Moon which is geocentric by nature. Accordingly, he relates the content of Book III and IV of *De revolutionibus*, which to a large extent pertains to contemporary practical astronomy, including the issues vital for the reform of the calendar. Significantly enough, although Rheticus gives only a general description of the theory of the Moon, he goes at length to elucidate the problems of the precession and the solar motions, making a frequent recourse to figures and calculations.

In those times the concept of practical astronomy also extended to various aspects of astrology. As has already been mentioned, Melanchton perceived mathematical astronomy as a God-given instrument which allows man not only to adore God's creation but also to discern in it the incessant manifestations of Divine power. In this sense, Rheticus remained Melanchton's faithful student. He must have experienced an epiphany of sorts when he learned about a certain aspect of Copernicus' theory that was fit for elaborating the concept of historical astrology which was then intensely discussed, not least in the scholarly circles of Wittenberg. This discovery has been described by Rheticus in the chapter entitled "The Kingdoms of the World Change with the Motion of the Eccentric", which, for a moment, interrupts purely astronomical discourse (as we would call it nowadays). Significantly enough, this fragment finds no counterpart in *De revolutionibus*.

According to Copernicus' model of the circulation of the Earth round the Sun, the centre of the circle made by our planet itself made a small circle, completing the full cycle in 3434 Egyptian years. As a result, the distance of this centre from the Sun, i.e. the eccentricity of the Earth, was subject to cyclical changes, ranging from the smallest, through the medium, to the largest value. Rheticus discusses this phenomenon within the framework of geocentric astronomy, replacing the positions of the Sun and the Earth, and thus he refers to the eccentricity of the Sun and associates it with the turning points in the history of the world, those which have already taken place as well as those which are to come.

> We see that all kingdoms have had their beginnings when the center of the eccentric was at some special point on the small circle. Thus, when the eccentricity of the Sun was at its maximum, the Roman government became a monarchy; as the eccentricity decreased, Rome too declined, as though aging, and then fell. When the eccentricity reached the boundary and quadrant of mean value, the Mohammedan faith was established; another great empire came into being and increased very rapidly, like the change in the eccentricity. A hundred years hence, when the eccentricity will be at its minimum, this empire too will complete its period. In our time it is at its pinnacle from which equally swiftly, God willing, it will fall with a mighty crash. We look forward to the coming of our Lord Jesus Christ when the center of the eccentric reaches the other boundary of mean value, for it was in that position at the creation of the world.[75]

We can associate the events mentioned by Rheticus with the dates calculated according to Copernicus' theory: the Creation of the World – 4354 B.C., the creation of the Roman monarchy – 65 B.C., the establishment of Islam – 794 A.D., the fall of Islam – 1652, and the second coming of Christ – 2510.[76] Out of these five turning points Rheticus knew only two, and the apparent compliance with historical dates must have pleased him. The whole historical period comprised the two full cycles of the eccentricity, and thus 6868 years in Copernicus' calculations. "This calculation does not differ

much from the saying of Elijah, who prophesied under divine inspiration that the world would endure only 6,000 years"[77], concluded Rheticus.

The idea of the cosmic cycles can be traced back to antiquity, and it became incorporated into the astrology of the Latin West as late as in the 12th century with the appearance of the translation of the treatise by Abū Maʿšar (Albumasar), a Baghdad astrologer. The treatise entitled *De magnis coniunctionibus* (*On the Great Conjunctions*) was subsequently published first in Augsburg in 1489, and then in Venice in 1515. Albumasar's ideas were elaborated by yet another astrologer from Baghdad, Māšāʾ Allāh (Messahala). The prophecy was based on the observation of the three types of conjunctions of the slowest planets, i.e. Jupiter and Saturn. These planets meet on the firmament every 20 years which was referred to as the great conjunction. When such a meeting finally takes place in one of the signs of the zodiac, being in turn part of one of the four triplicities,[78] the successive conjunctions confine themselves to the signs of this triplicity for the next 240 years. In this way, the change of the triplicity defined greater conjunctions. There were yet conjuctions of another type called the greatest conjunctions which coincided with the completion of the cycle in 960 years when conjunctions return to the first triplicity. One example should suffice here. According to Messahali, Jupiter and Saturn met for the first time in the watery triplicity in 3321 B.C., which presaged the biblical flood.

The cyclical nature of the history of the world was discussed by Melanchton and his followers, though the recourse made by the Islamic scholars to the idea of great conjunctions was criticized time and again. However, astrology was still a way to combine the Book of Nature with the Scriptures and the history of mankind. In fact, this could be yet another reason for the attractiveness of Copernicus' theory for Rheticus.

In the extant manuscripts of Copernicus there is only one reference to astrology found in the introduction to Book I of *De revolutionibus*. Although the fragment is known from the holograph, it is missing from the first edi-

tions: "If then the value of the arts is judged by the subject matter which they treat, that art will be by far the foremost which is labeled astronomy by some, astrology by others, but by many of the ancients, the consummation of mathematics"[79]. Consequently, the reference to astrology appears in the context of the use of appropriate terminology. And yet Copernicus was certainly familiar with astrological practice.

Still a student in Kraków, Copernicus purchased the Latin translation of the astronomical treatise entitled *De iudiciis astrorum* by Albohazen as well as the astronomical tables necessary for astrological calculations (the *Alfonsine Tables* and Regiomontanus' *Tabulae directionum*).[80] Moreover, once he had already completed the basic outline of his astronomy, he was to some extent involved in preparing tables for practising astrologers. Bernard Wapowski, Copernicus' friend and then the secretary of King Sigismund I, reported in a letter as of October 15, 1535, about the dispatch from Kraków to Vienna of an astronomical almanac calculated on the basis of some new Copernicus tables. Pointing to the errors made by others, Wapowski argued: "I wish that this device become widely known, especially among experts in heavenly matters who compose almanacs in Germany, in order that they make [them] more correct and acknowledge their error and the error of their tables". This seems vital as "neither changes of air nor annual judgments can be made correctly without true motions and aspects of the planets".[81] Interestingly enough, only a few months earlier in the same year, Johannes Apelt sent a horoscope from Nuremberg to Duke Albert of Prussia, hinting that should he have any problems with interpreting the document or finding a competent person for this task, he should turn to the old Canon in Frombork[82]. It is highly probable that Apelt had Copernicus in mind though we have no further evidence for this identification.

If so, whose was the idea of putting Copernicus' theory about the motions of the Earth at the service of historical astrology? On the one hand, while referring to this "prediction" (*vaticinium*), Rheticus does not associate it directly

with Copernicus. On the other hand, Rheticus placed it in the *First Account of «The Revolutions» by Nicolaus Copernicus* when Copernicus was still alive and his decision clearly did not ruin their relations as Rheticus remained in Varmia long after the publication of his book.

Rheticus first mentions Copernicus' concept of the Sun placed in the centre of the Universe, and the Earth among other planets, in the conclusion of the chapter on the motions of the Moon. By then, the reader has already become acquainted with the more practical aspects of Copernicus' astronomy discussed from a traditional standpoint, as well as with the model of the motions of the Moon which serves as an example of Copernicus' more ambitious enterprise: to free astronomy from the equant. This allows Rheticus to proceed to the presentation of other claims included in Book I of *De revolutionibus*; about which he had earlier mentioned that they there was no need to discuss them. At this point, however, we eventually learn about the six basic reasons for abandoning the hypotheses of ancient astronomers as well as about the new system of the world and the justification of the three motions of the Earth.

The first reason for Copernicus' claim concerning the motion of the Earth which Rheticus points to is "the indisputable precession of the equinoxes […] and the change in the obliquity of the ecliptic". The second reason also derives from mathematical astronomy: "the diminution of the eccentricity of the sun is observed, for a similar reason and proportionally, in the eccentricities of the other planets".[83] Both problems have already been discussed by Rheticus in a relatively thorough way, and yet – surprisingly enough for his readers – in the earlier presentation of the theory of precession and the diminution of the eccentricity of the Sun, the issue of the motion of the Earth was not mentioned at all.

The next three reasons enumerated by Rheticus refer indirectly or directly to the authorities. To prove the claim that the centres of the circles in which the planets move are located near the Sun, Rheticus points to the relevant passages of Pliny's *Natural History*. Copernicus also uses this

argument (*De revolutionibus* I,10), although in a somewhat veiled way. Next comes the fundamental claim also expressed in the title of the fourth chapter of Book I of *De revolutionibus*: "The Motion of the Heavenly Bodies is Uniform, Eternal, and Circular or Compound of Circular Motions".[84] In this way, Copernicus returns to the basic assumptions of heavenly physics as set by ancient philosophers, and he rejects the equant derived from the mathematical astronomy of Ptolemy. The third reason is well known from scholastic disputes and expressed in the form of Galen's popular aphorisms: "Nature does nothing without purpose" and "So wise is our Maker that each of his works has not one use, but two or three or often more".[85] Although this reason can also be found in *De revolutionibus* I,10, Rheticus cites the ancient authority in Greek, whereas Copernicus writes in Latin and does not point to the source of his inspiration.

The sixth and final reason for rejecting the old cosmological ideas consists in the fundamental justification of the heliocentric system and is also articulated by Copernicus both in his dedicatory letter to the Pope (Rheticus was ignorant of this text when he wrote his *Account*) as well as in the key passage of the tenth chapter of Book I of *De revolutionibus*. Having introduced the new arrangement of the spheres, Copernicus states: "In this arrangement, therefore, we discover a marvelous symmetry of the universe, and an established harmonious linkage between the motion of the spheres and their size, such as can be found in no other way".[86] In turn, Rheticus writes about the discovery of "the rule which reminds us that the order and motions of the heavenly spheres agree in an absolute system".[87] He also refers to the apologia for the Sun, found in the same chapter in Copernicus' work, but he puts his major emphasis on the special importance of the mean motion of the sun in geocentric astronomy (the phenomenon resulting from the annual circulation of the Earth round the Sun). Interestingly enough, here too Rheticus seems to be echoing Copernicus' later argument from the dedicatory letter: "Mathematics is written for mathematicians".[88]

Setting the ground for the introduction of the new cosmology, Rheticus reaches for an irrefragable argument: the results of the observations force us to reform astronomy and had Aristotle, Ptolemy and Averroes (the most Aristotelian of all Islamic scholars) known them, they would have supported Copernicus' theory. The chapter is short and the careful arrangement of citations only strengthens its message.

The concise description of the heliocentric system of the universe is placed by Rheticus in-between citations from Aristotle and Pliny which are absent from *De revolutionibus*, like the citations mentioned in the previous chapter. When Rheticus, following Copernicus, refers to the relativity of motion by using Virgil's words, he finds a relevant passage in the *Eneid*, although different than the one already used by his preceptor.

Rheticus also returns to the problem which was first brought up by Copernicus: he juxtaposes the incoherence of geocentric theories and certain randomness of the constructions proposed by them with "the inexpressible harmony and agreement of all things"[89] in the heliocentric system. The chapter ends with a remark concerning the number of planets circulating round the Sun:

> By what number could anyone more easily have persuaded mankind that the whole universe was divided into spheres by God the Author and Creator of the world? For the number six is honored beyond all others in the sacred prophecies of God and by the Pythagoreans and the other philosophers. What is more agreeable to God's handiwork than that this first and most perfect work should be summed up in this first and most perfect number?[90]

In Rheticus' view the number of planets in the heliocentric system, which happens to be also the first perfect number,[91] becomes the best warranty of the newly discovered heavenly harmony (*harmonia coelestis*). Sixty years later, Johannes Kepler, in his first Copernican treatise, *Mysterium cosmographicum*, will strive to prove that the Creator used five Platonic polyhedra

to construct the world and it is their nature that is reflected in the number of spheres, and in their proportions and causes of motion.

The chapter devoted to the three motions of the Earth is in fact a return to the description of the solutions applied by Copernicus in his heliocentric astronomy. However, prior to the presentation of planetary models, Rheticus makes yet another personal detour. He sketches a general and rather idealized portrayal of Copernicus as an investigating astronomer. Copernicus always begins with the observations made both by the ancient scholars and by himself to verify the compliance of the models of the motions of heavenly bodies with reality. What follows is the comparison of Copernicus' conclusions with ancient theories. And if "he finds that astronomical proof requires their rejection", he puts forward some new hypotheses "not indeed without divine inspiration and the favor of the gods".[92] At this point, Copernicus falls back on geometry to draw conclusions based on these hypotheses which, in turn, allows him to check them against his observations. The ultimate consequence is the new laws of astronomy. Following this description is Rheticus' enumeration of some dubious solutions of Ptolemaic astronomy such as the equant or the theory of the motion of the planets in latitude. Finally, he presents the theory of the motion of the planets in longitude and latitude, i.e. he summarizes the content of Book V and VI of *De revolutionibus*.

At the end of the astronomical part, Rheticus promises that once he has studied *De revolutionibus* more thoroughly he should write a *Second Account*. Then he makes his apologies in case he has all too eagerly stood "against venerable and sacred antiquity" for which he implores Schöner's leniency. Additionally, he affirms that Copernicus' only wish was to follow Ptolemy, just as Ptolemy followed the path of yet earlier astronomers. However, the phenomena and mathematics left him no choice. Whatever he did was not motivated by a mere quest for novelty as "[s]uch is his time of life, such his seriousness of character and distinction in learning, such, in short, his loftiness of spirit and greatness of mind […]".[93] The paragraph ends with

a declaration to subject Copernicus' work to other people's assessment, which presumably heralds the publication of *De revolutionibus*.

The *First Account* concludes with the longest of Rheticus' personal writings and the least astronomical, i.e. the *Encomium Prussiae* ("In Praise of Prussia"). From the standpoint of the history of science, this text appears exceptionally interesting, predominantly because of the account of the discussion of Giese and Copernicus concerning the necessity of the publication of *De revolutionibus*. In this context, one can but wonder to what extent Rheticus follows his own information strategy or the strategy agreed upon with Giese and Copernicus, or perhaps, simply relates the events which were described to him by, as he put it, "friends familiar with the whole matter".[94]

Undoubtedly Giese attempted earlier to convince Copernicus to make his discoveries public. We know that both friends wrote to each other about this matter. At the beginning of the 17th century, Jan Brożek, a professor at the Academy of Cracow, was still in possession of the twenty letters which Giese and Copernicus had exchanged on the subject.[95] Giese also wrote, probably in the 1530s, a short treatise entitled the *Hyperaspisticon* wherein he defended the heliocentric theory.[96] Consequently, Rheticus could meet with a thoroughly devised strategy.

The first of Giese's arguments recalled by Rheticus pertained to the reform of the calendar, an issue crucial for the Church. Copernicus was said to have yielded and declared that he would prepare astronomical tables based on his theory, without however revealing any of his fundamental assumptions. Giese was critical of this idea: the tables devoid of theoretical background would have been imperfect, whereas mathematics relied on evidence and on not taking anything for granted. Additionally, the novelty of Copernicus' theory would hinder or altogether make it impossible for others to discover the fundamental assumptions of the new approach on the basis of the tables alone. If, however, Copernicus, decides to present his theory he can first of all provoke some of the more intelligent and better educated philosophers

to reconsider Aristotle's arguments about the motionless Earth, even more so that "they desire to look to the principal end of astronomy and to the power and the efficacy of God and nature".[97] Secondly, Copernicus should not be afraid of criticism. Thus, Ptolemy himself was criticized, and one should disregard the opinions of the uneducated people who are ignorant of geometry.

The striking feature is the emphasis placed on the usefulness of Copernicus' theory in the matters of the calendar, and therefore in pastoral matters. Fittingly enough, Rheticus stresses that Giese is a high church official of exceptional mind and spirit. The contradiction with Aristotelian physics is again played down by stressing the discrepancy between what Aristotle knew in his time and what he would do with the knowledge accessible to Copernicus. Last but not least, a true scholar cannot be afraid of criticism notwithstanding its source. What is missing here is the question of the possible incompatibility of the heliocentric theory with the official interpretation of the Scriptures, as well as Rheticus himself and his role in persuading Copernicus to publish his manuscript.

"In Praise of Prussia" ends with a brief erudite piece on harmonious souls where Rheticus manages to accommodate both Plato and the anecdote about the king of Scythes.

Even though Rheticus praises in the *Narratio prima* Copernicus' excellent mind and character, he reveals few details from his life. This can be partially ascribed to the fact – known from Giese – that Rheticus wrote a separate biography of the astronomer (which has unfortunately perished). The *First Account* confirms the information known from other sources such as, for example, Copernicus' commitment to astronomical observations in Bologna and Rome, associating him in Bologna with an Italian astronomer and astrologist, Dominico Maria di Novara. An interesting hint about the instruments available to Copernicus pertains to Giese's equatorial ring. In *De revolutionibus*, Copernicus meticulously described the construction of his major

instruments, these being a solar quadrant, parallactic ruler and armillary astrolabe (in which he followed the *Almagest*), but he did not mention this particular Ptolemy instrument, used for observing equinoxes. It is intriguing to know that Copernicus "always has before his eyes the observations of all ages together with his own, assembled in order as in a catalogue".[98] If such a catalogue indeed existed, it would be an invaluable source of information about Copernicus' readings as well as about his own observational activities. And yet the extant material amounts to 60 astronomical observations of Copernicus, of which approximately one half was included in *De revolutionibus*, whereas the rest survived scattered over the pages of the books from his library.

By writing his *Narratio prima* Rheticus also set a rhetorical fashion of referring to Copernicus as a new Ptolemy. He wrote: "I rather compare him with Ptolemy […] because my teacher shares with Ptolemy the good fortune of completing, with the aid of divine kindness, the reconstruction of astronomy […]".[99] Both contemporary and later scholars followed Rheticus in this, even if they did not entirely agree with the heliocentric astronomy. Gemma Frisius (1508–55), for example, would refer to Copernicus as "another Ptolemy",[100] Reinhold – as "another Atlas or Ptolemy",[101] Tycho Brahe, in 1574, in his lecture on mathematics, spoke about "another Ptolemy",[102] whereas Michael Maestlin (1550–1631), the teacher of Kepler, on his copy of *De revolutionibus* wrote about Copernicus: "after Ptolemy, the prince of all Astronomers".[103]

The Fruit of Copernicus' Most Abundant Gardens

We do not know how many copies of the *Narratio prima* were printed in Danzig. Whatever was the case, Rheticus made sure that they reached the right people. Malanchton must have been pleased with the heliocentric justification of historical cycles. The readers in Nuremberg received not only the overview of the basic assumptions of the new theory but also some details

and figures referring to the precession and, in traditional terminology, to the motion of the Sun. Having read the *First Account*, Gasser, a physician with a keen interest in astrology, astronomy and geography, and Rheticus' friend and mentor, enthusiastically welcomed Copernicus' discoveries which he described in his letter to Vögelin:

> Nevertheless, what it undoubtedly seems to offer is the restoration – or rather, the rebirth – of a true system of astronomy. For in particular it makes highly evidential claims concerning questions that have long been sweated over and debated all across the world not only by very learned mathematicians but also by the greatest philosophers: the number of the heavenly spheres, the distance of the stars, the rule of the Sun, the position and courses of the planets, the exact measurement of the year, the specification of solstitial and equinoctial points, and finally the position and motion of the Earth, along with other such difficult matters.[104]

Apart from Rheticus' book, this was probably the first text whose author was embracing heliocentrism. Gasser's whole letter also became the preface to the second edition of the *Narratio* published in Basel in 1541 in Robert Winter's printing house. Similarly as the first edition in Gdańsk, the second edition was printed *in octavo*, and the long erratum compiled by Zell was used to remove the errors found in the original publication.

Gasser once again praised Copernicus' astronomy in the preface to his astrological *practica* for 1546. He dedicated the Latin version of his book to Rheticus, inviting him to write a new introduction to the heliocentric astronomy, and the German version to Caspar Joachim Täntzel, a gentleman from Tyrol.[105] In his German preface Gasser once again presented Copernicus' theory as a new cosmological doctrine describing the true system of the world.

Rheticus never compiled a new introduction to Copernicus' theory (just as he did not write a *Narratio secunda* even though he mentioned such an

intent in the *First Account* on several occasions) but in 1550 he published the *Ephemerides novae … ad annum 1551* – the presentation of astronomical phenomena in 1551 calculated on the basis of *De revolutionibus*. In the preface to his treatise Rheticus referred to some facts from Copernicus' life (e.g. he confirmed Copernicus' close acquaintance with Dominico Maria di Novara), cites some of Copernicus' opinions (usually on earlier astronomers), and declares that while writing the *Ephemerides* he "strove not to deviate from Copernicus' theory even by a single inch […]".[106] In 1550 there appeared yet another version of the Copernican astronomical calendar. This one was entitled the *Ephemerides duorum annorum 50. et 51. supputatae ex novis tabulis astronomicis* and authored by Reinhold, Rheticus' older friend from Wittenberg. The "the new tables" mentioned in the title were in fact the famous *Prutenicae tabulae coelestium motuum* (*Prutenic Tables*) published by Reinhold a year later.

Reinhold undertook to prepare the astronomical tables on the basis of Copernicus' theory soon after he had read *De revolutionibus*. As early as in January 1544 he informed Duke Albert that he intended to call them the *Prutenic Tables*.[107] However, the project required a lot of time as Reinhold first had to derive from Copernicus' work the parameters of the planetary models, then recalculate them, and finally set the results in a convenient form typical of the astronomical practice of that time.[108] Three centuries earlier the Ptolemaic theory was used in a similar way to develop the *Alfonsine Tables*.[109] Reinhold's aim here was obvious: the *Prutenic Tables* were to replace the *Alfonsine Tables*. Even if this aim was not entirely achieved, Reinhold succeeded otherwise: following his publication, all those wishing to calculate the positions of celestial bodies according to Copernicus' theory reached not for *De revolutionibus* but for the *Prutenic Tables* which were easier to use.[110]

This does not mean, however, that Reinhold shared Rheticus' enthusiasm for the new world model. Neither the *Narratio prima* nor *De revolutionibus* made the scholars of the influential academic centre in Wittenberg embrace

the heliocentric cosmology.[111] They did however recognize the usefulness of Copernicus' mathematical constructions for astronomical calculations. On the front page of his copy of *De revolutionibus* Reinhold wrote: "The axiom of astronomy: Celestial motion is uniform and circular, or composed of uniform and circular motions".[112] This view was also shared by others, whereas Gasser's stance was an exception.
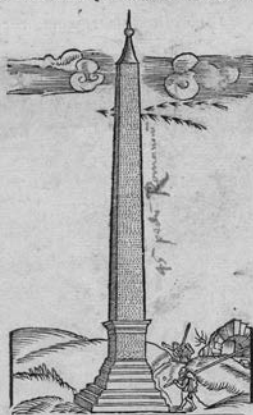
The year 1551 saw the publication of Reinhold's *Prutenic Tables* and was also an important year in Rheticus' life as he published the *Canon doctrinae triangulorum* (*Canon of the Science of Triangles*) in Wolfgan Gunther's printing house in Leipzig. Rheticus was interested in this domain of mathematics at least from the time when he assisted in the printing of the trigonometric part of *De revolutionibus* i.e. *De lateribus*. This publication featured a table which was a modified and extended version of Copernicus' table of half-chords subtending double arcs which corresponded to the sinus. Rheticus could have had a hand in this small modification.[113] However in 1551, Rheticus, presently professor at Leipzig University, went a few steps further. He became the first scholar ever to include in his canon the tables of all six trigonometric functions, and additionally to assign their values directly to the angles of the triangle and not to the chords of the circle as had been done before him.[114] Still in the same year, 1551, Leipzig was stunned by a sex scandal involving Rheticus which eventually made him leave both the university and the city.

The forced trip was not the first of Rheticus' prolonged wanderings since he had submitted *De revolutionibus* for print and moved from Wittenberg to Leipzig. In the autumn of 1545 Rheticus travelled to Milan to meet the renowned Italian mathematician and astrologer Girolamo Cardano (1501–76) to whom he delivered the natal horoscopes of some important persons. When a few months later he was leaving Italy, his health was devastated by a nervous breakdown. He spent this difficult time at his friend's home in Lindau. Finally, he turned up at the university in Leipzig at the beginning of the winter term in 1548. In 1551 he left Leipzig, this time for ever.

Figure 8. Rheticus' gnomon in Cracow. *Ioannis Verneri … De triangulis sphoerici Libri Quatuor. De meteoroscopiis libri sex. Nunc primum Studio & Diligentia Georgii Ioachimi Rhetici in lucem editi*, Crakow 1557. The handwritten note gives information about the height of the obelisk: 45 Roman feet i.e. approximately 13 meters. The Jagiellonian Library, shelf mark BJ St Dr. Cim.8274.

Following a two-year sojourn in Prague where he studied medicine, Rheticus finally reached Cracow. He settled down for good in the city where his preceptor had learned the fundamentals of astronomy. Rheticus certainly benefited from his aura of a Copernicus' student and propagator of the reformed astronomy. As soon as in the first year of his stay he managed to convince Jan Boner, a wealthy Cracow citizen, to finance the construction of a huge gnomon whose height went above ten meters. He wrote in one of his letters: "By this means, God willing, I shall describe anew the whole sphere of the fixed stars".[115] Rheticus was fascinated with the gnomon – an instrument constructed in a way resembling Egyptian obelisks – till the end of his life.

Whatever were Rheticus' plans as regards astronomy, he never managed to reach the level set by the *Narratio prima*, and even more so by *De revolutionibus*. As late as in 1563 he wrote to Tadeáš Hájek (1525–1600), a Czech astronomer:

> I have just reviewed Copernicus' work and I am planning to append it with our commentaries. My friends insist that I undertake this project following the recent conjunction of Saturn and Jupiter which was observed on August 25 at half past seven p.m. […].[116]

Rheticus also failed to keep his promise this time. However, he continued to be fascinated by the apparent relationship between celestial cycles and the history of the world, the relationship which he so astonishingly accommodated into his *First Account*. Rheticus confirmed this fascination in 1557 in a dedicatory letter to King Ferdinand which was to precede the edition of the works of Johannes Werner prepared in Cracow:

> As regards the stars, I do believe that the Ottoman empire is about to plunge into inevitable, sudden, unexpected and astonishing catastrophe as the coming under the influence of the fiery triplicity and the power of watery triplicity begins to fail.[117]

In 1572 Rheticus wrote yet another *vaticinium*, this one prophesizing the fate of the seven successive kings of Poland.[118]

In the meantime the third edition of *Narratio prima* was printed. It accompanied the second edition of *De revolutionibus*, published in Basel by Sebastian Henric Petri. Rheticus' text was again preceded by Gasser's letter and placed after Copernicus' treatise (the page numbers ran continuously throughout the whole book), however, in an abbreviated version without "In Praise of Prussia". Due to the fact that this edition of *De revolutionibus* was printed in a larger *quarto* format, the text was set in two columns and the printer remained faithful to the content of the second edition.

Although Rheticus had a reputation in Cracow of a good physician and astrologer, he never discarded mathematics and worked on his *opus magnum* i.e. the most complete and most extensive trigonometric tables which had been merely foreshadowed by the *Canon* published in Leipzig. However, other duties and limited financial means would slow down his calculations and the overall process of writing. In his somewhat sneering commentary on Rheticus' medical authorities, Andreas Dudithius (1533–89), a Hungarian humanist and diplomat based in Cracow, reported in 1570:

> Rheticus keeps playing Argonaut, and with the Swiss, Theophrastus [Paracelsus], as his pilot, he takes the course straight into the rocks […] I am saddened by this and I often tell him that everybody should commit himself to those arts which he knows best but all in vain. Neither Praetorius, nor Schüler, nor myself can win him back for mathematics. Medicine is important and brings profits but we all agree that one should not follow the footsteps of Theophrastus.[119]

Presumably it was the opportunity of continuing his work in better conditions which made Rheticus leave Cracow in 1572 and move to Košice (Cassovia) where he accepted the invitation of Baronet Johannes Rueber who agreed to pay for arithmeticians assisting in the compilation of his trigonometric tables. In the meantime, in Wittenberg, Rheticus' enterprise be-

came known to Praetorius Valentin Otho (Otto, approximately 1550–1603) who had been impressed by reading the *Canon of the Science of Triangles*. He decided to join Rheticus in Košice. This is how he described their meeting in the spring of 1574:

> The first few sentences were enough for him to understand the reason for my arrival. "I was your age when I visited Copernicus!" – exclaimed Rheticus. "Had it not been for my visit, his work would have never seen the printer".[120]

Otho's stay with Rheticus was shorter than Rheticus' visit in Frombork as the latter died in Košice on December 4, 1574. As far as Otho's report on his first encounter with Rheticus might have been to some extent exaggerated, he in fact played a more important role in making Rheticus' work accessible to the world than Rheticus' did in the publication of *De revolutionibus*. In the next twenty years Otho managed to complete the work on the trigonometric tables and to write the accompanying text. The monumental work of more than 14,000 pages was published in 1596 with the support of Frederic IV, Elector Palatine. The tables of the six functions brought together in the *Opus Palatinum de triangulis* were computed in intervals of 10 seconds of arc and calculated to 10 decimal places. They were replaced by more accurate tables as late as at the beginning of the 20th century.[121]

Otho would admit that what made him travel to Košice was primarily the dialogue placed by Rheticus at the end of his *Canon* published in Leipzig.[122] The dialogue of the lover of mathematics and his guest began with a question concerning Rheticus. The lover of mathematics replied: "It is indeed the man who treats us to the fruit of Copernicus' most abundant gardens".[123] Perhaps what Rheticus had in mind was not only the *Narratio prima* but his more advanced trigonometric studies. If this was the case, he would have been pleased with the "conjunction of 1596" when both the *Opus Palatinum* and the fourth successive edition of the *First Account* were published. The latter was prepared by Maestlin who, while supervising the publication of

Kepler's *Mysterium cosmographicum* (Tübingen 1596), attached Rheticus' treatise to the work of his former student.[124]

In his edition, Maestlin gave to the *Narratio prima* its own front page, kept Vögelin's poem but inserted a five-page preface preceding Gasser's letter. In this preface he justified attaching Rheticus' account to Kepler's work. Accordingly, he claimed that the introduction to Copernicus' astronomy in the *Mysterium cosmographicum* was excessively brief and that Rheticus often explained in a more elucidating way matters which appeared obscure in Copernicus' own work.[125] Maestlin also added some marginal notes about the subject matter, emphasising the figures (the results of the observations, parameters of the theory, etc.), and offering cross references to the relevant passages in other works, including, naturally, *De revolutionibus*. However, there are also some other comments. At the point where Rheticus admits: "[…] I am persuaded that now at last I have a more accurate understanding of that delightful maxim which on account of its weightiness and truth is attributed to Plato: 'God ever geometrizes' […]",[126] Maestlin remarked: "[I wonder] what Rehticus would say if he had learned that the Divine geometry corresponds to the five regular solids described by Kepler?".[127]

Another extra feature became the four figures as Rheticus did not include a single illustration. One of these figures was copied from *De revolutionibus*,[128] but the three remaining figures were drawn by Maestlin himself. Two of them which depicted the motions of the equinox[129] and of the celestial pole[130] according to Copernicus' theory (the third was supposed to be a more precise representation of the systems of the spheres in the heliocentric model of Cosmos[131]) were accompanied by descriptions. These however were not the only textual interpolations made by Maestlin. He added, for example, the information which Rheticus obviously could not supply, i.e. the date of Copernicus' death as of January 19, 1543 (which is incidentally wrong)[132], and the report of Tycho Brahe of 1588 about his suc-

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5. dies, 31. minuta, si tempus ad æquinoctium medium, ad id confe-
ramus, quod exultat, cum in quatuor annis vnus dies colligitur.
Cæterùm Sol tempore Ptolemæi æquinoctium verum in 47. min.
post æquinoctium medium in signorum consequentiam relique-
rat: Albategnij autem ætate æquinoctium verum in 22. min. ante
æquinoctium medium in signorum antecedentiam erat. Priùs igi-
tur Sol ad æquinoctium verum, quàm ad medium, vel vbi æquino-
ctialem verum reliquerat, venit, quod est contrarium priori exem-
plo. Quantum itaque temporis vni grad. 9. min. respondebit, tan-
tum de diebus respectu æquinoctij medij decedet: & residuo, nem-
pe 5. diebus, 31. min. accedet, & quia eodem modo cum differen-
tia anguli diuersitatis propter eccentricitatis decrementum, cui 30.
diei minuta respondent, agendum, vnus dies 30. min. propter mu-
tationem anguli diuersitatis, & inæqualem præcessionis motum,
reliquis duabus inæqualis motus Solis causis admixtis, tempore
mediocri decedent, & additamentum verum à tempore Ptolemæi
ad Albategnij obseruationis tempus 178. dierum, 44. min. exibit.
Sed idem decrementum adiunctum 5. diebus, 31. min. monstrat
7. dies, & 1. min. excidisse. quod often dendum erat.
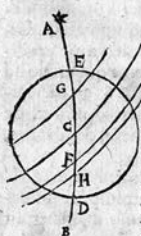
Schema Anomaliæ præcessionis Æquinoctiorum.
& inæqualis magnitudinis anni
Tropici.

