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**An Introduction
to the Topic “Copernicus and Astrology”.
A Commentary on the Theses
of Robert S. Westman**

Abstract

This article is an introduction to the subject of Copernicus and astrology. It presents an overview of a set of facts and positions of researchers exploring the relevant ideas of Copernicus, as well as the author’s own perspective. A key role is played by a critique of R.S. Westman’s theses.

Keywords: *Copernicus, science of stars, astrology, astronomy, terms and their different meanings, R.S. Westman*

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Wprowadzenie do tematyki „Kopernik a astrologia”. Komentarz do tez Roberta S. Westmana

Abstrakt

Artykuł stanowi wprowadzenie do tematyki „Kopernik a astrologia”. Przedstawiono przegląd zbioru faktów i stanowisk badaczy myśli Kopernika, które łączą się z tą tematyką, a także stanowisko autora. Kluczową rolę pełni krytyka tez R.S. Westmana.

Słowa kluczowe: *Kopernik, nauka o gwiazdach, astrologia, astronomia, terminy i ich różne znaczenia, R.S. Westman*

1. Astrology – Mesopotamia and the Ancient World¹

Etymologically speaking, astrology is the science of stars (from Greek *ἄστρον* (*ástron*) + *λόγος* (*lógos*)), which deals with the prediction of: a) natural phenomena (occurring in the celestial sphere and the terrestrial sphere) based on the configuration of the positions of the Sun and the Moon, the planets / wandering stars, the fixed stars and b) the fate of a specific person, nation, land, enterprise, etc. based on the configuration of the positions of the Sun and the Moon and the planets /

¹ The origin of the article: in Kokowski's 2009 monograph, the topic of Copernicus and astrology played a marginal role. I recalled there (pp. 51, 52, 104, 286, 405) that in none of his works did Copernicus, unlike Rheticus, promulgate ideas that could be interpreted as acceptance of the principles of astrology. This was also claimed by many earlier researchers of this subject.

The situation changed when Robert S. Westman, in his 2011 monograph and later works, presented a radicalized view of Copernicus and astrology. However, the beginnings of this interpretation date back to 1993.

To test Westman's theses, an online conference “Copernicus and Astrology” was organized on May 29, 2024, as part of the work of the Commission on the History of Science (Polish Academy of Arts and Sciences) and the Science Studies Research Unit (Institute for the History of Science, Polish Academy of Sciences).

The conference speakers included dr hab. Sylwia Konarska-Zimnicka, Associate Professor at the Jan Kochanowski University in Kielce, George Borski, a young researcher associated with Stichting ‘De Rebus’, Foundation for the History and Philosophy of Science (Amsterdam – Almere, The Netherlands), and the author of this article.

The article at hand is an extension of the paper that was an introduction to the subject of the conference. The topic will be continued in the next two articles – see Borski, Kolkov [2024](#); Konarska-Zimnicka [2024](#).

wandering stars² in relation to the fixed stars, in particular some part of the zodiac. The foundation of astrology is a basic ontological axiom: *the assumption of the existence of an influence of celestial bodies on the whole of nature (both the Earth and the rest of the cosmos), including the human organism, with the impact not only on its physical, but also intellectual and mental spheres.*³

According to many researchers of the topic (e.g. Dobrzycki 1971, pp. 15–19; Doktor 1987, p. 7; Koch-Westenholz 1995, pp. 32–73; Saunders 1998; Lewis 2003, p. 144), the science understood in this way originated probably in Mesopotamia in the 4th–3rd millennia BC,⁴ then spread and gained recognition throughout the ancient world.⁵

² Originally, it concerned five planets: Mercury, Venus, Mars, Jupiter, and Saturn. After the discovery of additional planets in the 18th and 19th centuries, i.e. Pluto (1781) and Neptune (1846), advocates of astrology included these celestial bodies in the set of planets taken into account in the construction of astrological horoscopes.

³ According to A.A. Long (1982), this axiom was developed by the Stoics and has a universal meaning of the sympathy of celestial and terrestrial phenomena. The term ‘sympathy’ in this meaning was used, for example, by Sextus Empiricus (1949, p. 325). However, I think that this axiom (though not the term ‘sympathy’ itself) is much older – it was born in the ancient culture of Mesopotamia, and perhaps even earlier in the megalithic culture.

In discussing this issue, A.A. Long introduced a useful distinction between *hard astrology* and *soft astrology*: “I will distinguish, during this paper, between ‘hard’ astrology, which claims that heavenly bodies are both signs and causes of human affairs, and ‘soft’ astrology which regards heavenly bodies only as signs of human affairs without also attributing a causal role to the heavenly bodies... (Long 1982, p. 170, fn. 19).

How this ontological axiom was interpreted, see below.

⁴ In my opinion, however, it cannot be ruled out – but this is just a guess not supported by written sources – that the beginnings of astrology date back to the megalithic culture, i.e. the 5th millennium BC. This is also the opinion of Nicholas Campion (2008, vol. I, pp. 15–49).

⁵ However, according to some researchers *basing on a solid analysis of source texts*, only the foundations of astrological knowledge were created in Mesopotamia, and astrological research was fully developed only in Hellenistic times – see e.g. Pingree 1997; Rochberg-Halton 1984; 1992; Rochberg 1988; 1992; 2004; 2010; Tanzella-Nitti 2002; Taylor 2006; Cooper 2018; Ulanowski 1992; 2022.

The aforementioned foundations of astrological knowledge are related to the study of cosmic omens – fortune-telling from celestial phenomena (from the Latin *omen*, *omina* – ‘fortune-telling’), distinguished from astrological research proper: “(1) *Omina*, which studied celestial phenomena as signs or indicators of future terrestrial events, and which originated in ancient Mesopotamia, and (2) astrology proper, which studied the influence of the heavenly bodies on the course of

From ancient times to the 17th century astrology was the pinnacle of astronomy (etymologically, the science describing stars/heavenly bodies; Latin ‘astronomia’ comes from Greek ἄστρον + νόμος (*astron* + *nómos*), i.e. star + law), because astrology used the tools of astronomy as an auxiliary science providing predictions of the positions of Sun, Moon, planets and fixed stars).

It is common knowledge that the greatest contribution to astronomy and astrology in antiquity was made by Claudius Ptolemy, the author of *Almagest* (on mathematical and observational astronomy), *Planetary Hypotheses* (on physical astronomy) and *Tetrabiblos* (on astrology).⁶

The interpretation of the above-mentioned basic ontological axiom of astrology has been a controversial issue since the ancient times. It was connected with a critical discussion on the determinism and indeterminism of natural phenomena and human fates, in which participated the Stoics (including Zeno, Manilius, Chrysippus, Carneades, Diogenes of Babylon, Posidonius and Panaetius, who rejected astrology), the Neoplatonists (including Geminus of Rhodes, Plotinus, and Proclus) and the Skeptics (including Favorinus, Sextus Empiricus and Cicero, who rejected astrology), as well as the supporters of astrology: Ptolemy and Julius Firmicus Maternus, and the opponents of astrology: St. Bishop Augustine and St. Isidore of Seville.⁷

events on earth, and which originated in the Hellenistic Greek sphere” (Rochberg-Halton 1992, p. 504).

⁶ “Ptolemy’s *Tetrabiblos* is without doubt the single most influential book in all of Western Astrology. Its effect upon astrology is as great as Isaac Newton’s *Principia* on Physics” (Hand 1994, p. i).

From the first half of the 12th century, when the first translation of *Tetrabiblos* (*Quadripartitum*) into Latin was made, Ptolemy was called the prince of astrologers in Latin Europe (Broecke 2003, p. 59). For example, John of Glogów thus defined Ptolemy in his *Tractatus preclarissimus iudiciis astrorum de mutatione aëris* (Cracoviae: Florian Unglern et Wolfgang Lern, 1514, Boss., XVI. Qu. 1671, pp. 9vb, 10rb): “omnium sapientium in scientia stellarum princeps”.

Let us add that in the 15th and 16th centuries, some European researchers criticized medieval Arabic astrology, which deformed Ptolemy’s views on this matter; this is the so-called back to Ptolemy – see Faracovi 2014.

⁷ The ancient thinkers mentioned here knew a great deal about astrology, its advantages, limitations and disadvantages. I think that their level of knowledge far exceeds that of many contemporary experts in this field (which is a very strong argument for the need to develop the history of thought and the history of science). I find the

The legacy of Hellenic and Hellenistic astronomy and astrology was creatively taken up:

- a) in the Middle Ages in Arab culture by Abū Maʿšar (Al-bumasar), the author of *De magnis coniunctionibus* (*On the Great Conjunctions*) [Augsburg 1489, Venice 1515]; Mashallah ibn Athari (Mashallah); Alcabitus; al-Kindi; Albohazen Hali, the author of *Praeclarissimus liber completus in iudiciis astrorum* (Venice, 1485: Erhard Ratdolt),
- b) in Christian Europe, on the one hand, in the 12th–16th centuries, works combining philosophy, astrology and theology were created by St. Bishop Albert the Great (*rational astrology*), the Wittenberg School (among others, Philip Melanchthon, Caspar Peucer, Erasmus Reinhold, Hieronymus Wolf, Jakob Milich, Martin Chemnitz, Paul Eber), and St. Cardinal Robert Bellarmine (*Thomasian astrology*) – see Brosseder 2005; Rutkin 2018; on the other hand, in the 12th–17th centuries, in reference to the Stoic Panaetius and the Neoplatonists: Geminus of Rhodes, Plotinus and Proclus, the Skeptics: Favorinus, Sextus Empiricus and Cicero, and the Christian philosophers and theologians: St. Bishop Augustine and St. Isidore of Seville, there was an ongoing debate on the incompatibility of prophetic astrology with the dogmas of the Christian faith (including the Christian concept of free will) and empirical knowledge, among others by St. Thomas Aquinas, Bishop Étienne Tempier (d. 1279) – the condemnation of the theses of the radical Aristotelians (1270, 1277), Bishop Nicholas of Oresme, Cardinal Archbishop Peter of Ailly, John Gerson, Marsilio Ficino, Giovanni Pico della Mirandola, Girolamo Fracastoro, Martin Luther, and the bull *Coelli et terrae* (1586) – see Lanuza-Navarro, Ávalos-Flores 2008; Vescovini 2014; Hendrix 2007; 2010; 2018;

critique of astrology particularly interesting. I was greatly impressed by the critical commentaries of Sextus Empiricus (floruit mid-late 2nd century AD in Athens and Alexandria) – see Sextus Empiricus 1949.

2020; 2023; Tarrant 2020; in the case of Giovanni Pico della Mirandola, author of *Disputationes adversus astrologiam divinatricem* (Bologna 1496), it was about distinguishing true natural effects of the action of the celestial spheres on the Earth from false astrological speculations.

Let us quote Pico della Mirandola here:

Astrologiam vero cum dico, non eam intelligo quae siderum moles et motus mathematica ratione metitur, artem certam et nobilem et suis meritis honestissimam auctoritateque hominum doctissimorum maxime comprobata; sed quae de sideribus eventura pronunciat, fraudem mercenariae mendacitatis, legibus interdictam et civilibus et pontificiis, humana curiositate retentam, irrisam a philosophis, cultam a circulatoribus, optimo cuique prudentissimoque suspectam, cuius olim professores gentilicio vocabulo Chaldaei, vel ab ipsa professione genethliaci dicebantur (40, 1–11) (cited from Rutkin 2010, p. 146).

But when I say astrology, I do not understand that which measures the sizes and motions of the stars with mathematical argument, a certain and noble art, most honest in its benefits, and approved especially by the authority of the most learned men; but that which announces what will happen from the stars, a fraud of mercenary mendacity, prohibited by laws both civil and papal, retained by human curiosity, ridiculed by philosophers, worshipped by quacks, suspected by the best and most prudent, whose professors were formerly called by the gentile term of Chaldaeans, or by their very profession, genethlics] (cited from Rutkin 2010, p. 136).

2. The science of the stars, astronomy, astrology and mathematics

Since the dawn of time, people have been interested in stars. With the development of ancient culture, a research discipline dedicated to this emerged – the science of stars.

Plato used the term ‘astronomy’ in his writings to designate this science, *developed using geometry and arithmetic*. In turn, Aristotle understood the science of the stars to be the study of these stars using the Aristotelian principles of metaphysics and physics, and he called such science ‘astrology’. The Chaldeans, on the other hand, understood the science of the stars as a science used to predict people’s fate, based on the previously adopted fundamental assumption about the existence of specific influences of heavenly bodies on man and nature.

These three different meanings of the science of the stars are manifested in the works of Ptolemy in the *Almagest*, *Tetrabiblos* and *Planetary Hypotheses*, in which their author combined three traditions: Platonic astronomy (presented in the *Timaeus*, which preaches probabilism and hypothetism of the postulated entities of the theory), Aristotelian metaphysics and physics, and the Chaldean idea of the possibility of predicting human fate based on the configuration of heavenly bodies (cf. Hübner 1989; Losev 2012; Feke 2018).

