Copernicus' Rhetoric: Arguments for Heliocentrism in the Early 16th Century

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Abstract

It is commonly acknowledged that Copernicus and his publications were pivotal in initiating the scientific revolution, an era marked by continuous innovation and revolutionary ideas in science and natural philosophy. However, Copernicus also brought forward another revolution, using rhetoric in science as a powerful tool to persuade a skeptical public. Both natural sciences and philosophy have prided themselves on a rigorous and objective approach to acquiring knowledge about nature. This ideal scientific method has been a cornerstone of scientific inquiry for centuries. However, ironically, scientific publications are considered literature and contain distinctive rhetoric that persuades readers beyond logical reasoning and experimentation. Two of Copernicus' works, On the Revolutions of the Heavenly Spheres (De Revolutionibus Orbium Coelestium) and Little Commentary (Commentariolus), are distinguished examples of such a phenomenon. By investigating the application and effect of rhetoric in Copernicus' works, one can gain insights into the persuasive aspects of scientific communication while highlighting the sociocultural obstacles Copernicus faced during his time.

Keywords: Copernicus, Rhetoric, De Revolutionibus, Commentariolus, Heliocentrism, ethos, pathos

First and foremost, it is commonly acknowledged that Copernicus and his publications played a pivotal role in initiating the scientific revolution, an era marked by continuous innovation and revolutionary ideas in science and natural philosophy. However, as suggested by Jean Dietz Moss, the author of Novelties in the Heavens: Rhetoric and Science in Copernican Controversy, Copernicus also brought forward another revolution, one in the use of rhetoric in science as a powerful tool to persuade a skeptical public.[1]

Both natural sciences and philosophy have prided themselves on a rigorous and objective approach to acquiring knowledge about nature. This ideal scientific method has been a cornerstone of scientific inquiry for centuries. However, ironically, scientific publications are considered literature and contain distinctive rhetoric that persuades readers beyond logical reasoning and experimentation. Two of Copernicus' works, On the Revolutions of the Heavenly Spheres (De Revolutionibus Orbium Coelestium) and Little Commentary (Commentariolus), are distinguished examples of such a phenomenon. By investigating the application and effect of rhetoric in Copernicus' works, one can gain insights into the persuasive aspects of scientific communication while highlighting the sociocultural obstacles Copernicus faced during his time.

1 Moss, Jean Dietz. Novelties in the Heavens: Rhetoric and Science in the Copernican Controversy. Chicago: University of Chicago Press, 1993.

Introduction to Copernicus

Nicolaus Copernicus (1473–1543) was a prominent Polish astronomer and mathematician who formulated a revolutionary heliocentric solar system model, challenging the prevailing geocentric model proposed by Aristotle.[2] He made two outstanding publications in 16th-century Europe, De Revolutionibus and Commentariolus. Commentariolus was written around 1514 as a manuscript on Copernicus' heliocentric ideals, to circulateaiming to circulate it among European scientific scholars to seek responses. Later, in 1543, at the time of his death, Copernicus published De Revolutionibus, a comprehensive proposal of the heliocentric theory that included mathematical proofs of his ideas. By challenging the established geocentric cosmological model proposed by Aristotle, Copernicus's works not only laid the groundwork for future endeavors by prominent astronomers like Galileo and Kepler but also served as an inspiration for transformative change within the field of science.[3]

Copernicus was born on February 19, 1473, as the youngest of four children of Nicolaus Copernicus Sr. His

2 "Nicolaus Copernicus." Stanford Encyclopedia of Philosophy, 2004. Accessed July 8, 2023. plato.stanford.edu/archives/win2021/entries/copernicus/.

3 Dear Peter. Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700. Princeton University Press, 2001.

family could be considered wealthy, as his father was a prosperous merchant, and his mother's family had been prominent merchants in Torun. In 1491, Copernicus had the fortunate opportunity to enroll at the University of Krakow, where he studied various subjects, including mathematics, astronomy, medicine, and even canon law. In 1496, Copernicus traveled to Italy to further advance his education within universities.[4] In 1504, Copernicus initiated his research regarding the heliocentric model. At that time, he had returned to Poland and settled in his uncle's bishopric palace. There, he commenced his astronomical observations and studies while also performing church duties and receiving salaries at the Collegiate Church of the Holy Cross.[5]

Narrative Rhetoric in Commentariolus

Commentariolus is an initial manuscript penned in Latin by Nicolaus Copernicus around 1514. It introduces the heliocentric astronomical theory, which challenges the conventional belief that Earth is the center of the universe while offering observational evidence supporting this revolutionary idea.