AB Ecliptica. A prima stella Arietis. C æquinoctium
medium, siue sectio æquinoctialis medij & ecliptica. Huius præ-
cessio ab A est æqualis. DE diameter circuli anomaliæ æqui-
noctiorum, per quam verus æquinoctialis libratione it reditq́;
F est locus veri æquinoctij, siue sectionis veri æquinoctialis &
ecliptica, tempore Hipparchi: G, autem tempore Ptolemæi, &
H tempore Albategnij. CF est 21. scr. CG 47. scr. CH 22.
scr. FG 68. scr. at GH 69. scr. qualium CE vel CD est 70.
scr. Rheinholdus in tabulis, Prut: numerat CE vel CD 1. gr.
11'. 22". 30"'.

Tantæ molis erat, tali ratione stellarum fixarum, & Solis mo-
tus restituere, quo ex motuum eorum colligantia, vera annuæ
quantitatis ab æquinoctijs ratio colligi posset. Regnum itaque in
astronomia doctiss. Viro D. Præceptori meo Deus sine fine dedit,
quod Dominus ad astronomicæ veritatis restaurationem guberna-
re, tueri, & augere dignetur, Amen.   Sta-

Figure 9. The page from the fourth edition of the *Narratio prima* (Tübingen 1596)
with the interpolated diagram depicting the motion of the equinox and the descrip-
tion. It was attached by Michael Maestlin to the chapter "Special Consideration of
the Length of the Tropical Year". ETH-Bibliothek Zürich/e-rara.ch.

cess in measuring the parallax of Mars in opposition.[133] The fourth edition of the *Narratio prima* also comprised "In Praise of Prussia" and was followed by the appendix written by Maestlin and entitled: "On the Dimensions of the Heavenly Circles […] after the Theory of Nicolaus Copernicus".

In 1621 the second edition of Kepler's *Mysterium cosmographicum* appeared, with yet another edition of the *First Account* also including the illustrations made by Maestlin. Four years earlier Copernicus' work was printed for the third time in Amsterdam. In this way the final result of the contest the *Narratio prima* vs. *De revolutionibus* equaled 5 to 3.

Jarosław Włodarczyk

Notes

[1] *Nicolai Copernici Torunensis De revolutionibus orbium coelestium libri sex / Mikołaja Kopernika Toruńczyka O obrotach ciał niebieskich ksiąg sześć*, ed. J. Baranowski (Warsaw, 1854).

[2] J. J. Retyk, *Relacja pierwsza z ksiąg* O obrotach *Mikołaja Kopernika*, transl. I. Lewandowski, introd. and commentary J. Włodarczyk (Warsaw, 2015).

[3] *Three Copernican Treatises: The* Commentariolus *of Copernicus. The* Letter against Werner. *The* Narratio prima *of Rheticus*, transl. with introd. and notes by E. Rosen (New York, 1939) and successive editions.

[4] For the complete bibliography see Retyk, *op. cit*.

[5] N. Copernicus, *On the Revolutions*, transl. and commentary by E. Rosen (Baltimore and London, 1992), 6.

[6] An invaluable source of information on Rheticus' biography is K. H. Burmeister, *Georg Joachim Rheticus 1514–1574. Eine Bio-Bibliographie*, vol. I–III (Wiesbaden, 1967–68), as well as his later studies. See also D. Danielson, *The First Copernican: Georg Joachim Rheticus and the Rise of the Copernican Revolution* (New York, 2006).

[7] See K. H. Burmeister, *Achilles Pirmin Gasser, 1505–1577: Arzt und Naturforscher, Historiker und Humanist*, vol. I–III (Wiesbaden, 1970–75); D. Danielson, "Achilles Pirmin Gasser and the Birth of Copernicanism", *Journal for the History of Astronomy*, 35 (2004), 457–74.

[8] *Corpus reformatorum. Philippi Melanthonis opera quae supersunt omnia*, vol. IV, ed. by C. G. Bretschneider (Halle, 1837), col. 839: *natum ad Mathemata pervestiganda*.

[9] Questio: an leges damnent praedictiones astrologicas? recitata a Georgio Ioachimo Rhetico, d. 17. April. 1536 in *Corpus reformatorum*, vol. X (Halle 1842), col. 712–5.

[10] *Ibidem*, col. 713.

[11] See e.g. C. Brosseder, "The Writing in the Wittenberg Sky: Astrology in Sixteenth-Century Germany", *Journal of the History of Ideas*, 66 (2005), 557–76; N. Roelants, *Lutheran astronomers after the Fall (1540–1590): A reappraisal of the Renaissance dynamic between astronomy and religion*, PhD diss., Ghent University, 2013. The intellectual maturing of Rheticus in this environment is discussed by J. Kraai, *Rheticus' Heliocentric Providence*, PhD diss., Ruprecht-Karls-Universität, Heidelberg, 2003.

[12] *In arithmeticen praefatio Georgii Ioachimi Rhetici* in *Corpus reformatorum*, vol. XI (Halle, 1843), col. 284–92. See also S. Deschauer, *Die Arithmetik-Vorlesung des Georg Joachim Rheticus, Wittenberg 1536* (Munich, 2003).

[13] *In arithmeticen praefatio…*, col. 291.

[14] *Ibidem*.

[15] Burmeister, *op. cit.*, vol. III, 20. It was a dedicatory letter published by Petreius together with the astrological treatise *De iudiciis nativitatum* (*On Natal Horoscopes*) by Antonius de Monteulmo. "A splendid description" is of course the *First Account*. The English citation follows N.M. Swerdlow, "Annals of Scientific Publishing: Johannes Petreius's Letter to Rheticus", *Isis*, 83 (1992), 273–4. See also M. Biskup, *Regesta Copernicana* (*Studia Copernicana*, vol. VIII), 188.

[16] *Nicolaus Copernicus Gesamtausgabe*, vol. VIII/1: *Receptio Copernicana. Texte zur Aufnahme der Copernicanischen Theorie*, ed. by H. Nobis, A. M. Pastori et al. (Berlin, 2002), 107. See also Biskup, *op. cit.*, 206–7. The English citation follows Danielson, *The First Copernican….*, 98.

[17] *Nicolai Copernici Torunensis…*, 546–7.

[18] *Corpus reformatorum*, vol. III (Halle, 1836), col. 597.

[19] The citation follows N. M. Swerdlow, "Regiomontanus on the Critical Problems of Astronomy" in *Nature, Experiment, and the Sciences*, ed. T. H. Levere and W. R. Shea (Dordrecht, 1990), 173–4.

[20] *Three Copernican Treatises…*, 109.

[21] Biskup, *op. cit.*, 181–3.

[22] M. Foltz, *Geschichte des Danziger Staadthaushalts* (Gdańsk, 1912), 160.

²³ J. Green, "The First Copernican Astrologer: Andreas Aurifaber's Practica for 1541", *Journal for the History of Astronomy*, 41 (2010), 157–65; R. L. Kremer, "Calculating with Andreas Aurifaber: A New Source for Copernican Astronomy in 1540", *Journal for the History of Astronomy*, 41 (2010), 483–502.

²⁴ Biskup, *op. cit.*, 185.

²⁵ The citation follows Green, *op. cit.*, 162–3.

²⁶ Biskup, *op. cit.*, 186.

²⁷ *Three Copernican Treatises*…, 190.

²⁸ Biskup, *op. cit.*, 187.

²⁹ *Ibidem*, 195.

³⁰ Swerdlow, "Annals of Scientific Publishing…", 274.

³¹ K. H. Burmeister, "Der Konstanzer Arzt Dr. med. Georg Vögelin (1508–1542), ein früher Anhänger des Kopernikus", *Archiwum Historii i Filozofii Medycyny*, 62 (1999), 97–104.

³² Danielson, *op. cit.*, 212.

³³ M. List, Marginalien zur Handexemplar Keplers von Copernicus: De revolutionibus orbium coelestium (Nürnberg, 1543), "Studia Copernicana", 16 (1978), 456. The English citation follows E. Rosen, *Copernicus and the Scientific Revolution* (Malabar, FL, 1984), 192.

³⁴ *Ibidem*.

³⁵ Burmeister, *op. cit.*, 25; Biskup, *op. cit.*, 193. The English citation follows Rosen, *op. cit.*, 194.

³⁶ Copernicus, *op. cit.*, XX.

³⁷ *Ibidem*, 22.

³⁸ The letter of Giese to Rheticus as of July 26, 1543; see Biskup, *op. cit.*, 213. Possibly Rheticus mentioned this treatise in his letter as of June 2, 1541 to Paweł Ebera who was staying at Melanchton's in Wittenberg at that time; see Burmeister, *op. cit.*, 26–27. If that was the case we would know precisely when Rheticus worked on this treatise.

³⁹ The critical edition of the text along with the English translation and arguments supporting Rheticus' authorship can be found in: R. Hooykaas, *G. J. Rheticus' Treatise on Holy Scripture and the Motion of the Earth* (Amsterdam, 1984). However, it should be mentioned that some researchers disagree with Hooykaas' stance.

⁴⁰ *Three Copernican Treatises*…, 125.

[41] See J. Włodarczyk, "Solar Eclipse Observations in the Time of Copernicus: Tradition or Novelty?", *Journal for the History of Astronomy*, 38 (2007), 351–64.

[42] *Erasmi Reinholdi Salueldensis Theoricae Novae Planetarum Georgii Purbachii ... recens editae et auctae novis scholiis...* (Wittenberg, 1542), f. Z8. The English translation follows Włodarczyk, *op. cit.*, 354.

[43] J. Kraai, The Newly-found Rheticus Lectures in *Beiträge zur Astronomiegeschichte* (*Acta Historica Astronomiae*, vol. 1), 1 (1998), 32–40.

[44] *Erasmi Reinholdi…*, f. C7 and E3.

[45] Biskup, *op. cit.*, 194–7.

[46] *Ibidem*, s. 199–200.

[47] See e.g. J. Babicz, Mikołaj Kopernik a geografia, *Kwartalnik Historii Nauki i Techniki*, 18 (1973), 495–502.

[48] K. H. Burmeister, Georg Joachim Rheticus as a geographer and his contribution to the first map of Prussia, *Imago Mundi*, 23 (1969), 73–6; W. Horn, Sebastian Münster's Map of Prussia and the Variants of it, *Imago Mundi*, 7 (1950), 66–73. There is only one extant copy of Zell's map of 1542.

[49] Such phrasing was used by Rheticus in his letter to Duke Albert sent from Frombork on August 28, 1541. See Burmeister, *op. cit.*, 32–8; Biskup, *op. cit.*, 200.

[50] It was first published in F. Hipler, "Die Chorographie des Joachim Rheticus, aus dem Autographon des Verfassers", *Zeitschrift für Mathematik und Physik*, 21 (1876), 125–50.

[51] J. L. Berggren, A. Jones, *Ptolemy's Geography: An Annotated Translation of the Theoretical Chapters* (Princeton–Oxford, 2000), 57.

[52] *Nicolaus Copernicus Gesamtausgabe…*, 78.

[53] *Ibidem*, 85.

[54] This refers to *Epistola de magnete* (A *Letter on magnet*), a 13th century treatise. Gasser must have had one of the manuscript copies of this text which he later published in 1558.

[55] Biskup, *op. cit.*, 201–2.

[56] See L. A. Birkenmajer, *Stromata Copernicana* (Cracow, 1924), 200–2. There are two extant and complete copies of the *Commentariolus* and one fragmentary copy of it. See J. Dobrzycki, L. Szczucki, "On the Transmission of Copernicus's *Commentariolus* in the Sixteenth Century", *Journal for the History of Astronomy*, 20 (1989), 25–8.

[57] *Three Copernican Treatises…*, 59.

[58] Presently in the Jagiellonian Library.

[59] L. A. Birkenmajer, *Mikołaj Kopernik* (Cracow, 1900), 350–88; A. Birkenmajer, "Trygonometria Mikołaja Kopernika w autografie głównego jego dzieła", *Studia Źródłoznawcze*, 15 (1971), 3–70.

[60] See L. A. Birkenmajer, *op. cit.*; J. Zathey, "Analiza i historia rękopisu "De revolutionibus"", in *Rękopis dzieła Mikołaja Kopernika „O obrotach". Facsimile*, Warsaw–Cracow 1972 (*Dzieła wszystkie*, t. I), 1–39; E. Rosen, "When Did Copernicus Write the „Revolutions"?", *Sudhoffs Archiv*, 61 (1977), 144–55.

[61] See N. M. Swerdlow, "The Holograph of *De Revolutionibus* and the Chronology of its Composition", *Journal for the History of Astronomy*, 5 (1974), 186–98; *idem*, "On Establishing the text of "De Revolutionibus"", *Journal for the History of Astronomy*, 12 (1981), 35–46; N. M. Swerdlow, O. Neugebauer, *Mathematical Astronomy in Copernicus's De Revolutionibus* (New York, 1984), 87–9. Swerdlow also finds other reasons to postpone this date and hypothesizes that almost the whole of Copernicus' work was written in the 1530s.

[62] Petreius published: Regiomontanus' *De triangulis omnimodis* (1533), Apianus' *Instrumentum primi mobilis* (with Geber's treatise *De astronomia*, 1534) and Vitelo's *Perspectiva* (1535). The other two works were printed in Basel, these being the original Greek texts of Euclids' *Elements* (1533) and Ptolemy's *Almagest* (1538). All three volumes bear Rheticus' dedication on the front page wherein he refers to Copernicus as his preceptor, which suggests that the books were not necessarily presented during the first days of his visit to Frombork.

[63] Biskup, *op. cit.*, 197.

[64] This refers to *In Copernici libellum epigrama* (*The Epigram on Copernicus' Book*); Latin text in J. Dantyszek, *Pieśni* (Olsztyn 1973), 106.

[65] The dedication confirms the continuously strong ties of Rheticus and Aurifaber. The latter, once he had left Gdańsk, received the scholarship of Duke Albert and studied medicine in Padua. However, in 1542, he returned to the university in Wittenberg. In 1543, Aurifaber married the daughter of Hans Luft, the printer who published for Rheticus' *De lateribus* by Copernicus. His later career was linked with Königsberg and the ducal court.

[66] The Greek and English texts can be found in O. Gingerich, *An Annotated Census of Copernicus'* De Revolutionibus *(Nuremberg, 1543 and Basel, 1566)* (Leiden, 2002), 355–61.

⁶⁷ *Nicolaus Copernicus Gesamtausgabe…*, 111.

⁶⁸ L. A. Birkenmajer, *op. cit.*, 588.

⁶⁹ See Swerdlow, On Establishing…; O. Gingerich, "An Early Tradition of an Extended Errata List for Copernicus's "De Revolutionibus"", *Journal for the History of Astronomy*, 12 (1981), 47–52.

⁷⁰ Cf. Swerdlow, *op. cit.*, 41–2.

⁷¹ Biskup, *op. cit.*, 213.

⁷² Ibidem, s. 210.

⁷³ Gingerich, *An Annotated Census…*, 135 and 137.

⁷⁴ *Three Copernican Treatises…*, 110.

⁷⁵ *Ibidem*, 121–2.

⁷⁶ Cf. N. M. Swerdlow, "Copernicus and Astrology, with an Appendix of Translations of Primary Sources", *Perspectives on Science*, 20 (2012), 354–78.

⁷⁷ *Three Copernican Treatises…*, 122.

⁷⁸ A triplicity is formed by three signs of the zodiac which are separated by the same distance from each other on the ecliptic. There is fiery triplicity (Aries, Leo, Sagittarius), earthy triplicity (Taurus, Virgo, Capricornus), airy triplicity (Gemini, Libra, Aquarius) and watery triplicity (Cancer, Scorpius, Pisces).

⁷⁹ Copernicus, *op. cit.*, 7.

⁸⁰ P. Czartoryski, "The Library of Copernicus", *Studia Copernicana*, 16 (1978), 355–96.

⁸¹ Biskup., *op. cit.*, 155–6; the English citation follows N. M. Swerdlow, "Copernicus and Astrology, with an Appendix of Translations of Primary Sources", *Perspectives on Science*, 20 (2012), 353–78. Unfortunately, the planned almanac was not printed and the manuscript has been lost.

⁸² *Ein alter thumherr zur Frauenburg*; see Biskup, *op. cit.*, 155.

⁸³ *Three Copernican Treatises…*, 136.

⁸⁴ Copernicus, *op. cit.*, 10.

⁸⁵ *Three Copernican Treatises…*, 137.

⁸⁶ Copernicus, *op. cit.*, 22.

⁸⁷ *Three Copernican Treatises…*, 138.

⁸⁸ Copernicus, *op. cit.*, 6. In Latin: *Mathemata mathematicis scribuntur* …

⁸⁹ *Three Copernican Treatises…*, 145.

⁹⁰ *Ibidem*, 147.

[91] Number 6 is the first of the perfect numbers, i.e. a number which is the sum of all its divisors smaller than that number. In this case: $6 = 1 + 2 + 3$.

[92] *Three Copernican Treatises…*, 163.

[93] *Ibidem*, 186–7.

[94] An interesting analysis of this fragment can be found in J. Drewnowski, *Mikołaj Kopernik w świetle swej korespondencji*, Wrocław 1978, 61–77.

[95] Birkenmajer, *op. cit.*, 656. Unfortunately, these letters have been lost. Brożek compared them with the content of *Narratio prima*, but he did not present his conclusions; see Drewnowski, *op. cit.*, 64.

[96] Biskup, *op. cit.*, 157. A treatise said to include a favourable opinion on Copernicus expressed by Erasmus of Rotterdam has been lost. Again, we know about the existence of such a treatise from a note by Brożek.

[97] *Three Copernican Treatises…*, 194.

[98] *Ibidem*, 163.

[99] *Ibidem*, 109.

[100] R. Gemma Frisius, *De radio astronomico et geometrico* (Antwerp, 1545), f. 28v-29r. Cf. K. Galle, "Building on Ruins: Copernicus' Defense of Ancient Astronomers against Modern Critics", *Endeavour*, 32 (2008), 94–100.

[101] E. Reinhold, *Prutenicae tabulae coelestium motuum* (Tübingen, 1551), sig. a.4r.

[102] T. Brahe, *Opera omnia*, vol. I (Libraria Gyldendaliana, 1913), 149.

[103] Gingerich, *An Annotated Census…*, 225.

[104] Burmeister, *Georg Joachim Rhetikus…*, vol. III, 15; the English citation follows Danielson, *op. cit.*, 212.

[105] *Idem*, *Achilles Pirmin Gasser…*, vol. III, 80–5, 109–10.

[106] *Nicolaus Copernicus Gesamtausgabe…*, 125.

[107] J. K. Voigt, *Briefwechsel der berühmtesten Gelehrten des Zeitalters der Reformation mit Herzog Albrecht von Preussen* (Königsberg, 1841), 519.

[108] O. Gingerich, "The Role of Erasmus Reinhold and the Prutenic Tables in the Dissemination of Copernican Theory", *Studia Copernicana*, 6 (1973). 43–62, 123–5.

[109] The task of the authors of the *Alfonsine Tables* was easier as Ptolemy also left an extended extract from the tables based on his *Almagest*, along with the instructions which made their use easier.

[110] Untill 1585 there were four editions of the *Prutenic Tables*.

[111] R. S. Westman, "The Melanchton Circle, Rheticus, and the Wittenberg Interpretation of the Copernican Theory", *Isis*, 66 (1975), 164–93; *idem*, *The Copernican Question: Prognostication, Skepticism, and Celestial Order* (Berkeley, 2011), 141–70; see also J. Dobrzycki, "Wcześni czytelnicy Kopernika", *Odrodzenie i Reformacja w Polsce*, 41 (1997), 33–42.

[112] Gingerich, *An Annotated Census…*, 269.

[113] Rheticus' contribution is not certain, see G. Rosińska, "Nie przypisujmy Rhetykowi dzieła Regiomontana", *Kwartalnik Historii Nauki i Techniki*, 28 (1983), 615–9.

[114] A comprehensive discussion of Rheticus' trigonometric can be found in e.g.: G. van Brummelen, *The Matematics of the Heaven and the Earth: The Early History of Trigonometry* (Princeton and Oxford, 2009), 273–83.

[115] Burmeister, *Georg Joachim Rhetikus…*, vol. III, 123; the English translation follows Danielson, *op. cit.*, 126.. The obelisk was destroyed soon after Rheticus had left Cracow; see J. Dianni, "Pobyt J. J. Retyka w Krakowie", *Studia i Materiały z Dziejów Nauki Polskiej*, 1 (1953), 74–5.

[116] Quoted after: *ibidem*, 71.

[117] Burmeister, *op. cit.*, 138. Rheticus failed to execute this publishing project, and in Cracow he managed to print only the preface. The lost manuscript was found at the beginning of the 20th century.

[118] L. A. Birkenmajer, *op. cit.*, 613–4.

[119] A. Dudithius, *Epistulae, pars II (1568 –1573)*, ed. M. Borowska et al. (Budapest, 1995), 123. Johannes Praetorius (Richter, 1537–1616) and Wolfgang Schüler were soon appointed chairs of mathematics in Wittenberg.

[120] J. J. Rheticus, V. Otho, *Opus Palatinum de triangulis* (Neustadt, 1596), f. b4v.

[121] The success of Rheticus' tables also stems from some corrections made at the beginning of the 17th century by Bartholemaeus Pitiscus, the mathematician associated with Frederic IV.

[122] Rheticus, Otho, *op. cit*.

[123] J. J. Retyk, *Canon doctrinae triangulorum* (Leipzig, 1551), f. C1v.

[124] The modern edition along with the commentary can be found in: Johannes Kepler, *Gesammelte Werke*, vol.. 1, ed. by. M. Caspar, 1st edition: Monachium 1938, 2nd edition: 1993, 81–131. See also: A. Grafton, "Michael Maestlin's Account of Copernican Planetary Theory", *Proceedings of the American Philosophical Society*, 117 (1973), 523–50; K. A. Tredwell, "Michael Maestlin and the Fate of *Narratio*

Prima", *Journal for the History of Astronomy*, 35 (2004), 305–25; G. Grasshoff, "Michael Maestlin's Mystery: Theory Building with Diagrams", *Journal for the History of Astronomy*, 43 (2012), 57–73.

[125] J. Kepler, *Mysterium cosmographicum* (Tübingen, 1596), 89.

[126] *Three Copernican Treatises*…, 168.

[127] *Ibidem*, 136. In his *Mysterium cosmographicum* Kepler argues in favour of heliocentrism and the existence of the six planets circulating round the Sun (the most distant planet known at that time was Saturn) by invoking the construction where the planetary spheres are separated by five Platonic polyhedra (tetrahedron, cube, octahedron, dodecahedron and icosahedron).

[128] *Ibidem*, 125. The illustration from *De rev*. III,4.

[129] *Ibidem*, 106.

[130] *Ibidem*, 129.

[131] *Ibidem*, 117.

[132] *Ibidem*, 94. Maestlin also reports Copernicus' date of birth, including the minutes: February 19, 1473 at 4 and 48 minutes p.m. This date is correct as Maestlin follows the sources which probably derived information from Rheticus. See e.g. L. A. Birkenmajer, *op. cit.*, 406–12.

[133] Kepler, *Mysterium*…, 141–2.

Georg Joachim Rheticus

Narratio prima

or First Account of the Books
On the Revolutions
by Nicolaus Copernicus

AD CLARISSIMVM VIRVM
D. IOANNEM SCHONE-
RVM, DE LIBRIS REVOLVTIO
nū eruditiſſimi viri,& Mathema
tici excellentiſſimi, Reuerendi
D. Doctoris Nicolai Co-
pernici Torunnæi, Ca-
nonici Varmien-
ſis,per quendam
Iuuenem, Ma-
thematicæ
ſtudio
ſum
NARRATIO
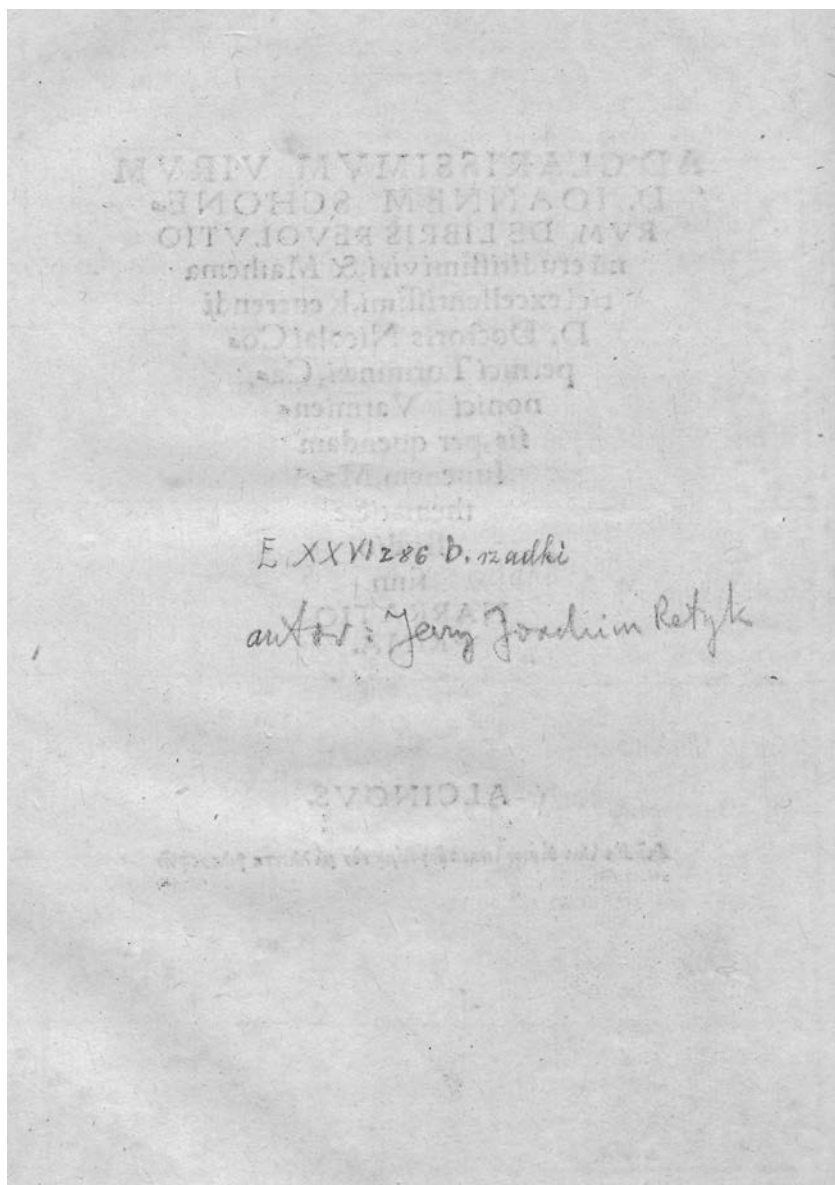**PRIMA.**

| **ALCINOVS.**

δεῖ δ᾽ ἐλεύθεριον εἶναι τῇ γνώμῃ τὸν μέλλοντα φιλοσοφεῖν

1540

Ioanni Scinro

CLARISSIMO VIRO, D. IOAN-
ni Schonero, vt parenti suo colendo,
G. Ioachimus Rheticus
S. D.

RIDIE IDVS MAIAS
ad te Posnaniæ dedi literas, quibus
te de suscepta mea profectione in Pruſ
siam certiorem feci: et significaturum
me quàm primum possem, famæ ne
& meæ expectationi responderet
euentus, promisi. Etsi autem vix iam
x Septimanas in perdiscendo opere
Astronomico ipsius D. Doctoris, ad
quem concessi, tribuere potui, cum propter aduersam ali-
quantulum valetudinem, tum quia honestissime à Reueren
dissimo, D. Domino Tidemanno Gysio, Episcopo Culmen
si vocatus, vnà cum D. Præceptore meo Lobauiam profe-
ctus aliquot septimanis à studijs quieui. Tamen vt promis
sa denicq præstarem, & votis satisfacerem tuis, de his, quæ
didici, qua potero breuitate & perspicuitate, quid D. Præ-
ceptor meus sentiat, ostendam.

　　Principio aũt statuas velim Doctiss: D. Schonere, hunc
virum, cuius opera nunc vtor, in omni doctrinarum gene-
re, & Astronomiæ peritia Regiomontano non esse minorē.
Libentius autem eum, cũ Ptolemæo confero, non quòd mi-
norem Regiomontanum Ptolemæo æstimem, sed quia,
hanc felicitatem cum Ptolemæo præceptor meus commu-
nem habet, vt institutam Astronomiæ emendationem diui-
na adiuuante Clementia, absolueret, cum Regiomontanus,
heu crudelia fata, ante columnas suas positas, è vita migrarit.

　　D. Doctor, Præceptor meus, sex libros conscripsit, in
quibus, ad imitationem Ptolemæi singula Mathematicõs, et
Geometrica Methodo docendo & demonstrando, totam
Astronomiam complexus est. Primus liber generalem
Mundi descriptionem, & fundamenta quibus omnium æ-
tatum obseruationes, & apparentias saluandas suscepturus
est, continet. 　　　　　　　　　　　A ij 　　　His

His quantum de doctrina sinuum, Triangulorum planorū
& sphæricorum suo operi necessarium æstimauit, subiungit.