However, in the *Almagest* Ptolemy himself did not use the term ‘astronomy’ at all and in the *Tetrabiblos* he used it only six times, always in the phrase “di’ astronomias” [using astronomy], and he did not use the term ‘astrology’, but the term ‘apostelematography’ or ‘apotelesmatika’ (cf. Hübner 1989; Feke 2009; 2018; Losev 2012; Muszyński 2012), which included both astronomy and astrology in meaning. Nevertheless:

[T]he two sciences remain distinct. According to Ptolemy, astrology and astronomy use astronomia [or, better said, *tools of astronomy* – M.K.] to different ends. Astrology employs astronomia [*tools of astronomy* – M.K.] to predict the qualitative changes produced in the sublunary realm from the stars’ configurations, which result from their movements. Astronomy, on the other hand, uses astronomia [*tools of astronomy* – M.K.] to predict the stars’ movements and configurations themselves (Feke 2018, p. 169).

This idea was expressed more accurately by Oswald Schrekenfuchs (1569), quoted by Westman:

Astrorum Scientiam in duas diuidi partes. Haec scientia despescitur in Astronomiam et Astrologiam. Astronomia est doctrina, que mediantibus Geometria, et Arithmetica, inquit, ac demonstrat motus uarios, magnitudines, et

distantias corporum coelestium, ut paucis multa dicam, ipsa omnes diuersitates, et mutations apparentiarum, tam in planetis quam in reliquis stellis, saluat.

Astrologia autem est doctrina, que ex stellarum motu ac uirtute, natura atque situ diuesos qualitatum et quantitatum motus in corporibus, praedicat (Westman 2011a, p. 519, fn. 56).

The science of stars is divided into two parts. This science encompasses Astronomy and Astrology. Astronomy is a doctrine which by means of Geometry and Arithmetic investigates, and shows the various motions, magnitudes, and distances of the heavenly bodies, to name a few [of] many things; it itself saves all the diversities and changes of appearances, both in the planets and in the rest of the stars.

But astrology is a doctrine which predicts the various qualities and quantities of movement in bodies from the movement and virtue of the stars, their nature and situation.

Nevertheless, from antiquity to the 16th and 17th centuries, the names ‘the science of the stars’, ‘astronomy’, ‘astrology’ and ‘mathematics’ were often treated interchangeably.⁸ It was clear from the specific context what astronomical or astrological, or mathematical aspect was meant by the authors discussing the science of the stars.⁹

3. Subdisciplines of the science of the stars / astronomy / astrology / mathematics

From ancient to modern times, the science of the stars has undergone multi-faceted development. Taking this development synthetically, we

⁸ One example comes from Giorgio Valla and his encyclopedia *De expetendis ac fugiendis rebus* (Venice, 1501), according to which “Astrologia astrorum scientia est...” (Book 1). We know that Copernicus used this encyclopedia – see L. Birkenmajer 1924, pp. 152–168.

⁹ Moreover, according to Robert Schmidt, the translator of *Tetrabiblos*, the belief widespread among some researchers that the contents of astronomy and astrology are identical is erroneous. In Ptolemy, astronomy and Aristotle’s physics are two preliminary disciplines on which astrology is based (see Ptolemy 1994, note 1, pp. 1–2). I share this view.

can distinguish many subdisciplines – trends that emerged, developed, lasted or disappeared.

The basic division is as follows: the study of the stars is divided into mathematical astronomy and physical astronomy, which together describe and explain the movements, sizes and distances of celestial bodies, and practical astronomy, which describes the effects of celestial bodies on Earth.¹⁰ Practical astronomy includes many subdisciplines, such as: astronavigation (navigational astronomy), astrogeography (astronomical geography), natural or physical astrology (choreography: terrestrial astrology, astrometeorology / astrological meteorology, astrobotany / astrological botany, astrozoology / astrological zoology, astromineralogy / astrological mineralogy, iatromathematics / medical astrology / astrological medicine) and prophetic astrology (*astrologia divinatrix*; *astrologia indicaria*) or superstitious astrology (*astrologia superstitiosa*).¹¹

Divinatory astrology includes: mundane or political astrology, which concerns the creation of horoscopes of rulers, territories and countries; natal astrology, which concerns the creation of horoscopes of people (two variants determined by the starting date: birth or conception); horary (hourly) astrology, which concerns the search for an answer to a specific question asked at a specific date; elective astrology, the opposite of horary astrology, when the answer to the question we are interested in is known and we want to know when we should make such a decision.¹²

Natural, medical and prophetic/superstitious astrology was based on mathematical and physical astronomy as well as astrological physics (describing the mechanisms of astrological interactions).¹³

¹⁰ This type of division was used, for example, by Claudius Ptolemy, Albohazen Hali, and Albert of Brudzewo. The latter used it in his work *Commentariolum super Theoricis novas planetarum*, first published in 1495 in Milan, and reprinted in Kraków in 1900 (see Albertus de Brudzewo 1900, pp. 16–17). During his studies in Kraków, Copernicus most likely already analyzed copies of this work used by Cracovian lecturers – see Sylla 2017, p. 47.

¹¹ In turn, astrology can be divided into subdisciplines or trends. Jim Lewis's *Astrology Encyclopedia* (2003) distinguishes 25 disciplines (astrological trends) from ancient times to the present day, and also provides several geographical descriptions, including Chaldean/Mesopotamian, Chinese, and Egyptian astrology.

¹² Cooper 2018, pp. 382–383.

¹³ See L. Birkenmajer 1900, pp. 94–95; Cornell 1933/ (3rd rev. ed.) 1992; Allen (1941) 1966, p. 13; Pines 1964; Casirer 1942b, p. 343; Pingree 1968; Barton, Tamsyn

Then, in the 18th and 19th centuries, prophetic/superstitious astrology was considered a pseudoscience,¹⁴ but still had numerous supporters, astrogeography got rid of astrological overtones, astrometeorology

1994, pp. 179–191; Broecke 2003, pp. 7–27; Poggi 2003; Taub 2003; 2012; Rutkin 2002; 2006; 2018; Cooper 2011, pp. 123–124; [2018](#); Hübner 2012; Losev 2012; Rožek 2016, p. 253; Sylla 2017, pp. 46–48; Konarska-Zimnicka 2018, p. 137, fn. 1; Pfeffer 2023.

This division is conventional in nature, and although it refers to historical terminology, it serves to organize the discussion on various types of research carried out by the adepts of the “science of the stars” from ancient to modern times, in particular to isolate components related to the activity of divining the fate of people, societies, and the development of events etc., based on the configuration of celestial bodies / stars (wandering stars, i.e. planets, and fixed stars). I believe that it is worth undertaking systematic, detailed historical research of various disciplines included in the “science of stars”. I recommend this topic to the attention of researchers.

¹⁴ For example, *Encyclopaedia Britannica* from 1768 puts it this way (in the first volume of the first edition of this encyclopedia): “ASTROLOGY, a conjectural science, which teaches to judge of the effects and influences of the stars, and to foretel future events by the situation and different aspects of the heavenly bodies. *This science has long ago become a just subject of contempt and ridicule* (Colin Macfarquhar (ed.), *Encyclopaedia Britannica*, 3 vols. (Edinburgh, 1768–1771), vol. 1, p. 433 – cited from Rutkin 2018, pp. 241–242; italics added by M.K.).

The recognition of astrology as a pseudoscience was preceded by, on the one hand, the emergence of a philosophical, astrological and theological synthesis in the 12th–16th centuries (e.g. St. Bp. Albert the Great, Melanchthon; see Rutkin 2018) and, on the other hand, the ongoing debate in the 12th–17th centuries on the incompatibility of divinatory astrology with the dogmas of the Christian faith and empirical knowledge (discussed, among others, by St. Bp. Augustine, St. Isidore of Seville, St. Thomas Aquinas, Bp. Étienne Tempier (d. 1279)) and the condemnation of theses of the radical Aristotelians (1270, 1277) by Bp. Nicholas of Oresme, Cardinal Archbp. Peter of Ailly, John Gerson, Marsilio Ficino, Giovanni Pico della Mirandola, Girolamo Fracastoro, Martin Luther, and the papal bull *Coelli et terrae* (1586) – see Lanuza-Navarro, Ávalos-Flores 2008; Vescovini 2014; Tarrant 2020.

Regarding pseudoscience, see e.g. Thagard [1978](#). I will add one more remark omitted by Thagard. Although I am not a supporter of prophetic astrology for empirical reasons (lack of compliance of astrology’s predictions with empirical facts; extremely unrealistic mechanism of influence on humans and the sublunar sphere of distant planets – extremely weak sources of radiation compared to the Sun) and theological reasons (inconsistency of the astrological ontological axiom with the human free will according to Christian theology), I do not agree with the thesis of Eugeniusz Rybka (1971, p. 23) that prophetic astrology can only be implemented in the geocentric system and cannot be implemented in the heliocentric system.

Professor Rybka’s thesis is not new at all, because it had been preached before by, for example, W.W. Tarn (1952, p. 348) and David Pingree (1968, p. 118). It was already

changed into meteoreology, iatromathematics into physiology, and mathematical and physical astronomy entered into a close dialogue with modern physics, which led to the emergence of, among others, astrophysics and relativistic cosmology in the 19th and 20th centuries.

4. Two Chairs in Alma Mater Cracoviensis

At the beginning of the 15th century, two Chairs were founded in the Alma Mater Cracoviensis: the Chair of Mathematics and Astronomy, established in 1405 by Master Jan Stobner or the Kraków burgher Stobner (therefore also called the Stobner Chair) and functioning perhaps already since 1410, or at the latest 1415, and the Chair of Astrology, probably established at the beginning of the second half of the 15th century by Marcin Król of Żurawica, as can be proven by the astrological forecast for 1451 prepared by this author.

denied by George Sarton (1959, p. 60) and Eugenio Garin (1976a, p. xi). I will add that Tarn-Rybka's thesis is contradicted by, for example, the astrological forecaster for 1541 determined on the basis of the *Copernican Tables* by Andreas Aurifaber in the work entitled *Practica auff das Jar M.D.XLI...* (Danzig, 1540) (Green 2010; Włodarczyk 2015, pp. 20–23) or Kepler's activity as an astrologer (Garin 1976a, pp. xi, xii, 12, 125; Gingerich 1981, p. 289; North 1994, pp. 312–314; Rabin 1997; Konarska-Zimnicka 2018, pp. 360–361, fn. 237). Tarn-Rybka's mistake is repeated by Marcin Karas (2018, p. 72, fn. 263).

Incidentally, the content of the monograph by M. Karas (2018) is very interesting from the perspective of my research interests. I only regret, as a historian and philosopher of science and a scientist living in Kraków, that its author, working at the Jagiellonian University in Kraków, only occasionally refers to my habilitation thesis (Kokowski 2004), although he includes it in his basic studies in the introduction to his monograph (Karas 2018, p. 11: “A comprehensive analysis of Copernicus's originality in the light of the latest literature is the English-language publication by the Polish scientist Michał Kokowski entitled “Copernicus's originality (page 314)” [...]. The author's research is characterized by an interdisciplinary approach and clarity of the conclusions, a synthetic approach and knowledge of the sciences and their methodology. The monograph presents a very broad background against which heliocentrism is considered”) and does not quote my other basic publications (Kokowski 1996; 2001; 2009), the content of which is closely related to his arguments, e.g. on Copernicus's nationality, his methodology, the problem of Earth's movements, the views of T.S. Kuhn on Copernicus, etc. *I assess such a strategy as a manifestation of a very serious crisis in scientific discourse and a waste of an opportunity to engage in a valuable, critical scientific discussion.*

The Chair of Astrology operated until 1780. It was closed by the decision of Hugo Kollataj as a result of criticism of the compliance of forecasters with empirical facts, by, among others, Jan Poszakowski and Antoni Wiśniewski (Kowalewska 2009, p. 282; Rok 2023).

5. Copernicus's studies in Kraków and astrology

From the fall of 1491 or the winter of 1492 until the summer of 1495 at the latest,¹⁵ Copernicus studied at Alma Mater Cracoviensis, which was the European center of astronomy and astrology.

During his studies, *he had the opportunity to listen to* many lectures on mathematical and physical astronomy, as well as several on divinatory astrology, including a lecture on Ptolemy's *Quadripartitum* / *Tetrabiblos*, an author considered the prince of astrologers,¹⁶ as lectures of this type were held in Kraków at that time, as evidenced by university lists of lecturers' activities.¹⁷

I would like to emphasize that we must speak in this context about the probability and not the certainty of Copernicus's participation in specific university classes, as lists of attendance are not known.

As for Copernicus's participation in the lectures on Ptolemy's *Quadripartitum* / *Tetrabiblos*, it is probable that he attended the lectures on this subject given in 1494 by Wojciech Krypa of Szamotuly. This is supported by the fact that a series of such lectures was organized only once in the years 1491–1495 (L. Birkenmajer 1924, pp. 55–60).