It incorporates detailed descriptions of heliocentrism, including the order of the spheres (Fig.1), the Sun's apparent motion, the measurement of equal motions through fixed stars, the moon, and the rest of the planets. However, no mathematical calculations or proofs are present in the manuscript; it is a mere statement of facts and observations.[6]

4 "Nicolaus Copernicus." Stanford Encyclopedia of Philosophy, 2004. Accessed July 8, 2023. plato.stanford.edu/archives/win2021/entries/copernicus/.

5 "Nicolaus Copernicus." National Museum of Space History. Accessed July 8, 2023. https://www.nmspacemuseum.org/inductee/nicolaus-copernicus/?doing_wp_cron=1688863140.7727150917053222656250.

6 Rosen, Edward. "The Commentariolus of Copernicus." Journal of the History of Ideas, vol. 35, no. 4, 1974, pp. 607-633. JSTOR, www.jstor.org/stable/2708789.

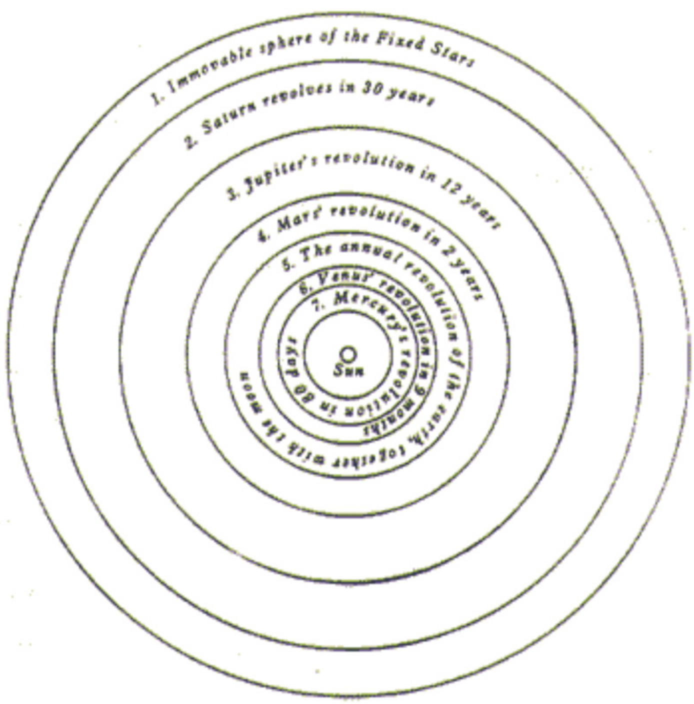

Figure 1 Heliocentric Planetary Orbits[7]

7 Edward Rosen, translator, De revolutionibus orbium coelestium (Baltimore: Johns Hopkins University Press, 1992).

The rhetorical devices and techniques within the Commentariolus are planned less meticulously than his publication, De Revolutionibus. As a half-completed manuscript aimed at circulating among prominent philosophers and authorities to cultivate support, the Commentariolus is simply an informative text. Nevertheless, due to the absence of mathematical proofs regarding his central idea, Copernicus employed a narrative account alongside observational evidence corresponding to the heliocentric universe to persuade the readers.

By presenting his heliocentric model in a narrative form, Copernicus made it easier for the readers to follow his line of reasoning and envision the implications of his ideas. The narrative account begins as Copernicus asserts the challenges of contemporary theories of the geocentric planetary motion system. There are two main ways to decipher planetary motion based on Aristotelian principles. The first is from Callippus and Eudoxus, who attempted to develop a theory of motion using concentric circles. However, the first theory could not account for all apparent revolutions of heavenly bodies, making it entirely incompatible as a description of the universe.

On the other hand, the motion employs both eccentrics and epicycles, which was commonly agreed upon by philosophers during Copernicus' time. Ptolemy and other prominent astronomers advanced this theory. By highlighting the historical disagreement upon the modeling of the universe, Copernicus illustrates the potential possibility for a new theory that better describes the universe and observational data.[8]

Copernicus then describes the drawbacks of the second model, which Ptolemy widely accepted and embraced. He begins with, "Yet the planetary theories of Ptolemy and most other astronomers, although consistent with the numerical data, seemed likewise to present no small difficulty."[9] More specifically, new equalizing circles must be conceived for the theory to suit observational data. However, under such circumstances, the planets would not move with uniform velocity. Such a notion apparently contradicts Aristotle's belief in uniform motion within heavenly bodies.

Aristotle asserts that there are two types of motion: natural and violent. Natural motion was thought to be inherent to an object based on its nature, while violent motion was caused by external forces acting upon it. In the context of celestial bodies, Aristotle believes that they possess natural motion, which he asserts to be uniform and circular.[10]

Copernicus states that these faults in the geocentric model prompted him to seek and postulate a new arrangement of circles that would align with Aristotle's philosophy, aiming to create a new planetary motion system where all planets move with uniform motion.