Secundus est de doctrina primi motus, & his quæ sibi
de stellis fixis hoc loco dicenda putauit. Tertius de motu
solis, & quia experientia eum docuit, quantitatem anni ab æ=
quinoctijs numerati, ex motu etiam stellarum fixarum depen
dere, in prima huius libri parte, vera ratione, & diuina pro=
fectò solertia, motus stellarum fixarum, mutationesʻque puncto
rum solsticialium & æquinoctialium inquirere ostendit.

Quartus liber est de motu Lunæ & Eclipsibus.

Quintus de motibus reliquorum planetarum.

Sextus de Latitudinibus.

Priores tres libros perdidici, quarti generalem Ideam conce=
pi, reliquorum verò hypotheses primum animo complexus
sum. Quantum ad priores duos attinet, nihil tibi scriben=
dum putaui: idʻque partim peculiari quodam meo consilio,
partim quòd in doctrina primi motus nihil à communi et re
cepta ratione discedit, nisi quòd tabulas declinationum, ascen
sionum rectarum, differentiarum ascensionalium, et reliquas
ad hanc doctrinæ partem pertinentes, ita de integro constru=
xit, vt ad obseruationes omnium ætatum, per partem pro=
portionalem accommodari possint. Quæ igitur in tertio li
bro tradit cum hypothesibus omniū reliquorum mótuum
quantum in præsentiarum pro ingenij mei tenuitate assequi
potuero, tibi deo dante, dilucide recitabo.

De moti=
bus stel=
larum fi=
xarum.
Cum D. Doctor præceptor meus Bononiæ, non tam
discipulus, quàm adiutor & testis obseruationum Doctissi=
mi viri Dominici Mariæ: Romæ autem circa annum
Domini M. D. natus annos plus minus viginti
septem, professor mathematū, in magna scholasticorum fre=
quentia, & corona magnorum virorum et artificum in hoc
doctrinæ genere: Deinde hic Varmiæ, suis vacans studijs,
summa cura obseruationes annotasset, ex obseruationibus
stellarum fixarum elegit eam, quam anno domini M. D.
XXV de Spica Virginis habuit. Constituit autem eam
elongatam fuisse à puncto autumnali 17 grad, 21 m. ferè, cū
ipsius declinationem meridianam non minorem 8 gra. 40
minu.

minu. deprehenderet. Deinde conferens omnes obserua‑
tiones authorum cum suis, inuenit anomaliæ reuolutio‑
nem, seu circuli diuersitatis esse completam, nośq nostra æta
te à Timochare vsq, in secunda reuolutione esse. Quare me‑
dium motum stellarum fixarum, atq̃ æquationes diuersi
motus, geometrice constituit. Quia enim Timocharis ob‑
seruatio Spicæ, anno xxxvi. primæ periodi Calippi, collata
cum obseruatione anni xlviij. eiusdem periodi, nos docet
stellas illa ætate in lxxij annis vnum gradum processisse. De‑
inde ab Hipparcho ad Menelaum semper in Centum annis
vnum gradum confecisse: constituit apud se, Timocharis ob‑
seruationes in postremum quadrantem circuli diuersitatis in‑
cidisse, in quo motus apparuerit mediocris diminutus. In tem
pore aūt intermedio inter Hipparchum & Menelaum motū
diuersitatis fuisse in loco tardissimo. Siquidem Menelai ob‑
seruationes & Ptolemæi collatæ, ostendunt in lxxxvi annis
per vnum gradum stellas tunc motas. Quare Ptolemæi.
obseruationes factas motu anomaliæ existente in primo qua‑
drante, stellaśq tunc motas motu tardo addito, siue aucto.
Porrò quia à Ptolemæo ad Albategniū vni gradui lxvi. an‑
respondent, atq nostræ obseruationes collatæ cum Albate‑
gnij ostendant stellas motu diuerso iterum in lxx annis vnū
gradum conficere, sed ad alias suas in Italia habitas, obserua‑
tio ea, quam supra dixi, collata, ostendit stellas fixas motu
diuerso, in centum annis, iterum per vnū gradum progredi:
Sole quoq clarius est, à tempore Ptolemæi ad Albategniū,
motum diuersitatis, terminum mediocrem primum præte‑
rijsse. totuḿq quadrantem mediocris additi: Et circa Alba‑
tegnij tempora fuisse in loco summæ velocitatis Ab Al‑
bategnio aūt ad nos tertium quadrantem motus diuersi esse
absolutum, & interim stellas progressas motu veloci dimi‑
nuto, alterum limitem mediocris motus prætergressum, &
nostra ætate iterum in quartum quadrantem motus medio‑
cris diminuti anomaliam peruenisse. Proinde iam iterum
motum diuersum tardissimum limitem appetere. Hæc
aūt D. præceptor vt ad certam rationem redigeret, quo or‑
dine cum omnibus obseruationibus consentirent, constituit.
                    A iij   motum.

motum diuersum in MDCCXVII annis Aegyptijs cōple=
ri, maximam'cp æquationem 70 ferè minutorum, motum
aūt medium stellarum in anno Aegyptio 50 secundorum
ferè esse, atcp integram motus medij futuram reuolutiōem
in XXVMDCCCXVI annis Aegyptijs.

De anno ab æqui= noctio, genera= lis consi deratio.

Hanc motuum in stellis fixis rationem, comprobant
etiam annuæ quantitates à punctis æquinoctialibus obser=
uatæ, atcp certo cōstat, quare à Timochare ad Ptolemæū dies
integer minus $\frac{1}{20}$ diei interciderit: ab hoc aūt ad Albategniū
7 dies ferè, ab Albategnio ad suas observationes, quas anno
Domini MDXV habuit, dies 5 ferè: necp hæc omnino in=
strumentorū vitio, vt hactenus creditum, sed certa & cōsen=
cienti sibi vbicp ratione, fieri. Quare minime ab æquino=
ctijs æqualitatem motus sumendam, sed à stellis fixis, vt mi=
rabili cōsensu, omniū ætatū tā de solis & lunæ, quàm de reli
qrū Planetarū motibus observationes testant. Quia à Timo
chare ad Ptolemæum stellæ processerunt motu tardissimo
$\frac{1}{500}$ solum diei, quartæ super 365 dies: à Ptolemæo aūt ad
Albategnium, quia veloces $\frac{1}{105}$ diei, quadranti decedere re
ceptum est, nostra ætate si conferantur observationes ad
Albategnij, patet deesse quadranti $\frac{1}{128}$ diei partem. Tardo
igitur motui maior anni quantitas ab æquinoctijs responde=
re videtur, veloci minor, decrescenti velocitati anni aug=
mentum, adeo, vt si accurate anni quantitas ab æquinoctijs
nostra ætate examinetur, cum Ptolemæo ferè iterum con=
sentiat. Proinde statuendum puncta æquinoctialia moue=
ri in præcedentia, quemadmodū in Luna nodos, & nequacp
stellas secundum signorum consequentiam progredi·
Imaginandum itacp fuit esse æquinoctium medium, quod
procedat à prima stella Arietis orbis stellati, æquali motu
postponendo stellas fixas, & vtrincp ab hoc æquinoctio me
dio, ipsum æquinoctium verum motu diuerso & regulari
discedere, cuius tamen elongationis semidiameter 70 minu=
ta non multum excedat, sicp certam & quantitatis anni ab
æquis

æquinoctijs rationem singulis ætatib. extitisse, et adhuc ho-
die deprehendi posse, pretercp quòd hæc ratio exactissime, &
quasi ad minutum, obseruationib. stellarum fixarum omniũ
artificum respondet. Vt autem huius rei gustum aliquem
tibi doctiss. D Schönere, prebeã, en computaui tibi præcessio
nes æquinoctiorũ veras, ad quædã obseruationũ tempora.

Anno Aegyptio		Præcessio vera, G. M.		Tempore
Ante nati uitatem Domini	293	2	24	Timocharis
	127	4	3	Hipparchi
Post nati uitatem Domini	138	6	40	Ptolemæi
	880	18	10	Albategnij
	1076	12	37	Arzahelis
	1525	27	21	Nostro

Ptolemæi præcessio subtracta à locis stellarum in Pto-
lemæo positis, relinquit quantũ à prima stella Arietis distent.
Albategnij deinde præcessio addita, ostendit verum locum
obseruationis, hoc sit in omnibus alijs similiter. Maxime aũt.
hæc ad amussim obseruationibus omnium artificum respon
dent, vbi etiam singula annotantur minuta, vel ex declina-
tionibus positis habentur, aut ex Lunæ motu ad maiorem
præcisionem reducto, vt nostræ nos docent obseruationes
cum veterum collatæ.   Nam neglectis vt vides ali-
quot minutis, partem saltem gradus recitant $\frac{1}{2}$ vel $\frac{1}{3}$ vel $\frac{1}{4}$
&c. Hæc autem motibus absidum planetarum non satis
faciunt, proinde peculiarem motum eis tribui oportuit, vt
patebit ex Solis Theoria.   Cæterum cum deprehendisset
à stellis fixis æqualitatem motus sumendam, inuestigauit di
ligentiss. annum siderium, quem repperit ccclxv dierum,
xv minutorum, xxiiij secundorum ferè esse, & perpe-
tuo fuisse, à quo têpore factas obseruationes côstat. Nam q̃d
referente Albategnio Babilonij tria secunda plus ponunt,
Thebit vnum secundum minus, hæc sine iniuria vel instru-
mentis, & obseruationib⁹, quæ vt scis. minime ἀκριβοτάτω
esse possunt, vel diuersitati motus solis, vel etiam quod ves

tuſtiſſimi, non habita certa eclipſium ratione, diuerſitates
aſpectus Solis in obſeruationibus neglexerunt, imputari po=
teſt: nequacᵶ tamen comparandus hic error, totius huius tem
porisà Babilonijs ad nos, cum illo, qui eſt 22 ſecundorum di=
ei inter Ptolemæum & Albategnium.   Quod aũt neceſſe
fuerit inter Hipparchum & Ptolemæum, diem minus

$\frac{1}{20}$ intercidere: inter hunc & Albategnium 7 ferè deficere, nõ
ſine ſumma voluptate, ex prædicta motuum ſtellarum rati=
one, & ipſius D. præceptoris de motu ſolis tractatione tibi
Doctiſſ. D. Schonere collegi, vt paulo poſt videbis.

De Mu=   Mutationem maxime declinationis, hanc rationem ha=
tatione   bere D. Doctor, præceptor meus repperit, vt dum motus
obliqui= diuerſitatis ſtellarum fixarum ſemel compleretur, dimidia
tatis E= obliquitatis contingeret. Quare & integram mutationis
clipticæ, obliquitatis reuolutionem in III M CCCCXXXIIII
          annis AEgyptijs fieri conſtituit.

          Timocharis, Ariſtarchi et Ptolemæi temporibus muta
          tionem obliquitatis in tardiſſima variatione fuiſſe conſtat,
          adeo vt immutabilem maximam declinationem crederent,

ſemper $\frac{11}{83}$ partes circuli magni: Albategnius poſt hos 23
grad.   35 minu. ferè ſua ætate prodidit.   Deinde Ar=
zahel poſt eum cxo. ferè annis 23 grad: 34 minut:
Prophatius Iudeus ab hoc iterum ccxxx annis, 23 grad.
52 minut.   Noſtra autem ætate non maior 23 grad.

28 $\frac{1}{2}$ min. apparet. Proinde cum clarum ſit in, cccc, annis ante

Ptolemæum motum mutationis obliquitatis tardiſſ. fuiſſe.
ab hoc verò ad Albategnium per Dccl. annos ferè decre=
uiſſe per 17 minut. & ab Albategnio ad nos in Dcl. annis
ſaltem per 7 minu. ſequitur mutationem obliquitatis fieri,
quemadmodum planetarum ab ecliptica diſceſſus, motu
quodam librationis, ſeu in lineam rectam, cuius eſt, in me=
dio velociſſimum eſſe, circa extrema tardiſſimum.   Fuit
igitur Polus æquinoctialis ſeu eclipticæ circa Albategnij tem
pora, in medio ferè huius librationis motus, hoc autem ſecu=
                                                    lo circa

lo circa alterum terminum tardiſſimum, quo in loco maxi-
ma vnius poli ad alterum fit appropinquatio. Sed ſupra
poſuimus, per motum æquinoctialis ſaluari motus ſtella-
rum fixarum, & diuerſitatem annuæ quantitatis ab æqui-
noctijs, & huius poli ſunt vertices terræ, à quib. poli eleua
tiones ſumuntur. Vides igitur, vt te Doctiſſ. D Scho-
nere, obiter moneã, quales hypotheſes ſeu Theorias motu-
um obſeruationes exigant. Verùm adhuc clariora teſti-
monia audies. Porrò aſſumit D. præceptor minimam
obliquitatem 23 grad. 28 min. futuram, cuius ad maxi-
mam ſit differentia 24 minutorum. Ex his conſtituit
geometrice tabulam minutorũ proportionalium, vt maxi-
ma eclipticæ obliquitas, inde ad omnes ætates elici poſſit.
Sic fuere minuta proportionalia tempore Ptolemæi 58:Al-
bategnij 24:Arzahelis 15 : noſtra ætate 1. His ad 24 min.
differentiæ facta parte ·pportionali, patet mutationis obli-
quitatis certam regulam eſſe deprehenſam.

  In Solis motu, cũ circa anni fluxã inſtabilĕ́q́ quantitatĕ
oñis difficultas verſe̅f, prius de apogij et eccentricitatis mu-
tatiõe dicendum, vt omnes cauſas inæqualitatis anni ad
ſtruamus: Quas tamen omnes regulares & certas oſten-
dit D. præceptor, aſſumptis Theorijs ad hóc accõmodatis.
  Cum Ptolemæus ſtatueret apogium Solis fixum, ma-
luit vulgatam recipere opinionem, quàm ſuis credere obſer-
uationibus, quæ parum fortaſſis à vulgata differebant.
Sed vt certa tamen coniectura ex ipſius narratione elicitur,
conſtat eccentricitatem circa Hipparchum, nempe per cc ante
ipſum annos, talium partium. 417 fuiſſe, qualium quæ ex
centro eccentrici eſt 1 0000. Ptolemæi autĕ ætate earundĕ
414 , Arzahelis(cui potiorem fidem etiam Regiomonta-
nus noſter tribuit)ex maxima æquatione 3 4 6 ferè fuiſſe cõ
ſtat, ſed noſtro tempore 3 23 ſiquidem maximam æquatio
nem non maiorem 1 grad. 50 $\frac{1}{2}$ min. ſe deprehendere D.

Præceptor affirmat. Deinde cum diligentiſſime perpende-
ret motus abſidũ Solis et reliquorum planetarum, primum
inuenit, vt etiam ex prædictis vides, peculiaribus motibus

De eccen
tricitate
& motu
Apogij
Solis.

                              B   abſida-

abſidas ſub ſphæra ſtellarum fixarum procedere, necҙ plus
conuenire, vt vno motu apparentes motus ſtellarum fixa-
rum & abſidum, nec non mutationis obliquitatis ab vna
cauſa dependere affirmemus, ҙ ſi quis veſtrorum artificum,
qui τὸυσ ἀντομάτουσ planetarum motus referunt, vna eadem
ҙ machinatione ſingulorum planetarum motus et appareu
tias effingere conetur. Aut quis pedem, manum & lingu-
am ab eodem muſculo, & vi motrice eadem ſuas omnes acti
ones perficere, defendendum præſumeret. Attribuit ita ҙ D.
præceptor apogio Solis duos motus, mediũ ſcilicet et diffe
rentem, quib. ſub octaua ſphæra moueatur.   His accedit,
quod cum æquinoctium verum æquali & diuerſo motu in
antecedentia ſignorum moueatur, Solis & reliquorum pla-
netarũ apogia, quemadmodum ſtellæ fixæ, poſtponantur:
Quare vt omniũ ætatũ obſeruationes, conſentienti ſibi in-
uicem lege reſponderēt, tres iſtos motus à ſe inuicem diſcer-
nere coactus eſt.

Hæc vt intelligas, aſſuimas maximam eccentricitatem
4 1 7, minimam 3 2 1 futuram, & differentia ſit 96 partium,
diameter ſcilicet parui circuli, in cuius circumferentia ab ortu
ad occaſum centrum eccentrici moueatur: à centro igitur
mundi ad centrum huius parui circuli 2 6 9 partes erunt.
Omnes autem hæ partes, vt mox dictum eſt, talium ſunt,
qualium quæ ex centro eccentrici 1 0000 partium.   Habes
machinationem, quam ex tribus ſupera recitatis eccentrici-
tatibus inueſtigauit, ſimili prorſus ratione, quemadmodum
ex tribus Lunæ eclipſibus, æquales ipſius motus, diuino certe
inuento corriguntur.   Porrò ſtatuit centrum eccentrici re-
uolutionem conficere, æquali velocitate, qua, & omnis mu
tationis obliquitatis diuerſitas redit.   Atҙ hæc res digna
profecto eſt ſumma admiratione, quòd tanto, et tam mira
bili conſenſu perficitur.

Ante natiuitatem Domini LX fere annis erat maxima
eccentricitas, atҙ eodem etiam tempore maxima Solis decli-
natio, & qua ratione vna, ſimili & prorſus non alia reliqua
quoҙ decreuit, vt ſæpius maximam mihi in varia rerum
mearum fortuna, hic & item alij id generis Naturæ luſus mi
tiga-

tigationem adferant, ægrum'cp animum suauissime leni
ant.

Addam et vaticinium aliquod. Omnes Monarchias in-
cæpisse videmus, cū centrum eccentrici in aliquo insigni hu-
ius parui circuli loco fuit. Sic cum Solis esset maxima eccen-
tricitas Romanum Imperium ad Monarchiam declinauit, &
quemadmodum illa decreuit, ita & hoc tancp consenescens
defecit, atcp adeò euanuit.　Cum perueniret ad quadran-
tem, terminum'cp mediocrem, lata est lex Mahometica, ince-
pit itàcp aliud magnum imperium, & velocissime ad mo-
tus rationem creuit. Iam in centum annis, cum minima fu-
tura est eccentricitas, hoc quocp imperium suam cōficiet peri-
odum, ut iam circa ista tempora in summo sit fastigio, à quo
æque velociter, Deo volente, lapsu grauiore ruet.
Centro autem eccentrici ad alterum terminum medio-
crem perueniente, speramus adfuturum Dominum nostrum
Iesum Christum. Nam hoc in loco circa creationem Mundi
fuit, necp multum discrepat hæc computatio à dicto Eliæ ,
qui diuino instinctu, Mundum VIM tantū annos duratu-
rū vaticinatus est, quo tempore duæ ferè reuolutiones pera-
guntur.　Ita apparet hunc paruum circulum verissime ro-
tam illam fortunæ esse, cuius circumactu, mundi Monarchiæ
initia sumant, atcp mutentur.　In huncenim modum, sum-
mæ totius historiæ Mundi mutationes, tancp hoc circulo in
scriptæ conspiciuntur.　Porrò qualia illa imperia esse debue
rint, æquis ne legibus, an Tyrannicis constituta, quomodo
ex magnis coniunctionibus & alijs eruditis coniecturis de
prehendatur à te breui, Deo volente, coràm audiam.

Porrò dum centrum eccentrici descendit versus cen
trum vniuersi, consentaneum est, centrum parui circuli secun
dum signorum consequentiam, singulis annis Aegyptijs
per 25 ferè secunda procedere.　Et quia centrum eccentrici à
summa distantia in antecedentia mouetur, æquatio respon-
dens motui anomaliæ temporis propositi, à medio motu
subtrahitur, donec semicirculus compleatur, in reliquo
verò additur, vt verus Apogij motus habeatur.
Maxima autem æquatio inter apogium verum et medium

(marginal note:) Ad mo-
tum cen-
tri eccen-
trici Mo-
narchias
mundi
mutari.

Geometrice, vt conuenit, ex prædictis deducta est 7 grad. 24 min. reliquæ, vt fieri solet, pro ratione centri eccentrici in hoc paruo circulo sunt constitutæ. Motum diuersum certum habemus, quia sunt tria loca data, de medio motu est aliqua dubitatio, quia non habemus ad illa tria loca, veram apogij Solis sub Ecliptica positiõem, idcp propter errorem, qui inter Albategnium & Arzahelem incidit, vt refert Regiomontanus noster lib. iij propositione xiij Epitomes.

Albategnius nimis libere abutitur mysterijs Astronomiæ, vt multis in locis videre est. Si hoc in constitutione apogij Solis quocp fecit, vt demus sanè eum certum tempus æquinoctij habuisse, quia tñ impossibile est, vt etiam Ptolemæ⁹ testatur, solstitioɼ si tempora præcise instrumentis cõstituere, siquidē vnum minutum declinationis, quod certè facile sensum effugit, nos quatuor ferè gradibus hoc loco defraudare potest, quibus quatuor respondent dies, quõ potuit locū apogij Solis constituere? Si processit per loca eclipticæ intermedia, vt propositione xiiij eiusdem tertij Regiomontanus tradit, parum certiori argumento vsus est.   Quod ergò errauerit, sibi imputet, qui eclipses elegit non circa apogium, sed circa longitudines medias eccentrici Solis contingentes, vbi apogium Solis per sex grad⁹, a vero ipsius loco collocatū, nullum notabilem in eclipsib. errorem inducere potuit.   Arzahel, referente Regiomontano, 4 0 2 obseruationes se habuisse gloriatur, & ex hoc apogij locum constituisse, cõcedimus ista diligentia veram quidem eccentricitatem reperisse, sed cū non pateat eum eclipses Lunæ circa absidas Solis adhibuisse in consilium, nihil magis ei assentiendum apparet, in summæ absidis cõstitutione, quam Albategnio.   Hic vides quanto cùm labore D. præceptori enitendum fuerit, vt medium apogij motum constitueret. Ipse per XL ferè annos in Italia, & hic Varmiæ eclipses & motum Solis obseruauit, atcp elegit hanc obseruationem, qua constituit anno Domini M D XV apogium Solis

6 $\frac{2}{3}$ Cancri grad. obtinuisse. Deinde omnes eclipses in Ptolemæo examinans, & ad suas quas ipse diligentissime obseruauit

uauit conferês mediũ apogij annuum motũ, à ſtellis quidẽ fle
xis 25 ferè ſecundorũ, ab æquinoctio autê medio m. 15 ſecun.
ferè eſſe cõſtituit, atcp hac ratione per vtrumcp motũ medi=
um & diuerſum, vera præceſſiõe adhibita, colligitur, quod
verus apogij locus ab æquinoctio vero Hipparchi quidem
tempore in 63 grad, fuerit, Ptolemæi 64 $\frac{1}{2}$, Albategnij
76 $\frac{1}{2}$, Arzahelis 8 2, noſtra autê ætate cũ experientia omnia
conſentire. Hæc profecto melius conueniunt, quàm Alfon
ſina, quib. apogium Solis in 12 Geminorum Ptolemæi
tempore fuiſſe conſtituitur, noſtro in principio Cancri, ad
Arzahelis ſententiam nos duob. gradibus propius accedi=
mus. Albategnij loci apogij iuxta illos cõputatio 1 grad.
ſuperat, nos ab eo nõ immerito 6 gradib. deficimus. Nam
D. Doctor, præceptor meus, minime à Ptolemæo, & ſuis
obſeruationib. diſcedere poteſt, tum quia ſuas oculis ſuis vi
dit, & deprehendit, tum etiam. quia cernit ſumma diligentia
& per ecliples, Solis Lunæ'cp motus Ptolemæum ad
amuſſim examinaſſe, certoſcp, quo ad eius fieri potuit, con=
ſtituiſſe. Quod autê ab eo vno gradu ferè differre cogi=
mur, id nos motus apogij, quod ipſe fixum putauit, edocu=
it, quare et minorem hoc in loco examinandi curam adhi=
buit.

Habes quæ ſit D. præceptoris mei de motu Solis ſen=
tentia. Compoſuit itacp tabulas, quibus omni tempore
propoſito, verum locum apogij Solis, veram eccentricita=
tem, veraſcp æquationes, æquales Solis motus ad ſtellas fi=
xas & æquinoctia media, vnde verum Solis locum corre=
ſpondentem cũ omnium ætatum obſeruationibus colli=
gat. Hinc manifeſtum eſt, tabulas Hipparchi, Ptolemæi,
Theonis, Albategnij, Arzahelis, & ex his aliqua ex parte
conflatas Alfonſinas temporaneas ſolummodo eſſe, & ad
ſummum cc annos durare poſſe, donec videlicet notabilis
diuerſitas quantitatis anni, eccentricitatis, æquationis &c.
contingat. Id quod ſimili certa ratione in motibus et appa
rentijs reliquorum planetarum accidit. Non immerito igi=
tur D. Doctoris, præceptoris mei Aſtronomia, perpetua
B iij   vocari

vocari poterat, vt omnium ætatum obſeruationes teſtan-
tur, & procul dubio poſteritatis obſeruationes confirma-
bunt.   Cæterum motus ſuos & loca abſidum à prima ſtel
la Arietis computat, cum à ſtellis fixis motuum ſit æquali-
tas, deinde præceſſione vera addita, quantum ſingulis ætati
bus, vera planetarum loca, ab æquinoctio vero diſtiterint,
colligit & conſtituit.   Quòd ſi talis paulò ante noſtram æ-
tatem rerum cœleſtium doctrina extitiſſet, nullam Picus in
octauo & nono libro occaſionem, non ſolum Aſtrologiam
ſed & Aſtronomiam impugnandi habuiſſet. Ipſi enim indi-
es videmus, quemadmodum notabiliter à veritate com-
munis calculus diſcrepet.

Quanti-
tatis an-
ni ab æ-
quino-
ctijs ſpeti
alis conſi
deratio.

Plericg in emendatione Calendarij, diuerſas etiam quantita-
tes anni, ab authoribus conſtitutas, ſed confuſe, enumerant:
necg quiccg determinant, quod certe mirum in tantis Mathe
maticis.   Vides autem doctiſſ. D. Schonere, quatuor, ex
prædictis, cauſas inæqualis mot? Solis ab æquinoctijs. In-
æqualitatem præceſſionis æquinoctiorum, inæqualitatẽ
motus Solis in ecliptica, decrementũ eccentricitatis, denicg
apogij duplici de cauſſa progreſſum. Quare et ijſdem de cau
ſis, annum ab æquinoctijs minime æqualem eſſe poſſe.
Ptolemæo quidem facile ignoſci poteſt, quòd æqualitatem
ab æquinoctijs ſumendam poſuit, cum ſtellas fixas in conſe
quentia moueri, locum'cg apogij fixum ſtatueret, necg ec-
centricitatem Solis decreſcere.   Quomodo autem alij ſe ex-
cuſare velint, ego non video.   Etſi namcg concederemus
eis, ſtellas et apogium Solis eodem motu in ſignorum con
ſequentiam ferri, nihilcg propterea de tempore ab æquino-
ctio vero, in rei veritate mutari, ſed potius propter inſtru-
mentorum defectum, omnem (quod tamen dicere, noſtra æ-
tate foret abſurdiſſimum) diuerſitatem contingere: ſiqui-
dem apogij Solis progreſſus, parum admodum quantita-
tem anni mutat.   Tamen non ideo ſequetur, Solem regu-
lariter ad æquinoctium verum ſemper æquali tempore re
dire, quemadmodum Lunam dicimus regulariter ab apo
gio medio Epicycli elongari, ad idem'cg æquali tempore re
uerti, vt Doctiſſ. Marcus Beneuentanus ex Alfonſinorum
ſententia refert.   Nam cum certè eccentricitatem Solis, non
poſſimus

possimus negare non mutari, ipsi viderint, quomodo affir-
ment, propter mutationem anguli diuersitatis à mo-
tu medio, anni quantitatem ab æquinoctio obseruatam
non mutari. Ego profectò reipublicæ & studiosis omni-
bus, quibus D. Doctoris, præceptoris mei labor profutu-
rus est, plurimum gratulor, quòd nos certam diuersitatis an
ni rationem habeamus. Sed vt hæc omnia facilius animo
perspicias Doctiss. D. Schonere, en tibi ob oculos idem
in numeris propono, vt his deniq, quæ supra promisi, res-
pondeam.
    Sit Sol in puncto vernalis æquinoctij medij, quod
tempore obseruationis æquinoctij autumnalis ab Hippar-
cho factæ, anno ante natiuitatē Domini cxlvii trib⁹ grad.
29 min. primam stellam Arietis præcedebat. Sol proce-
dat ab eodem puncto octauæ sphæræ, vt in anno sidereo
(scilicet ccclxv dieb., xv minutis, xxiiii secundis ferè)
ad idem punctum reuertatur. Quia autem æquinoctium
mediū in anno sidereo Soli procedit obuiam per 50 ferè se
cunda, fit vt Sol prius ad punctum vernale medium per
ueniat, q̃ ad locum vnde digressus fuit, vbi videlicet Sol
& æquinoctiuro medium in eodem eclipticæ puncto con-
iuncti erant. Minor igitur annus ab æquinoctio medio
quàm sidereus, qui ex nostris hypothesibus ccclxv die-
rū xiiij m. xxxiiij, secun. ferè esse colligitur. Sed si inqui-
ramus quot dies, & partes diei respectu æquinoctij medij,
in cclxxxv annis, qui sunt inter Hipparchum & Ptolemæū
excrescant, inueniemus lxix dies ix min. ferè: deficerent
itaq; ij dies vi minuta si singulis annis quartā diei partem
excrescere assumam⁹. Perpendam⁹ igitur et reliquas causas,

donec vnum tantum diem minus $\frac{1}{20}$ diei desiderari reperi-

amus.
Tempore obseruationis Hipparchi, æquinoctium verum
præcedebat æquinoctium medium secundum signorum an
tecedentiam, 21 minutis eclipticæ stellatæ ferè, in quo pun-
cto tunc Sol erat. Sed tempore Ptolemæi sequebatur æqui-
                                                      noctium

noctium verum ipsum medium 47 ferè minutis. Igitur,
cũ Sol tempore Ptolemæi peruenisset ad 21 minutum an-
te punctum æquinoctij medij, vbi Hipparchi tempore æ-
quinoctialem verum reliquerat, non erat æquinoctium,
neqʒ cum peruenit ad æquinoctium medium, sed postqʒ il-
lud per 47 minu. transcendit, in centrum terræ, vt Plinius
loquitur, incidit, in locum videlicet æquinoctij veri. Fu-
erunt igitur Soli 1 grad. 8 mi. ascendenda quẽ arcũ motu
vero 1 die 8 mi. confecit. Hoc seruo ad latus, & perpendo
quantũ angul⁹ diuersitatis hoc in loco decreuerit, & inuenio
illi vnum ferè minutum diei correspondere, patet itaqʒ, di-
ebus ab æquinoctio medio cõputatis, tempus 1 diei 9 mi.
accedere, quare & recte Ptolemæum prodidisse inter suam
et Hipparchi obseruationem à vero æquinoctio ad verum,
cclxxxv annos, lxx dies, xviij minuta esse. Proinde &
lvij diei minuta deficere, quod etiam ex subtractione 1 diei
9 minu. de ŋ dieb. vi minutis, supra respectu æquinoctij
medŋ desideratis, innotescit.