Copernicus also learned astrology from the 10th-century work entitled *Praeclarissimus liber completus in iudiciis astrorum* / *The Most Famous Complete Book of Fortune-telling from the Stars* (Venice, 1485) by Haly Abenragel, the most frequently quoted author in European astrological literature. Copernicus acquired the book during his studies in Kraków; it was bound together with *Preclarissimus liber elementorum Euclidis perspicacissimi in artem geometrie incipit qu afoelicissime* (Euclid's *Elements*, Venice: Ratdolt, 1482).¹⁸

¹⁵ These are approximate dates, quoted from: Chachaj 2023, pp. 38, 93.

¹⁶ See fn. 6, above.

¹⁷ See Karliński 1873; Polkowski 1873, pp. 118–120; Wislocki 1886; L. Birkenmajer 1900, pp. 191–193; 1924, pp. 50–134; Markowski 1993; Goddu 2010, pp. 25–33; Chachaj 2023, pp. 60–88.

¹⁸ According to M. Curtze, L. Birkenmajer and J. Wasiutyński, G. Rosińska, M. Folkerts, S. Kirschner and A. Kühne, D. Juste, and S. Konarska-Zimnicka, in this

It is also likely that Copernicus learned astrology from three other works (in Latin translations) by Arab authors: an introduction to the art of astrology entitled *Liber introductorius ad magisterium iudiciorum astrorum*, by al-Qabisi, known in Latin Europe as Alcabitius (d. ca. 967), and the treatise *De causis orbis et motus eius...* (*On the Causes of the Spheres and Their Motions...*) by Mashallah (ca. 740–815), as well as the famous work *Centiloquium* (*One Hundred Aphorisms*), attributed to Ptolemy,¹⁹ because lectures in Kraków were based on these textbooks (Polkowski 1873, pp. 118–120).

Furthermore, Copernicus also acquired in Kraków the co-bound *Tabulae Astronomice Alfonsi Regis* (Venice, 1492) and the work of the astronomer and astrologer Regiomontanus: *Tabule directionum projectionum; famosissimi viri magistri Joannis Germani de Regiomonte in natiuitatibus multum viles* (*Tables of Directions and Projections of the Famous Master John the German from Königsberg, Very Useful for Horoscopes*) (Augsburg: Ratdolt, 1490). Importantly in this context, the above-mentioned tables were used as basic tools for creating horoscopes (determining astrological houses) (L. Birkenmajer 1893, pp. 29–30; 1900, pp. 26–69; Włodarczyk 2015, p. 45; Konarska-Zimnicka 2018, pp. 19–80; Piotrowski 2023).²⁰

book, Copernicus included his notes in which, among other things, he quoted the *Tetrabiblos*. These notes concern e.g., the father's lifespan and mother's parents – see Curtze 1875, pp. 57–59; L. Birkenmajer 1900, pp. 191–193; 1924, pp. 50–60, 337–338; Wasiutyński 1938, pp. 68–70; 1963; Rosińska 2002, pp. 119–120; Copernicus 2019, pp. 564–570; Piotrowski 2023; Juste 2024; Konarska-Zimnicka 2024.

However, P. Czartoryski (1978, pp. 359, 366) questions the authorship of at least some of these notes, though without providing the necessary details or a list of such notes; this position is shared by E. Rosen (1984, pp. 111–112); A. Goddu (2004, p. 221, 1. SPS 145); G. Blumenthal (2014, p. 4, fn. 3).

After a scrutiny of the notes included in the digital version of Hali's work and Euclid's *Elements* (made available by the University Library in Uppsala), I have very serious doubts as to the validity of Czartoryski-Goddu's verdict based on an analysis of Copernicus's writing alone, and that is why I support G. Rosińska's opinion (2002, pp. 119–120) that these are Copernicus's notes, written “in his youthful hand” (from the Kraków period). Additionally, due to the fact that the content of these notes correlates very well with Copernicus's family situation, I believe that professors P. Czartoryski (implicitly) and A. Goddu (explicitly) are wrong in denying Copernicus's authorship of these marginalia.

¹⁹ This work was the basic textbook on astrology for medical students in Bologna – see Rutkin 2006, p. 546.

²⁰ I believe that Copernicus also knew another work by Regiomontanus entitled *Disputationes inter Viennensem et Cracoviensem super Cremonensia in planetarum theoriae*

6. Copernicus’s studies in Bologna and Padua and astrology, Joachim Rheticus, Domenico Maria da Novara and Robert S. Westman

Information obtained from Georg Joachim Rheticus:

- a) Copernicus was an assistant and helper in the observations of Domenico Maria [da Novara], not his student: (“Cum D. Doctor meus Bononiae, non tam discipulus, quam adiutor, & testis obseruationum doctissimi Viri Dominici Marie” (*Narratio prima* [1540](#), p. 4);
- b) Copernicus lived with Domenico Maria [da Novara] while studying in Bologna (“Vixerat cum Dominico Maria Bononiensi”) (*Ephemerides novae* [1550](#), p. A3; see also Ashworth [2024](#)).

From later studies, including by Westman himself (e.g. 1993; 2011a), it is known that Novara was both an astronomer and an astrologer – he created horoscopes and prognostics.²¹

Addition by Robert S. Westman

R.S. Westman (1993; 1994; 2011a; [2011b](#); [2014](#); [2016](#); [2019](#); [2024](#)) added to the information from Rheticus that:

- a) Copernicus lived in the same house as Domenico Maria da Novara: 1) *it is not known how long* (2011a/[2011b](#), p. 87); 2) *as many as four years: 1496–1500* ([2016](#), p. 35; [2019](#), p. 297) (sic!); 3) *for some time* (1993, p. 1; [2024](#));
- b) from Novara, Copernicus learned about the debate on astrology and the works: *Tetrabiblos* (Venice, 1493); *Epitome in Almagestum* by Georg von Peurbach and Regiomontanus (Venice, 1496), and *Disputationes adversus astrologiam divinatricem* (*Disputations Against Divinatory Astrology*) by Giovanni Pico della Mirandola (Bologna,

deliramenta (*Dialogue Between a Viennese and a Cracovian About the Ravings of Gerard of Cremona on Planetary Theories*) (1474). The Viennese was Regiomontanus himself, and the Cracovian was Martin Bylica of Olkusz, Kraków university professor and later the court astrologer of Matthias Corvinus, king of Hungary.

²¹ See e.g. Polkowski 1873, p. 142, fn. 2; L. Birkenmajer 1900, pp. 424–448; Wasutyński 1938, p. 570, n. 30; Biliński 1975; Truffa 2007; Westman 1993, pp. 2–3; 2011a, pp. 87–99 (he does not refer to earlier studies that signaled that Novara dealt with astrology); Bònoli, De Meis (eds.) 2012.

- 1495 or 1496) (2011a/[2011b](#), pp. 87, 93, 96, 97, 99; [2016](#), pp. 29, 35; [2019](#), p. 299; [2024](#)) (sic!);
- c) thanks to Novara, during his law studies in Bologna, Copernicus was associated with the culture of creating astrological forecasts (1993, pp. 2–3; 2011a, pp. 76–105/[2011b](#); [2016](#), pp. 28–35; [2019](#), p. 299; [2024](#)) (sic!);
 - d) Novara, however, was not a close collaborator of the Florentine Neoplatonists, which was previously stated e.g. by Thomas S. Kuhn (1957, p. 130) without providing a source, but this does not mean that Neoplatonic thought did not influence Copernicus [*this is a valid point* – M.K.] (1994, p. 87, fn. 19; [2019](#), p. 297; R.S. Westman knew this back in 1991);
 - e) during his law studies in Bologna (1496–1500), Copernicus improved his knowledge of astrology, which was necessary in the practice of medicine at that time and which Copernicus studied in Padua in the years 1501–1503 ([2024](#)²²);
 - f) the reason for Copernicus’s development of the heliocentric system was the crisis of astrology, related to, among others, the inconsistency of the order of the planets, which was clearly pointed out *only* by Giovanni Pico della Mirandola (1495 or 1496) and Copernicus’s theory was a response to the work of this author (1993; 2001, pp. 3–4 (1495); 2011a/[2011b](#); 2013, pp. 50–51; [2019](#); [2024](#)) (sic!);
 - g) *only* Edward Rosen (1978, pp. 356–357) showed that Copernicus could not have obtained knowledge about the quotation from Averroes’s *The Paraphrase of Ptolemy* without reading Pico’s work (1993, p. 4; 2011a, p. 104) (sic!);
 - h) Copernicus wrote *De revolutionibus* following the example of Ptolemy’s *Almagest* (a work on mathematical astronomy) and he also intended (sic!) to write an astrological treatise following the example of Ptolemy’s *Tetrabiblos* (2011a/[2011b](#), pp. 104–105; [2019](#), p. 300);

²² “In 1501 he stayed briefly in Frauenburg but soon returned to Italy to continue his studies, this time at the University of Padua, where he pursued medical studies between 1501 and 1503. At this time medicine was closely allied with astrology, as the stars were thought to influence the body’s dispositions. *Thus, Copernicus’s astrological experience at Bologna* (sic!) was better training for medicine than one might imagine today” (Westman [2024](#)).

- i) Copernicus painted his self-portrait (sic!), having probably (sic!) acquired the skill of painting during his studies in Padua, because there was a flourishing community of painters in Padua and nearby Venice at that time (sic!) ([2024](#)).

7. Criticism of R.S. Westman's theses

For historians of philosophy, science, medicine and ideas, it is an indisputable fact that during Copernicus's studies in Kraków (from the fall of 1491 or the winter of 1492 to the summer of 1495 at the latest), Bologna (from the fall of 1496 to March 4, 1500), Rome (after March 4, 1500 to the spring of 1501), Padua (from September 1501 to 1503) and Ferrara (May 1503),²³ he became acquainted with natural, medical and divinatory astrology. At that time, it was the pinnacle of astronomy/mathematics and was valued by rulers. It was a fundamental cultural framework: a mathematized cosmology that was *thoroughly astrological in nature*.²⁴ This was said by, among others, St. Bp. Albert the Great, Pietro d'Abano and Johannes Regiomontanus (all connected with the University of Padua).²⁵

It is also known from many sources and studies that from antiquity to the 16th–17th centuries, medicine had very strong connections with divinatory astrology; a discipline called medical astrology / astrological medicine or iatromathematics was developed, and it could not be practiced without the ability to prepare horoscopes.²⁶

²³ These are approximate dates, quoted from: Chachaj 2023, pp. 38, 93, 98, 112, 136, 164, 165, 168, 213.

²⁴ These issues are aptly expressed by, for example, Thorndike 1955; Dooley (ed.) 2014a; Dooley 2014b.

²⁵ About Regiomontanus as an astrologer – see Swerdlow 1990; 1993.

²⁶ See Cornell 1933/(3rd rev. ed.) 1992; Thorndike 1955; Cooper 2011; 2013; Swieżawski 1980, vol. 5, pp. 312–314; Sellar 2008. When assessing the importance of medical astrology in the Middle Ages, Thorndike (1955, p. 277) compared it to the medieval “unified field theory”, as noted by Cooper 2013, p. 537.

In assessing the importance of horoscopic astrology from antiquity to the sixteenth century, Otto Neugebauer compared it to the importance of modern mechanical theory and pure science: “Its actual development [i.e. horoscopic astrology] must be considered as an important component of Hellenistic science ... To Greek philosophers and astronomers, the universe was a well defined structure of directly related bodies. The concept of predictable influence between these

This discipline was practiced in ancient times by, among others, Hippocrates (ca. 460 BC–ca. 375 BC) and Galen (died ca. 216), and in the Arab Middle Ages, e.g. by Avicenna (980–1037). Their works formed the basis of the medical canon of European medieval and Renaissance universities. Medical students of the University of Padua also studied them, also at the time when Copernicus was a student there; in particular, this concerns Galen's astrological interpretation of the Hippocratic doctrine of critical days, described in *De diebus decretoriis* (see Galen 2011; Cooper 2011; 2013). Many other thinkers valued this discipline, including St. Bp. Albert the Great, author of the *Speculum astronomiae* (*The Mirror of Astronomy*, c. 1260),²⁷ Pietro d'Abano (1257–c. 1316), author of the *Conciliator differentiarum philosophorum et praecipue medicorum* (*Conciliator of the Differences Between Philosophers and Especially Physicians*; Mantua, 1472)²⁸ and Marsilio Ficino (1433–1499), author of the *De vita libri tres* (1489) and translator of the works of Plato and the Platonists.²⁹ His books were in Copernicus's library.

There were also loud critics of astrology, mainly prophecy, including St. Bp. Augustine (354–430), St. Isidore of Seville (d. 636), St. Thomas Aquinas (1224 or 1225–1274), Bp. Étienne Tempier (d. 1279), Bp. Nicholas d'Oresme (ca. 1320–1384), Henry Langenstein of Hesse (ca. 1325–1397), Card. Archb. Peter of Ailly (1350–1420), John Gerson (1363–1429), Giovanni Pico della Mirandola (1463–1494) and Girolamo Fracastoro (1478–1553).³⁰

bodies is in principle not at all different from any modern mechanistic theory [...] Compared with the background of religion, magic, and mysticism, the fundamental doctrines of astrology are pure science" (Neugebauer 1962, p. 171; cited in: Long 1982, p. 165).