Verùm dicamus de defectu 7 dierum inter Ptolemæ-
um & Albategniũ, quod ideo est illustre, quia maius est
temporis interuallum, nempe dccxliij annorum: quare
& omnes causæ magis erunt conspicuæ. Tempore Pto-
lemæi æquinoctium medium, præcedebat ipsam primam
stellam Arietis 7 grad. 28 ferè min. in signorum antece-
dentiam. AEquinoctio autem medio, subinde Soli obui-
am eunte, vt dictum, factum est, vt in annis intermedijs
irter Ptolemæum & Albategnium clxxx dies 14 min. fe-
rè per additamenta respectu æquinoctij medij excrescerent.
Deficient igitur v dies, 31 min. si tempus ad æquinoctium
medium, ad id conferamus, quod exultat cum in quattuor
annis vnus dies colligitur. Cæterum Sol tempore Pto-
lemæi æquinoctium verum in 47 min. post æquinoctium
medium in signorum consequentiam reliquerat. Alba-
tegnij autem ætate æquinoctium verum in 22 min. ante æ-
quinoctium medium in signorum antecedentiam erat. Pri-
us igitur Sol ad æquinoctium verum, quam ad medium,
vel vbi æquinoctialem verum reliquerat venit, quod est
con-

contrarium priori exemplo. Quantum itaᵬ temporis vni
grad. 9 min. respondebit, tantū de diebus respectu æquino=
ctij medij decedet, et residuo, nempe v diebus. xxxi mi, ac=
cedet: et quia eodem modo cū differentia anguli diuersitatis
propter eccentricitatis decrementū, cui xx diei minuta respon=
dent, agendum: vnus dies, xxx min. propter mutationem
anguli diuersitatis & inæqualem præcessionis motum, reli=
quis duabus inæqualis motus Solis causis admixtis, tempore
mediocri decedent.   Et additamentum verum à tempore
Ptolemæi ad Albategnij obseruationis tempus clxxviij die=
rum xliiij min. exibit.   Sed idem decrementum adiun=
ctum v diebus xxxi min. monstrat vij dies et 1 min excidisse.
Quod ostendendum erat.   Tantæ molis erat, tali ratione
stellarum fixarū & Solis motus restituere, q̄ ex motuū eorū
colligantia, vera annuæ quantitatis ab æquinoctijs ratio col=
ligi posset.   Regnum ita'ᵬ in Astronomia doctiss. viro, D
præceptori meo, Deus sine fine dedit.   Quod Dominus ad
Astronomicæ veritatis restaurationem gubernare, tueri et au
gere dignetur, Amen.

        Statui tibi breuiter Doctiss. D. Schonere integram tra=
ctationem motus Lunæ & reliquorum planetarum, quem=
admodum stellarum fixarum et Solis conscribere, vt quæ vti
litates ex D. præceptoris libris ad studiosos Mathematicæ to
tam'ᵬ posteritatem, veluti ex vberrimo fonte promanaturæ
sint, intelligas.   Verùm cum viderem mihi opus in præ=
sentiarum nimis excrescere, peculiarem hac de re Narratio
nem instituendam duxi.   Quòd igitur his tanᵬ præcur=e=
re, viam'ᵬ præparare necessarium putauero, hoc loco expe
diam.   Et hypothesib. motus Lunæ & reliquorum pla=
netarum generalia quædam inspergam, quo & de toto hoc
opere maiorem spem concipias, & quæ eum coëgerit necessi=
tas ad alias assumendas hypotheses seu Theorias perspicias.

        Cum in principio nostræ Narrationis præmiserim D.
præceptorem suum opus ad Ptolemæi imitationem institue=
re, mihi amplius nihil quasi relictum esse video, quod de ip=
sius emendandi motus ratione apud te prædicem.   Siqui=
dem Ptolemæi indefatigabilem calculandi diligentiam, quasi
supravires humanas obseruationum certitudinem, et veredi
                                        C   iinam

uinam rationem omnes motus et apparentias perſcrutandi,
exequendíʼcʒ, ac poſtremo tam vbíʼcʒ ipſius inter ſe conſentien=
tem docendi & demonſtrandi Methodũ nullus, cui quidem
Vrania eſt propitia, ſatis admirari & prædicare poteſt.

In hoc autem eò D. præceptori meo maior, quàm Pto=
lemæo labor incumbit, quòd ſeriem & ordinem omnium
motuum & apparentiarum, quem obſeruationes ii M.anno=
rum, tancʒ̃ præſtantiſſimi Duces in latiſſimo Aſtronomiæ
campo explicant, in certam ſibiʼcʒ mutuo conſentientem rati=
onem ſeu harmoniam colligere cogitur: cum Ptolemæus vix
ad quartam tanti temporis partem veterum obſeruationes,
quib. ſe tuto committeret, haberet.   Et cum ἀπὸ τȢ χρόνȣ
vero Deo, & præceptore legum politiæ cœleſtis, errores A=
ſtronomiæ nobis apperiantur.   Siquidem inſenſibilis, vel
etiam neglectus error, in principio conſtitutionis hypotheſi=
um, præceptorum & tabularum Aſtronomiæ, procedente
tempore ſeſe aperit, aut etiam in immenſum propagatur. D.
Doctori præceptori meo, non tam inſtauranda eſt Aſtrono=
mia, cʒ̃ de integrò exædificanda.   Ptolemæus potuit ple=
raſcʒ veterum, vt Timocharis, Hipparchi, & aliorum hypo
theſes, ad ſeriem oïs diuerſitatis motũ, quæ ſibi ex tantillo
obſeruationum tempore elapſo nota erat, ſatis concinne ac=
commodare.   Ideo recte et prudenter, quod & plauſibilius
erat, eas elegit hypotheſes, quæ & rationi, noſtriſʼcʒ ſenſib.
magis cõſonæ eſſe videbant, & quibʼ ſummi ante eũ artifices
uiſi fuerant. Cũ autem omnium artificum obſeruationes &
cœlum ipſum ac Mathematica ratio nos conuincant, quod
Ptolemæi & communes hypotheſes, nequacʒ̃ ad perpetuam,
ſibíʼcʒ inuicem conſentientem colligantiam et Harmoniam re=
rum cœleſtium demonſtrandam, & in tabulas ac præcepta
colligendam ſufficiant, neceſſe fuit vt D. præceptor meus no=
uas hypotheſes excogitaret, quib. videlicet poſitis, talcs mo=
tuum rationes Geometrice & Arithmetice bona conſequentia
deduceret, quales veteres & Ptolemæus olim τῷ θείῳ ψυχῆσ
ὄμματι in altum eleuati depræhenderunt: qualeſʼcʒ hodie vete=
rum veſtigia colligentib.in cœlo eſſe, diligentes obſeruatio=
nes ædocent.   Sic nempe in poſterum videbunt ſtudioſi,
quem Ptolemæus, & reliqui veteres authores vſum habeant,
                                                            quo

quo eos hactenus tanᵹ ex scholis exclusos, reuocent, et in pris
stinum honorem, veluti postliminio reuersos restituant.
Poëta inquit, Ignoti nulla cupido. Ideo non mirum, quare
Ptolemæus hactenus cum tota vetustate in tenebris neglectus
iacuerit, quemad. procul dubio et tu opt. D. Schonere, cum
alijs item bonis, doctisᵹ viris sæpius doluisti.

    Ratio Eclipsium vel vnica, Astronomiæ honorem apud **De Lu-**
imperitum vulgus tueri videtur. Hæc autem quam hodie **næ moti**
à communi calculo & in tempore & prædicenda quantitate **bus con-**
discrepet, indies videmus. Cum verò accuratissimas Pto= **sideratio**
lemæi & aliorum optimorum authorum obseruationes mi= **nes gene**
nime in constituendis tabulis Astronomicis, quod quosdam **rales, cũ**
facere videmus, tanᵹ falsas & reprobas reijcere debeamus, **nouis e-**
nisi manifestum aliquem arguente ætate errorem irrepsisse de= **ius hypo**
præhendamus. Quid enim magis est humanum, ᵹ falli **thesibus**
nonnunᵹ & decipi, vel etiam specie recti, præsertim in diffi=
cilimis istis reb., abstrusissimis, & nequaᵹ obuijs. In Lunæ
motu demonstrando assumit D. præceptor meus huiusmodi
Theorias & motuum rationes, quib. veteres excellentissi-
mos philosophos, minime in obseruationib. suis cœcos fui=
sse appareat. Quapropter sicut supra anni ab æquinoctijs
sumpti augmentum & decrementum regulare esse ostendi-
mus, ita ex diligenti quoᵹ Solis et lunæ motuũ examinatio-
ne deduci poterit, quæ singulis ætatib. veræ Solis, Lunæ, et
Terræ à se inuicem distantiæ, quaue ratione diametri Solis,
Lunæ & vmbræ diuersis temporib. aliter atᵹ aliter repertæ
fuerint, vt certa insuper etiam diuersitatis aspectuum Solis et
Lunæ ratio haberetur.

    Regiomontanus noster libro v propositione xxij, in=
quit. Sed mirum est, quod in quadratura, Luna in perigio
epicydi existente non tanta appareat, cum tamen si integra lu-
ceret, quadruplam oporteret apparere ad magnitudinem,
quæ apparet in oppositione, cum fuerit in apogio Epicydi.
Senserunt & idem Timochares & Menelaus, qui semper in
obseruationib. stellarum eadem Lunæ diametro vtuntur.
Sed & D. præceptorem meum experientia docuit diuersita-
tes aspectus, & quantitates corporis Lunæ, in omni ipsius à
Sole distantia, parum vel nihil differre ab ijs, quæ in coniun=
<div align="center">C   ij   ctione</div>

ctione & oppofitione contingunt, vt manifeftum fit Lunæ
minime talem, vt receptum, eccentricum tribui poffe. Po=
nit itacp quod Lunæ orbis, Terram cum adiacentib. Elemen=
tis complectatur, cuius deferentis centrum, fit centrum terræ,
fuper quo æqualiter centrum epicycli Lunæ deferens feratur.
Illam autem fecundam diuerfitatem, quam a Sole Luna habe=
re videtur, ita faluat.   Affumit Lunæ corpus epicyclo epi=
cycli homocentrici moueri, hoc eft, primo, qui ferè in con=
iunctione & oppofitione apparet epicyclo, alium paruum,
Lunæ corpus deferentem epicyclum, affingit.   Proportio=
nem autem diametri primi epicycli, ad diametrum fecundi fi=
cut 1097 ad 237 effe demonftrat.   Cæterùm talis eft motu=
um ratio.   Circulus decliuis, fuam, vt antehac, motus ratio=
nẽ obtinet: nifi quòd eiufdem æqualitatẽ à ftellis fixis habet.
Deferens, qui & concentricus, mouet regulariter & æqualiter
fuper fuo centro (fcilicet terræ) fimiliter æqualiter & regula=
riter à linea medij motus Solis difcedens.   Epicyclus pri=
mus, etiam fuper fuo centro vniforme, parui et fecundi epicy=
cli centrum, in fuperiori parte in antecedentia, in inferiori in
confequentia deferendo, circumuoluitur.   Ponit autem
iftum motum ab apogio vero, quod in fuperiori parte epi=
cycli primi linea ex centro terræ, per centrum eiufdem in cir=
cumferentiam eiecta oftendit, æqualem & regularem effe.
Luna autem in circumferentia parui & fecundi epicycli etiam
regulariter & æqualiter mouetur, æqualiter ab apogio vero
parui epicycli difcedens, quod videlicet à linea exeunte à cen=
tro primi epicycli, per centrũ fecundi in ipfius circumferentia
oftenditur.   Atcp huius motus hæc eft regula, vt ipfa Luna
bis in fuo paruo epicyclo, in vna deferentis periodo reuolua=
tur, quo tamen in omni coniunctione et oppofitione Luna in
perigio parui epicycli, in quadraturis autem in apogio eiuf=
dem reperiatur.   Hæc eft machinatio feu hypothefis, qua D.
præceptor omnia prædicta inconuenientia excludit, et quam
omnibus apparentijs fatiffacere ad oculos oftendit, quemad=
modum etiam ex tabulis ipfius eft colligere.

Porrò Doctiff. D. Schonere, quemad. nos hic in Luna ab
æquante liberatos effe vides, & tali infup Theoria affumpta,
quæ experientiæ et omnib. obferuationib. correfpondet.

                                                Ita etiam

Ita etiam in reliquis planetis æquantes tollit, tribuens cuilibet trium superiorum vnum solummodo epicyclum et eccentricum, quorum vterqʒ super suo centro æqualiter moueatur & pares planeta in epicyclo, cum eccentrico reuolutiones faciat. Veneri autem & Mercurio, eccentricum eccentrici. Quòd enim planetæ directi, stationarij, retrogradi, propinqui & remoti terræ &c. singulis annis conspiciuntur, per alium insuper, quàm ex superiorib. adstruitur, regularem telluris globi motum fieri posse demonstrat. Qui est, vt Sol vniuersi medium occupet, Terra autem loco Solis in eccentrico, quem orbem magnum appellare placuit, circumferatur. Atqʒ profectò diuini quiddam est, quod vnius terreni globi regularib. et æqualib. motibus certa rerum cœlestium ratio dependere debeat.

Primum autem, vt terræ mobilitate apparentias in cœlo plerasqʒ fieri posse, aut certè commodissime saluari, assumeret, eum, æquinoctiorum indubitata (sicut audiuisti) præcessio, et eclipticæ obliquitatis mutatio, induxit. Deinde quod illa eadem eccentricitatis Solis diminutio, pari ratione & proportionabiliter in eccentricitatibus reliquorum planetarum animaduertitur. Postea quod planetas suorum deferentium centra circa Solem, tanqʒ medium vniuersi habere appareat. **Principales rationes, quare à veterum Astronomorum hypothesibus recedendū sit.**

Sensisse autem & idem vetutissimos (pythagoricos interim vt taceam) vel hinc satis liquet, quod Plinius ait, venerem & Mercurium ideo non longius à sole, quàm ad certos & præfinitos terminos discedere, optimos haud dubie authores secutus, quia circa Solem conuersas absidas habeant, vnde & medium quoqʒ solis motum eis accidere oportuit. Cum verò Martem inobseruabile sidus vocat, atqʒ præter reliquas in motus Martis emendatione difficultates, dubium nō sit, quin maiorem nonuncqʒ qʒ ipse Sol diuersitatem aspectus admittat, impossibile esse videtur, terram mundi medium obtinere. Porrò etsi ex Saturni & Iouis in Matutino vesper tino'qʒ ortu ad nos habitudine, id ipsum hoc, facile etiam colligatur: in Martis tamen diuersitate ortuum, præcipue & maxime animaduertitur. Quia enim Martis sidus obtusum admodū lumen habet, non adeo sicut venus aut lupiter visum **Plinius lib. ii. cap. xvij.** decipit

C iij

decipit:sed pro ratione à terra distantiæ,magnitudinis muta=
tionem refert. Proinde cum Mars in vespertino ortu Iouis
sidus magnitudine æquare videatur,vt nisi igneo fulgore di=
scernatur:in apparitione autem & occultatione vix à secundæ
magnitudinis stellis discerni possit: sequitur ipsum proximè
ad terrã vespertino in ortu accedere:cōtra in matutino cʒ max.
procul abesse,quod certè ratione epicycli nullo modo contin=
gere potest. Terræ igitur,ad Martis & aliorum planetarũ
motus restituendos,alium locum deputandum esse patet.
Quarto hac vnica ratione commode fieri posse D.preceptor
videbat,vt quod maxime propriũ circularis motus est, om=
nes reuolutiones circulorum in mundo æqualiter & regula=
riter super suis centris,& non alienis mouerentur. Quinto
eum non minus Mathematicis, cʒ Medicis statuendum, quod
passim Galenus inculcat:Μηδ᾽ ἐν εἰκῇ τὴν φύσιν ἐργάζεθαι Ετ.ὅυ͡ωσ

Hæc verba
sunt in lib:
x de vsu
partium.

ἔιναι τὸν δημίουργον ἡμῶν σόφον ὡσ μὴ μίαν ἑκασον τῶν ὑπὸ αὐτῶ γιγονότων
ἔχιν τὴν χρείαν,ἀλλὰ καὶ δύο,καὶ τρεῖσ,καὶ πλείουσ πολλάκισ,Quare, cũ
hoc vnico terræ motu,infinitis quasi apparentijs satisfieri vi=
deremus, Deo naturæ cōditori eam industriã non tribuere=
mus,quàm communes horologiorum artifices habere cerni=
mus,qui studiosiss. cauent, ne vllã instrumento rotulam in=
serant,que aut superuacanea sit,aut cuius alia,paululum mu
tato situ commodius vicem suppleat? Et quid D præcep=
torem moueret,vt tancʒ Mathematicus aptam motus terre=
ni globi rationem non assumeret? Cum videret tali
assumpta hypothesi ad certam rerum cœlestium doctri=
nam constituendam, nobis vnicam octauam sphæram,
eam͡cʒ immotam, Sole in medio vniuersi immoto: In
motibus verò reliquorum planetarum eccentrepicyclos
aut eccentreccentricos vel epicycli epicyclos sufficere. His
accedit,quòd motus terræ in suo orbe, omnium planeta=
rum,excepta Luna,argumenta conficiat, quicʒ vnus solus,
causa omnis diuersitatis motus esse videatur, quæ videlicet
in tribus quidem superioribus à Sole: In Venere autem &
Mercurio circa Solem apparet. Deni͡cʒ & hunc motum
efficere, vt vnica saltem in latitudinem deferentis planetæ
deuiatione quilibet planetarum sit contentus: Sic͡cʒ princi
paliter planetarum motus tales etiam hypotheses exigere.
Sexto & postremo hoc maxime D. Doctorem præceptorē

meum mouit, quòd præcipuã omnis incertitudinis in Aſtro-
nomia cauſam eſſe videbat, quod huius doctrinæ artifices
(quod venia Diuini Prolemæi Aſtronomiæ parentis, dictũ
volo) ſuas Theorias, & rationes motus corporum cœleſtium
emendandi, parum ſeuere ad illam regulam reuocauerunt,
quæ ordinem & motus orbium cœleſtium, abſolutiſſimo
ſyſtemate conſtare admonet. Vt enim ampliſſime ſuum ho-
norem illis (quemadmodum par eſt) tribuamus, Tamen op-
tandum næ erat, vt in harmonia motuum cõſtituenda, Mu-
ſicos fuiſſent imitati, qui chorda vna vel extenſa vel remiſſa,
cæterarum omnium ſonos tamdiu ſumma cura & diligen-
tia adhibita formant & attemperant, donec omnes ſimul ex-
optatum referant concentum, neq̃ in vlla diſſoni quicquam
annotetur. Hoc, vt de Albategnio interim dicam, ſi in ſuo
opere ſecutus eſſet, haud dubiè & hodie omnium motuum
rationem certiorem haberemus. Eſt enim veriſimile Al-
fonſinos plurimum ex eo deſumpſiſſe. Atq̃ hac vnica re ne-
glecta aliquando, ſi modo vera fateri animus eſt, totius A-
ſtronomiæ ruina metuenda fuiſſet. In communib. Aſtro-
nomiæ principijs erat quidem videre, ad medium Solis mo-
tum omnes apparentias cœleſtes ſe dirigere, totam'q̃ motu-
um cœleſtium harmoniam pro ipſius moderamine conſtitui
& conſeruari: vnde & à veteribus Sol χορηγὸς, naturæ gu-
bernator, et rex dictus eſt. Sed quomodo hanc adminiſtra
tionem gereret: An quemadmodum Deus totum hoc vni-
uerſum gubernat, vt pulcherrime Ariſtoteles περὶ κόσμου de-
pingit. An verò ipſe totum cœlum toties peragrando,
nullo'q̃ in loco quietus Dei in natura adminiſtratorem age-
ret, nondum videtur omnino explicatum abſolutum'q̃ eſſe.
Vtrum autem horum potius aſſumendum ſit, Geometris &
Philoſophis (qui Mathematica quidem tincti ſint) deter-
minandum relinquo. Siquidem in huiuſmodi æſtimandis,
dijudicandis'q̃ cõtrouerſijs, nõ ex plauſibilibus opinionibus,
ſed legib. Mathematicis (in quorum foro cauſa hæc dicitur)
ferenda eſt ſententia. Prior gubernationis modus eſt reiec-
tus, poſterior receptus. D. Doctor autem, præceptor me-
us, damnatam rationem gubernationis in rerum natura
Solis, reuocandamſtatuit: ita tamen vt receptæ etiam & ap-
probatæ ſuus locus relinquatur. Videt namq̃, neq̃ in hu

manis rebus eſſe opus, vt Imperator ſingulas vrbes ipſe per
currat. quo ſuo deniꝗ munere, à deo ſibi impoſito, defun
gatur. Neꝗ Cor in caput, aut pedes, aliaſꝗ corporis par=
tes propter animantis conſeruationem tranſmigrare, ſed per
alia ὄργανα à Deo in hoc deſtinata, officio ſuo præeſſe. Dein=
de cum ſtatueret medium motum Solis, talem motum eſſe
oportere, qui non tantum imaginatione conſtaret, vt in reli=
quis quidem planetis, ſed haberet cauſam per ſe, cum ipſum
veriſſime χορδ'ευτην ὁμοῦ καὶ χοροσά]ην eſſe appareret, factum eſt,
vt ſuam ſententiam firmam, nec à vero abhorrentem com=
probaret. Nam per ſuas hypotheſes, cauſam efficientem æ
qualis motus Solis geometrice deduci poſſe ſentiebat, & de
monſtrari, quare iſte medius Solis motus, in omnib. reli=
quorum planetarum motibus & apparentijs, certa ratione
vt in ſingulis apparet, neceſſario depræhenderetur. Atꝗ
ex inde poſito telluris motu in eccentrico, in promptu eſſe
certam rerum cœleſtium doctrinam, in qua nihil murandū
quin ſimul totum ſyſtima, vt conſentaneum erat, de nouo in
debitas rationes reſtitueretur. Huiusmodi Solis in re=
rum natura gubernationem cum ex communibus noſtris
Theorijs ne ſuſpicari quidem poteramus, pleraꝗ veterum
Solis ἐγκώμια, tanꝗ poëtica negligebamus. Vides itaꝗ
quales ad ſaluandos motus hypoteſes, D. præceptorem his
ita conſtitutis aſſumere oportuerit.

Interrumpo cogitationes tuas Clariſſ. vir: video . n. te dū
cauſas renouandarum hypotheſium Aſtronomiæ, à D. Do=
ctore meo excellenti Doctrina, ſummoꝗ ſtudio indagatas au
dis, animo tecum cogitare, quænam tandem apta, renaſcentis
Aſtronomiæ, hypoteſium futura ſit ratio. ✳ Iſſud aūt homi=
nū genus, quod omnes ſimul ſtellas pro ſuo arbitratu, haud
ſecus ac iniectis vinculis, in æthere circumducere conatur, cō=
miſeratione potius ꝗ odio eſſe dignum, te iuxta cum alijs ve
ris Mathematicis, omnibus'ꝗ viris bonis iudicare. Cum
'ꝗ haud ignores quem locum hypotheſes ſeu Theoriæ apud
Aſtronomos habeant, & in quantum Mathematicus à Phyſi=
co differat ſentio te hoc quoꝗ ſtatuere: Quo obſeruationes,
ipſius'ꝗ cœli teſtimonia trahunt retrahunt'ꝗ ſequendum: om
nem'ꝗ

nemtʒ difficultatem ferendo, Deo duce, Mathematica & inde‑
fatigabili ftudio comitibus, fuperandam effe.   Proinde fi
quispiam ad fummum, principalem'cʒ finem Aftronomiæ fi‑
bi refpiciendum ftatuerit, vnà nobifcum D. Doctori, præcep‑
tori meo, gratias habebit, cogitabit'cʒ et ad fe Ariftotelis illud lib. §.
pertinere: τὰ• μὲ•ν δυ•ν ἀκριβεστέρας ἀνάγκας, ὅταν τὶς ἐπιτύχι, τὴ• de cælo.
τε χάρι• ἐχει• διῖ τοῖς ἱυρίσκουσι.   Et cum nos Ariftoteles, Calipp‑ libro xij
pi et fuo exemplo côfirmet ad caufas τῶς φαινομένων affignandas, metaph.
Aftronomiam, prout fe diuerfi corporum cæleftium motus
obtulerint, inftaurandam: necʒ Auerröem non fatis clemen‑
tem Ptolemæi Ariftarchum, fi modo ad phyfiologiam æquis
oculis refpicere velit, acerbius D. præceptoris hypothefes ex‑
cepturum, fperauerim.   Tantum abeft, vt Ptolemæum adeò
hypothefibus fuis, fi ei in vitam redire daretur, addictum &
adiuratum putarim, vt ad certam rerum cæleftium doctrinam
exædificandam, vbi regiam viam tot feculorû ruinis impedi‑
tâ & inuiam factam deprehenderet, non aliud infuper iter per
terras maria'cʒ inquifiturus effet, cum per aëra apertum'cʒ cœlû
ad optatam metam minus fcandere liceret.   Quid nam'cʒ de lib. IX.
ifto aliud, cuius hæc funt verba, ftatuerem? ὅυτε τὰ ἀναποδἰκτως Hæc fatis
ἀποτιθέμετα, ἱὰ• ἅπαξ σύμφωνα τοῖ• φαινομένοι• καταλαμβάνηται, χωρὶ• faciunt qui
δδῦ τινο•, κ•ὶ ἰπισὰ σ•ω• ἱυρῆσθαι δίωνται, κἄν δυσἰκθιτος ἢ ὁ τρόπος ἄν bᵇ altius, in
τῶγ τῆγ καταλήψιος. ἰπιιδὴ κ•ὶ καθόλου τῶν πρώτων ἀρχῶν, ἢ ὁ•υδ•ν, ἢ δυ‑ cʒdomos
στρμἰκώ•ωτον φύσιι τὸ ἄιτιον. Quàm verecunde autem, et prudenter fuperas
Ariftoteles de motuû cœleftium doctrina loquatur, paffim in fcandere,
eius libris videre eft.   Et ait alibi, πιπαδ'ωμίνου γάρ ἰsιν ἰπὶ το‑ cura fuit.
σούτον τ'ακριβὲ•• ἰπιζητιῖν κ•θ'ἱκεσον γένο• ἰφ'ὅσον ἡ τῦ πράγματος φύσι• lib. i. Eth.
•'πιδ'ξιτιι Cû autê tum in phyficis, tû in Aftronomicis ab effe‑
ctibus, & obferuationibus vt plurimû ad principia fit procef‑
fus, ego quidem ftatuo Ariftotelem, auditis nouarum hypothe
fium rationibus, vt difputationes de graui, leui, circulari latio‑
ne, motu & quiete terræ diligentiffime excuffit, ita dubio pro‑
cul candide confeffurum, quid à fe in his demonftratum fit, &
quid tancʒ principium fine demonftratione affumptum   Qua
re & D. Doctori præceptori meo fuffragaturum crediderim,
vtpote cum confter rectiffime, vt fertur, à Platone dictum,
                              D   7⁰⁹

τὸν Ἀριστοτέλεα τῆσ ἀληθέασ εἶναι φιλόσοφν. Contrà, si in durissima quædā verba proruptur' esset, aliter verò mihi persuadere nō possum, quin exclamans pulcherrimæ huius philosophiæ partis conditionem, his verbis deploraturus esset. πάνυ ἐμμελῶσ ἀπὸ Πλάτωνοσ λέλεκται, γεωμετρίκι τε κὴ τὰσ τάυτῃ ἐπομένασ, ὁ νεφῶττειν μὲν περὶ τὸ ὄν, ὕπαρ δ' ἀδύνατον ἀυτάῖσ ἰδῖν, ἕωσ ἂν ὑποθέσεσι χρώμεναι, τὰσ τὰσ ἀκινήτουσ ἰῶσι μὴ δυνάμεναι λόγον διδόναι ἀυτῶν. Et adderet: πολλὴν τοῖσ ἀθανάτοισ θεοῖσ χάριν ἔχειν δῖ, ἐπὶ τῷ τὸν ὅιον λόγον τῶν φαινομένων ἐιδέναι. Verùm enimuero, cū hæc nō tam huius loci sint, quàm alterius cuiusdam disputationis, quæ porrò restant D. Doctoris, præceptoris mei hypotheses, libere, &, vt his, quæ supra diximus aliquid lucis accedat, narrare ordine pergam.

<table>
<tr><td>lib. vij
Polit.</td></tr>
</table>

Vniuersi distributio.

℞ μετὰ α τὸ ἔλεττον,

℞ Aristoteles, inquit, Verissimum est id, quod posterioribus, vt vera sint, causa est. Sic cum D. præceptor meus, sibi tales hypotheses assumēdas esse statueret, quæ superiorū seculorum obseruationes vt veræ esse confirmarentur, causas continerent, et quemadmodum sperandum, causæ essent, vt in posterum omnes Astronomicæ τῶν φαινομένων prædictiones ueræ deprehenderentur. Principio non mediocribus laborib' superatis per hypothesim constituit: Orbem stellarum, quem octauū vulgo appellamus, ideo à deo conditū, vt esset domicilium illud, quod suo complexu totam rerum naturam complecteretur: quare vt vniuersi locum, fixum immobilem'q́ condidisse. Et quoniam non percipitur motus, nisi per collationē ad aliquod fixum: Sicut nauigantes in mari, quibus nec ampli' vllæ apparent terræ, cœlum vndiq́ et vndiq́ pontus, tranquillo à ventis mari nullum nauis motū sentiunt, tametsi tanta ferantur celeritate, vt in hora etiam, aliquot miliaria magna emetiantur: Ideo deum tot eum orbem, nostra quippe causa, insigniuisse globulis stellantibus, vt per.es eos, loco nimirum fixos aliorum orbium & planetarū contentorum ani maduerteremus positus ac motus. Deinde, quod his quidē consentaneum est, Deum, in huius theatri medium, Solem, suum in natura administratorem, totius'q́ vniuersi regem, diui na maiestate conspicuum collocasse

Pontanus
i Vraniæ

Ad cuius numeros & Di moueantur, & orbis
Accipiat leges, præscripta'q́ fœdera seruet.
Reliquos autem orbes in hunc modum distributos esse, Pri

unum locum infra firmamentum seu orbem stellarum Satur-
ni orbem fortitum: intra quem Iouis, deinde Martis conti-
neatur.   Solem verò Mercurij, deinde Veneris orbe circum-
dari, quo orbium quinq; planetarum centra, circa Solem re-
perirentur.   Sed intra concauam superficiem orbis Martis
& conuexam Veneris, cum satis amplum relictum sit spatiū,
globum Telluris cum adiacentibus elementis, orbe Lunari cir-
cumdatum, à magno quòdam orbe, intra se Mercurij & Ve-
neris orbes, item Solem complectente, circumferri, vt non ali-
ter, ac vna ex stellis inter Planetas suos motus habeat.
      Hanc totius vniuersi distributionem ex D. praeceptoris
mei sententia mihi perpendenti diligentius, praeclare simul, ac
recte Plinium sensisse intelligo, cum inquit: Mundi seu
coeli, cuius circumflexu tegantur cuncta, extera indagare, nec
interesse hominum, nec capere humanae coniecturam mentis:
Et subdit: Sacer est, immensus, totus in toto, imò vero ipse
totum, finitus & infinito similis. &c. Nam vbi D. praecep-
torem meum sequemur, nihil extra concauum orbis stellati
quod inquiramus erit, nisi quantum nos sacrae literae de his sci-
re voluerunt, tum etiam quicq; extra hoc concauum consti-
tuendi praeclusa erit via.   Quare totam reliquam hanc
naturam ceu sacrosanctam à Deo coelo stellato inclusam cum
gratiarū actione admirabimur & contemplabimur, ad quam
perscrutandam & cognoscendam multis modis, infinitis in-
strumentis, & donis nos locupletauit, & idoneos effecit: Et
quidem eò vsq; progrediemur, quo ipse voluit, neq; ab ipso
constitutos limites transgredi tentabimus.   Immensum
praeterea coelum esse, & vere infinito similem, quantum etiam
ad eius concauum, ex eo quidē inconfesso est, quod stellas om-
nes scintillare videamus, planetis exceptis, etiā Saturno, qui eo
rū coelo citimus, maximo fertur circulo. Sed idem longe ma-
nifestius ex D. praeceptoris hypothesibus per ἀποδείξεω patet.
Cū eni orbis magn⁹ terrā deferens, ad quinq; planetarū orbes
perceptibilē rationē habeat, vnde videlicet oēm apparentiarū
diuersitatē in his planetis, per eorū ad Solē habitudines proue
nire demonstrat: ac ois in terra Horizō orbē stellatū in aequalia

                                                          D ij   vt

vt vniuerſi circulus magnus interſecet, et orbes rouolutionum
ſuarum à ſtellis fixis æqualitatem habere comprobetur, ſatis cla
rum eſt, orbem ſtellarum maxime infinito ſimilem eſſe, quo‑
niamquidem orbis magnus ad eum collatus euaneſcat, omnia‑
'cp τὰ φαινόμενα non aliter conſpiciantur, ac ſi terra in medio v‑
niuerſi conſediſſet.

 Porrò, quamquam admiranda & haud indigna tum o‑
pifice Deo, tū quocp diuinis his corporibus motuū et orbium
ſymmetria ac nexus, quæ prædictis hypotheſibus aſſumptis
conſeruatur, animo citius concipi (propter affinitatem, quam
cum cœlo habet) quàm vlla voce humana eloqui poſſe affirma
uerim: quemadmodum in demonſtrationibus non tam
verbis, quàm perfectis & abſolutis, vt ita dicam, Ideis harum
ſuauiſſimarum rerum noſtris animis imprimi ſolent. Tamē
& in generali hypotheſium contemplatione eſt videre, quo‑
modo ineffabilis quocp conuenientia, omnium'cp conſenſus
ſeſe offerat. Nam præterquàm quod nullus in vulgaribus hy‑
potheſibus finis effingendarum ſphærarum apparebat, orbes,
quorū immenſitas nullo ſenſu, aut ratione percipi poterat, tar‑
diſſimis & velociſſimis circūducebantur motibus: Alij'cp à ſu
premo mobili omnes inferiores ſphæras motu diurno rapi
conſtituebant, cum tamen maxima turba diſputationum hac
de re concitata, qua ratione ſphæra ſuperior in inferiorem
ius habeat, nec dum conſtituere potuerint. Alij, vt Eudox⁹,
& qui eum ſunt ſecuti, cuilibet proprium orbem tribuebant,
cuius motu in die naturali circa terram ſemel circumferretur.
Præterea, dij immortales, quæ digladiatio, quanta lis vſcp ad‑
huc fuit, de orbium Veneris & Mercurij ſitu, & quomodo
ſint ad Solem collocandi: Verùm adhuc ſub iudice lis eſt,
quamcp vncp poſſe componi, vulgaribus iſtis hypotheſibus
conſtitutis, in difficili admodum eſſe, atcp adeò impoſſibile,
quis porrò eſt, qui non videt? Quid enim obſtiterit? etſi
quis Saturnum infra Solem collocet, orbiū et epicycli ad ſe in‑
uicem ſeruata interim ratione: cum in ijſdem hypotheſibus cō
munis orbium planetarum inter ſe dimenſio nondum ſit de‑
monſtrata, quo per eam quilibet orbis ſuo in loco Geometri‑
æ circumſcriberetur: ut ſanè hic ſilentio præteream, quantas

<div align="right">tragœ</div>

tragœdias, calumniatores pulcherrimæ huius partis philoso-
phiæ, & suauissimæ, commouerint, propter epicycli Veneris
magnitudinem, & quia assumptis æquantibus lationes orbiū
cælestium super proprijs centris, inæquales ponebantur.

    In D. præceptoris autem hypothesibus, orbe stellato, vt
est dictum, termino constituto, quilibet planetæ orbis suo à
natura sibi attributo motu vniformiter incedens, suam perio-
dum conficit, & nullam à superiori orbe vim patitur, vt in di-
uersum rapiatur.   Adde quod orbes maioris ambitus tar-
dius, & propiores Soli, à quo quis principium motus & lu-
cis esse dixerit, velocius, vt côueniebat, suos circuitus perfici-
unt.   Quare Saturnus sub ecliptica liber viam corripiens
in xxx annis reuolutionem complet.   Iupiter in xij, Mars
in duobus.   Centrum autem terræ anni quantitatem ad
stellas fixas determinat.   Venus in ix mensibus Zodiacum
permeat: Mercurius verò minimo orbe Solem circundans
in lxxx diebus mundum perlustrat.   Suntɋ ita sex tantum
orbes mobiles Solem, vniuersi medium, circumdantes, quo-
rum orbis magnus terram deferens communis est mensura,
quemadmodū et orbiū Lunæ: itē Solis à Luna distantiæ, & e-
a quæ ex centro globi terreni.   Et quidem senario nu-
mero quis commodiorem alterum, & digniorem elegerit?
quóue totum hoc vniuersum suos in orbes à Deo conditore,
mundiɋ opifice distinctum, mortalibus facilius persuaserit?
Is namɋ cum in sacris Dei oraculis, tum à Pythagoræis, reli-
quisɋ philosohis vt qui max. celebratur.   Quid autem
huic Dei opisitio conuenientius, quàm vt primum hoc & per-
fectissimū opus, primo et eodē perfectissimo numero includa-
tur?   Ad hæc, vt ita à prædictis sex orbibus mobilibus
harmonia cælestis perficiatur, vbi orbes omnes sibi eo pacto
succedant, vt & nulla ab altero ad alterum interualli immensi-
tas relinquatur: & quisɋ Geometria septus suum locum in
hunc tueatur modum, vt si quemcumɋ loco mouere tentes, si-
mul etiam totum systema dissoluas.   Sed generalibus his
prælibatis, accedamus sanè ad lationum circulariū, quæ côpe-
tunt singulis orbibus & sibi adhærentibus ac incumbentibus
corporibus, enumerationem.   Primo autem dicamus de

               D iij   hypothe

hypothesibus motuum terreni globi, cui nos inhæremus.

Cum D. præceptor meus Platonem & Pythagoræos summos diuini illius seculi mathematicos sequens, sphærico terræ corpori, circulares lationes ad τῶν φαινομένων causas assignandas, tribuendas censeret, videret�q (quemadmodum Aristoteles quoⲕ testatur) vno attributo terræ motu, & alias itⲉ lationes ipsi ad stellarum imitationem competere: tribus eam principio vt max. præcipuis moueri motibus, assumendum iudicauit. Primo namⲕ vniuersali mundi distributione, vt mox dictum est, assumpta, constituit terram intra Lunæ orbem, suis verticibus inclusam, tancⲕ sphærulam in torno, diuino ita ordinante numine, ipsius globi ab occasu ad ortum motu, diem noctem'ⲕ, atcⲕ aliam super aliam cœli faciem mortalibus, prout se Soli obuertat, producere. Secundo loco, centrum terræ cum sibi incumbentibus, elementis scilicet, & orbe lunari ab orbe magno, de quo semel atcⲕ iterum iam meminimus, vniformiter in eclipticæ plano, Secundum signorum consequentiam circumferri. Tertio, æquinoctialem & axem terræ ad planum eclipticæ conuertibilem habere inclinationem, & contra motum centri reflecti, ita, vt vbicunⲕ sit centrum terræ, æquinoctialis & poli terræ, propter talem axis terræ inclinationem & stellati orbis immensitatem ad easdem mundi partes semper fermè respiciant, quod fiet, si quantum terræ centrum ab orbe magno in consequentia ducatur, tantum axis terræ extremitates, qui poli terræ, singulis dieb' ferè in antecedentia procedere intelligantur, circa axem & polos, axi & polis orbis magni aut eclipticæ æquidistantes, circulos paruos describendo. His autem motibus, vbi ex D. præceptoris mei sententia binas polorum terræ librationes, duos item motus quibus centrum orbis magni æquali & deferenti motu sub ecliptica incedit, adiecerimus, cum his quæ superius de Lunæ motibus circa terræ centrum dicta sunt, habebimus doctiss. D. Schonere, quæ sit vera hypothesium ratio, ad totam doctrinam, quam primi motus recentiores vocant, quam'ⲕ de omnimodis stellatæ sphæræ motib' habemus, deducendam, & causas eorum assignandas, quæ circa Solis Lunæ'ⲕ

motus

Marginal note (left): Qui orbi magno et ei adhærentibus motus competant. Terræ motus tres. Diurnus Annuus Declinationis.

motus & pallioncs in his mille annis iam tranfactis, diligentibus artificum obferuationibus, contigiffe eft animaduerfum, vt fanè, quod poftea vberius dicendum erit, filentio prætereamus, quot nimirum orbis magni motus, apparentias, in reliquis quinc planetis ingerat. Tam paucis & ceu in vno orbe, tanta rerum doctrina comprehenditur.

In primi motus doctrina nihil venit mutandum. Quæ enim eft proprietas eorum, quæ funt adinuicem, maxima declinatione conftituta, eadem ratione inueftigabuntur reliquarum etiam partium Eclipticæ declinationes, afcenfiones rectæ, in toto terrarum orbe vmbrarum & gnomonum ratio, dierum quantitates, afcenfiones obliquæ, ftellarum ortus & occafus. &c. Hoc tamen inter has & veterum hypotheles intereft, quòd in illis contrà ac à veteribus præceptum eft, ftellato in orbe præter eclipticam, nullus circulus imaginatione proprie defcribatur. Reliqui verò, vt funt æquinoctialis, duo tropici, arctici & antarctici, horizontes, meridiani, omnes'cz alij ad doctrinam primi motus pertinentes circuli, verticales, altitudinum, paralleli, coluri &c, in terræ globo proprie defignantur, & per relationem quandam in cœlum referuntur.

Eorum autem quæ circa Solem apparent, præter apparentiam diurnæ circa terram reuolutionis, quam cum omnib² ftellis & planetis reliquis communem habet, & quæ Ptolemæus ac recentiores proprijs Solis motibus tribuerunt, accidunt ei & ea, quæ circa mutationes punctorum folfticialium æquinoctialium, & ftellarum ab ijfdem elongationes, atcz apogij à ftellis fixis variationes contingere deprehenduntur. Quæ omnia fe noftris oculis offerunt, haud fecus, ac fi Sol & ftellarum orbis mouerent. Quomodo enim in oriente emergere feu oriri, & paulatim fupra horizontem eleuari, donec meridianum pertingant, à quo pari ratione defcendere, deinde inferius hemifpherium permeare, indies'cz diurnas fuas reuolutiones côficere vulgò credant, ex primo motu, quê terræ D. præceptor iuxta Platonê tribuit, fatis euidentes caufas habet. Quod aũt Sol nobis fecũdũ fignorũ côfequentiã progredi vi deatur, atqui

atqui tali motu eclipticam deſcribere,& tempus annuum conſtituere nobis perſuadeamus, per alterum motum,quem D. præceptor terræ tribuit,fieri poteſt.   Terra enim orbe magno lata,& inter ſtellas Libræ & Solem morante, nos, qui quidem terram quieſcere putamus, Solem   Arietem ſtellarum habere exiſtimabimus, quippe ex terræ centro linea per Solem in orbem ſtellarum eiecta in Arietis aſtrum incidet:deinde terra progrediente ad ſcorpionem,Sol taurum petere videbitur,& hunc in modum totum Zodiacum permeare,cum tamen ipſo quieſcente hunc motum ei competere ſtatuamus.
Et annus ſidereus erit tempus,quo centrum terræ, ſeu Solis in apparentia, ab eadem ſtella ad eandem ſemel reuoluitur. Tertius terræ motus, certas & ordinatas in toto terrarum orbe, temporum viciſſitudines producit: per hunc nam cp fit,vt Sol & reliqui planetæ in circulo ad æquinoctialem obliquo ferri videantur,eadem cp ſit Solis ad ſingulos terræ tractus habitudo,quæ futura erat,terra medium vniuerſi per hypotheſin occupante,& planetis in circulo obliquo motis.   Quoniam nam cp æquinoctialis planum,propter polorum ſuorum(vt dictum)motum ab eclipticæ plano,in collatione ad Solem reflectitur & declinat, ſeu,vt græci dicūt,λοξώνται καὶ ἐγκλίνε,ſub ijsdem ferè eclipticæ locis, eadē æquinoctialis ab ecliptica redit declinatio,ipſi cp poli diurnæ reuolutionis ſemper ſub eodem quaſi ſtellatæ ſphæræ ſitu verſant. Deinde in maximis declinationibus æquinoctialis ab eclipticæ plano ad Solem, linea ex centro Solis exiens ad terræ centrum, ſectione conica terræ globum diurna reuolutione circumuolutum diſſecat, tropicos cp deſcribit.   Præterea quando æquinoctialis planum ab eclipticæ plano ad Solem maxime reflectitur in vniuerſa terra æquinoctium contingit, quippe cum à prædicta linea globus terræ in æquinoctiali in duas ſemiſphæras abſcindatur.   Sed reliqui paralleli dierum in terra prout reflectio & declinatio (ſiue, vt verbis vtar Ptolemæi, λοξώσιο καὶ ἐγκλίσιο) æquinoctialis ad Solem ſeſe commiſcent, notantur. Arctici verò & Antarctici à punctis contingentibus horizontes deſcribuntur.   Sed polares D. præceptori poli eclipticæ æquidiſtantes,circa æquinoctialis polos depingunt.
                                                         Globi

Globi terræ autem circulus magnus trānsiens per æquino=
ctialis & dictos ecliptice æquidiftantes polos, colurus folfti=
tiorum erit, & alius eundem in æquinoctialis polis ad angu=
los rectos fphærales interfecans coluri æquinoctiorum vicem
fubibit.   Atcp in hunc modum, vel cuius libet loci proprij
circuli, vel alij quorcumcp facile terræ infcribi, & exinde ad
fuperextenfum cœlum referri intelliguntur.

Porrò cum propter obferuationum imperium terræ glo
bus in eccentrici circumferentiam euolauerit, Sol in medium
vniuerfi fubfederit: & ficut in vulgaribus hypothefibus cen=
trum eccentrici inter centrum totius vniuerfi (quod in ijfdem
& terræ) ac ftellas geminorum noftra ætate erat, Ita contrà
in D. præceptoris hypothefibus, centrum orbis magni, quod
in principio noftræ Narrationis per centrum eccentrici intel=
leximus, inter Solem D. præceptori vniuerfi medium, &
ftellas fagittarij reperiatur: ac diameter orbis magni in centrū
terræ incidens medij motus Solis lineam referat, cum cp linea
ex centro terræ per Solis centrum in eclipticam eiecta, verum
locum Solis determinet: non eft obfcurum, quomodo Sol de
Ptolemæi recentiorum'cp traditione inæqualiter fub ecliptica
moueri æftimetur: atcp angul' diuerfitatis à motu medio geo
metrice inueftigetur.   Terra autem in fumma abfide orbis
magni exiftente, Sol apogij locum in eccentrico occupare cre=
datur, & contrà illa in ima abfide morante, ipfe in perigio con
fpiciatur.

Verùmenimuero qua ratione ftellæ fixæ à punctis æqui=
noctialibus & folfticialibus elongari videantur, & maxima
Solis obliquitas variari & c. (quod fub initium narrationis
ex D. præceptoris libro tertio deduxi) ex motu declinationis,
quem genera liter propofuimuus, & binis fibi inuicem occur=
rentibus librationibus dependere, D. præceptor collegit.

A polis, eclipticæ polis, vt non ita multo ante dictū, æquidi=
ftantibus, virincp 23 grad. 40 min. circuli magni numeren=
tur, ibicp duo notentur puncta, quæ polos æquinoctialis me=
dij referant: ac vt conuenit duo coluri folfticia & æquinoctia
                                                    E   media

media diſtinguentēs deſignentur.　Hæc ſanè diſcendi graꞏ
tia concipiantur & delinientur in orbiculo globum terræ conꞏ
tinente, cuius vniformi motu, tertius, qui quidē terræ tribuiꞏ
tur motus, contingat.　Centro autem terræ inter Solem &
ſtellas Virginis commorante, reflectatur ſeu obliquetur æquiꞏ
noctialis medius ad Solem, & linea veri loci Solis, per comꞏ
munem ſectionem plani eclipticæ, æquinoctialis medij, & coꞏ
luri diſtinguentis æquinoctia media tranſeat: idꞯ ita, vt ſit æꞏ
quinoctium vernale medium, & ſimul æquinoctium vernale
verum, vbi idem, quemadmodum ex ſequentibus liquido cō
ſtabit, ratio motuum ſic exiget.　Ab hoc loco terræ centro
æquali motu ad ſtellas fixas ſingulis diebus 59 min. 5 ſecund.
11 tert. procedente, punctum vernale medium tantundem in
præcedentia ſuper terræ centro conficiat, & paulò velotiori
greſſu incedens 8 ferè tert. angulum maiorem deſcribat: et hæc
eſt cauſa, quamobrem paulò ante declinationis motum æquaꞏ
lem fermè, æquali motui centri terræ ad ſtellas fixas diximus.
Sed creſcente ſubinde angulo, qui à puncto vernali æquinoꞏ
ctialis medij ſuper terræ centro (iuxta iam poſitum canonem)
deſignatur, priuſquàm centrum terræ ad locum eclipticæ, vnꞏ
de digreſſum reuertatur deniꞯ, linea veri loci Solis in æquiꞏ
noctium medium incidet: & ſtellæ videbuntur nobis medio
ſeu æquali aliquo motu in conſequentia, pro anticipationis raꞏ
tione, progredi, quæ anticipatio, vt principio dixi, in anno æꞏ
gyptio eſt 50 ſecund. ferè, & in xxvmdcccxvi annis ægypꞏ
tijs in integram reuolutionem excreſcit.　Patet itaꞯ quid ſit
æquinoctium medium, quid æqualis præceſſio, et quomodo
hæc ceu inſtrumentali fabrica, oculis poſſint ſubijci.
De Librationib⁹. Sit linea recta determinata A. B. vt exempli
gratia 24 minut., hæc puncto in duas æquales parteis diuiaꞏ
tur: deinde altero circini pede in C colocato deſcribaƚ circul⁹,
D, E: extenſione C, D, verſus A, 6 minut (quarta parte ſciliꞏ
cet) & eiuſdem magnitudinis de alia ab hac materia duo circeꞏ
li (vt ſic interim loqui liceat) fabricentur, & ita componantur,
vt alter eorum, circumferentiæ alterius applicetur, quo libere
circa ſuum centrum moueri poſſit.　Qui autem alterum ın
circum꜀

circumferencia fert primus vocetur, ac centro lineæ A, B, in puncto C, affigatur: secundi circelli centro nota F, & in circumferentia eiusdem ad placitum puncto assumpto, nota G, adpingatur. Quod si nota G secundi circelli, applicetur A, termino lineæ assumptæ, et F, notæ D eiusdem: ac æquali tempore G in vnam partem super centro F angulum describat, duplum angulo ab F super C in partem diuersam descripto: patet in vna primi circelli reuolutione notam G lineam A B, bis describendo perreptasse, & secundum circellum bis reuolutum. Quia autem tali descriptione lineæ rectæ per duos circulares motus compositos, G punctum, circa A & B terminos tardissime promouetur: in medio autem circa C concitatius, placuit D. preceptori talem notæ G, per A B lineam, motum, librationem vocare cum talis motus ad similitudinem pendentium in aëre fiat. Appellatur hic etiam motus, motus in diametrum. Nam imaginatione assumpto circulo cuius A B, centro C, sit diameter: ex chordarum doctrina: quo in loco eiusdem diametri A B circelloru motu, quem dixi, composito, G punctum sit, constituitur, tabulaq; prosthaphæresium fabricatur. Motum primi circelli super C præceptor anomaliā vocat, eo namq; motu prostaphæresis deprehenditur. Sic F centrum secundi circelli in circumferentia primi à D puncto in sinistram discedens, describat angulum, qui sub D C F sit graduum 30, & in crcumferentiam circuli A B ex centro C, eiecta C F H totidem graduum A H, arcum continebit, similem arcui D F primi circelli: & quia secundi circelli punctum G ab H ad dextram ratione dupla processit, à signo H in signum G linea recta ducta, patet eandem esse semissem dupli arcus A H, & G C semissem dupli arcus residui A H arcus de quadrante. Quare & A. G 1340 partium, quarū quæ ex centro 10000, quantum videlicet G distat ab A in diametro A B. Quod si vero A B præsupponatur 60, G erit taliū 4, & G B 56, vnde facta parte proportionali ad 24, habebitur in qua parte assumptæ lineæ rectæ determinatæ G signum subsistat in tali casu.

E ij   His ita

His ita πϱϗϰύϱϊϸ̈α sanè μύϸϸέ perceptis, in facili fuerit in-
telligere, quomodo & maxima æquinoctialis ab eclipticæ
plano obliquitas varietur, & vera æquinoctiorum præcessio
inæqualis fiat. Principio namᴓ, cum breuiores arcus à line-
is rectis, quoad sensum quidem, nihil differant, æquinoctia-
lis medij polo septentrionali punctum C imaginatione appli-
cetur. Linea autem A B sit arcus coluri distinguentis solsti-
cia media, B inter polum æquinoctialis medij septentrionalem
& adiacentem polum eorum qui eclipticæ polis æquidistant,
quare et terminus minimæ poli diurnæ reuolutionis, seu ter-
ræ, ab eclipticæ, vt dictum, polo distantiæ. A. verò inter eun-
dē Boreālē æquinoctialis medij polū, et eclipticæ planū vnde
& maximæ poli terræ, à polo eclipticæ, remotionis. Præterea
duobus circellis linea A B, vti conuenit, applicatis, intelliga-
tur quantum ad præsens polus terræ Borealis in G puncto, &
motu duorum circellorum composito, lineam A B. 24 minut.
describere: simili nempe machinatione polo meridionali mo-
to, lege oppositionis seruata, ceu pendente mundo maximam
declinationem mutante: Et assumatur primum circellum in
xxxiiij M xxxiiij annis ægyptijs reuolutionem complere, &
terminum à quo principium motus anomaliæ esse. A.
punctum circumferentiæ circuli, cuius diameter libratione pri-
ma describitur: atᴓ cuilibet statim patebit, si præter hanc vni-
cam poli terræ nullam haberent librationem, ipsiᴓ poli ter-
ræ à coluro distinguente solsticia media non abscederent, quo-
modo tali polorum terræ motu, tantum angulus inclinatio-
nis plani æquinoctialis veri ad eclipticæ planum, propter po-
lorum suorum progressum ab A versus C ad B decresceret,
contrà aliam circulationem complendo, à B ad C versus A
cresceret, nullamᴓ propterea inæqualitatem in æquinoctio-
rum præcessione appareret.

Porrò autem quoniam per obseruationes certò constat,
puncta æquinoctialia vera, à punctis æquinoctialibus medijs
hinc inde 70 minut. maxima prosthaphæresi elongari, obli-
quitatisᴓ mutationem, ad hanc duplam rationem habere: con-
stituendam D. Præceptor & alteram insuper illa inferiorem li-
bra-

brationem animum suum induxit, qua videlicet poli terræ à
coluro distinguente solsticia media, in mundi latera excurrerẽt,
idcp ita vt huius secundæ librationis A C B arcus, seu linea re
cta, cum coluro distinguente solsticia media quatuor angulos
rectos constituat. At verò in septentrione A dextrum mundi
latus, B sinistrum occupet: in meridie autem A sinistrum, B
dextrum & C huius, per notas G primæ librationis vtrincp
A C B lineas 24 minut. eiusdem describat: denicp in huius G
notas poli terræ re vera affigantur, & hac secunda libratione
vtrincp à dicto coluro in A vel B extremis terminis constitu=
tis, 28 tantumodo minutis deflectantur, cum polis in talib.
locis, colurus distinguens solsticia vera, cum distinguente sol=
sticia media notabiliter, maiorem angulum 70 minut. non cõ=
tineat.   Verum, quoniam prosthaphæreses præcessionis
respectu ad punctum vernale medium sumendæ, D. præce=
ptor secundam librationem, tancp per punctum vernale ve=
rum ad medium contingeret, eandem perpendit, maxime cum
hunc in modum prostaphæresiũ inuestigatio sit facilior. Qua
re & linea A B 140 minut. erit, & sic disposita vt respondeat
lineæ Boreali librationis secundæ: C autem in puncto verna=
li medio, puncto vernali vero G notam occupante, & vt quæ
ex centro alterutrius circellorum 35 minut. sit.   Præterea aue
tem terminus à quo initium motus, est punctum vernale me=
dium, à quo punctum vernale verum ad dextram A versus
excurrit.   Anomalia vero numeratur à puncto supremo cir=
culi, cuius dimetientem punctũ vernale verum describit, quod
in eiusdem circuli circumferentia ad septentrionem à coluro æ=
quinoctiorũ medio determinat. Et cũ in vna obliquitatis re
stitutione, præcessionis inæqualitas bis cõpleatur, huius secun
dæ librationis anomalia in M D ccxvij annis ægytijs persi=
cietur.   Quare & obliquitatis anomalia ex tabulis desum
pta duplicata, præcessionis anomaliam reddit, & illi simpli=
cis, huius vero duplicatæ cognomen est.   Quod si secunda
hæc libratio tantum ponenda fuisset, angulus inclinationis pla
ni æquinoctialis veri & eclipticæ, quod quidem dignum ani
maduersione esset, non variaretur, vt patet.   Verum om=
                                    E iij   nis aps

his apparentiarum diuersitas propterea contingens in sola praecessionis aequinoctij veri inaequalitate deprehenderetur; virisq; autem librationibus coincidentibus, poli terrae sibi inuicem occurrentibus, vt dictum, motibus circa polos aequinoctialis medij, figuras corollarum intortarum deliniabunt. Et cum poli terrae in colurum distinguentem solstitia media incidunt, verus coluruscum medio in eodem iacebit plano, punctumq; vernale verum cum medio coniungetur: cum tamen niſi polis vtriusq; aequinoctialis coniunctis, plana aequinoctialium, & colurorum distinguentium tam media, quàmvera solstitia, & aequinoctia omnino coniungentur.
Polo autem septentrionali in parte à C secundae librationis versus A dextrum limitem, morante, meridionali polo in puncto oppositoconstituto, aequinoctium verum sequitur medium, & Sol prius in medium quàm verum aequinoctialem incidit. Sed polis terrae mundi latera permutantibus, vt nempe polus Borealis à coluro solstitiorum mediorum siniſtrum, australis dextrum latus teneat, verum aequinoctiũ praecedit medium, citiusq; Sol cum vero, quàm cum medio aequinoctiali congreditur.   Caeterum ab A versus B polis terrae procurrentibus, quia aequinoctium verum Soli quaſi obuiam procedit, annus ad aequinoctia propter hanc causam decrescit; à B vero versus A, cum Solem quaſi fugiat, annus ad aequinoctia crescit. Et polis terrae circa C haerentibus, breuiori annorum spatio notabile anni crementum aut decrementum percipitur.   Cumq; apparens stellarum fixarum processus annuae quantitati ad aequinoctia colligatus sit, eadem prorsus ratione velotior & tardior punctorum solsticiorũ & aequinoctiorũ à stellis fixis elongatio in antecedentia animaduertit.
    De Solis autem Apogio quae principio ex obseruationibus secundum D. praeceptoris mei sententiam deduximus, quantum ad aequinoctij verni ab eo elongationem attinet, ex mox dictis satis innotuit.   Progressus vero ipsius apogij sub ecliptica à motu centri parui circuli, & orbis magni centri, in parui circuli circumferentia vniformi latione dependet. Diameter orbis magni aut eclipticae per Solis paruiq; circuli centra tranſiens, est linea mediarum absidum Solis; Sed diameter per

Solis orbis'cȝ magni centra eſt linea verarum abſidum?
Quemadmodum autem centrum orbis magni inter Solem et
locū eclipticæ vbi Sol perigium tenere creditur, reperit:ita ſimi
liter centrū parui circuli inter locū perigij medij et Solē ſtatuit.