²⁷ According to some researchers, however, such an attribution is not certain. Paola Zambelli and Scott E. Hendrix attribute this work to St. Bp. Albert the Great. I personally do not question this attribution.

²⁸ He stated the following: "qui deligenter inspiciunt concedunt hanc scientiam astronomiae non solum utilem sed et necessariam maxime medicinae" (Pietro d'Abano 1477, f. 22r.). See also Vescovini 1987.

²⁹ Allen 1941 and 1966, pp. 3–19; Swieżawski 1980, vol. 5, pp. 307–314; Voss 2000; Mallek 2001; Beecher 2002; Cooper 2011; 2013; Greenbaum 2015; Heidari 2022; Philips 2023.

³⁰ See e.g. Thorndike 1934a; 1934b; 1941a; 1941b (see the tables of contents); 1955; Pines 1964; Swieżawski 1980, volumes 1–6 (see the index of names and the index of subjects); Granada, Tessicini 2005; Cooper 2011; 2013 and Vescovini 2014.

Therefore, *in the theoretical and empirical layers*, the crisis of astrology in the Middle Ages and the Renaissance (I mean the incompatibility of astrological axioms with, among others, the Christian idea of freedom of will, the purely fictional nature of some terms (zodiac,³¹ houses, etc.) and problems with empirical predictions) was permanent. The discovery was made definitely not by Pico.³²

On the other hand, although Pico denied the occult and kabbalistic interpretations of Aristotelian-Ptolemaic astrology developed by medieval Hebrew and Arab thinkers, he did not fundamentally reject its Aristotelian-Ptolemaic core, and despite such criticism, the astrological vision of the world developed from antiquity to the Renaissance (e.g. by St. Bp. Albert the Great and Petro d’Abano) was still appreciated and developed in the 16th and 17th centuries at European universities.³³ It was appreciated by, among others, Melanchthon,³⁴ Tycho Brahe and Kepler. From this perspective, the crisis of astrology, manifesting itself in the reduction of its general cultural importance, appeared later, in the second half of the 17th century and in the 18th century.³⁵

In such a historical context, it is highly probable and even certain that Copernicus knew natural, medical and divinatory astrology. Nevertheless, we do not know of any document that would justify the thesis that Copernicus used astrological knowledge in his medical activities in Warmia, because both the preserved prescriptions and marginalia attributed to Copernicus are silent about it.

The other theses – interpretations of R.S. Westman, with the exception of Kuhn’s criticism (indicated in point d) above)³⁶ – have no

³¹ On the history of the term ‘zodiac’ – see Van der Waerden 1952–1953.

³² See below fn. 47, with the remarks by Marie Boas-Hall 1962, pp. 42–43.

³³ Rutkin 2006, p. 548 mentions in this context the universities of Bologna, Pisa, Padua, Louvain and German Lutheran universities. The university in Kraków is not on the list, but I think it is just an oversight.

³⁴ See Brosseder 2005.

³⁵ Rutkin 2002; 2006; 2018. This was combined with the abandonment of the so-called astrologizing Aristotelianism in favor of Newtonianism. See below fn. 55 with Thorndike’s (1934b) critique of Pico’s argument.

³⁶ Nevertheless, R.S. Westman (1994; 2011a; ... [2024](#)) repeatedly refers with approval to T.S. Kuhn’s (1957; 1962) interpretations of the Copernican revolution. Unfortunately, it is hagiographic in nature. The author does not take into account the results of my dissertations: Kokowski [1996](#); 2001 (the only monograph in world literature on the criticism of Kuhn’s interpretations of the Copernican revolution);

factual basis, because in the works of Copernicus there are no traces that he was a supporter of divinatory astrology or that he created horoscopes and astrological forecasts, because the sources are silent about it (also R.S. Westman knows about this, e.g. Westman 2011a, pp. 104–105). Nowhere in his writings did Copernicus mention that it was from Novara that he learned about the debate on astrology and about the *Tetrabiblos* (Venice, 1493), *Epitome in Almagestum* by Georg von Peurbach and Regiomontano (Venice, 1496), and *Disputationes adversus astrologiam divinatricem* by Giovanni Pico della Mirandola (Bologna, 1496). Copernicus's friends and his biographers did not comment on this matter either. Nevertheless, I think it is possible that Copernicus heard about these works from Novara. However, it is (almost) certain to me that Copernicus heard about the 1493 edition of the *Tetrabiblos* while studying in Kraków, because this Alma Mater was the European center of astrology at that time and it would not surprise me if this edition was in his own library, although there is no information about this so far.

On the other hand, it is known that, unlike Copernicus, Joachim Rheticus appreciated divinatory astrology, as clearly evidenced by the subsection of *Narratio prima* (1540) with the telling title “Ad motum eccentrici monarchias mundi mutari” (“The Kingdoms of the World Change with the Motion of the Eccentric”), in which Rheticus makes an astrological interpretation of Copernicus's theory presented in the *De revolutionibus*:

I shall add a prediction. 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,

2004; 2009, in which I demonstrated the multiple weaknesses of Kuhn's vision of the genesis and reception of Copernicus's theory.

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. 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, during which time nearly two revolutions are completed. Thus it appears that this small circle is in very truth the Wheel of Fortune, by whose turning the kingdoms of the world have their beginnings and vicissitudes. For in this manner are the most significant changes in the entire history of the world revealed, as though inscribed upon this circle (Copernicus / Rosen 1959, pp. 121–122).

Earlier Copernicologists,³⁷ as well as Westman himself and the author of this article,³⁸ knew about these views of Copernicus and Rheticus on prophetic astrology.

I limit myself here to presenting the views of authors from the English-speaking world: Edward Rosen categorically denied the possibility that Copernicus valued and practiced astrology, and Lynn Thorndike, Alexandre Koyré, J.L.E. Dreyer and Owen Gingerich approached this issue somewhat differently than Rosen:

It is a historic fact that the Copernican system was first publicly announced, if not precisely under astrological auspices at least to an astrological accompaniment and that such signifying the future was for long after associated with it in many men's minds. [...] Indeed, this astrological accompaniment was somewhat of a new idea itself, since

³⁷ Among others, Ignacy Polkowski ((ed.) 1873–1875, vol. I, p. 105), Ludwik Antoni Birkenmajer (1900; 1924); Jeremi Wasiutyński (1938, pp. 430–431); Edward Rosen (1939 [1st ed.], 1959 [2nd rev. ed.], 1971 [3rd ed.], fn. 57, pp. 122–123; 1941; 1978, p. 344, note to page 7:15; 1984, p. 111), Lynn Thorndike (1941a, pp. 414, 417, 419), Thomas S. Kuhn (1957, p. 93), Owen Gingerich (2004a, p. 201 / 2004b, pp. 182–184, 193).

³⁸ Westman 2011a, pp. 28–29; [2016](#), pp. 2–3; Kokowski 2009, p. 51–52, 286 fn. 48.

it represented the movement of the earth rather than the motion of the stars as influencing the course of human destiny. The *Narratio prima* of Rheticus [...] contained a discussion of the dependence of earthly monarchies and their vicissitudes through the ages upon the movement of the earth in its eccentric orbit (Thorndike 1941a, p. 414).

It is not improbable that Copernicus agreed with the astrological interpretation of the earth's eccentric set forth by Rheticus. His interest in astrology is shown by his possession of the work of Albohazen Haly on that subject [...] and by his adding to his copy notes from the *Quadripartitum* of Ptolemy. [...] But the most noteworthy fact is that he kept this interest out of *De revolutionibus* and confined the latter exclusively to astronomical argument. Ptolemy, it is true, had set the example in this respect by: devoting the *Almagest* to astronomy and considering astrology separately, though favorably, in the *Quadripartitum*. But Copernicus, who had slowly and reluctantly published *De revolutionibus* at the very close of his life, so far as we know published nothing in the field of astrology. This abstention may have been in part accidental, but it, as well as the new Copernican astronomical hypotheses, was not without significance for the future (Thorndike 1941a, p. 419).

Dr. E. Rosen points out that, in contradistinction with Rheticus, Copernicus nowhere in his books asserts a belief in astrology. Dr. Rosen is perfectly right. And yet it seems to me, at least—difficult to admit that Rheticus, who wrote his *Narratio* with the knowledge and probably under the supervision of Copernicus, would have dared to express these views if they were opposed to those of his master (Koyré 1943, p. 718, fn. 34).

Nothing of this theory of monarchies [viz. Rheticus's astrological speculations] is mentioned by Copernicus himself, but we cannot doubt that Rheticus would not have inserted it in his account if he had not had it from his 'D. Doctor Praeceptor,' as he always called him" (Dreyer 1953, p. 333; cited from Rosen 1984, p. 110; noted by Blumenthal 2014, p. 5).

All the available biographical information on Rheticus reveals his passion for astrology. Curiously, there is not a shred of evidence that Copernicus had any interest in the subject, even though he could hardly have avoided learning the standard rules of its practice. Given the ethos of the times, Rheticus and Copernicus must certainly have discussed the topic. Copernicus was surely not naive; he must have realized that astrologers would constitute a good fraction of the market for his treatise (Gingerich 2004a, pp. 188–189).

My Institute colleague Jarosław Włodarczyk commented on this subject in a similar style:

[...] 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 (Włodarczyk 2015, pp. 45–46).

Regarding the above-quoted opinions of Thorndike, Koyré, Dreyer, Gingerich and Włodarczyk, one can repeat Michel-Pierre Lerner’s remark that Luther and Melanchthon cooperated closely despite their different views on astrology, so it could have been similar in the case of Copernicus and Rheticus.³⁹

Regardless of this, let us recall here four historical facts proving that Copernicus could have had some astrological competence (*however, this does not mean that he shared the belief in the effectiveness of natural, medical or divinatory astrology*).

On April 8, 1535, Dr. Johannes Apelt sent a letter from Nuremberg to Albert, Prince of Prussia (and a senator of the Kingdom of Poland) with his horoscope prepared by Joachim Camerarius (1500–1574),

³⁹ Lerner 2012, p. 237; noted by Blumenthal 2014, p. 5.

adding that if the prince did not find anyone who could explain the horoscope to him, he should then seek help from an old canon in Frombork. This old canon was undoubtedly Nicolaus Copernicus himself (Biskup 1973, reg. 344). *This is not, however, a strong argument*, because Apelt did not mention Copernicus's name.

On October 15, 1535, Bernard Wapowski, a friend of Copernicus and then secretary of King Sigismund the Old, sent a letter from Kraków to Sigismund Herberstein of Vienna with Copernicus's astronomical almanac for the year 1536, calculated on the basis of Copernicus's new tables, in order to have it printed in Vienna and disseminated among "specialists in celestial matters in Germany" to protect the almanacs they were compiling from empirical errors (unfortunately, the almanac *was lost*). Almanacs of this type were useful tools for practicing astrologers.⁴⁰ *This is not, however, a strong argument*, because we do not know the content of this almanac.⁴¹

In the 1530s and/or on 4 June 1539, Martin Luther referred to Copernicus as an astrologer:⁴² *in this case Luther identified astrology with*

⁴⁰ Biskup 1973, reg. 345; Włodarczyk 2015, p. 45; Piotrowski 2023.

⁴¹ There are stronger arguments: see Borski, Kolkov 2024, ch. 3.1.5.

⁴² There are two statements by Luther on this subject:

1) *from the 1530s* (edited by Johann Goldschmidt Aurifaber): "Es ward gedacht eines neuen Astrologi, der wollte beweisen, dass die Erde bewegt wurde und umginge, nicht der Himmel oder das Firmament, Sonne und Monde; Gleich als wenn einer auf einem Wagen oder in einem Schiffe sitz und bewegt wird, meinete, er sasse still und ruhete, das Erdreich aber und die Baume gingen um und bewegten sich. Aber es gehet jetzt also: wer da will klug sehn, der soll ihm nichts lassen gefallen, was Andere machen, er muss ihm etwas Eigens machen, das muss das Allerbeste sehn, wie ers machet. Der Narr will die ganze Kunst Astronomiae umkehren. Aber wie die heilige Schrift anzeigt, so hiess Josua die Sonne still stehen, und nicht das Erdreich" (Luther 1568, p. 433; cited from: Wardęska 1975, p. 39, fn. 19; however, this quote is not in: *Luthers Werke, Kritische Gesamtausgabe. Tischreden*, Weimar, 1912, vol. I, no. 885, pp. 412–413 as I originally claimed following Wardęska (entry no. 885 is placed on p. 442 and concerns an entirely different matter); the proper quote is in: *Colloquia oder Tischreden*, in the series *Dr. Martin Luthers Saemmtliche Schriften*, vol. 22. St. Louis: Lutherischer Concordia Verlag, ed. Johannes Georg Walch, 1887, cap. 70, p. 1546);

2) *from June 4, 1539* (edited by Anton Lauterbach): "De novo quodam astrologo fiebat mentio, qui probaret terram moveri et non caelum, solem et lunam, ac si quis in curru aut navi moveretur, putaret se quiescere et terram, arbores moveri. Aber es gehet itzunder also: Wer da will klug sein, der soll ihme nichts lassen gefallen, was andere achten. Er muss ihme etwas eigenes machen, sicut ille facit, qui totam astrologiam

astronomy, but he was an opponent of prophetic astrology, which he distinguished from astronomy as a reliable science of the movements of the stars.⁴³

In 1581, Marcin Kromer, bishop of Warmia, called Copernicus “Praestanti astrologo” (outstanding astrologer), in the first epitaph of Copernicus in the Frombork cathedral.⁴⁴ *In this case, however, we are not certain whether bishop Kromer did not identify astrology with astronomy.*

However, what is particularly interesting in the context of this article, contemporary Polish supporters of astrology: – Dr. Malgorzata Korpikiewicz and Dr. Piotr Piotrowski, the current president of the Polish Astrological Society – have not found evidence in Copernicus’s works to attribute to him the title of a supporter of astrology (natural, medical or divinatory). Moreover, agreeing with the remarks of historians of science, they claim that Copernicus did not cast horoscopes, but was able to interpret them, because he acquired such knowledge during his studies in Kraków⁴⁵ and not – as Westman claimed – only during his studies in Bologna and thanks to his acquaintance with Domenico da Novara.