Tempore Ptolemæi linea verarum abſidum à prima ſtel
la Arietis in 57 grad. 50 minut. loco apogȳ apparentis, & in
237 grad 50 min perigij vtrincȝ terminabatur. Mediarū au‑
tem abſidum in 60 grad. 16 minut. & puncto oppoſito 240
grad. 16 minut. Nam centrum orbis magni, à ſumma parui

circuli à centro Solis diſtantia 21 $\frac{1}{3}$ fere grad. in anteceden

tia ‚pceſſerat, tātundē nempe eodē tempore anomalia ſim plici,
quæ & obliquitatis exiſtente. Vniformiter autem procedente
centro parui circuli ſuper Solis centro, & orbis magni centro
in parui circuli circumferentia, viſa eſt ſumma abſis Solis, tem‑
pore obſeruationis, quã habuit D. præceptor, 69 grad. 25 mi.
à prima ſtella Arietis tenere. At cum eodem tempore anoma‑
lia ſimplex 165 grad. fermè eſſet, proſthaphærelis 2 grad. 10
minut. fermè reperta eſt, centrum cȝ parui circuli inter Solem
& 251 grad. 35 minut locum perigij medȳ conſtitit. Præ‑
terea eccentricitas orbis magni ſeu excentrici Solis, ſi placet ita

loqui quæ Ptolemæo $\frac{1}{24}$ eius quæ ex centro orbis magni fuit

noſtra ætate $\frac{1}{31}$ partem ferè attingit, vt obſeruationes oſten‑

dunt: & D. præceptoris hypotheſibus conſtitutis, Mathema‑
tica adhibita, facile deducitur. Quomodo autem, & propter
centri orbis magni in paruo circulo motum, eccentricitates
quincȝ planetarū varientur, vt in cauſis renouandarū hypothe
ſiū propoſuimus, haud magno cū labore intelligi poteſt. In cõ
templatione vero quincȝ planetarū, cū duo potiſſimū cõſide‑
randa veniant, quò, & quantus centri terræ ad deferentium
planetas centra acceſſus vel receſſus fiat: Deinde quã illud au‑
gmentū vel decrementū rationē, ad illam quæ ex centro deferē
tis cuiuſlibet planetæ habeat, nõ opus erit, cauſas longius pete‑
re. In Satur. cū vel tota dimetiēs parui circuli nullū perceptibi‑
lem

lem admodum refpectum, ad eam quæ ex centro deferentiæ
eius habeat, propterea quod primus fub ftellato orbe feratur,
nullam variationis eccentricitatis Saturni, obferuationes inge
rere poterunt.   Deinde quià Iouis apogium per quadran
tem ferè à Solis apogio conftitit, hodie propter centri orbis
magni proceffum, nulla fenfibilis eccentricitatis eius depræhen
ditur mutatio, tametfi notabilis & perceptibilis ratio diame-
tri parui circuli, ad eam quæ ex centro orbis fui eſſet.   Atq
hæc eſt caufa, quare in Mercurio quoq nulla eccentricitatis fen
tiatur mutatio, cum fimiliter Solis apogij latus, fuo apogio
claudat.   Martis apogium diſtat ab apogio Solis ad finiſtram
50 ferè grad.   Veneris autem ad dextram 42 grad.   Sunt
itaq centra horum deferentium in idoneis locis conſtituta, ad
percipiendam variationem: & cum diameter parui circuli ad
vtriusq orbem, notabilem habitudinem habeat, obferuatio-
nibus de duobus his planetis per triangulorum doctrinam ex
aminatis, inuenit D. præceptor Martis quidem eccentricitati

$\frac{1}{42}$, Veneris verò $\frac{1}{5}$ partem, propter acceſſum centri orbis ma
gni ad Solem deceſſiſſe.   Ne autem vnus aliquis motus,
terræ attributus, parum teſtimonij videretur habere, induſtria
τȣ σοφȣ δημιουργȣ factum eſt, vt quilibet motus pariter et in om
nium planetarum apparentibus motibus notabiliter depræ
henderetur.   Adeo paucis motibus πλειονοτοι τοισ φαυμισιοισ
in natura neceſſarijs, satisfieri opportunum fuit. Ideoq & cen-
tri orbis magni motus non tantum ad Solem, & planetas eun-
dem circumdantes, fed etiam ad lunæ paſſiones pertingit.
Quemadmodum namq Ptolemæus diſtantiam Solis à terra
maximam conſtituit eſſe 1210 partium, qualium eſt quæ ex
centro terræ vna, & axem vmbræ earundem 265, ita D. præ
ceptor demonſtrat noſtra ætate eandem Solis à terra maximâ
elongationem eſſe 1179 partium, & axem coni vmbræ 265.
Cætera verò quæ his cohærent, ad vtriusq luminaris motus
& paſſiones, propter mutatas hypotheſes, perpendendas, ſe-
cundæ Narrationi huic fubſecuturæ refaruanda putaui.
                                                                        Dum

Dum vere dignam admiratione hanc nouarū hypothesiū, *Altera pars*
D. præceptoris mei fabricam animo mecū reputo, sæpius mi- *hypothesi-*
hi doctissime D. Schonere Platonici illius in mentem venit, *um, de mo-*
Qui postcǧ ostendit quid in Astronomo requiratur, subijcit de *tibus quin-*
ni *ᵇ*, ᾧσ ὀυκ ἄν ῥᾳδίωσ ποτέ πᾶσα φύσισ ἱκανὴ γένοιτο θεωρῆσαι μὴ θαυ- *ǧ planeta-*
μασῆσ μετέχουσα.   Cum autem apud *rum.*
te anno superiori essem, atcǧ in emendatione motuum Regio-
montani nostri, Peurbachij præceptoris eius, tuos & aliorum
doctorum virorum labores viderem, intelligere primum inci-
piebam, quale opus, quantus'cǧ labor esset futurus, hanc regi-
nam Mathematum Astronomiam, vt digna erat, in regiam
suam reducere, formam'cǧ imperij ipsius restituere.   Verùm
cum Deo ita volente, spectator ac testis talium laborum (quos
alacri sanè animo & sustinet & magna ex parte superauit iam)
D. Doctori, præceptori meo sim factus, me nec vmbram qui-
dem tantæ molis laborum somniasse, video.   Est autem
tanta hæc laborum molis, vt non cuiusuis sit Herois, eandem
ferre posse, & superare denicǧ.   Quibus de causis ego qui-
dem veteres memoriæ prodidisse crediderim, Herculem Ioue
summo prognatum, cælum, postǧ humeris suis amplius dif-
sideret, Atlanti iterum imposuisse, qui ætate longa assuefactus
magno animo, infractis'cǧ virib⁹, vt semel cæperat, hoc onus
vscǧ perferret.   Adhæc diuinus Plato, sapientiæ, vt inquit
Plinius, antistes, haud obscure in Epinomide pronunciat: A-
stronomiam Deo præeunte inuentam esse.   Hanc Platonis
sententiam, alij aliter forsasse interpretantur: ego verò, cum
videam D. Doctorem, præceptorem meum obseruationes
omnium ætatum cum suis, ordine ceū in indices collectas, sem-
per in conspectu habere: Deinde cum aliquid vel constituen-
dum, vel in artem & præcepta conferendum, à primis illis ob
seruationibus ad suas vscǧ progredi, & qua inter se ratione
omnia consentiant, perpendere: Porrò quæ inde bona con-
sequentia, Vrania duce, collegit, ad Ptolemæi, & veterum hy-
potheses reuocare, & postǧ easdē summa cura perponderans,
vrgente Astronomica ἀνάγκῃ deserendas deprehendit, necǧ
                              F   quidem

quidem fine afflatu diuino & numine Diuum nouas hypothe
fes affumere, & Mathematica adhibita quidnam ex talibus bo
na confequentia deduci poffit, Geometrice conftituere:atcp ve=
terum deni cp & fuas obferuationes ad affumptas hypothefes
accommodare, & fic,poft iftos labores omnes exantlatos, le=
ges Aftronomiæ demum confcribere,hunc in modum Plato=
nem intelligendum effe puto.   Mathematicum fiderum mo=
tus perfcrutantem,rectiffime affimulari cæco,cui tãtummodo
baculo fuo duce,magnum, infinitum,lubricum,infinitiscp de=
uijs inuolutum iter fit conficiendum.   Quid fiet? aliquan=
diu follicite incedens, baculo fuo viam quæritans, & eidem
quandocp defperandus innixus,cœlum,terrã, omnes'cp Deos
inuocabit,mifero fibi auxilio vt veniant.   Hunc permit=
ret quidem Deus aliquot annos fuas experiri vires,vt intelligat
denicp,baculo fuo minime ex inftãti periculo fe liberari poffe.
Porrò iamiam animũ defpõdenti,ipfius mifertus Deus manũ
porrigit,manu'cp ad optatã metã perducit. Baculus Aftrono=
mi eft ipfa Mathematica feu Geometria,qua viam tentare et infi
ftere primum audet.   Quid etenim humani ingenij vires ad
diuinas has res,tamque à nobis diffitas procul, inueftigan=
das, quàm caligantes oculi?   Proinde nifi deus illi pro fua
benignitate motus heroicos indiderit, & tancp manu, per in=
comprehenfibile aliâs rationi humanæ iter, deduxerit, haud
crediderim vlla in re Aftronomum cæco illo præftantiorem
et feliciorem effe: præterquàm quod fuo ingenio aliquando fi=
dens, et fuo illi baculo, diuinos exhibês honores, ipfam Vra=
niam ab inferis reuocatam, fibi congratulabitur. Vbi autem
rem fecum recta reputarit via, fe non beatiorem Orpheo effe
fentiet, qui quidem animo fuam fe Euridicen fequi cernebat,
cum ex orco faltabund⁹ afcenderet: poft verò,vt ad ora auer=
ni fuit peruentum,quam maxime habere fe fperabat,ex oculis,
iterum ad inferos delapfa,euanuit. Perpendam us itacp vt in
cœpimus & in reliquis planetis D.Doctoris,præceptoris mei
hypothefes,vt videamus,an conftanti animo,& Deo præeun
te, Vraniam ad fuperos perduxerit, fuæ'cp dignitati refti=
tuerit.

                                                        Poffet

Poffet quifpiam fortaffe ea, quæ de motu terræ circa So‹
lis, Lunæ'ꝗ apparentes motus dicuntur eludere: quamquàm nõ
video, quomodo præceffionis rationem ad fphæram ftellarũ
tranftulerit.　　　Reliquorum profectò planetarum apparen‹
tes motus, fi aut ad principalem Aftronomiæ finem, & fifte‹
matis orbiũ rationẽ ac confenfum: aut ad facilitatẽ fuauitatem
ꝗ, vndiꝗ caufis apparentium elucentibus, refpicere quis velit:
nullis alijs affumptis hypothefibus, commodius ac rectius de‹
monftrauerit.　　　Adeò omnia hæc tanꝗ aurea catena, inter fe
pulcherrime colligata effe apparent: & planetarum quilibet
fua in pofitione, fuo'ꝗ ordine, & omni motus fui diuerfitate,
terram moueri teftatur, & nos pro diuerfo globi terræ, cui ad‹
hæremus fitu, credere diuerfimodis eos motibus proprijs diua
gari.　　　Et quidem fi vfꝗ alibi eft videre, quomodo Deus
mundum noftris difputationibs reliquerit, hoc certe loco vt
quod maxime, eft cõfpicuum.　　Neꝗ verò quemꝗ mouere
hoc poffe arbitror, quod Deus Ptolemæum, & alios item præ
ftantes　　Heroas hac in parte diffentire patiatur: cum non
fit hæc ex earum opinionum genere, quas Socrates in Gorgia
hominibus pernitiofas dicit: Neꝗ vllam hinc aut ars ipfa, aut
diuinatrix illa, exinde promanans, ruinam trahat.

　　　Veteres omnem motus diuerfitatem, quam tres fuperio
res per refpectum ad Solem habere comperiebant, proprijs
ipforum epicyclis tribuebant.　　Deinde cum in ijsdem plane‹
tis reliquam apparentem inæqualitatem, minime fola eccentri‹
ci ratione fieri perfpicerent: ac calculus in eorum motuum fup‹
putatione, ad imitationem hypothefium Veneris, cum experi‹
entia & obferuationibus confentiret, talem quo ꝗ fecundæ ap
parentis inæqualitatis rationem affumendam putauerunt, qua‹
lem ex demonftrationibus Venerem habere concludebant:
vt nempe, quemadmodum in Venere, cuiuflibet planetæ
centrum epicycli, æquidiftanter quidem centro eccentrici
moueretur, fed æqualitatem motus refpectu centri æquan‹
tis fortiretur, ad quod punctum ipfe quoꝗ planeta
　　　　　　　　　　　　F ij　　　　　　　motu

motu proprio in epicyclo, æqualiter ab apogio medio disce-
dens, relationem haberet. Cæterum quemadmodũ. Venus
proprio & peculiari in epicyclo motu suas reuolutiones con-
ficeret: ratione autem eccentrici medio Solis motu incederet:
ita illi contrà in epicyclo Solem respicerent, in eccentrico vero
peculiaribus ferrentur motibus ipsæ obseruationes, vt consti-
tuerent, exigebant: dum terram in vniuersi medio retinere ni-
tuntur.   At præterquàm ea quæ ad Veneris apparentias
saluandas competere iudicauerunt, in Mercurij Theoria alium
insuper æquantis locum, & quod ipsum centrum, à quo epicy-
cli esset æquidistantia, in paruo circumuolueretur circulo reci-
piendum duxerunt.   Hæc acute sanè, vt veterum pleracʒ om
nia sunt inuenta, satis'cʒ concinna motibus & apparentijs, si or-
bes cœlestes inæqualitatem habere super proprijs centris, à quo
tamen natura abhorret admittamus: primam'cʒ & max. nota-
bilem diuersitatem apparentis motus quin cʒ planetarum, ipsis
(cum eandem in eis per accidens apparere constet) tancʒ pro-
priam tribuamus.

        In latitudinibus autem planetarum & illud quocʒ ἀξίω-
μα veteres negligere videntur, quod nempe omnes motus cor-
porum cœlestium, aut circulares sint, aut ex circularibus com-
ponantur: nisi fortasse quispiam Veneris & Mercurij reflexio-
nes declinationes'cʒ, quemadmodum paulò antè de motu de-
clinationis terræ est dictum, fieri intelligi velit, et declinationes
epicyclorũ in tribus superioribus, ac deuiationes in inferiorib⁹
per librationũ motus; Hoc, vt sanè concedatur, in reflexionib⁹
et declinationibus Veneris & Mercurij, siquidē eorũ inclinatio
num anguli, planorum eccentricorum et epicyclorũ, vbicʒ ijdē
manent; Declinationes vero epicyclorũ in tribus superioribus,
& deuiationes Veneris ac Mercurij per librationes fieri, com-
munis calculus refutat.   Vt namcʒ de deuiationibus tantum
dicam, quia minuta proportionalia, quibus deuiationes pro lo
cis centri epicycli extra nodos & absidas ratiocinamur, eadem
ratiõe indagarũt & cõstituerunt, qua in primi motus doctrina
portiũ eclipticæ declinationes inuestigan tur, fit vt in sexagesi-
mo gradu ab aliqua absidum eccentrici, centro quidem epicy-
                                                                cli ve-

cli veneris existente, colligamus deuiationem quinta minuto
rum, Mercurij autem $22\frac{1}{2}$ Quod si deferens poneretur per
librationes deuiare, in tali Veneris epicycli situ vera ratio non
vltra $2\frac{1}{2}$ minut· deuiationem, Mercurij verò $11\frac{1}{4}$ minut·
exposceret. In illius enim centri epicycli situ, angulus inclina=
tionis plani eccentrici ad eclipticæ non maior 5 minut·, in hu=
ius verò $22\frac{1}{2}$ ex librationum proprietate motus reperirentur.

Atᵠ ideo fortasse Ioannes de Regiomonte monendos studio
sos putauit, calculum in latitudinibus circa prope verum tan=
tum versari.   Postremo cum homines, quod Aristoteles
alibi pluribus ostendit, natura sua scire appetant, næ molestum
est satis, quod nusᵠ æque causæ τ δ̃ν φαινομίνων sint abstrusæ, at=
que, ceu cimmerijs tenebris, inuolutæ, quod ipse etiam Ptole=
mæus nobiscum testatur: vt interim plura de veterum in quin=
ᵠ planetis hypothesibus, ᵠ forte ipsa nouarum (vt sic dicam)
hypothesium cum enumeratio, tum ad veteres collatio re=
quirit, non adducam.   Ptolemæum equidem, & qui eum
sequuntur, æque atᵠ D. præceptorem ex animo amo. Siquidẽ
verò sanctum illud Aristotelis præceptum semper in conspectu
ac memoria habeo: φιλεῖν μὲν ἀμφοτέρυσ, πείθεδαι δὶ τοῖσ ἀκριβεσέροισ
δῦ· Etsi nescio, quomodo: me tamen magis ad D. præcepto=
ris hypotheses inclinari sentio. Id quod sit fortasse, partim quia
iam demum rectius me intelligere animum induco, suauissimũ
illud, quod Platoni ob grauitatem ac veritatem tribuitur,
τὸν θεὸν ἀεὶ γεωμετρεῖν·   Partim verò, quod in D. Præcepto=
ris Astronomiæ instauratione, ceu caligine discussa, aperto nũc
cœlo, & ambobus, vt dici solet, oculis, vim sapientissimi di=
cti illius Socratis in phædro, intuear: ἐάν τί τινα ἄλλον ὁρ·ήσομαι
δυνατὸν εἰσ ἕν κᶜὶ ἐπὶ πολλὰ πεφυκότα ὁρᾷν, τοῦτον διώκω κατόπιδε μετ' ἴχ=
νιον ὅσι θεοῖο·

His itaᵠ, quæ de terræ motu hactenus dicta sunt, à D.
præceptore meo confirmatis, sequitur (sicut in caulis renouan=
darum hypothesium retulimus) vt omnis diuersitas apparen=

F iij   tis mo=

Hypothe= ris motus planetarū, quæ in eis παρὰ τὸν δ᾿ πρὸσ τὸν ἥλιον δ᾿χημεrισ᾿ά.
ses motuū μὸυσ **contingere videtur, propter annuum terræ motum in or-
quinc̉ pla= be magno fiat:vt c̉ planetæ re vera sola adhuc altera inæqua-
netarū secū litate, quæ penes Zodiaci partes obseruatur incedant. Quam-
dum lon= obrem eis eæ hypotheses tantum, quibus duæ diuersitates mo-
gitudinē. tus demonstrari possunt, competunt. Quemadmodū autem
in Luna D. præceptor maluit epicyclo epicycli vti, ita in trib⁹ q
dem superioribus planetis, ad ordinem & motus commensu
rationem commodius demonstrandam eccentrepicyclos ele=
git: in Venere verò & Mercurio eccentri eccentricos. Cum
autem nos veluti ex terræ centro trium superiorum motus su-
spiciamus, at inferiorum reuolutiones tanc̉ infra nos intuea-
mur, consentaneum erat, vt ad centrum orbis magni, orbium
planetarum centra referrerentur, à quo deinde ad ipsum terræ
centrum motus, omnes c̉ apparentias quàm rectiss. transfera
mus.   Quare & in quinc̉ Planetis eccentricum illum intel
ligi oportet, cuius centrum extra centrum orbis magni est.
Verùm vt rectius intelligatur nouarum hypothesium consti=
tuendarum ratio, omnia deniqꝫ perspicua magis, magisꝙ in
aperto sint: Ponamus principio, quinc̉ planetarum pla-
na eccentricorum esse in eclipticæ plano, et centra deferentium
& æquantium circa orbis magni centrum, sicut apud veteres
circa terræ centrum.   Deinde spacia, quæ sunt inter orbis ma-
gni centrum, & puncta seu centra æquantium in partes qua-
tuor æquales diuidantur.   Porrò cuiuslibet quidem trium
superiorum centrum eccentrici in tertiam sectionem, ab orbis
magni centro apogium versus eleuetur: ac extensione quartæ
residuæ, in eccentrici circumferentia epicyclus describatur, &
apparebit fabrica motus proprij cuiuslibet in longitudinem. Si
itaꝗ ex D. præceptoris mei sententia, planeta in huius epicy=
cli circumcurrentis parte superiori in consequentia, in inferiori
in antecedentia ita procedat, vt centro epicycli existente in apo-
gio eccentrici, ipse planeta in perigio sui epicycli reperiat: et con
trà centro epicycli in eccentrici perigio morante, planeta epycicli
apogium obtineat: atꝗ hac motuum similitudine planeta
in epicyclo, cum centro epicycli in eccentrico pari tempore suas
                                                  periodos

periodos abfoluat, clarum eft, fublatis æquantibus fupe=
riorum planetarum diuerfitatem motus, refpectu centri orbis
magni regularem effe,& ex æqualibus componi. Epicyclus
namcp tali ratione affumptus,in munus æquantis fuccedit,&
eccentricus fuper fuum centrum,ac planeta in epiciclo ad centrũ
epicycli cui inhæret,æquali tẽpore,æquales defignat angulos.

Veneris autem motus fic conftabit,reiecto deferente,cu=
ius vicem orbis magnus fupplet,circa tertiam fectionem,exten
fione quartæ refiduæ, defcribatur paruus circulus. Deinde
centrũ epicycli Veneris,qui hic eccentricus eccentrici, eccentricus
fecundus & mobilis vocabit,in circũferentia dicti parui circuli
tali moueatur lege,vt quoties terræ centrum in abfidum line=
am inciderit, ipfum centrum eccentrici in puncto parui circuli,
centro orbis magni proximo exiftat. Terra autem media
fuo in orbe inter vtramcp abfida,ipfum centrum eccentrici Ve
neris in puncto parui circuli à centro orbis magni remotiffi=
mo fubfiftat,atcp ad easdem partes in fignorum confequentiã
quemadmodum & terra moueatur,duas tamen, vt ex his fe=
quitur,reuolutiones in vna terræ circuitione peragens.

Sed Mercurij motuum ratio,in genere quidem cum Ve=
neris Theoria,conuenit: recepto infuper epiciclo,cuius diame=
trum per libratiõem defcribat,propter diuerfitatem reliquam.
Cæterum vt fe ad terræ motum accommodet, recipit quanti=
tatem eius,quæ ex centro deferentis mobilis 3573 :Eccentricita
tem autem deferentis primi 736 partium: quantitatem eius,
quæ ex centro parui circuli,mobile deferentis centrum conti=
nens 211 part. ,atcp diametrum,dicti epicycli,380 partiũ,qua=
liũ ea quæ ex centro orbis magni ad centrũ terræ 10000. In mo
tu aũt talem legem fortitur,vt centrum eccentrici mobilis,cõtrà
ac in Venere cõtingebat,longiffime ab orbis magni cẽtro diftet
terra in abfidũ linea planetæ exiftente:et ad maximã propinqui
tatẽ accedat,terra ab abfidib.planetæ per quadrantem remota.
Epicyclum,vt patet,fixũ habebit,cuius diametrũ refpicientem
centrũ deferentis mobilis,ipfe planeta motu libratiõis reptãdo
in lineã rectam,defcribit,hac lege feruata,vt cũ centrũ eccentrici
mobilis in maxima à cẽtro orbis magni diftãtia fuerit,planeta
<div align="right">perigium</div>

perigium ſui epicycli teneat, quod eſt inferior terminus diame
tri, quàm deſcribit: vice verſa reliquum terminum, qui apo=
gium dici poterat, cum idem centrum eccentrici mobile proxi=
mum centro orbis magni fuerit. Motus autem abſidum plane=
tarum, quemadmodum & alia quædam alteri etiam reſeruan=
tur Narrationi.

Hæc eſt tota ferè hypotheſium ratio, ad omnem propriã
diuerſitatem motus planetarum, ſecundum longitudinem ſal=
uandam.　　Quapropter ſi oculus noſter in centro orbis ma=
gni exiſteret, radij viſuales ex eo per planetas, ceu lineæ vero=
rum motuum in ſtellarum ſphæram eiectæ, à planetis non ali=
ter in ecliptica circumducerentur, quàm dictorum circulorum
& motuum rationes exigerent: vt proprias eorum diuerſita=
tes motuum in Zodiaco oſtenderent.　　Verùm quia nos ter
ræ incolæ, ex ea cœleſtium apparentes motus contemplamur,
ad eius centrum tanÿ ad baſim, intimumÿ domicilij noſtri
omnes motus, apparentiasÿ referimus: eductis ex eo per pla=
netas lineis, veluti oculo ex orbis magni cêtro, in terræ centrũ
tranſlato, omnium inde, vt à nobis quidem videntur, τῶν φαινο
μένων diuerſitates ratiocinandas eſſe, patet.　　Veras autem
& proprias diuerſitates motus planetarum, ſi eſſet animus col
ligere, id per lineas ex centro orbis magni, vt dictum, exeũtes
efficiendum fore.　　Veruntamen, quo expeditius nos, ex ijs
quæ porrò reſtant, enumeranda ἐν τοῖς φαινομένοιϛ planetarum
explicemus, totaÿ tractatio facilior & ſuauior exiſtat, concipi=
antur ſanè animo, non tantum lineæ verorum apparentium
motuum ex centro terræ per planetas in eclipticam procedẽ=
tes, ſed etiam ex centro orbis magni, ideoÿ proprie diuerſita=
tis motus lineæ dictæ.

Incedente itaÿ terra motu orbis magni, vbi eò peruentũ
fuerit, vt ipſa in eadẽ linea recta inter Solẽ & aliquẽ ex tribus
ſuperioribus planetis interponatur, planeta quidem veſpertino
ortu oriri videbitur: & quia terra ſic ſita ipſi quam proxima
eſt, veteres poſuerunt planetam eſſe terræ proximum, & circa
epicycli ſui perigium.　　Sole autem appropinquante ad li=
neam veri & apparentis loci planetæ, quod ſit terra peruenien
te ad

te ad oppofitum iam dicti loci, planeta vefpertino occafu difpa
rere incipit, maximecβ à terra elongari, quoad linea veri loci
planetæ etiam per centrū Solis tranfeat, atcβ Sole inter plane-
tam & terram interueniente, planeta occultatur: à qua deinde
occultatione propter perpetuum terræ motum, quia linea ve-
ri loci Solis, à linea veri loci planetæ difcedit: planeta iterum
matutino ortu, vbi quantum arcus vifionis requirit, iuftam à
Sole diftantiam nactus fuerit, oriri confpicietur. Porrò quo-
niam orbis magnus in horum trium planetarum hypothefi-
bus, munere epicycli à veteribus cuilibet planetarum attribu-
ti fungitur: in diametro orbis magni, ad planetam vfcβ conti-
nuata, apogiū perigium'cβ planetæ verum, refpectu orbis ma-
gni reperietur. Apogium autem & perigium medium,
im diametro orbis magni, quæ lineæ ex centto eccentrici in cen
trum epicycli prot actæ æquidiftanter mouetur: & cum terra
in mediate verfus planetam, ipfi planetæ appropinquet, in reli-
qua & oppofita remoueatur, illic quidē extremitates diame-
trorum orbis magni perigia referent: hic vero apogia, cum il-
la medietas in locum inferioris epicycli partis fuccedat, hæc au-
tem fuperioris. Fac effe, haud longè à Solis & planetæ con-
iunctione fit terræ centrū in planetæ apogij loco vero, refpectu
fcilicet orbis magni, ipfacβ linea propriæ diuerfitatis cū apparē
tis loci linea planetæ, coincidat. Ab hoc autem loco terra fuo
motu procedente, lineæ propriæ diuerfitatis et linea veri loci
planetæ, fefe in corpore planetæ interfecare incipient. Altera
regula-i fuo motu diuerfo in fignorum confequentiam perget:
altera vero ab eadem fefe reflectens, referet nobis planetam ve
lotius in ecliptica incedere, quàm reuera motu proprio proce-
dat. Verum terra peruerniente ad portionem orbis magni plane
tæ propiorem, hæc è veftigio in antecedentia fefe conuertit, vt
apparens planetæ progreffus nobis fubinde tardior videatur.
Amplius quia terra verfus planetam afcendit, ipfa veri mo-
tus Solis linea à planeta promouetur: ac planeta ad nos accedere
veluti de parte fuperiori defcendens æftimabitur. Tam diu
autem planeta directus videbitur, quoufcβ terræ centrum ad
eum, orbis magni ad planetam, fitum peruenerit, vbi angulus
<div align="center">G   diurnus</div>

diurnus reflexionis lineæ veri loci planetæ in antecedentia æ=
qualis exiftat, angulo diurno propriæ diuerfitatis in côfequen
tia.   Ibi namcp duobus fe perimentibus motibus planeta fta=
tione prima per aliquot dies, pro ratione Orbis magni ad ec=
centricum planetæ propofiti, ipfiuscp planetæ in fuo orbe fitû,
propriacp motus fui velocitate, ftare apparebit.   Porrò ab
hoc item loco terra propiore facta planetæ, fit vt planetam re=
gredi, & in antecedentia moueri credimus, ipfa quippe refle=
xione notabiliter proprium planetæ motum fuperante, idcp,
eòvſcp, quo terra perigium verum planetæ refpectu orbis ma
gni contingat, vbi planeta in medio repedationis loco, oppofi=
tioni Solis, terræ cp proximus confiſtet.   Quo in fitu Mars re
pertus, præter communem, ratione orbis magni, reflexionem
feu diuerfitatem afpectus, & aliam infuper, propter perceptibi=
lem quantitatê eius quæ ex centro terræ ad ipfius diftantiam,
afpectus diuerfitatem admittit, quemadmodum diligens tefta=
bitur obferuatio.   Poftremo vt terra abhac centrali cum pla=
neta, vt ita dicam, coniunctione in confequentia remouebitur:
ipfa reflexio in antecedentia eadem ratione, qua antè creuerat,
minuetur, donec facta denuo motuum compenfatione, plane=
ta ftatione fecunda ftationarius fiat: poftea proprio planetæ mo
tu fuperante reflexionem, terra procedente dirigatur, quo tan=
dem in directionis loco medio planeta appareat, terra iterum a=
pogium planetæ verum vnde eam deduximus, obtineat: om
nes cp iam dictas apparentias ordine in fingulis planetis nobis
introducat.   Atcp hæc eft prima orbis magni, in contempla=
tione motuum planetarum vtilitas, qua à tribus magnis epi=
cyclis in Saturno, Ioue, & Marte liberamur. Quod autem ve=
teres argumentum planetæ dixerunt, hoc D. præceptor motû
commutationis planetæ vocat quia per eum apparentias ra=
tione motus terræ in orbe magno contingentes ratiocinamur,
quas nihil aliud effe conftat refpectu orbis magni, quàm pa=
rallaxes Lunæ, propter habitudinem eius quæ ex centro terræ
ad eiufdem orbes.   Cuiuslibet autem planetæ centri epicycli
motus, à terræ motu æquali, qui et Solis mot⁹ medius eft, fub
tractus, commutationis motum æqualem relinquit: & nume=
                                                          ratur

ratur ab apogio medio, à quo & terra æqualiter elongat, vn=
de & in promptu cuiuslibet verus & apparens planetæ mo=
tus in ecliptica ex D. præceptoris tabulis prosthaphæresium
planetarum habetur.