It should be added here that the astrological genesis of the Copernican theory propagated by R.S. Westman was severely criticized by a historian of mathematical astronomy, Noel M. Swerdlow, who accused Westman of intellectual dishonesty: ignorance of Pico della Mirandola’s work *Disputationes adversus astrologiam divinatricem* (1st ed. 1496), arbitrariness and selectivity of translations, and omission of key information from the history of astrology and astronomy. Unfortunately, I share Swerdlow’s view.

To the above-mentioned insightful remarks of N.M. Swerdlow, I will add six more.

invertere vult. Etiam illa confusa tamen ego credo sacrae scripturae, nam Josua iussit solem stare non terram” (*Luthers Werke, Kritische Gesamtausgabe. Tischreden*, Weimar 1916, vol. IV, no. 4638, pp. 412–413); cited from: Wardęska 1975, p. 39, fn. 19.

As a side note: it should be emphasized that it is doubtful whether Luther actually called Copernicus a fool (der Narr) and denied Copernicus’s achievements in astronomy. Because it is hard to imagine a situation in which Joachim Rheticus – who, after all, came from the circle of Melanchthon and Luther – could have gone to see such an alleged “fool”. See Kleinert 2003; Kokowski 2009, p. 347, note 270; pp. 48–49.

⁴³ See Luther 1568, pp. 433–435.

⁴⁴ Sikorski 1989, p. 144, fn. 16.

⁴⁵ Korpikiewicz 1985; Piotrowski 2012; 2023. This is also claimed by the historian of astrology, Sylwia Konarska-Zimnicka (2024).

1) The thesis that Copernicus's reading of Giovanni Pico della Mirandola's *Disputationes adversus astrologiam divinatricem* (1st ed. July 1496⁴⁶) was important for the genesis of Copernican theory is not Westman's original achievement. It was advanced in one form or another before Westman by: Ludwik Birkenmajer (1900, p. 95); Marie Boas-Hall (1962, pp. 42–43, 168–169);⁴⁷ Jerzy Dobrzycki (1971, p. 19); Stefan Swieżawski (1973, p. 257; 1980, pp. 126–127; 1983b), Henri de Lubac (1974, pp. 123, 331–334),⁴⁸ and especially Nicholas Campion (2008, vol. I, pp. 99–112, particularly pp. 106–112).

What distinguishes Westman from the aforementioned researchers is his conviction that Copernicus formulated his theory in response to the crisis of astrology described *only* in the work *Disputationes adversus astrologiam divinatricem* (1st ed. 1496). This is *an incorrect thesis*, because otherwise Copernicus's works would have included numerous references

⁴⁶ Contrary to the opinion of L.A. Birkenmajer (1900, p. 95, fn. 1) and the original view of R.S. Westman (1993, p. 3), the edition of Pico's work was published in July 1496, not in 1495. Westman (2011a, p. 96) also knows this.

⁴⁷ “[...] Even more serious, the current tables of planetary positions drawn up at the command of Alphonso the Wise in Spain at the end of the thirteenth century, were so grossly inaccurate as to inconvenience astrologers. For these and other reasons, astronomers were uneasy; it is almost fair to say that the Copernican revolution was predicted a century before Copernicus published his great work. Even laymen knew that astronomy needed reform: thus, the humanist Pico della Mirandola (1463–1494), arguing against astrology on religious, philosophical and scientific grounds (it denied the omnipotence of God, it denied man's free will and it was strikingly inaccurate) pointed out that the astronomers altered their system, as he believed they would.

Because they were thoroughly imbued with the humanist point of view, the astronomers of the fifteenth century naturally turned to the ancients for a clue to the way out of the astronomical labyrinth in which they found themselves, just as Copernicus was to do in the next century [...]” (Boas-Hall 1962, pp. 42–43).

⁴⁸ This was noted by Sheila J. Rabin (1997 p. 765, note 41): “No one has followed up this suggestion [of Lubac 1974, s. 333] regarding either Copernicus or Kepler [“that Pico influenced both Copernicus and Kepler to abandon the Aristotelian dualism between the heavens and the earth and further pushed Kepler toward establishing his celestial physics”]; however, Westman, 1993, [p.] 4, has shown that Pico's deriding the inability of astrologers to decide the true order of the planets appears to have helped spur Copernicus's reform [...]”. The author of these words, however, made a mistake in thinking that it was only Henri de Lubac (1974) who noticed the influence of Pico della Mirandola's thought on Copernicus. (I used a copy of Lubac's work, belonging to the collection of the late Prof. Stefan Swieżawski, kept in the Jagiellonian Library. I would like to thank the staff of the BUJ Manuscript Reading Room for providing me with this copy.)

to the central issues discussed in *Disputationes* ..., e.g. the distinction between astronomy and divinatory astrology; a list of various very serious reservations about divinatory astrology; astrological philosophy of nature: mechanisms explaining the influence of Sun, Moon, wandering stars or planets, fixed stars and comets on man, and geographical regions; and the idea of personal dignity, free will, and the opposition of material and spiritual factors influencing human development. *But Copernicus did not address such issues in his writings.*

Moreover, contrary to the thought of Giovanni Pico della Mirandola, Copernicus thus identifies astronomy, astrology, and mathematics in book I, ‘Introduction’ of his *De revolutionibus*:

Proinde, si artium dignitates penes suam de qua tractant materiam aestimantur, erit haec longe praestantissima: quam alii quidem astronomiam, alii astrologiam, multi vero priscorum mathematices consumationem vocant (Kopernik 1953, p. 21).

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 (Copernicus / Rosen 1978a, p. 7).⁴⁹

Copernicus did this in agreement with many other authors (see above), who since antiquity often treated the terms ‘science of the stars’, ‘astronomy’ and ‘astrology’ interchangeably. One of them was Giorgio Valla, mentioned in this article, who included in the encyclopedia *De expetendis ac fugiendis rebus* (Venice 1501) a treatise entitled *De tota astrologia libri iii*, devoted to the entire body of astronomical and astrological knowledge. We know that Copernicus was familiar with this encyclopedia (see L. Birkenmajer 1924, pp. 152–167).

According to R.S. Westman, the central problem for Copernicus was the problem of the cosmological structure of the world: the choice of

⁴⁹ Such interchangeable use of names originates from antiquity. However, from antiquity to the Enlightenment, there was an evolution of terminology, manifested in the distinction between, among others, natural astrology, which included medical astrology/iatromathematics, and divinatory astrology. Pico’s work concerned the critique of divinatory astrology.

an appropriate cosmological system and its arrangement, including the order of the planets. Copernicus allegedly encountered this problem in Bologna while studying the work of Giovanni Pico della Mirandola. The problem with this interpretation is that we have long known that in the *De revolutionibus* (Book I, Introduction, Ch. VI, Ch. X) Copernicus mentioned other authors who touched on this topic, such as Cicero, Plutarch, Plato, Pliny, Ptolemy, Alpetragius, Albategnius Aratensis, Averroes, Martianus Capella, Vitruvius and Aristotle.⁵⁰

The issue of the cosmological structure of the world – the choice of the appropriate cosmological system and its arrangement, including the order of the planets – was also discussed in Valla's encyclopedia (1501) mentioned above. Moreover, Copernicus mentioned other important problems that concerned him, e.g. the length of the tropical year, models of the motion of the Sun and Moon, imperfections of models of homocentric spheres and models of eccentrics and epicycles (*De revolutionibus*, Book I, Introduction) and the problem of the equant (*De revolutionibus*, Letter dedicatory, Books IV and V).⁵¹

However, from the research so far, we know about the only probable reference of Copernicus to Pico's work.

In his *De revolutionibus* (Book I, Ch. X), Copernicus supposedly obtained information about the sunspot and the conjunction of Mercury and the Sun from Pico's work, which information, due to accepting the idea of the perfection of the supralunar spheres, was interpreted as the transit/passage of Mercury through the disk of the Sun:

Quamuis et Auerroes in Ptolemaica *Parafrasi* nigricans quiddam se vidisse meminit, quando Solis et Mercurij copulam numeris inueniebat expositam (Kopernik 1953, p. 36).

Yet in his *Paraphrase* of Ptolemy, Ibn Rushd reports having seen something blackish when he found a conjunction of the [S]un and Mercury indicated in the tables (Copernicus/Rosen 1978, p. 19).

However, in his *Paraphrase* of Ptolemy, Averroes mentions that he noticed something dark on the Sun when

⁵⁰ A list of these works is provided by, for example, A. Birkenmajer 1953b.

⁵¹ However, Ptolemy himself did not use the term 'equant', but Peurbach and Regiomontanus did. See a short history of the terms: Benjamin, Toomer 1971, p. 405, n. 3; Copernicus / Rosen 1978a, p. 429, note on p. 278:39.

his calculation showed the complete conjunction of the Sun and Mercury (trans. by M.K.).

According to L. Birkenmajer (1900, pp. 94–95), C.A. Nallino (1944, p. 82), A. Birkenmajer (1953b, note p. 68,6, pp. 106–108), B.R. Goldstein (1969, pp. 53–55); E. Rosen (1978a, note p. 19:24, pp. 356–357), R.S. Westman (2013, pp. 31–32; 2019, p. 299) and O.L. Akopyan (2015, pp. 631–632), this statement is a result of reading the work of Pico della Mirandola (Bologna 1496 / Venice 1498):

**nō p̄cip̄r̄ . Auerrois ī paraphraſū magnæ compōnis Ptolemai dicit ſe quōdā ī ſole
duas quaſi maculas nigricātes ānotāſſe / cūq; nūeros digeſſiſſet p̄ id t̄p̄s īnuentum
mercuriū ſolis radus oppoſitū. Recte igitur Moſes ægyptius ex Abubachetiſ quoq;**

Fig. 1. Pico della Mirandola 1496, p. Hii v

Auerrois in paraphrasi magnae compositionis Ptolomaei dicit se quondam in sole duas quasi maculas nigricantes annotasse, cumque numeros digessisset per id tempus inuentum mercurium solis radus oppositum.⁵²

⁵² English translation: “Averroes, in a paraphrase of Ptolemy’s great work, says that he once noticed what seemed to be two blackened spots on the Sun, and when he made calculations for that time, he found Mercury [he found that Mercury was] opposite (sic!) to the Sun” (translated by M.K.).

In other words, Averroes found that Mercury was in opposition (sic!) to the Sun, which, however, does not happen due to the limited elongation (angular distance) of Mercury from the Sun: a maximum of 29 degrees (in the case of Venus: a maximum of 48 degrees). Consequently, it is an error either of Averroes himself, or rather of the translator of Averroes’s work, repeated by Pico. It should rather read: “he found Mercury in the rays of the Sun” / “in conjunction with the Sun” / “conjoined with the Sun”.

L. Birkenmajer 1900, p. 94 claims that this is a quote from the 1495 edition: Bononiae 1495 (fol. Incunab. Bibl. Jag. Nr. 2281), lib. X, cap. 4, fol. H² lin. 2–5. “Auerrois in paraphrasi magnae compositionis Ptolomaei dicit se quondam in sole duas quasi maculas nigricantes annotasse, cumque numeros digessisset per id tempus inuentum Mercurium solis radiis oppositum.” / “Auerrois, in a paraphrase of Ptolemy’s great composition, says that once upon a time he noted two black spots on the Sun, when he had calculated the numbers during that time Mercury had been found to be opposite to the rays of the Sun” (translated by M.K.).

He makes a mistake: Pico’s work was first published in 1496. Moreover, in the first edition the quotation does not have a capital letter in the word ‘Mercurium’ and instead of ‘radiis’ there is actually the word ‘radus’, which changes the meaning of Averroes’s statement to some extent (see below fn. 53 and 54).

re defectu nō p̄cipi. Auerrois i paraphrali magnae coponis Ptolomaei dicit se quo
dā in Sole duas q̄li maculas nigricātes ānotasse / cūq; nūeros digessisset per id tem
pus inuētū Mercuriū Solis radiis oppositū. Recte igit̄ Moles aegyptius ex Abu

Fig. 2. Pico della Mirandola 1498, p. 478

Auerrois in paraphrasi magnae compositionis Ptolomaei dicit se quondam in Sole duas quasi maculas nigricantes annotasse, cumque numeros digessisset per id tempus inuentum Mercurium Solis radiis oppositum (...) (Pico della Mirandola 1498, p. 478).⁵³

However, contrary to Westman's assurances, it was not Rosen who authored the thesis that Copernicus's borrowing of information from Averroes's *Paraphrase of Ptolemy* must have come from Pico's work, because Pico was referring to Averroes's work, preserved only in a Hebrew translation, which Pico read because he knew the language. This was already claimed by L. Birkenmajer (1900, pp. 89–95), based on the findings of Moritz Steinschneider (1892, p. 54; 1893, p. 36 §10; p. 547, §340) that there was no Latin translation of Averroes's work, of the Jesuit Josephus Blancanus (1415, p. 57, lines 28–29) and of Johannes Kepler (1617).

Let us now note two issues:

- a) a large discrepancy between the text of Pico della Mirandola (two dark spots on the Sun *and the "opposition" of Mercury*) and the text of Copernicus (one dark spot *and the conjunction of Mercury*, identified with the passage/transit of Mercury through the disk of the Sun);⁵⁴

⁵³ "Auerrois, in a paraphrase of Ptolemy's great composition, says that he once noticed two blackish spots on the Sun, when he had calculated the numbers during that time and found Mercury opposite (sic!) the Sun's rays" [it should be: in conjunction with the Sun / conjoined with the Sun] (translated by M.K.). See also fn. 52 and 54.

Swerdlow's translation, from the 1557 Basel edition: "Auerrois in paraphrasi Magnae compositionis Ptolomaei dicit sequondam in Sole duas quasi maculas nigricantes annotasse, cumque numeros digessisset perid tempus, inuentum Mercurium Solis radijs oppositum" (Liber X, caput IIII, s. 685): "Averroës, (however,) in the paraphrase of the *Great Treatise* of Ptolemy, said that he himself had once observed in the sun two spots, more or less verging on black, and when he carried out computations for that time, found Mercury interposed to the rays of the sun" (Swerdlow 2012b, pp. 5–6).

⁵⁴ As an aside, as already noted by A. Birkenmajer (1953b, pp. 103, 108), according to J.J. Lalande, *Astronomie*, 3rd ed., II Paris 1792, pp. 448–452, 462, Averroes's observations could not have been of the passages of Mercury and Venus across the disk of the Sun, because these planets are invisible to the naked eye against the background

- b) the text quoted from *Disputationes adversus astrologiam divinatricem* (1496) / *Disputationes adversus astrologiae* (1498) can be found in Book X, Ch. IIII (p. H₂):

**Caput IIII Argumentatōes astrologorū q̄b̄ sua roborāt dogmata ad q̄nq̄
fere genera redigi / infirma quidē & inefficacia.**

Fig. 3. The title of Ch. IV of Book X (p. H₂)

(“Argumentationes astrologorum quibus sua roborant dogmata ad quinque fere genere redigi, infirma quidem & inefficacia” (Book X, Ch. IIII: “The arguments astrologers use to reinforce their dogma have been reduced to about five types, really weak and ineffective”) – see these arguments:

	Libet	X
Auerrois in paraphraſi al mageſti Moles Abubacheliſ	qđ cū uice ſolaris erepti reddūt nō eripiūt lumen / ſed cōmutant : quare defectus nō p̄cipiſ . Auerrois i paraphraſi magnā compōnis Ptolemai dicit le quodā i ſole duas quaſi maculas nigricātes ānotaffe : cūq̄ nūeros digeſſiſſet p̄id t̄ps in uentum mercuriū ſolis radius oppoſitū . Recte igitur Moles ægyptius ex Abubacheliſ quoq̄ teſtimonio ſitū & ordinē planetarū ſcertū ꝑnunciauit . Nā lunā qđ ſcimus oībo in / ſeriores caliq̄ ueſtibulū ꝑpter maiore aspectus diuerſitatē quā minore iudicat neceſſario habitudinē ſemidiametri terræ ad ſpharæ ſemidiametrum . Quomō uero tres aliæ ſe habeāt ſol / uenus / mercurius / incertū . Similiter notū quatuor has ſtel / las nobis ꝑximiores aliis tribus : ſed illarū iter ſe tritū ſitū & ordinē ratio nō demōſtrat Cū igitur genethliaci nitūtur ordini huiusmodi cōſequētiæ ꝑcipio nitūtur ꝑrimū quidē ſalō : tum ſi ueſꝑ foret incerto : licet autē de ſignis idē obieſtare quādo (qđ ſa / tis demōſtrauimus) i zodiaco nullū aut quatuor æque principia ſint . D Atū de ꝑri / mo genere argumentationis : a parabolica ſimilitudine ſic ꝑbant : decimus locus in edito cæli uertice patet . quartus latet i imo terræ . Cū igitur magis cōpertū cuiq̄ de matre ſit q̄ de patre : cōuenit ut ꝑr decimū locū mater iudicetur . pater aut ꝑ quā / tū q̄ modus nō eſt aliter q̄ ex ſuo titulo reſutandus . Nā quācūque de iſtis ſimilitu dinibz argumenta ꝑtūtur nō ſolū ꝑhiloſophis ſunt indigna docētibz : uerū nec dia / lectis apta uel uilia diſputatibz : qn nec rherorꝑ ꝑꝑaſiōibz cōmoda / & uanæ fere poetica luſum potius ꝑſeferunt q̄ ſeriaz cuiuſq̄ ꝑbarionis idoneā auctōritatē a ma / thematicis argumētati eos dicebā cum bene decreta mathematicis male uertūt ad ſuas ꝑdictiōes qualia quā ſuperius de zodiaci in ſigna : ſignorū i partes : ꝑartium i minutias diuiſiōes dicebamus . Itē cū qđ recta quāda alia obliqua ſigna illis dicun tur : ob alcenſionis moras inæquales iꝑſi trāſſerūt ad naturā rectitudinis & obliqui / tatis i moribz . Ex aſtologicis colligūt quotiens aſtologicū aliqđ dogma ꝑincipiū faciunt alterius dogmatis cōſirmandi . dialecticis utūtur / ſi quando cōes & ꝑbabiles quodā ex natura uel ꝑria ꝑhiloſophia ꝑꝑōnes aſſumūt . Sed id q̄ rariffimū . Neq̄ enī memini apud eos legiſſe me rōnem quā fidē dialecticæ ꝑꝑabilitatis afferret .	
Secundū ge / nus argumē / tādi aſtolo / gorum .		
Tertiū genus argumētan / di .		
Quartū ge / nus . Quintū		

Fig. 4. Pico della Mirandola, *Disputationes adversus astrologiam divinatricem* (Bologna 1496, Book X, Ch. IIII, p. H ii₂)

of the Sun’s disk. See also Goldstein 1969. I will add that the simultaneous transit of Mercury and Venus is an extremely rare phenomenon – the next one will happen on June 26, 69163 (Meeus, Vitagliano 2004), and the last one happened in 373173 BC (Wikipedia 2024) (which, however, is disputed by McFleppers, Ghosh 2021 as empirically implausible). It follows that Averroes must have actually observed two sunspots on the Sun, which, however, could not have existed there due to the paradigm/axiom of perfection of heavenly bodies applicable in the intellectual culture of the time.

That is, they concern criticism of divinatory astrology and *not issues in the field of mathematical astronomy and physical astronomy* (on which Copernicus focused).⁵⁵

Therefore, the above-mentioned fragments from Copernicus's work and Pico's work *are not at all irrefutable evidence* of Copernicus's dependence on Pico. Copernicus may have learned about the quote from Averroes from another, now unknown study.

It turns out that such a work was already indicated by Moritz Steinschneider in 1903: it is a Latin or Castilian translation of Averroes's *Paraphrase of the Almagest*, made before the mid-14th century for Alfonso X. Copies of this work were available in Bologna and Spain. This information was provided by Alphonsus, son of Dionysius of Lisbon (d. 1352), translator of Averroes's works, in the preface to his translation of Averroes's writing *De separatione primi principii* (codex Digby 256, fol. 190r–194v).⁵⁶ This fact was noted by Aleksander Birkenmajer in 1922 and 1953,⁵⁷ and was overlooked, among others, by R.S. Westman. Therefore, Copernicus may have come across this translation of Averroes's *Paraphrase of the Almagest* or another writing referring to this work while studying in Bologna.⁵⁸

2) Contrary to the opinion of R.S. Westman, there are no rational premises that would make it more or less probable that Copernicus

⁵⁵ An English translation of the entire chapter 4 (including the fragment with five types of astrologers' arguments) – see Sverdlow 2012b, pp. 3–7. See also a discussion of the entire Pico's treatise in: Shumaker 1972, pp. 18–27; Thorndike 1934b, pp. 485, 532, 529–530.

Note that Thorndike criticizes Pico: "This effort to give the impression that most of the great minds of the past have condemned astrology is weak and unconvincing to anyone at all acquainted with the past history of the subject. Pico selects only those persons and data that support his contention, suppressing the evidence to the contrary, or misrepresents the attitude of other personages. On the whole, his citations are about as unconvincing as those of the astrologers in favor of their art. He had a wide, if not exhaustive, acquaintance with the past literature germane to his theme, but the use he makes of it is that of the advocate and dialectical disputant, almost at times that of invective, rather than that of the impartial historian of ideas" (cited from: Fischer 2006, p. 89, ch. 37).

⁵⁶ Steinschneider 1903, p. 59.

⁵⁷ A. Birkenmajer 1922, p. 30, fn. 2; 1953b, fn. p. 68,8, p. 108.

⁵⁸ This was done critically by, for example, Levi ben Gerson (14th century, southern France) in an astronomical treatise written in Hebrew – see Goldstein 1969, p. 54.

intended to write an astrological treatise following the example of Ptolemy's *Tetrabiblos*. This is just pure literary speculation without any basis in sources.

3) With a view to the tradition of the science of the stars and *its various branches*, we know that from ancient times to the Renaissance, astrology was the consummation of the science of the stars. That is why R.S. Westman cannot be right in claiming that it was the astrological and prognostic problems (i.e. the crisis and criticism of astrology) that made Copernicus reform the foundations of astronomy, because the crisis affected the very foundations of astronomy, without the astrological component.⁵⁹

4) It is *highly paradoxical* that Robert S. Westman, in his astrological interpretation of the development of Copernicus's thought, only marginally treats the astrological thread related to Kraków, the center of European astrology in the 15th century,⁶⁰ although his research topic entitled “The Copernican Question: Prognostication, Skepticism and Celestial Order” concerned the period from Copernicus's student years in Kraków and Bologna in the 1490s to 1713, the date of the second edition of Newton's *Philosophiae Naturalis Principia Mathematica*, and originally to about 1610, the date of publication of Kepler's *Astronomia nova* (1609) and Galileo's presentation of the discoveries made using the telescope – see Westman 2001, p. 233, note 1; 2011a.

5) It cannot be rationally denied that the cult of the Sun, solar symbolism and the heliocentric metaphysics of Neoplatonism – *paradoxically omitted* by Westman – were an intellectual challenge for Copernicus, which he had to face when creating his system, usually referred to as heliocentric.⁶¹

⁵⁹ Cf. ch. 2 and 3 above.

⁶⁰ Westman discusses Albert of Brudzewo's division of the science of stars as it relates to astrological topics. The achievements of the Kraków astrological center are described, among others, by A. Birkenmajer 1937; Markowski 1971; 1975; Konarska-Zimnicka 2018.

⁶¹ This issue was drawn by, among others, Ernst Goldbeck (1919, pp. 224–226); Edwin Arthur Burtt (1925, pp. 42–44); Jeremi Wasiutyński (1938, pp. 57–60; 2003); Thomas S. Kuhn (1957, p. 130); Alexandre Koyré (1961, p. 61 / 1973, p. 66); Frances A. Yates (1964, pp. 154–155); S.K. Heninger Jr (1963, ed.) 1965; 1974; Zdeněk Horský (1966); Eugenio Garin (1967; especially 1973a, pp. 680–681; 1973b, pp. 87–88; 1975;

And so in *De revolutionibus* (Book I, Ch. X), Copernicus explicitly referred to the cult of the Sun and solar symbolism.

In medio vero omnium residet Sol. Quis enim in hoc pulcherrimo templo lampadem hanc in alio vel meliori loco poneret, quam unde totum simul possit illuminare? Siquidem non inepte quidam lucernam mundi, alii mentem, alii rectorem vocant. Trimegistus visibilem Deum, Sophoclis Electra intuentem omnia. Ita profecto tanquam in solio regali Sol residens circum agentem gubernat Astrorum familiam. Tellus quoque minime fraudatur lunari ministerio, sed ut Aristoteles de animalibus ait, maximam Luna cum terra cognationem habet. Concipit interea a Sole terra, et impregnatur annuo partu (Kopernik 1953, p. 38).