Alteram porrò orbis magni vtilitatum partem, haud il=
la leuiorem, in Veneris & Mercurij Theoria nanciscemur. Cũ
nam'cȝ nos hos duos planetas ex terra tanquàm è specula ob=
seruemus, & si ipsi non aliter atcȝ Sol fixi manerent, tamẽ nos,
quia per orbis magni motum circa eos circumducimur, nihilo
minus ipsos planetas, vt Solem, suis motibus zodiacum pera=
grare putaremus.   Et quia obseruationes testantur Vene=
rem et Mercurium in suis orbibus etiam proprijs moueri mo=
tibus, præter Solis motum medium, quo in succedentia ferun=
tur, & alia quocȝ in eis apparentiæ per accidens, ratione orbis
magni conspicientur. Principio enim orbes eorum, epicyclos
putabimus, qui tancȝ proprijs deferentibus cum Sole æquali=
bus passibus zodiacum conficiant: sic terra existente ad perigiũ
primorum deferentium, toti ipsorum orbes in eccentrici apo=
gio existimabuntur, & contra ad apogium orbes in perigio.
Præterea quemadmodum planetis superioribus apogia &
perigia per respectum ad planetas, ipso in orbe magno deter=
minantur, ita econuerso in Veneris & Mercurij orbibus, respe
ctu centri terræ vbicum cȝ fuerit signantur, & pro motu ter=
ræ annuo per omnia deferentium loca pertrahuntur. Termini
diametri deferētis mobilis, quæ lineæ medij motus Solis, sci=
licet quæ excentro orbis magni in terræ centrum æquidistanter
mouetur, sunt absides mediæ. Absides quæ in parte defe=
rentis mobilis, opposita terræ, summæ: quæ in propiore,
infimæ haud iniuria vocabuntur. Si autem motus terræ annu
us quiesceret, cum Venus in nouem mensibus suam reuolutio
nem, vt supra dictũ, peragat, & Mercurius quasi in tribus, qui
libet in suo temporis spatio, bis nobis è terra cum Sole cõiun
gi, bis stationarius, bis cȝ extremos limites in deferentium cur=
uaturis contingere: semel autem matutinius, vespertinius, re=
trogradus, directus, apogæus et perigæus appareret. Por
rò oculo in orbis magni centro, proprij saltem motus diuer=

ſi Veneris & Mercurij, quemadmodum & reliquorum ſeſe
offerrent:nempe totum zodiacum ſuis motibus peragrantes
fierêt ad Solem oppoſiti,reliquisꝗ eum intueri ϰ̔ηματισμοῖο cer
nerentur.　　　Verumenimuero cum necꝗ ex centro orbis ma
gni ſtellarum motus contemplemur, necꝗ terra motu annuo
quieſcit,ſatis perſpicuum erit,quare eædem apparentiæ nobis
terram inhabitantibus tanta varietate appareant.　　Venus &
Mercurius terræ præſaltant,pro ſuorum orbi im magnitudi＝
ne motu velotiore:ipſa terra motu ſuo annuo eos inſequitur:
quare Venus ad terram in xvi ferè menſibus,　Mercurius in
quatuor reuertitur: atꝗ in hoc temporis ſpatio omnes appa＝
rentias,quas Deus ex terris conſpici voluit,nobis oſtendere re
petunt.　　　Lineæ propriarum diuerſitatum motus regulari＝
ter incedunt, ſuper centro orbis magni ſuas reuolutiones in
tempore ſibi à Deo præffinito conficientes.　Lineæ autem ve＝
rorum locorum,quæ & ex centro terræ per Venerem et Mer
curium traiectæ, longe aliter circumducuntur, tum quia à
puncto extra illorum orbes educuntur, tum quia illud ipſum
punctum eſt mobile.　Nos putamus Venerem et Mercurium
in ſuis orbibus eo motu procedere, quo veteres in epicyclo
eos moueri ſtatuerunt: cum tamen ille motus ſuperatio tantum
ſit, qua velotior planeta, terræ motum ſeu Solis medium ex＝
cedit.　Hanc ſuperationem vocat D. præceptor commutatio＝
nis motum, ijſdem plane de cauſis, quib. in tribus ſuperiori＝
bus.　　Fit itaꝗ, vt omnes Veneris et Mercurij apparentiæ,
quæ etiam ex terra fixa apparuiſſent, propter terræ motum
tardius reuertantur:vt eꝗ eædem in omnibus ſuorum deferen＝
tium partibus,& eclipticæ locis contingant, quo omnimodi
eorum motus deprehenderentur.　　Nequaquam enim terra
ſub Cancro fixa, Ptolemæᵒ deprehendiſſet Mercurium breuiſ
ſimas à Sole circa Libram euagationes,& Venerem circa Tau＝
rum habere.　Vbicumꝗ autem terra ſuo in orbe magno fue＝
rit,& Venus aut Mercurius in lateribus ſui deferentis depre＝
henſus,maxime à Sole nobis diſtare videbitur.　Eductis ve
ro ex centro lineis contingentibus vtrinꝗ Veneris & Mercurij
deferentes,in ſuperiori portione ad terram relatione facta,in ſi
　　　　　　　　　　　　　　　　　　　　　gnorum

gnorum consequentiam ferentur:in inferiori & terræ proxi-
ma contrâ, vbi & ſtare retrocederecʒ ad ſenſum videntur: cũ
nempe linea veri loci planetæ æqualem angulum diurnum,
ſuper terræ centro efficit in antecedentia,angulo medij motus,
qui & terræ in conſe. uentia, vel maiorem. &c.   Ex his itacʒ
manifeſtum eſt,quare Venus & Mercurius circa Solem inuo-
lui conſpiciantur.   Cæterum ſole quocʒ clarius eſt,orbem
terram deferentem vere Magnum appellari. Si enim Impera
tores propter res feliciter bello geſtas,aut gentes deuictas, Ma-
gnorum accepere cognomenta,dignus certe & hic orbis erat,
cui auguſtiſſimum attribueretur nomen,cum ipſe quaſi ſolus,
legum cœleſtis politiæ participes nos faciat:omnesʒ errores
motuum emendet:cumcʒ in gradum ſuum pulcherrimam hanc
philoſophiæ partem reponat.   Ideo autem eſt dictus orbis
magnus,quia tam ad ſuperiorum planetarum orbes, cʒ ad infe
riorum magnitudinem notabilem habet, quæ præcipuarum
apparentiarum ſit occaſio.

    Porrò in latitudinibus planetarum primum eſt videre,
quàm recte deferenti centrum terræ Magni nomen tribuatur:
quod eò inſuper maiorem admirationem meretur:quò veterũ
hac de re præcepta perplexiora obſcurioracʒ eſſe conſtat. Mo-
tus planetarum in longitudinem,egregia quidem teſtimonia
perhibent,quod terræ centrum,orbem,quem dicimus magnũ
deſcribat.   In Latitudinibus autem planetarum eius vtilita-
tes,ceu in illuſtri quodam loco poſitæ,magis ſunt conſpicuæ,
cum ipſe nuſcʒ ab eclipticæ plano diſcedens, præcipua tamen
cauſa omnis diuerſitatis apparentiarum in latitudinem exiſtat.
Tu verò doctiſſ. D. Schonere ideo ſummo amore orbem
hunc proſequendum et amplectendum uides,quod totam mo
tus in latitudinem doctrinā tam breuiter, tamcʒ dilucide,om
nibus propoſitis cauſis, ob oculos ponat.   Lineæ

    Sint primo trium ſuperiorum deferentes ex Ptolemæi
ſententia ad eclipticam inclinati, quorum apogia ſeptentrionẽ
verſus,perigia autem ad meridiem reperiantur:vtcʒ ſic ipſi pla
netæ in ſuis orbibus, quemadmodum Luna in orbe decliui,
extra cuius planum non egreditur,circumferantur.   Lineæ

(margin) Quõdo
planetæ ab
ecliptica diſ
cedere appa
reant,

G   iij   propri

propriæ diuerſitatis, Dracones planetarum, vt vulgo vocant, deferentium ad eclipticæ habitudines & interſectiones, ad planetarum motus deſignabunt. Lineæ autem verorum locorum, prædictas lineas in centris planetarum interſecantes, pro centro terræ in orbe magno ſitu ad planetam, & ipſius planetæ in ſuo orbe decliui, vera planetarum loca propiora, & remotiora ad eam quæ per ſignorum medium referent, pro angulorum habitudine, quos ad eclipticæ planum conſtituunt, quemadmodũ Mathematica ratio expoſcit. Quam ob cauſam planeta in quacũ ſui deferentis & epicicli in circulo decliui, portione morante:& centro terræ exiſtente in remotiori à planeta orbis magni medietate, quàm veteres ſuperiorem epicicli partem dixere, latitudines apparentes minores fieri oportere, angulo inclinationis deferentis ad planum eclipticæ, clarum eſt. Quia in tali centri terræ ſitu ad planetam, angulus apparentis latitudinis acutior eſt angulo inclinationis, interior videlicet exteriori & oppoſito. Porrò centro terræ perueniente ad propiorem medietatem orbis magni ad planetam, contra latitudo apparens maior angulo inclinationis, ijſdem plane de cauſis & contrà, conſpicitur: quippe qui antè exterior & oppoſitus, iam interior. Atque hæc eſt cauſa, quamobrem veteres putauerint, centro epicicli extra nodos conſiſtente, ſuperiorem ſemper epicicli partem, inter deferentis & eclipticæ planũ exiſtere: reliquam autem medietatem ad eam partem vergere, ad quam medietas deferentis à centro epicicli occupata inclinaret. Diametrum vero tranſeuntem per longitudines medias epicicli, æquidiſtanter eclipticæ plano incedere. Et epiciclo in nodis, planetam latitudinem nullam habere, in quacumcõ epicicli ſui parte, quod in his hypotheſibus verificatur, planeta in aliquo nodorum morante, & terra quacumcõ in parte orbis magni reperta. Si angulus ſuperficiei epicicli ad ſuum deferentem, in veterum hypotheſibus æqualis perpetuo angulo inclinationis plani deferentis & eclipticæ fuiſſet repertus, hoc eſt, ſi epicicli planum ſemper in æquidiſtantia eclipticæ fuiſſet deprehenſum, prædicta latitudinum ratio, ſufficeret. Verum cum huius diuerſum obſeruationes geometrice examinatæ inferant,

ferant, vt eſt videre apud Ptolemæũ libro vltimo, τῆϛ μεγάλης συντάξεωσ ponit D.præceptor, per motum librationum, angulum inclinationis deferentis ad eclipticam, certa ratione augeri & minui, reſpectu nimirum motus planetæ medij in circulo decliui, & ipſius terræ in orbe magno. Quod fiet ſi in vna motus cõmutationis periodo, diameter per quam fit libratio bis ab extremis limitibus circuli decliuis deſcribatur, idcɟ tali conditione obſeruata, vt planeta exiſtente in ortu veſpertino angulus inclinationis ſit maximus, quare & latitudinis quocɟ apparentis maior, in ortu vero matutino minimus, vnde & ipſa apparens latitudo, vt conueniebat, minor exiſtat.

Veneris autem & Mercurij apparentiæ in latitudinem, vnica deuiatione excepta, ſpeculationis facilitate ſuperiorum planetarum Theorias ſuperant. Sed Veneris latitudines primo perpendamus. Intra orbem magnum, primum Veneris ſphæra occurrit. Ponit itacɟ D. præceptor planum, in quo Ven⁹ mouetur, ab eclipticæ ſeu orbis magni plano declinare, ſuper diametro per abſidas proprias deferentis primi, ita vt orientalis medietas, à plana eclipticæ ſuperficie in ſeptentrionẽ eleuetur, ad inclinationis angulum, quem in Ptolemæi hypotheſibus epicycli planum cum deferentis plano contineret: Occidentalis autem medietas ad meridiem. Per orientalem vero medietatem intelligenda ea, quæ eſt à loco ſummæ abſidis in cõſequentia etc. Sola hac & ſimplici hypotheſi omnes declinationum & reflexionum regulas, cum cauſis, ex loci terræ ad planetæ planum habitudine facile erit peruidere. Cum nam 'cɟ per terræ motum annuum ad oppoſitas partes ſummæ abſidis deferentis primi peruenerimus: vbi Veneris orbem tancɟ epicyclum & in apogio ſui deferentis exiſtere putamus, tunc planum in quo defertur Venus, nobis ab eclipticæ plano reflexum videbitur. Nam illud nos, in tali ſitu, per traſuerſum aſpicimus. Et quia idem planum ex inferiori loco intuemur, quæ ad ſeptentrionem prominet, pars nobis oculos meridiei obuertentibus, erit ſiniſtra: reliqua vero ad meridiem, dextra. Procedente autem terra ſurſum verſus planetæ abſidem ſummam, orbis Veneris à ſui eccentrici apogio

apogio defcendere creditur, ipfíumq̃ adeò planum deferentis
Venerem inclinatum, tanc̃q̃ ex loco altíore defpicere incipimus.
Quare reflexio fucceffiue in declinatiōem mutatur, vt per qua=
drantem à priori loco diftante, vbicumc̃q̃ planeta in eleuatis
partibus confpiciatur, declinationem folum ab ecliptica ha=
beat. In tali fitu, cum nos terræ adhærentes, fimus in oppo
fito medietatis deferentis, quæ eft à fumma abfide in cōfequen=
tia, & ab eclipticæ plano in feptentrionem eleuata, dixerunt
veteres epicyclum Veneris in defcendente nodo effe, & apog iũ
epicycli ad feptentrionem maxime declinare, perigium verò
ad meridiem. Porrò euehente nos fublimes terra motu
fuo annuo, verfus locum fummæ abfidis Veneris, orbis eius
ceû epicyclus infimam abfidem fui deferentis appetere videbi=
tur, & planum epicycli nobis planum in quo Veneris ftella,
quod ante inclinatum nobis erat ad planum eclipticæ, iterum
fefe ad nos reflectere apparebit: & feptentrionalis medietas de
ferentis, extra planum eclipticæ prominens, dextrum fiet, quia
orbem Veneris defuper afpicimus. Vbi autem ad locum
fummæ abfidis Veneris centrum terræ peruenerit, nulla decli=
natio, & fola reflexio confpicietur, atqui Veneris orbis in infi=
ma deferentis fui de veterum fententia, effe abfide credetur. At=
c̃q̃ hic eft τῶν φαινομένων ordo, dum centrum terræ femicircu=
lationem complet, à loco infimæ abfidis Veneris in confequen
tiam fignorum, ad locum fummæ abfidis Veneris afcendens.
Eadem autem ratione defcendente terra reflexio ad noftrum
afpectum paulatim in declinationem mutabitur: & quia me=
dietas plani deferentis à fumma abfide in antecedentia, nobis
tali inceffu terræ fit oppofita, apogium deferentis Veneris in
meridiem à plano eclipticæ declinare incipit, donec terra in no=
nagefimo gradu à loco abfidis conftituta, vtrac̃q̃ medietas ad
eclipticæ planum declinata confpiciatur, orbisc̃q̃, ceu epicyclus
Veneris in nodo afcendente ad fummam abfidem putetur: à
quo loco terra recedente declinatio iterum in reflexionem com
mutetur: ac confecuta locum infimæ abfidis Veneris, eafdem
apparentias latitudinum, in Venere terra iterum producere in=
cipiat. Ex quibus patet, terra ad lineam abfidum Veneris
pofita,

posita, planum deferentis planetam, reflexum apparere, in qua-
drantibus verò ab his, declinatum:in locis autem intermedijs
mixtas latitudines conspici.

Cum autem præter has latitudines, quas veteres epicy-
clo Veneris tribuerunt, & alia à veteribus deuiatio, à Profe-
mæo τῶν ἐκκέντρων κυκλῶν ἡ ἐγκλισις dicta, se his permisceat, ac
eandem per deferentis centrum epicycli Veneris, qui iam sub-
latus est, demonstrarunt, aliam & cum obseruationibus ma-
gis consonam D. præceptor rationem ineundam iudicauit.
Hanc autem rationem D. Doctoris, præceptoris mei deuia-
tionem saluandi, vt facilius quoq; haud secus, ac reliqua vsq;
proposita, assequamur:constituamus planum, cuius mox me
minimus, esse medium planum, ac ideo fixum, à quo verum,
iam huc iam illuc certa euagetur ratione. At quia omnes mo
tus, polorum respectu minori labore ac dispendio percipiunt,
principio tenendum, alterum polorum plani medij in septen-
trionem, à plano eclipticæ ad inclinationis anguli quantitatem
eleuari: alterum autem ex opposito tantundem in meridiem
deprimi. Et quæ de septentrionali polo, aut ijs, quæ circa
hunc fieri ostensuri sumus, simili ratione, ratione minirum op-
positionis habita, de meridionali intelligi oportere. Proinde
circa septentrionalem plani medij polum, assumamus esse cir-
culum mobilem, cuius ea quæ ex centro maximis obliquitati-
bus plani medij à plano vero correspondeat. Ipse autem polus
septentrionalis plani veri per librationis motum, dicti circuli
diametrum describat. Porrò circulus mobilis insequatur
planetæ motum, vt Venus suo motu incedens, relinquat dua-
rum quamlibet se insequentium intersectionem, id q; hac lege,
vt anno exacto ad relictam deniq; reuertatur. Ducto vero
circulo magno per vtriusq; plani polos, ab huius communi
cum plano vero intersectione, vtrinq; 90 gradibus numera-
tis, cum poli plani veri & medij scilicet differunt, nodi seu in-
tersectiones dictæ determinantur. Interim autē dum Veneris
ad alterutrū nodorum periodus completur, à polo plani ve-
ri per librationis motum, dicti circuli mobilis diameter bis
describatur. Hæc autem ita fiant, quo planetam cum terræ

H   centro

centro tale pactum iniuiſſe appareat? vt quoties terra ad defe-
rentis abſidas fuerit, Venus vbicumqʒ ſuo in deferente vero,
maxime in ſeptentrionem à plano medio deuiet, hoc eſt, maxi
me extra viam mediam conſiſtat.   Præterea terra per qua-
drantem ab abſidibus deferentis diſtante, ipſe planeta cum toto
ſuo plano vero, in medij deferentis plano iaceat.   Sed terra
reliqua loca intermedia peragrante, ipſe quoqʒ in deuiationi-
bus intermedijs ſuum curſum teneat.   Hoc terræ & plane-
tæ pactum vt eſſet perpetuum, ordinauit Deus, vt primus li-
brationis circellus, vt ita dicam, eodem tempore ſemel reuolue
retur, quo vna Veneris ad alterutrum mobilium nodorum
fieret reuerſio.   Hæc vt exemplo illuſtriora fiant. Si in ali-
quo deuiationis motus principio, polus ſeptentrionalis plani
veri à polo plani medij adiacentis, maxime meridiōalis fuerit:
ac Venus tantum in maximo deuiationis limite, qui eſt ſep-
tentrionalis extiterit: terræ quoqʒ centro in aliqua abſidum
Veneris commorante: in quarta anni parte, terra motu annuo
ad locum inter abſidas medium veniet, & eodem tempore
planeta ad ſuam interſectionem ſeu nodum mobilem: &
quia motus librationis commenſuratur cum motu planetæ
ad nodos ſeu interſectiones, primus librationis circellus qua-
drantem quoqʒ conficiet, et per reliquum circellum, qui altero
eſt velocior duplo, polus plani veri ſub polum plani medij
conſtituetur;   Quare & ambo plana coniungentur. Rece-
dente autem planeta ab hoc nodo, terra procedet ad alteram
abſida eccentrici primi, & polus plani veri per librationem à
polo plani medij ad ſeptentrionem promouebitur.   Sic fiet,
vt etſi Venus meridiana ſit: quemadmodum in noſtro exem
plo: tamen latitudo meridiana minuatur: ſi ſeptentrionalis
eadē creſcat. Eō loci autē vbi peruentū fuerit, polus plani veri,
libratiōis motu maximū ad ſeptētrionē limitē attinget: et plā
neta motu ſuo annuo ad nodos, in medio inter vtramqʒ inter
ſectionē, maximā iterū in ſeptentrionē deuiationē habebit. Ap-
paret itaqʒ motū circuli aſſumpti, hūc habere vſum, vt in anno,
Veneris ad nodos fiat reuolutio, ſemperqʒ terra collocata in ab
ſidum linea, planeta vbicumqʒ in ſuo plano vero fuerit, maxi-
                                                                    mam

mam à plano medio deuiationem habeat: & in medio inter
vtramᶜᵩ absida terra constituta sit in nodis.   Porrò libratio-
nis motu fieri, vt Venere in aliquo nodorum existente, ambo
plana coniungantur: & illa pars plani veri, quam ingreditur,
ad septentrionem semper à medio discedat: quo, prout conue-
nit, latitudo hæc perpetuo Borealis maneat.

   Quemadmodum autem Veneris planum, quod me-
dium appellare placuit, in absidum eccentrici primi linea ab
ecliptica intersecatur: & eius plani medietas à summa abside in
consequentia ad septentrionem prominet, reliqua oppositiois le-
ge in meridié vergente Ita in Mercurio simili ratione est pla-
num medium, quod super suarum absidum linea, vt par
erat, ab eclipticæ plano vtrincᵩ inclinatur, vt viceuersa medie-
tas plani medij à summa abside in antecedentia, septentriona-
lis sit. Quare in centri terræ annua reuolutione, declinationes
& reflexiones in Mercurio permutatæ ad Veneris scilicet, de-
prehendentur.   Verùm hæc varietas vt eo conspicua ma-
gis foret, disposuit Deus & deuiationem plani veri Mercurij à
medio, v.t ea medietas perpetuo quam ingreditur, à plano me-
dio ad meridiem discederet: et terra ad absidas ipsas consisten-
te, cum suo plano vero in medio plano iaceret.   Quo fit
deniᵖ, vt in latitudinem, præter dictas differentias, à Venere
nullas habeat, nisi quod hæc quocᵩ deuiatio, maior in Mercu-
rio est, quàm in Venere, veluti etiam inclinationis angulum
maiorem habet,   Cæterùm reliquæ latitudinum Mercu-
rij latitudines, facilime non aliter, atcᵩ in Venere colligentur.

Pars superat cœpti, pars est exhausta laboris

   Hic teneat nostras, anchora iacta rates.
Vt primam hanc narrationem nostram poëtæ verbis fi-
niam. Alteram autem mei promissi partem quum primū
iusto adhibito studio totum D. præceptoris mei opus euolue
ro, colligere incipiam.   Eò verò gratiorem tibi vtramᶜᵩ fo-
re spero, quo clarius artificum propositis obseruationibus, ita
D. præceptoris mei hypotheses τοῖσ φαινομένοις consentire
videbis, vt etiam inter se, tancᵩ bona definitio cum definito
conuerti possint.   H ij   Clarisa

Clariſsime & doctiſsime D. Schonere, æt anꝗ pater mihi ſemper colende, reliquum nunc iam eſt, vt hanc meam operam qualemcumꝗ æqui boniꝗ conſulas.　Nam quamquam non neſciam quid humeri mei ferre poſsint, quidue ferre recuſent: tamen tuus in me ſingularis, &, vt ſic dicam, paternus amor, fecit, vt omnino non formidarim hoc cœlum ſubire, et, quoad eius quidē fieri potuit, omnia ad te re= ferrem, quod Deus opt. max. bene vertere dignetur, deprecor, mihiꝗ aſpiret, vt iuſto tramite ad propoſitum finem, labo= rem cœptum perducere queam.　Si quippiam autem ardore quodam Iuuenili (qui quidem ſemper, vt ille inquit, magno magis, ꝗ vtili ſpiritu ſumus præditi) dictum ſit, aut per impru dentiam exciderit, quod liberius contra venerandam & ſan= ctam vetuſtatem dictum videri poſsit, quàm fortaſsis ipſa re= rum magnitudo & grauitas poſtulabat, tu certe, quod'ꝗ apud me dubiū non eſt, in meliorē accipies partem, & potius animū in te meū, quàm quid præſtiterim, ſpectabis.　Porrò velim te, de doctiſsimo viro, D. doctore, meo præceptore hoc ſtatuere, tibiꝗ perſuaſiſsimū habere, apud eū nihil prius, nec antiquius eſſe quicꝗ, quàm veſtigijs Ptolemæi vt inſiſtat: nec aliter, ac ipſe Ptolemæus fecit, veteres & ſe antiquiores multò ſecutus. Dum autem τὰ φαινόμενα, quæ Aſtronomum regunt, & Ma= thematica ſe cogere intelligeret, quædam præter volunta= tem etiam vt aſſumeret: ſatis interim eſſe putauit, ſi eadem ar te in eundem ſcopum cum Ptolemæo tela ſua dirigeret, eti= amſi arcum & tela ex longe alio materiæ genere, quàm ille, aſ ſumeret: ac hoc loco illud arripiendum: δεῖ δ᾽ ιλευθ ἱριον ἔιναι τῇ γνώμῃ τὸν μέλλοντα φιλοσοφεῖν.　Cæterùm, quod alienum eſt ab ingenio boni cuiuslibet, maxime verò à natura philo= ſophica, ab eo vt qui max. abhorret D. præceptor me?: tantū abeſt, vt ſibi à veterum recte philoſophantium ſententijs niſi magnis de cauſis, ac rebus ipſis efflagitantibus, ſtudio quo= dam nouitatis, temere diſcedendum putarit. Alia eſt ætas, alia morum grauitas, doctrinæ ꝗ excellentia, alia deniꝗ ingenij cel ſitudo, animi ꝗ magnitudo, quàm vt tale quid in eum cadere queat, quod quidem eſt, vel ætatis Iuuenilis, vel τῶν μεγα φρονοῦν

τῶν ἰπὶ θεωρίᾳ μικρᾷ, vt Aristotelis vtar verbis, vel arden=
tium ingeniorum, quæ à quolibet vento, suis'cꝗ affectibus
mouentur ac reguntur, vt etiam ceû κυβερνιτῇ excusso, quoduis
obuium sibi arripiant & acerrime propugnent.   Ve=
rùm vincat veritas, vincat virtus, suus'cꝗ honos perpetuo
habeatur artibus, & quilibet bonus suæ artis artifex in lucem,
quod prosit, proferat, atꝗ in hunc tueatur modum, vt verita=
tem quæ siuisse videatur.   Neꝗ verò D. præceptor bonorū
& doctorū virorum iudicia vncꝗ abhorrebit, quæ subire vl=
trò cogitat.

Pindarus in illa oda, quæ literis aureis in templo Miner= ENCO=
uæ consecrata fertur, celebrans Diagoram Rhodium pugilē, MIVM
victorem Olympicum: ait patriam eius Veneris esse filiam, & PRVS
Solis plurimum adamatam coniugem: Deinde Iouem ibi SIAE.
multum pluisse auri, id'cꝗ propterea, quòd suam Mineruam co
lerent: quare & ab ea ipsa sapientiæ nomine, et ἰγκυκλο παιδίας,
quam impendio colebār, claram redditam. Hoc præclarum
Rhodiorū ἰγκώμιον an vlli præterea regioni hac nostra ætate,
cꝗ Prussiæ (de qua pauca dicere in animo est, quod ea forte tu
quocꝗ audire volebas) quis aptius accommodauerit, ego qui
dem non video.   Nec dubito, quin eadem numina guber=
nantia hanc regionem deprehenderentur, si peritus aliquis A=
strologus, diligenti cura, pulcherrimæ huius, fertilissimæ & fe
licissimæ regionis præsidentes stellas inquireret. Quemad=
modum autem Pindarus ait,

Φαντὶ δ᾽ ἀνθρώπων παλαιαὶ
Ρήσιες, ὄυπω ὅτι
Χθόνα δατέοντο ζευστ, καὶ ἀθανάτοι,
Φανερὰν ἐν πελάγε
Ρόδον ἔμμιν ποντίῳ.
Αλμυροῖσ δ᾽ ἐν Βενθεσιν νᾶσον κεκρύφθαι.
Απεόντοσ δ᾽ ὄυτισ ἔν
Δεξεν λάχος ἀελίω

Καὶ ῥά μιν χώρας ἀκλαρώ
Τον λ πὸν ἄγνον θεόν.
Μναδίστη δὶ, ἵνῶ ἄμπαλον μίλα
Λετ δίμεν ἀλλά μιν οὐκ
Κιασεν, ἐπεὶ πολιάς
Εἶπε τιν' αὐτὸς ὁρᾶν ἔνδον θαλάσσης
Αὐξομέναν πεδόϊςι
Γολύβοσκον γάιαν ἀνθρώ
Γοισι, καὶ ἵ υφρονε μήλοισ.

Ita olim haud dubie Prussiam pontus habuit: & quod
certius quis, propius'cʒ signum capiat, quàm quod hodie in con
tinente, longiss. à littore Succinum reperiatur.   Quare & ea
dem lege, deorum munere, vt ê mari enata, Apollini cessit,
quam tanͨͫ coniugem suam Rhodum olim, nunc adamat.
Non potest Sol Prussiam perinde radijs rectis pertingere, ac
Rhodum? fateor, sed hoc alijs multis compensat modis, &
quod in Rhodo radiorum rectitudine præstat, hoc in Prussia
mora sua supra Horizontem efficit.

Deinde Succinum Dei peculiare esse donum, quo hanc
imprimis regionem ornare voluerit, neminem negaturum
puto. Imò si succini nobilitatem, & vsum, quem in medici=
nis habet, quis perpenderit, non iniuria Apollini sacrum iudi=
cabit, eius'cʒ adeò munus egregium, quo Prussiam coniugem
suam, tanquàm pretiosissimo ornamento magna in copia do=
net.   Cum'cʒ Apollo præter artem medicam & μαντικὴν,
quas inuenit primus & coluit, studio etiam venandi teneatur,
videtur hanc regionem præ cæteris omnibus elegisse: & cum
longo tempore ante præuideret immanes Turcas Rhodon su=
am deuastaturos, in has parteis sedem suam transtulisse, atqui
huc cum Diana sorore commigrasse, vero non videtur absimi=
le.   In quascunͨcʒ enim parteis oculos vertas, si syluas consi=
deres, viuaria, quæ græcis παραδίσοι sunt, et Apiaria, ab Apol
line consita dices: Si arbusta & campos, eorundem'cʒ lepo=
raria & ornithones: Si lacus, stagna, fontes, Dianæ sacra di=
xeris, Deorum'cʒ piscinas.   Atͨcʒ adeò Prussiam præ alijs
regionibus elegisse apparet, in quam, ceu suum Paradisum,
                                                                 Præter

præter ceruos, damas, vrfos, apros, & id genus alias, vulgo
notas feras, Vros etiam, Alces, Bifontes, &c. quos alibi locœ
rum vix reperire eft, inueheret: vt interim filentio præteream
plurima & ea rara admodum auium, nec non pifcium genea
ra.   Proles autem, quam Apollo ex Pruffiaconiuge fufce-
pit, funt: Regiusmons, fedes Illuftriffimi principis, D. Domini
Alberti, Ducis Pruffiæ, Marchionis Brandenburgenfis, &c.
oïm doctorum ac clarorū virorū noftra ætate meconatis. Toa
runna, olim emporio, nunc verò alumno fuo D. præceptore
meo fatis clara.   Gedanum Pruffiæ metropolis, fapientia
& fenatus maieftate, opibus, & renafcentis rei literariæ gloria,
conspicua.   Varmia collegium multorum doctorum &
piorum virorum: clara Reuerendiffimo D. Domino Ioanne
Dantifco, eloquentiffimo & fapientiffimo Præfule. Mariena
burgum ærarium fereniffimi Regis Poloniæ.   Elbinga
vetus Pruffiæ domicilium, quæ fanctam quoc literarum cua
ram fufcipit.   Culma clara literis, & vnde ius culmenfe
originem duxit.   AEdificia verò & munitiones, Apollia
nis regias & ædes diceres: hortos, agros, totam'cg regionem
Veneris delitias, vt non immerito ῥόδος dici poffit.   Porrò
Pruffiam filiam effe Veneris haud eft in obfcuro, fi vel terræ
fertilitatem quis perpenderit, vel venuftatem & amœnitatem
totius regionis.   Venus fertur orta mari, ita & Pruffia eius
& Maris filia eft, ideo'cg non tantum eam fertilitatem præbet
vt Holandia & Selandia annona ab ea alantur, fed & quaa
fi horreum fit vicinis regnis: item Angliæ & Portugaliæ.
Præter hæc optima quæcg pifcium genera, & alias res pretio
fas, quibus ipfa circumfluit, alijs affatim fuppeditat. Cæterùm
follicita Venus de ijs, quæ ad cultum, fplendorem, bene ac hua
maniter viuendum attinebant, necg, negante foli natura, in
his partibus nafci & haberi poterant, mari denicg auxiliante ef
fecit, vt commode in Pruffiam aliunde inuehi poffent. Verū
cum hæc tibi doctif. D. Schonere notiora funt, quàm vt à me
prolixius referri debeant, atcg ab alijs integris ea de re ædiris
libellis tractentur, vberiore encomio fuperfedeo.
        Hoc tantum addam, vt eft Pruffica gens populofa, præ
                                                                fidentis

fidentis numinis beneficio, ita quoq; est singulari humanitate
prædita.   Præterea cum omni genere artium Mineruam
colant, & Iouis ob hoc benignitatem sentiunt.   Nam vt non
dicam de inferioribus artibus attributis Mineruæ, vt Architec
tonicæ et huic cognatis: principio Illustrissimus princeps, dein=
de omnes præsules, proceres'q; Prussiæ, penès quos summā re
rum est, ac rerumpub. gubernatores, vt Heroas decet, summo
studio passim renascentes in orbe literas amplectuntur: adeo'q;
& soli & communi consilio alere & propagare student. Qua
re & Iupiter fulua cōtracta nebula multum auri pluit, hoc est,
vt ego interpretor, quia Iupiter præesse dicitur imperijs & re=
buspub. cum magnates studiorum sapientiæ & Musarum cu
ram suscipiunt, tunc Deus subditorum, nec non vicinorum re=
gum, principum ac populorum animos ceu in auream nubem
cōtrahit, ex qua pacem, omnia'q; cōmoda pacis, tanquā guttas
aureas destillet: animos trāquillitatis, et publicæ pacis amantes,
ciuitates bonis legibus constitutas, viros sapientes, honestam
& sanctam liberorum educationem, piam deniq; ac puram re=
ligionis propagationem &c.