At rest, however, in the middle of everything is the sun. For in this most beautiful temple, who would place this lamp in another or better position than that from which it can light up the whole thing at the same time? For, the sun is not inappropriately called by some people the lantern of the universe, its mind by others, and its ruler by still others. [Hermes] the Thrice Greatest labels it a visible god, and Sophocles' Electra, the all-seeing. Thus indeed, as though seated on a royal throne, the sun governs the family of planets revolving around it. Moreover, the earth is not deprived of the moon's attendance. On the contrary, as Aristotle says in a work on animals, the moon has the closest kinship with the earth. Meanwhile the earth has intercourse with the sun, and is impregnated for its yearly parturition (Copernicus / Rosen 1978, p. 22).

1976a; 1988, p. 184); Stanisław Mossakowski (1973/1974, 2008); Bogdan Suchodolski (1973, pp. 117–121); Stefan Świeżawski (1973, p. 257; 1980, pp. 126–127; 1983b, p. 220); Bronisław Biliński (1975; 1977); Michał Kokowski (2001, see the entry under 'neoplatonism'); Dilwyn Knox (2002) and Piotr Piotrowski (2012; 2023).

To be precise, however, it should be noted that it was not in fact a heliocentric system, because its center was a fictitious entity, the so-called average Sun, not the physical Sun. See Thorndike 1941a, pp. 422–423; Swerdlow 1973, pp. 471–476; Shank 2017, pp. 102–106.

The reference to *Trimegistus* (and not *Trismegistus*, as it should be)⁶² is perhaps related to Copernicus’s knowledge of the work of John of Glogów entitled *Introductio in primam philosophiam Aristotelis* from the end of the 15th century, in which the following statement appears:

[...] et ille Hermes antiquus Trimegistus scribens de Deo ad Asclepium collegam suum, inquit, quod homo est nexus Dei et mundi [...] (fol. 2; cited from: L. Birkenmajer 1924, p. 122).⁶³

Moreover, in Copernicus’s letters written in his own name – described in the literature imprecisely as ‘private’ (Drewnowski’s term), the oldest from February 29, 1524 (?),⁶⁴ and the most recent from September 28,

⁶² It was a legendary figure. A synthetic description of research on this issue is provided by Kuczyńska 1992, pp. 138–144. On the Hermetic tradition, see James 1993/1996, pp. 121–162.

⁶³ “And that the ancient Hermes Trimegistus, writing about God to his colleague Asclepius, says that man is God’s link with the world”. However, the other theses of the Birkenmajers – that Copernicus took this view either from a) Marsilio Ficino’s *De sole et lumine, De triplici vita* (Florence, 1489), several copies of which were sent to Kraków’s Callimachus and his disciples (L. Birkenmajer 1924, p. 122) or b) the treatise of Hermes Trismegistus entitled *Poimandres*, translated into Latin in 1468 by Ficino, entitled *Liber de potestate et sapientia Dei* (A. Birkenmajer 1953b, notes to p. 71, 18 (pp. 113–114); 1963, p. 47) – are not true, because there is no incorrect spelling of the nickname “Trimegistos”, nor the term ‘visibilem deum’ (‘visible god’). See also Rosen 1970 (which explains many ambiguities related to Copernicus’s poor knowledge of Hermes’s thought); Campa 2016 (reviews discussions on this topic).

I will add that the theme of ‘homo est nexus Dei et mundi’, referring to *The Asclepius* of Hermes Trismegistus, was later taken up by, among others, St. Bp. Albert the Great, Berthold of Moosburg, cardinal Nicholas of Cusa and Marsilio Ficino – see Jeck 1999; Anzulewicz 2010; Gersh 2021. Therefore, Copernicus could have encountered this thread not only in the work of Hermes Trismegistus himself.

⁶⁴ In my opinion, Copernicus also used this seal in his letter of October 22, 1518 to the Warmian Chapter. Poor quality photocopies of this letter are available – see Wasiutyński 1938, illustration on p. 280; Schmauch 1942 (photo on the title page) and Schmauch 1943, p. 216, tab. XXVIII – which should be compared with a scan of the recto page of the original kept in the Archives of the Archdiocese of Warmia in Olsztyn (AAW Olsztyn, Rep. 128; *I would like to thank Rev. Prof. Andrzej Kopiczka, head of AAW, for providing me with this scan*) and other originals of Copernicus’s letters, and their scans or photocopies, especially with a letter to bishop Ferber of February 29, 1524 (scan: [Alvin-Letter-29-02-1524](#) (Uppsala) – *I would like to thank Dr. Ina-Maria Jansson, archivist from the Special Collections Department of the University Library in Uppsala, for sending*

1541 – there is an imprint of a signet ring depicting *Apollo (Phoebus) with a lyre*, symbolizing the Sun god.⁶⁵



Fig. 5. Imprint of Nicolaus Copernicus's signet ring on the letter of June 21, 1541 (Staatliches Archivlager in Göttingen). Public domain. URL: <http://pauart.pl/app/artwork?id=564b3b0b0cf2a0f6ce2e7391> (digitalisation: PAU, PAUart project)

There is no doubt that this type of solar symbolism was associated with Pythagorean, Platonic and Neoplatonic thought (Tatarkiewicz 1972),⁶⁶ the above-mentioned Hermeticism (Yates 1964; 1973/1997)

me the link to this scan); Wasiutyński 1938, illustration after p. 328 recto/verso) and a letter to bishop Dantyszek of June 5, 1536 (Wasiutyński 1938, illustration after p. 408 verso). Unfortunately, Copernicus's earlier 'private' letters (earlier than those from October 22, 1518) have not survived, so we cannot determine with certainty whether Copernicus had already used his seal. However, I assume that he did from the moment of the discovery of 'heliocentric Neoplatonic metaphysics', i.e. in the years around 1500.

⁶⁵ Wasiutyński 1938, p. 386; but the paragraph is not available in the 2nd edition: 2007, p. 371; Kuczyński 1970; 1971; Mossakowski 1973/1974, 2008; Drewnowski 1978, pp. 22–23.

⁶⁶ Dilwyn Knox (2002, p. 411; 2007, p. 210), adopting a different hermeneutics/research perspective, denies the important meaning of Neoplatonic symbolism of the Sun and treats it as purely literary.

"Even if we were to grant that Ficino's Latin translation of the *Pimander* was Copernicus's source, it would prove very little. It hardly corroborates on its own the assertion that Copernicus was steeped in contemporary Neoplatonism or Hermeticism, Ficino's version of it or not. It is much simpler to assume that Copernicus's invocation to the sun is just a rag-bag of classical tags – from Pliny, Cicero, Sophocles, Hermes Trismegistus [...] – rather than a bold declaration of Neoplatonic or Hermetic allegiance. [...] Nor, it should be added, does Rheticus relate Copernicus's sun symbolism to Platonic sources. He speaks of his master's wish to re-establish the sun as emperor of the universe, administering its dominions without hurrying from one city to the next. Or, using another common analogy, found in Platonic and non-Platonic sources alike both before and after Copernicus, the sun was like a heart sustaining the body from its

and Renaissance syncretic thought, which tried to reconcile all religious and philosophical trends.

The Renaissance philosopher and astrologer Marsilio Ficino, author of *Liber de Sole* (Florence, 1493), was a vocal follower of Renaissance syncretism and solar symbolism who propounded the thesis that the Sun governs the sky and the Earth (see Ficino 2017, ch. VI). His works were in the library of Copernicus.

Let us note here that Copernicus (unlike Giordano Bruno later) was not a supporter of the Neoplatonic idea of the infinity of the world, because in Book I, Ch. VIII he stated:

Let us therefore leave the question whether the universe is finite or infinite to be discussed by the natural philosophers. We regard it as a certainty that the earth, enclosed between poles, is bounded by a spherical Surface (Copernicus / Rosen 1978, p. 16).

Copernicus proclaimed this because, among other things, he knew from observations that the deviation from the bisection of the celestial sphere by the plane of the observer's horizon was unmeasurable using available measuring instruments, which had limited measurement accuracy (see Book I, Ch. VI). Therefore, Copernicus's world / universe is similar to infinite (due to the limited accuracy of measuring such a lack of deviation from bisection), and it would be infinite if the measurement error of observing the horizon bisection was exactly 0 degrees, minutes,

middle. [...] Platonic or Neoplatonic sun symbolism is, to put the matter bluntly, a red herring anyway. What preoccupied Copernicus philosophically was the earth's motion, not the sun's location at the centre of the universe. This is evident from several passing comments that Copernicus makes in the opening chapters of *De revolutionibus*” (Knox 2002, p. 411). I do not share the opinion of Prof. Knox that the position of the Sun in the Copernican system was not an important issue for Copernicus.

Knox (2002, pp. 399–400) also pointed out that there is no basis for the widespread claim made by, among others, Dorothy Stimson (1917, p. 25), Edwin A. Burt (1925, pp. 42–44), Angus Armitage (1938, p. 47), Thomas S. Kuhn (1957, p. 128), Alistair C. Crombie (1952, vol. II, p. 167; 1959/1960, vol. II, p. 209), Cesare Vasoli 1973, pp. 87–89) and Bronisław Biliński (1975, pp. 34–35; 1977), that Domenico Maria de Novara was a Platonist or a supporter of Florentine Platonism and Pythagoreanism, and thus refuted the idea that Novara's interests were shared with Copernicus during the latter's stay in Bologna in the years 1496–1500.

seconds, etc., and the instruments were error-free (i.e. their measurement sensitivity was not limited by any effects).⁶⁷

6) There is no doubt that the genesis of Copernicus's cosmological system (i.e. the heliostatic theory) is also closely related to: a) the issue of calendar reform and the issue of (long-term) movements of the eighth sphere (medieval Arab astronomers, Renaissance Christian astronomers);⁶⁸ b) the issue of the so-called removal of the equant from Ptolemy's theory in the name of Plato's principle of perfect circular motions (medieval Arab astronomers and Renaissance Christian astronomers);⁶⁹ c) the issue of the measure of distance and order in Aristotelian systems of homocentric spheres and in Ptolemaic systems (the idea of nesting spheres)⁷⁰; d) the discussion of medieval scholastics on the possibilities of the Earth's movements and its three movements: daily, annual and declination / inclination (Buridan, Oresme, Albert of Saxony)⁷¹ and e) the medieval and Renaissance discussion on various physics of astronomical phenomena: Aristotelian, Pythagorean, Platonic, Stoic, Albertine, Buridianian and Neoplatonic, because Copernicus's physical astronomy was a kind of synthesis of different theoretical concepts developed by various philosophical schools.⁷²

⁶⁷ Cf. Kokowski 1997, pp. 301–306; 2001, pp. 177, 213, fn. 37; 2023, p. 98, fn. 20. Copernicus also shows no traces of interest in other Neoplatonic concepts, e.g. emanations.

⁶⁸ Ravetz 1965a/1965b; Dobrzycki 1965; Swerdlow 1973; Neugebauer, Swerdlow 1984; Kokowski 1996; 2004; 2009.

⁶⁹ Swerdlow 1973; Neugebauer, Swerdlow 1984; Kokowski 1996; 2004; 2009.

⁷⁰ Van Helden 1985, pp. 4, 22–37, 42.

⁷¹ Duhem 1909; 1913–1959; Crombie 1952, vol. II, pp. 167–178; Grant 1962; 1994; Markowski 1968; 1971; 1972; 1973; 1993; Markowski et al. 1973; Drewnowski 1979; Kokowski 1996; 2001; 2004; 2009.

Let us note that J.M.M.H. Thijssen (2004), who questions the existence of the Buridan school in the sociological sense, i.e. the existence of a master / teacher / lecturer surrounded by listeners (his students), does not deny, however, the substantive connection between the content of Buridan's works and the 'pupils' of this so-called 'school'.

⁷² See Kokowski 1996; 2004; 2009; Knox 1999; 2002; 2007. Therefore, calling Copernicus an Aristotelian, Platonist, Pythagorean, Stoic, Neoplatonist, etc. is justified only in relation to selected fragments of the ideas proclaimed by Copernicus. His physical astronomy was a kind of *minimalist syncretism*. Copernicus emphasized that the final answers to some questions require decisions based on the philosophy of nature, e.g. the problem of the finite or infinite size of the world/universe or the choice of equivalent geometric models as representations of astronomical phenomena. He tried to avoid unambiguous answers (which is an expression of the minimalism mentioned above).

We have seen above that R.S. Westman, in creating his interpretation of Copernicus's views on astrology, used the strategy of *literary fiction*, claiming that Copernicus was a supporter of astrology – *understood as the science of the influence of celestial bodies on man* – despite the silence of the sources on this matter. This is not an isolated case in R.S. Westman's work. In an article published in the *Encyclopædia Britannica* (last update: 8 August 2024), R.S. Westman stated that Copernicus was a painter and the creator of the self-portrait (*these are old ideas*) who additionally learned to paint while studying in Padua (*this is a new idea by Westman*)⁷³ – this is another example of literary fiction. The reason is very elementary: had Copernicus been the author of self-portrait, he would not have limited himself to painting his own figure only, he would have painted also his relatives, bishops and canons of Warmia, etc., because he was not a selfish and antisocial person, as evidenced by his lively activity in the Warmian chapter.⁷⁴

8. Conclusions

Based on currently available sources and historical studies, in opposition to R.S. Westman (1993; 2011a; 2011b; 2013; [2016](#); [2019](#); [2024](#)), I think that there are no scientific grounds to claim that:

- a) Copernicus accepted divinatory astrology, in particular the ontological astrological axiom;
- b) the genesis of Copernicus's two astronomical theories, presented in the *Commentariolus* and *De revolutionibus*, was closely related to divinatory astrology and the activities of Domenico Maria da Novara (supporter of astrology and prognosticator) and Giovanni

⁷³ Attributing painting skills to Copernicus has a rich history, e.g. Tobiasz Stimmer (1571–1574), Tycho Brahe (*Epistolarum astronomicarum libri*, 1589) and Pierre Gassendi (*Nicolai Copernici vita*, 1654, according to which Copernicus studied visual perspective already during his university years in Kraków), and the reception of these ideas by later authors, to the authors of the alleged discovery of Copernicus's grave, because, contrary to popular belief, which prevails even among researchers specializing in Copernicus research, no solid scientific evidence of this discovery has been presented so far. See Kokowski 2005a/[2007a](#); 2005b/[2007b](#); 2009; (ed.) 2012a; [2012b](#); [2012c](#); [2014](#); [2020](#).

⁷⁴ Cf. e.g. Biskup 1973. The moral of the story is that in the scientific activity of a historian of science, one should avoid fascination by popular science, use at least a bit of common sense, and develop richer research hermeneutics (i.e. improve the tools of interpretation).

Pico della Mirandola (opponent of divinatory and occult astrology) in this field.

In the context of contemporary knowledge, theses a) and b) are scientific myths, the result of R.S. Westman's abandonment of the principles of the methodology of historical sciences in favor of historical fictionalism straight out of literary fiction.

On the other hand, it cannot be ruled out that Neoplatonic solar symbolism / heliocentric Neoplatonic metaphysics, *but in combination with Pythagorean, Platonic and Stoic thought* (ideas of mathematical order and harmony), *Aristotelian, Albertine and Burdanian thought, as well as certain "solar coincidences" of Ptolemy's system*⁷⁵ may have caused Copernicus to recognize the immobility of the Sun and the (almost) central place of the Sun in his cosmological system, along with giving the Earth an annual motion around the Sun.

Let me remind here the theses I have previously presented regarding the genesis of Copernicus's theory, which are still valid.

Based on the knowledge of the content of Copernicus's works and studies in the field of history and methodology of exact sciences and philosophy, I believe that when he was developing his astronomical theories (described in the *Commentariolus* and *De revolutionibus*), Copernicus creatively referred to three traditions: mathematical astronomy, physical astronomy and natural philosophy. However, the specific solutions that he adopted in his theories – the combination of three movements of the Earth: daily, annual and declination (more complex in the *De revolutionibus* than in the *Commentariolus*) and the measure of order (relating the average distance of *each* planet from the center of the Solar system to its period around the Sun) – were his original achievements.

Copernicus did this using four complementary strategies:

1) *a demarcation strategy* which consisted in distinguishing between a) mathematical astronomy, hence the phrase "mathematical works are written for mathematicians" (*De revolutionibus*, Book I, Preface:

⁷⁵ The "solar coincidences" of the Ptolemaic system are the annual period of the Sun's revolution around the ecliptic and the annual period of the so-called epicycle. 'Lower planets' (Mercury and Venus) and the deferent circulation of each of the 'upper planets' (Mars, Jupiter, and Saturn) with the period of the synodic year, i.e. the time between two successive oppositions of the Sun. J.L.E. Dreyer (1953, p. 312) aptly pointed out such properties of Ptolemy's system, which was also noticed, although not so precisely, by Marcin Karas (2018, pp. 118–119, fn. 474).

Dedicatory Letter), b) physical astronomy and natural philosophy (physics), hence the phrase: “[...] let us leave the question whether the world is finite or infinite for discussion to natural philosophers” (*De revolutionibus*, Book I, Ch. VIII) and c) astrological explanations; there is not the slightest trace in the *Commentariolus* or *De revolutionibus* of the use of this type of explanations;⁷⁶

2) *a strategy of critical research on the history of astronomy*, consisting in analyzing the history of various models of astronomical phenomena and the cosmological structures of these models; hence Copernicus’s statement (*De revolutionibus*, Book I) about the lack of agreement between various adepts of stellar science / astronomy / mathematics as to the basic parameters of astronomical models and cosmological assumptions called, from Greek, *hypotheses*;

3) *a syncretic strategy in the field of physical astronomy and natural philosophy (physics)*, consisting in an attempt to reconcile various physics of astronomical phenomena: Aristotelian, Platonic, Stoic, Albertine, Burdanian and Neoplatonic; its fruit was Copernicus’s celestial proto-physics;⁷⁷

4) *a strategy of hypothetical and correspondence thinking*, consisting in using the tools of the method of mathematical and physical sciences, which I call the hypothetico-deductive method of correspondence thinking.⁷⁸

⁷⁶ It is worth emphasizing that a clear articulation of these demarcation criteria solves the real Gordian knot of the interpretation of Copernicus’s thought, i.e. distinguishing between the thread of mathematical astronomy, the thread of physical astronomy/celestial physics and the astrological thread (natural, medical and divinatory astrology), and preparing answers to the questions: “Was Copernicus an astrologer (in the sense that he practiced astrology and was a supporter of natural, medical and divinatory astrology)?” and “Was astrology (natural, medical and divinatory) a source of Copernicus’s inspiration in reforming astronomy?”

⁷⁷ I introduce this term to denote the fact that Copernicus: a) made a *sketchy* syncretic synthesis of various physics of astronomical phenomena: Aristotelian, Platonic, Stoic, Albertine, Burdanian and Neoplatonic, and b) at the same time emphasized that his physical astronomy/celestial physics was not a philosophy of nature. On this point, I disagree with Copernicus to some respect, because his physical astronomy was a form of natural philosophy, though different from Aristotelian one, as well as with A. Goddu (2010; 2013), who minimizes non-Aristotelian threads in Copernicus’s thought and develops in his publications a distorted, exaggerated pro-Aristotelian interpretation of Copernicus’s achievements.

⁷⁸ Kokowski 1996; 1997; 2001; 2004; 2009; 2012. The hypothetico-deductive method of correspondence thinking consists of two interconnected parts: the hypo-

Therefore, in opposition to well-known researchers, I believe that the following theses have no scientific justification: a) Copernicus was only an imitator of the Pythagoreans, in particular Aristarchus of Samos,⁷⁹ b) he was only an imitator of the Buridanists,⁸⁰ c) the thought of the Buridanists did not have a significant influence on Copernicus, because in the times of Copernicus it no longer had supporters in Kraków,⁸¹ d) Copernicus was a slavish follower of Arab astronomers

thetico-deductive method, whose roots go back to Plato (including *Timaeus*) and the Buridanists, and the method of correspondence thinking, whose roots go back to Hellenic and Hellenistic astronomy (including, among others, Ptolemy). Note: This is not an anachronism. Two orders are manifest here: the historical (temporal) context and the metahistorical-methodological (atemporal) context.

⁷⁹ Heath 1913; Stahl 1945; Africa 1961; 1962; Rosen 1962; 1978b and other authors from the 16th to the 20th century – see a review of their positions in: Kokowski 2009, pp. 65–68, 310–315. According to the current knowledge, Copernicus did not know Archimedes's treatise *On the Counting of Sand* (published in 1544), which laid the foundations of the cosmological structure of Aristarchus's theory: the stationary Sun in the center of the system, the daily and annual motion of the Earth around the Sun, etc. Even if he had known it, it was only a proto-idea of the heliocentric theory. Copernicus's theories (described in the *Commentariolus* and *De revolutionibus*) are much more developed.

⁸⁰ Duhem 1909; 1913–1959.

⁸¹ Goddu 2010, pp. 338. Some researchers, including the above-mentioned André Goddu, authors of the commentary to the French edition of *De revolutionibus* (Copernicus 2015, pp. 103–104, note 4) and Marian Chachaj (2023, p. 90, note 255; using the findings of A. Goddu 2010 and D. Knox 2005), apart from Buridan's idea of probable explanations, the idea of hypothetical three movements of the Earth and the principle of relativity of motion [*to which Copernicus undoubtedly referred* – see Markowski 1968; 1971; 1972; 1973; 1993; Markowski et al. 1973; Drewnowski 1979; Kokowski 1996; 2004; 2009], reduce the Buridanian thought only to the theory of impetus, which cannot be found in Copernicus's works using an elementary linguistic analysis of the texts of the *Commentariolus* or *De revolutionibus*.

In fact, on the basis of purely linguistic analyses, we can only point to fragments of Copernicus's texts in which he used the term 'impetus' – Kokowski 2009, pp. 218–231; Goddu 2010, pp. 338–345. But this does not lead directly to the conclusion that Copernicus knew the theory of impetus (this was overlooked by the critics of my thesis about Copernicus's knowledge of Buridan thought, including the idea of impetus – Goddu 2010, pp. 338–339, 348, fn. 57; the authors of the commentary to the French edition of *De revolutionibus* – see Copernicus 2015, pp. 103–104, fn. 4). In order to find the theory of momentum in Copernicus, it is necessary to a) conduct a content analysis – see e.g. Knox 2005, pp. 171–177 (the term 'impetus' used in the sense of force or gravity) and also b) reconstruct Copernicus's astronomical models using mathematical analysis and then reinterpret them from the perspective of the

from the Maragha school⁸² and e) it is astrology – according to R.S. Westman – that was the source of the reform of astronomy carried out by Copernicus. These claims are modern scientific myths and the result of the use of poor research hermeneutics.⁸³

In other words, I argue that: a) although the thought of the Pythagoreans and Buridanists had a significant influence on Copernicus, he was not merely a slavish imitator of them, b) although there are numerous similarities between the models of Copernicus and the Arab astronomers, he was not a slavish imitator of the Arab astronomers of the Maragha school, the achievements of which, *paradoxically, according to current knowledge*, he was not familiar with,⁸⁴ c) despite his knowledge of astrology (natural, medical and divinatory), Copernicus did not deal with it beyond the period of his university studies and it was not a source of inspiration for his reform of astronomy; and d) the source of inspiration

theory of impetus; I demonstrated this using the example of the analysis of Copernicus's precession model – see Kokowski 1996, pp. 33–42, 51–62. With this in mind, I argued: “(...) Copernicus's astronomical-physical system, based on Buridanian physics of impetus, determined the further development of modern astronomy and physics, including the Keplerian heliocentric system, Galileo's kinematics and astronomical views, and Newtonian mechanics with its theory of gravity” (Kokowski 2012d, p. 65). However, it is worth correcting this statement by replacing “based on Buridanian physics of impetus” with “which stemmed from Pythagorean, Platonic, Stoic, Albertian, Buridanian and Neoplatonic hypothetical and probabilistic natural philosophy” (which much better reflects the idea presented in Kokowski 1996; 2004; 2009).

⁸² Cf. Roberts 1957; Kennedy, Roberts 1959; Abbud 1962; Roberts 1966; Kennedy 1966; Neugebauer 1968; Swerdlow 1973; King, Saliba (eds.) 1987; Saliba 1984; 1987; 1991; 1994; 1997/2000; Neugebauer, Swerdlow 1984; Barker, Ariew 1991b; Barker, Heidarzadeh 2016; Ragep 2017 (an excellent overview of the discussion); Goddu 2018, pp. 198–203. This view was opposed by Blåsjö 2014; 2018; see also footnote below.

⁸³ Cf. Kokowski 1996; 2001; 2004; 2009, pp. 76–79, 330; 2012d.

⁸⁴ There is no doubt, however, that medieval Arab astronomy had a great influence on the development of medieval and Renaissance European astronomy, including the astronomy developed by Copernicus himself. On the one hand, like Noel M. Swerdlow and F. Jamil Ragep, I am amazed by the numerous striking similarities and coincidences of Copernicus's models and the models of Arab astronomers, and on the other hand, like Otto Neugebauer, Mario Di Bono and Viktor Blåsjö, I am intrigued by the internal logic development of astronomical models and the topic of multiple discoveries – see e.g. Neugebauer 1968, p. 90; Di Bono 1995, p. 149; Hugonnard-Roche 1997/2000; Rashed, Morelon (eds.) 1997/ (red.) 2000; Kokowski 2012d; Blåsjö 2014; 2018; Ragep 2017.

for Copernicus's reform of astronomy was the poor state of astronomy itself (*without the astrological component*) in Copernicus's times, which he was able to notice in a dialogue with the centuries-old tradition of astronomical research.⁸⁵

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⁸⁵ The reception of this reform was a complex cultural process. During it, both the reform and Copernicus himself were referred to by many, even extremely contradictory, names – see Kokowski 2001 (the only monograph in world literature so far on the interpretation of Copernicus's achievements by Thomas S. Kuhn); 2004 (the monograph in which I defended the originality of Copernicus's achievements, contrary to the then accepted opposing view held by American historians of science); 2009 (the first monograph in world literature on the reception of Copernicus's achievements written from the perspective of the history of ideas).

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