        Sæpius citatur naufragium Aristippi, quod apud Rhodū
insulam fecisse eum perhibent, vbi eiectus, cum quasdam geo
metricas in littore figuras conspexisset, iussit socios suos bono
esse animo, inclamitans se hominum vestigia videre: ne q; eum
sua opinio falsum habuit. Nam & sibi & suis, eruditione qua
pollebat, ab hominibus doctis & amantibus virtutem, neces=
saria ad vitam tollerandam facile parabat.   Ita, vt dij me am=
ent, Doctiss. D. Shonere, cum Prutteni sint hospitalissimi, haud
adhuc contigit mihi vllius his inpartibus magni viri adire æ=
des, quin aut statim in ipso limine geometricas' figuras cerne=
rem, aut illorum animis geometriam sedentem deprehende=
rem.   Quare omnes ferè vt sunt boni viri, studiosos ha=
rum artium, quibus possunt studijs &', officijs prosequuntur.
Siquidem nuncq̃ vera sapientia, & eruditio à bonitate & bene
ficentia seiuncta est.

        At præcipue duorum magnorum virorum erga me stu=
dia admirari soleo, cum facile agnoscam q̃ mihi sit curta eru=
                                                                    ditionis

ditionis suppellex, meꝗ meo pede metiar. Alter eſt autem
ampliſſimus Præſul, cuius ſub principium mentionem feci:
Reuerendiſſimus D. Dominus Tidemannus Gyſius, Epi=
ſcopus Culmenſis. Eius autem R. P. cum chorum virtutum
& doctrinæ, quemad. D. Paulus in epiſcopo requirit, ſan=
ctiſſime abſoluiſſet: ac intellexiſſet non parum momenti ad
gloriam Chriſti adferre, vt iuſta temporum ſeries in Eccleſia,
& certa motuum ratio ac doctrina extaret: D. Doctorem,
præceptorem meum, cuius ſtudia & doctrinam multis ab=
hinc annis exploratam habebat, antè non deſtitit adhortari ad
hanc prouinciam ſuſcipiendam, quàm impulit. D. præcep=
tor autem cum natura eſſet κοινωνικὸς, et videret reipub. quoꝗ
literariæ motuum emendatione opus eſſe, facile Reuerendiſſi=
mi præſulis, & amici precibus ceſſit, & recepit tabulas Aſtro=
nomicas, cum nouis canonibus ſe compoſiturum, neque, ſi
quis ſui eſſet vſus, Rempublicam, quod cum alij, tum Ioannes
Angelus fecit, laboribus ſuis defraudaturum. At quoniam
iam olim ſibi eſſet perſpectum, obſeruatiões ſuo quodammo=
do iure tales hypotheſes exigere, quæ nõ tam euerſuræ eſſent
hactenus de motuum, & orbium ordine, recte, vt quidem re=
ceptum, creditum'ꝗ vulgò, diſputata & excuſſa: quàm etiam
cum ſenſib. noſtris pugnaturæ, iudicabat Alfonſinos potius,
quàm Ptolemæum imitandum, & tabulas cum diligentibus
canonibus, ſine demonſtrationibus proponendas: ſic futurum
vt nullam inter Philoſophos moueret turbam: vulgares Ma=
thematici, correctum haberẽt motuum calculum: veros autem
artifices, quos æquioribus oculis reſpexiſſet Iupiter, ex nume=
ris propoſitis facile peruenturos ad principia & fontes, vnde
deducta eſſent omnia: quemadmodum quoꝗ vſꝗ adhuc do=
ctis elaborandum fuit, de vera hypotheſi motus ſtellati orbis
ex Alfonſinorum doctrina. Sic fore vt doctis liquido con=
ſtarent omnia: neque tamẽ Aſtronomorũ vulg⁹ fraudaretur
vſu, quem ſine ſcientia ſolum curat & expetit: atque illud Py=
thagoreorum obſeruaretur, ita philoſophandum, vt doctis &
Mathematicæ initiatis, philoſophiæ penetralia reſerantur &c.
Ibi tum Reuerendiſſimus oſtendebat imperfectum id munus

<div align="center">I   Reipu=</div>

Reipub. futurum, nisi & causas suarum tabularum propone﹣
ret, et, imitatione Ptolemæi, quo consilio, quaue ratione, qui﹣
bus'cp nixus fundamentis artis ac demonstrationibus, medios
motus & prosthaphæreses inquisierit, radices ad temporum
initia confirmauerit, insuper adderet. Adhæc addebat, quan﹣
tum hæc res incommodi, & quot errores in tabulis Alfonsi﹣
nis attulisset: cum cogeremur eorum placita assumere ac pro﹣
bare, non aliter, quàm, vt illi solebant, αὐτὸς ἔφα, quod in Ma﹣
thematis quidem nullum prorsus locum habet.   Porrò cum
hæc principia & hypotheses, tan᷍cp ex diametro cum veterum
hypothesibus pugnent, vix inter artifices aliquem futurum,
qui olim tabularum principia perspecturus esset, eáque, post᷍cp
tabularum vires, vt c᷑u veritate c᷍osentientes, acquisiuissent, in
publicum proferret.   Non hic locum habere, quod sæpius in
Imperijs ac c᷍osilijs & publicis negocijs sit, vt aliquandiu c᷍osilia
occultentur, donec subditi fructu percepto, spem nequaquam
dubiam faciant, fore, vt ipsi consilia sint approbaturi. Quan﹣
tum autem ad philosophos attinet, prudentiores & do﹣
ctiores diligentius seriem disputationis Aristotelicæ examina﹣
turos, & perpensuros quomodo Aristoteles, post᷍cp pluribus
se argumentis immobilitatem terræ demonstrasse credidit, c᷍o﹣
fugiat tandē ad illud argumentῦ. μαρτυς ͏δ δὲ τούτοις καὶ τὰ παρὰ τῶν
μαθηματικῶν λεγόμενα περὶ τὴν ἀςρολογίαν. τὰ γὰρ φαινόμενα συμβαίνει μετα﹣
βαλλόντων τῶν χημάτων οἷς ὁρίσαι τῶν ἄςρων ἡ τάξις, ἀςς ἐπὶ τῦ μέσου κει﹣
μένης τῆς γῆς. Porrò hinc secum constituturos, si hæc conclusio
præmissis disputationibus non poterit subijci, ne oleum & o﹣
peram impensam perdamus, potius vera Astronomiæ ratio as﹣
sumenda erit: deinde reliquarum disputationum aptæ solutio
nes indagandæ, & recurrendo ad principia, diligentia maiore,
pari'cp studio excutiendum, an sit demonstratum, centrum ter﹣
ræ, esse quo᷍cp centrum vniuersi. Et si terra in orbem Lunæ ele﹣
uaretur, quod terræ partes auulsæ non sui globi centrum ad﹣
petituræ essent, sed vniuersi, cum tamen omnes ad angulos re﹣
ctos superficiei globi terræ incidant.   Præterea cum Magne﹣
tem videamus naturalem motum habere versus Septentrionē
item diurnæ reuolutionis, an motus circulares terræ attributi,
                                                                        necessa﹣

necessario violenti sint.   Amplius vtrum possint tres motus
à medio, ad medium & circa medium actu separari: & alia,
quibus vt fundamentis Timæi & Pythagoreorum placita re-
fellit.   Atcp hæc & huiusmodi secum perpendent, si ad
principalem Astronomiæ finem & ad Dei & naturæ poten-
tiã.gc industriã respicere voluerint. Quod si aurem docti vbicp
acrius & pertinacius suis principijs insistere in animo habue-
rinr, decreuerint'cp, monebat D. præceptorem, se fortunam me-
liorem expetere non debere, quam quæ Ptolemæi huius disci-
plinæ Monarchæ fuisset: de quo Auerroes summ⁹ aliâs philo
sophus, postcp concludisset epicyclos & eccentricos in rerum
natura omnino esse non posse, & Ptolemæum ignorasse qua- **lib.xi super**
re veteres motus Girationis, posuissent, tandem pronunciat: **xij Meta-**
Astronomia Ptolemæi nihil est in esse, sed est conueniens cõ **phy com-**
putationi, non esse. Cæterùm indoctorum, q.os græci ἀ θιωρη **ment.xlv**
τουϛ, κ μουσουϛ, κφιλοσοϝουϛ και αγιωμετρητουϛ vocãt, clamores pro **Gell.i cap.**
nihilo habendos, cũ necp istorum gratia vllos viri boni labo **ix**
res suscipiant. His & alijs multis, vt ex amicis rerum omnium
conscijs comperi, eruditissimus Præsul tandem apud D.præ-
ceptorem, euicit, vt polliceretur se doctis & posteritati de la-
boribus suis iudicium permissurum.   Quare merito boni
viri et studiosi Mathematum, Reuerendissimo Domino Cul-
men si magnas iuxta mecum habebunt gratias, quod hanc o-
peram Reipub.præstiterit.   Quoniam autem Munificen-
tissimus præsul hæc studia impendio amat, diligenter'cp colit,
habet & armillam æneam ad obseruanda æquinoctia, quales
duas, sed aliquanto maiores Ptolemæus Alexandriæ fuisse cõ-
memorat, ad quas videndas passim ex tota Græcia confluebãt
eruditi.   Curauit etiam sibi, verè principe dignum gno-
monem ex Anglia adferri, quem cum summa animi volupta-
te vidi, siquidem ab optimo artifice, neque rudi Mathematices
fabricatus est.

     Alter verò meorum Meccœnatum est Spectabilis, ac strec-
nuus D. Ioannes à Vuerden, Burgrabius Nouensis &c. Con-
sul inclytæ ciuitatis Gedanensis.   Qui vt ex amicis quibus-

                              I   ij   dam

dam de meis ſtudijs audiuit,non dedignatus eſt, me qualem⸗
cunq; ſuis verbis ſalutare, & petere, vt ſe antè conuenirem,
quàm Pruſſia excederem. Quod, cum D. præ⸗
ceptori meo indicarem, ipſi hoc meo nomine tum placuit,
& virum eum ita mihi depinxit, vt me tanq̃ ab Achille illo
Homeri vocari intelligerem. Nam præter quàm quòd in
belli pacis'q; artibus excellit,etiam Muſicam Muſis fauentib⁹
colit,qua ſuauiſſima harmonia ſpiritus ſuos recreet & excitet,
ad Reipub.onera ſubeunda ac perferenda. Dignus quem
Deus opt. max. fecerit ποίμενα λαῶν. Et beata Reſpub,cui Deus
tales præfecerit adminiſtratores.

Socrates in Phædone damnat illorum ſententiam, qui
animam Harmoniam dixere,& recte quidem, ſi nihil præter
elementorum in corpore craſim intellexere. Quod ſi autem
ideo animam harmoniam eſſe definierunt,quòd & ſola cum
Dijs mens humana intelligeret harmoniã,quemadmodũ &
ſola hæc numerat, quare & quidam Numerum dicere non
ſunt veriti. Deinde etiam quòd cernerent grauiſſimis quan⸗
doq; animæ morbis concentibus muſicis mederi: nihil hæc
ſententia,quòd anima hominis præſertim heroici harmonia
dicatur,incommodi habere videbitur. Quapropter rectiſſi⸗
me quis eas reſpub. beatas dixerit, quarum gubernatores ani⸗
mas harmoniacas,hoc eſt,philoſophicas naturas habuerint.
Qualem certe Scytha ille nequaq̃ habuit,qui equi hinnitũ au⸗
dire malebat, quàm excellentiſſimum muſicum, quem alij ad
ſtuporem vſq; audiebant. Vtinam autem omnes reges, prin
cipes, præſules,alij'q; regnorũ proceres animas ex Cratere har⸗
moniacarum animarum ſortirentur,& non dubitarem, quin
optimæ hæ diſciplinæ, quæ'q; propter ſe potiſſimum ſunt ex⸗
petendæ,ſuam dignitatem ſint obtenturæ. Hæc habui
Clariſſime vir, quæ ad te in præſens de D.Doctoris mei hy⸗
potheſibus,Pruſſia, & Mecœnatibus meis ſcribenda putaui.
Bene vale vir doctiſſ. & ſtudia mea tuis conſilijs gubernare
ne dedignere. Scis enim nobis Iuuenibus max. ſeniorum &
prudentiorum conſilijs opus eſſe. Nec te venuſta illa græ⸗
corum ſententia fugit: Γνῶμαι δ' ἀμεινονες ἐσι τῶν γεραιτέρων

Ex

Ex Musæo noſtro Varmiæ ix Calend.
Octobris, anno Domini
M. D. XXXIX.

HENRICVS ZEELLIVS

Lectori   S.

Ne quid in nobis vel diligentiæ, vel fidei iure quodam=
modo tuo Candide Lector deſiderares, operam hanc noſtram
in interpretandis græcis ſententijs, quibus author ob maiorem
authoritatem vti maluit, haud grauatim nauauimus. Ad=
didimus præterea errata, vnde mendas, quæ non quidem no=
ſtra negligentia, ſed neſcio quo fato, dum æditionem prope=
ramus, irrepſere, citra tuum laborem corrigas.   Quod
noſtrum in te ſtudium, ſi modo æquus eſſe volueris, gratum
habebis.   Vale.

Quæ in   **A.**
ἀκριβοτάτα·   exquiſitiſſimæ.
B
τοὺς ἀυτομάτους·   vltroneos ſeu Spontaneos.
C
ἀπὸ τοῦ χρόνου.   à tempore.
τῶ θείῳ ψυχῆσ)   diuino mentis oculo.
μηδὲν)   Nihil naturam fruſtra operari.
ἀυτως)   Adeò opificem noſtrum eſſe ſapientem, vt vnum
quodcp eorum, quæ ipſe condidit non vnam tantum habeat
vtilitatem, ſed duas etiam, & tres: non raro verò plures.
χορηγὸσ.   princeps choreæ, ſeu choragus.
περὶ κόσμυ.   de mundo.
ὄργκτα.   inſtrumenta.
χορδωτὴν.   inchordatorem ſimul & chori moderatorem.
ἐγκώμια.   laudes.   **D**
τὰσ μὲν) Veriores ſententias, quando quis aſſequitur, gratias
tunc habere oportet his, qui adinuenere.
τῶν φαινομένων.   apparentiarum.
ὄυτι τὰ)   Necp quæ ſine demonſtratione poſita, ſi ſemel cū
apparencijs conueniſſe ſunt deprehenſa, ſine certa quidam via
                                    I iij   ſeu

seu ratione, & longa meditatione comprobari non potuere, et
in difficili admodum fuerit comprehensionis eorum rationem
constituere.   Quia primorum principiorum vt plurimum
natura aut nulla est causa, aut sanè interpretatu difficilis.

κεπαιδυμίνου)   Rectè instituti est, eò vsque verum vnoquo‑
cp in genere inquirere, quouscp cuiusuis rei natura patitur.

τὸν ἀρισοτίλεα)   Aristotelem veritatis esse philosophum.

Γαυὶ ἱμμιλῶς)   Admodum scitè à Platone dictum est, cum
geometriam, tum & reliquas, quæ quidem hanc sequuntur, de
ipsa essentia somniare.   Euidenter verò, seu coram vt res in‑
tueantur, ipsis est impossibile, dum hypotheses, quibus vtun‑
tur, infallibiles eas ponunt, cum non possint earum reddere
rationem.

πολλὴν)   Magnas dijs immortalibus gratias habere opor‑
tet, propterea quod certam interim apparentiarum rationem
teneamus.

ἀ ποδ'έξις.   demonstrationes.
τὰ φαινόμενα.   apparentiæ.
λοξ'ιυιται)   obliquatur, & declinat.
λοξώσιϛ)   obliquatio & declinatio.

                    E

ἀπὰχυτέρᾳ μούσᾳ.   crassiore Musa.
τοῦ σοφοῦ δημιούργου.   sapientis opificis.
πλιιόντοι τοῖς φαινομένοις.   pluribus apparentijs.

                    F

ἀσ'ουκ ἂν)   Quòd non facile omni naturæ, nisi quæ & ip‑
sa sit admiratione digna, contingat contemplatio.

ἀνάγκῃ.   fatali lege.
ἀξίωμα.   pronunciatum seu enunciatum.
φιλεῖν ιδϣ)   Amarè quidem vtrumcp, sequi verò veriorem
eorum oportet.

τὸν θεὸν)   Deum semper agere geometram.

ἐάν τι πνα)   Si quem alium putauero posse vnum & plura,
pro rerum conditione, discernere, eum ego, ipsis etiam vestigijs
insistens, haud secus ac diuinum quoddam numen sequar.

παρὰ τοὺς)   propter habitudines ad Solem.
ἐν τοῖς φαινομένοις   in apparentijs.

G

τῆς μεγάλης συντάξεως.   magnæ compositionis, vulgò Al=
magesti.

H

δεῖ δ') Futurum philosophū libero esse iuditio necessitas est.
τῶν μεγαφρονούντων) Superbientium ob exiguam rerum cogni=
tionem.
κυβερνιτῆ.   nauclero.
Φαντὶ δ' ἀνθρώπων) Maiores commemorant ante eum diem,
quum Iupiter & Dñ immortales terram diuiderent, Rhodum
in mari nuncꝗ conspectam: sed insulam eam in fundo maris de=
lituisse. Absente autem Sole, nemo interim pro eo sortem su
bijt, atqui ipsum, castum deum, regionum exhæredem relique
re. Deinde verò cum ipse cæteros ea de re admonuisset: Iupi=
ter quidem volebat secundo sortem conijcere, verùm ne fieret,
per ipsum Solem stetit. Aiebat nam ꝗ se à longe videre, è ca=
no mari terram quandam emergere, cum hominum tum peco
rum feracissimam.
ῥόδης.   rosa.

I

κοινωνικὸς.   communicator.
αὐτὸς ἔφα.   ipse dixit
μαρτυρεῖ δ') His autem testimonia perhibent & ea, quæ de
Astrologia à Mathematicis dicta sunt. Accidunt enim ap=
parentiæ mutatis subinde habitudinibus, quibus astrorum or=
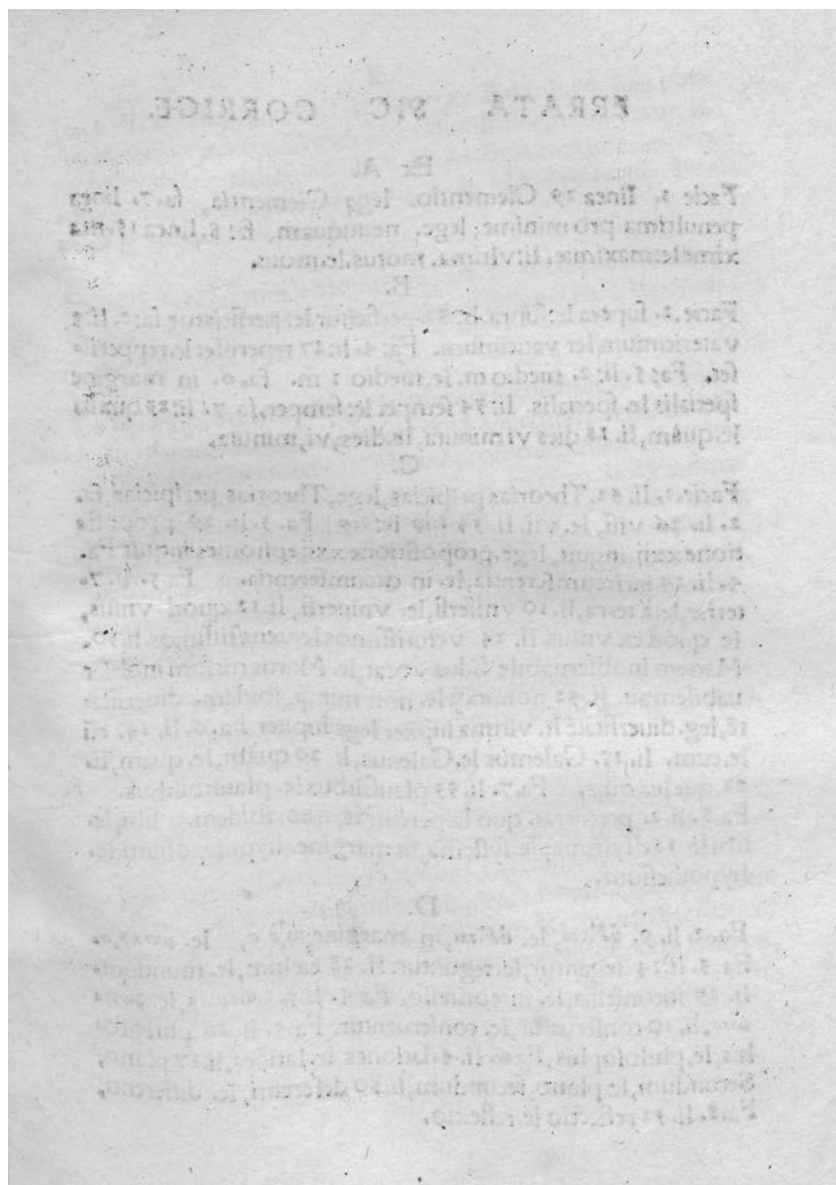do constituitur, tanꝗ in medio terra posita.
ἀθεωρήτους) minime contemplatiuos, à Musis alienos, phi=
losophiæ ignaros & geometriæ imperitos.
φυλακα λαῶν   custodem populorum.
γεύμα δ') Senum consilia sunt præstantiora.

EXCVSVM GEDANI PER
FRANCISCVM RHO
DVM. M. D. XL.

ERRATA SIC CORRIGE.

Ex A.

Facie 1. linea 29 Clementio. lege Clementia, fa. 7. linea penultima pro minime, lege. neutiquam, fa: 8. linea 15. maxime le:maximæ. li:vltima. motus,le.motu.

B.

Facie. 2. supera le:supra. li: 32. perficitur le: perficiatur. fa: 2. li. 3 vatericinium le: vaticinium. Fa: 4. li: 27 reperisset le.repperisset. Fa: 5. li: 2. medio m. le.medio 1 m̄. fa. 6. in margine spetialis le. specialis. li: 34 semper le:semper. fa 7. li:23 quàm le.quàm, li. 28 dies vi minuta, le.dies, vi, minuta.

C.

Facie. 1. li. 32. Theorias pespicias, lege, Theorias, perspicias, fa. 2. li. 26 vist, le. vst. li. 34 ꝺꝭꝙ le: ꝺꝭꝙ Fa. 3. li. 29 propositione xxij, inquit, lege. propositione xxij epitomes inquit Fa. 4. li. 24 incircumferentia, le. in circumferentia. Fa. 5. li. 7. terræ, le. à terra, li. 10 vniferfi, le. vniuersi, li. 12 quod vnius, le. quod ex vnius. li. 24 vetutissimos le.vetustissimos.li.30. Martem inobseruabile sidus vocat, le. Martis cursum inobser uabilem ait, li. 32 nonuncꝗ le. non nuncꝗ, ibidem. diuersita tē, leg. diuersitatē li. vltima Iupiter lege Iupiter. Fa. 6. li. 14. eū le.cum. li. 15. Galemus le.Galenus, li. 20 quàm, le. quam, li. 22. que le. quæ. Fa. 7. li. 33 plausilibus le. plausibilibus. Fa. 8. li. 2. percurrat. quo le. percurrat, quo. ibidem. sibi, le. sibi li. 18. systima, le. systema, in margine. hypoteposium le. hypothesium.

D.

Fa. 2. li. 9. ἀδίνα, le. ἀδίνα, in margine, μιὰ α, le. μιταϸ, α. Fa. 3. li. 14 tegantur, le. teguntur. li. 28 cælum, le. mundum. li. 29 inconfesso, le. in confesso. Fa. 4. li. 5. φαινόμινα, le. φαινό μιτα, li. 10 conseruatur, le. conseruantur. Fa. 5. li. 26 philoso his, le. philosophis, Fa 6. li. 4. lationes, le. latiōes, li.17 plano, Secundum, le. plano, secundum, li. 30 deferenti, le. differenti, Fa. 8. li. 32 reflectio le. reflexio.

E.

Fa. 1. li. 1. Globi erræ le. Globi terræ. Fa: 2. li. 30. hæc pū-
cto in, le. hæc puncto C. in. ibidem. diuidtur lege diuidatur, li.
31. colocata leg. collocata. Fa. 3. li. 24 crcumferentia, le. cir-
cumferentia. li 31 A in le. A, in. Fa. 8. li. 23 πλειονοιοι τοῖσ φαινο
μένοισ le. πλειοντοι τοῖσ φαινομένοισ.

F

Fa. 1. li. 1. nōuarum le. nouarum, fa. 2. li. 16. Deus manum,
le. Deus, manum. Fa. 3. li. 5. fistema le. systema Fa. 4. li. penul-
tima portium, l:. partium.

G

Fa. 1. li. 4. planeta occultatur le. planeta occultetur, li. 14 im le.
i. 1, li. 16. mediate, lege medietate li. 25 velccius le. velocius. li.
33 planeta promouetur le. planeta promouebitur, Fa. 2. li. 17
ab hac, le, ab hac. Fa. 3. li. 26, exentro le. ex cētro. li. 29 infimæ
haud, lege. infimæ: haud, li. antepenultima, matutinius, vesper-
tinius, lege, matutinus, vespertinus, Fa. 4. li. 3. χηματισμοῖσ le.
χηματισμοῖσ, li. 7. quiescit. le quiescat, li. penult. centro lineis le.
centro terræ lineis. Fa: 7. li. 31 trasuersum le. transuersum. Fa.
8. li. 14 epicycli nobis, lege epicycli, nobis.

H

Fa. 1. li. 20 minirum le. nimirum, Fa. 2. li. 4. prætereaterra le.
præterea terra Fa. 3. li. 26 latitutines le. varietates. fac. 5. lin. 3.
κυβερπιτῆ leg. κυβερπτῆ.

I

Fa. 2. lin. 13 tabularum, leg. tabulæ. fac. 6. lin. fint, leg. fint.
fac. 5. lin. 8 αυτοματουσ lege αυτοματεὺσ Fac. 6. lin. 22. πἄχυτίρα
lege παχυτίρκ. fac. 7. lin. 3. κυβερπιτῆ. leg. κυβερπιτῆ
Sicubi autem scriptum inueneris, depræhendere, cœlum, prece
ptor, cepi, incepit, hypotesis, solsticium &c: fac legas seruata or
thographia, deprehendere, cœlum, præceptor, cœpi, incœpit,
hypothesis, Solstitium. &c.
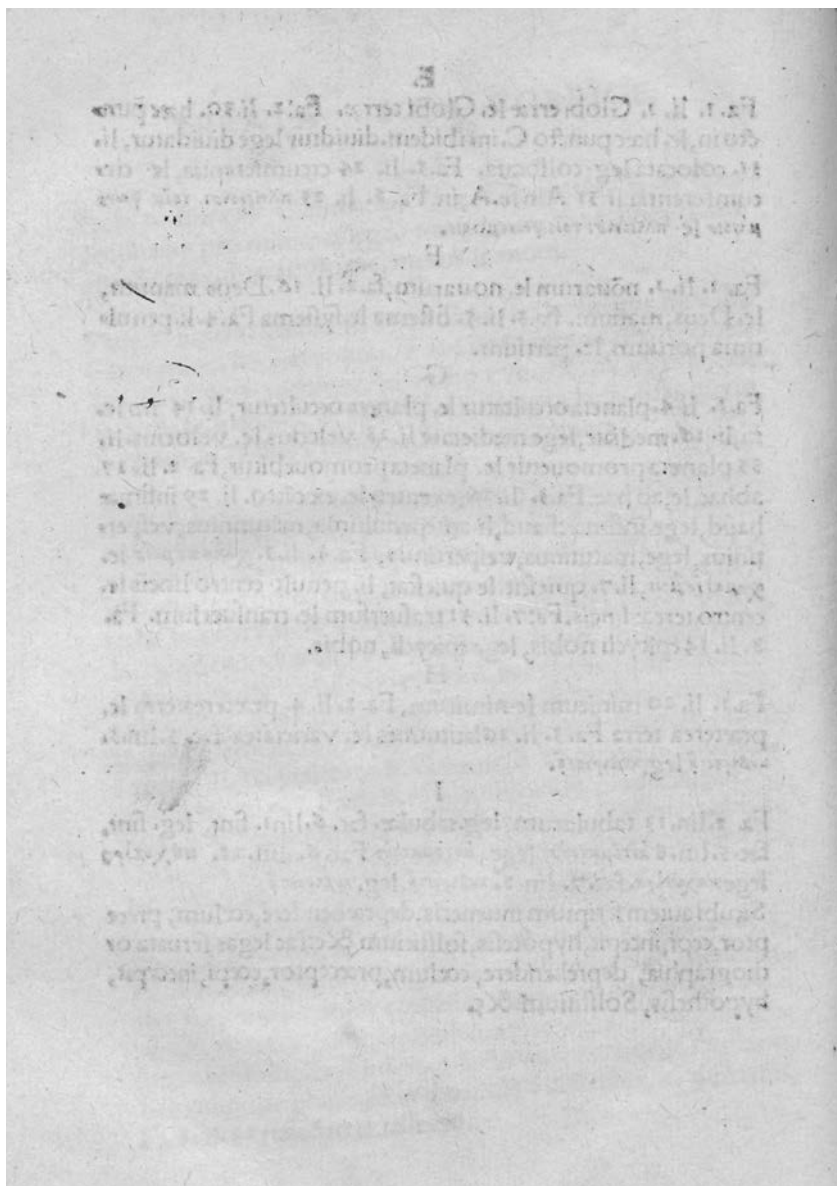
Dear Readers,

Lubawa town went into this publication not without a reason. The figure of Nicolaus Copernicus is the key one in the history of Lubawa and he is associated with the figures of Chełmno bishops who resided on the Lubawa castle. One of the bishops, Jan Dantyszek, Nicolaus Copernicus corresponded with while the other, Tiedemann Giese, was his friend and they would meet in Lubawa.

The figure of Georg Joachim Rheticus is also of a vital importance as he came to Lubawa with Nicolaus Copernicus to acquaint Giese with the most famous work of the astronomer, titled "De revolutionibus orbium coelestium" (On the Revolutions of the Heavenly Spheres), which at those times was a revolutionary one for the world of science. It was in Lubawa in 1539 that the crucial decision to publish the great work of Nicolaus Copernicus was made.

The figures of both Copernicus and Rheticus will undoubtedly be mentioned on numerous occasions in the year 2016, when the Lubawa land will celebrate its decent 800 jubilee. It was in 1216 when the name *terra lubovia* appeared in the bull of the Pope Innocent III. I am inviting you to Lubawa – the town of Copernicus, Rheticus, Chełmno bishops, rich history and the pleasantly surprising present day.

The Mayor of Lubawa Town

Maciej Radtke

www.lubawa.pl

Lubawa, 31st March, 2015