8Rosen, Edward. "The Commentariolus of Copernicus." Journal of the History of Ideas, vol. 35, no. 4, 1974, pp. 607-633. JSTOR, www.jstor.org/stable/2708789.

9 Rosen, Edward. "The Commentariolus of Copernicus." Journal of the History of Ideas, vol. 35, no. 4, 1974, pp. 607-633. JSTOR, www.jstor.org/stable/2708789.

10 "Aristotle's Natural Philosophy." Stanford Encyclopedia of Philosophy. Stanford University, 2021. https://plato.stanford.edu/archives/sum2021/entries/aristotle-natphil/.

Afterward, Copernicus guides the audience to examine the creation of a geocentric model. He believes that the established geocentric ideals are founded upon a piece of concrete evidence: the fact that humans see planets orbiting the Earth.[11] Aiming to defy such a principle, Copernicus cleverly criticizes the observational evidence put forth by natural philosophers, postulating that the Earth is not moving, which he believes could be an illusion caused by appearances.

Copernicus proposes three motions of the Earth: annual revolution around the Sun, daily rotation, and declination. The first motion is the annual revolution in a Grand Orb around the Sun, with the Grand Orb being a large orbital of the Earth. The distance from the Sun's center to the Grand Orb's center is 1/25 of the Grand Orb's radius. Copernicus states that people traditionally believed the Sun was in motion. However, as the Orb's radius is assumed to be imperceptible when compared with the height of the sky, the Earth's motion would produce the same appearance. He argues that the geocentric motion of the Sun is non-uniform, with a maximum inequality of 2 1/6, contradicting Aristotle's theory of natural motions. The second motion is the daily rotation of the Earth. This rotation allows humans to perceive the universe as moving. The third motion is the declination of the Earth, a motion entirely speculated by Copernicus. He associates the magnetism of a magnetized iron needle with the spherical Earth, further explaining the observed motions of heavenly bodies on Earth.

Furthermore, Copernicus argues that equal motion should be measured using fixed stars rather than equinoxes. Equinoxes result from the Latin word "equi" and "nox," signifying the time when the Sun's path intersects the celestial equator, resulting in the same length of daylight and darkness. This is because the equinoxes are shifting considerably, and calculations based on the equal length of the annual revolution using them as a reference would be inaccurate. Philosophers predating Copernicus have attempted to calculate the annual time. Hipparchus computed the length as 365 days and 6 hours, whereas al-Battani calculated it as 365 days and 5 hours 46 minutes. Copernicus stresses that these differences did not arise from errors in observation, as they directly correspond to the predicted shift in the equinoxes. With his method, Copernicus calculated the year length as 365 days, 6 hours, and 20 minutes, a value identical to that of the ancient Egyptians.

In addition to these arguments, Copernicus emphasizes

11 Rosen, Edward. "The Commentariolus of Copernicus." Journal of the History of Ideas, vol. 35, no. 4, 1974, pp. 607-633. JSTOR, www.jstor.org/stable/2708789.

the evidence of the apparent retrograde motion of planets, which supports the other part of his model—the revolving of other planets around the Sun. He categorizes them into two components: those having an outer orbit to the Grand Orb and those with an inner orbit. The celestial sphere's orbits embrace each other in the following order: beginning with the immovable sphere of fixed stars, containing and providing a frame of reference for everything. Directly beneath it is Saturn, followed by Jupiter and then Mars. Next is Earth's Grand Orb, with Venus and Mercury following.

The first category includes Saturn, Jupiter, and Mars. The motion of retrograde is called the second anomaly, which is not a result of a change in the planet's motion but rather due to the change in Earth's observational position on the Grand Orb. In the first case, when the Earth's orbital speed surpasses the planet's motion, Copernicus argues that our line of sight directed towards the planets in the sky will regress. This means that from the perspective of humans on Earth, the combined motion of the Earth and the planet results in a different apparent path for the planet in the sky compared to its actual path. On the other hand, when the planet is setting in the evening or rising in the morning, the forward direction helps advance the line of sight instead of regressing it. When the line of sight moves in the opposite direction to the planet, the planet's motion seems to reduce, neutralize, or even retrograde from the perspective of humans on Earth. The second section consists of Venus and Mercury. The effect of the perceived orbits of the planets is similar to the first section but opposite.

By employing this narrative account to convey the information, Copernicus not only presents his arguments more immersively but also establishes a more intimate relationship with the readers. This approach effectively serves its purpose of cultivating support within authorities and the scientific community, which is evident in the section following.[12]

Responses to Commentariolus

In a lecture held in 1533 in the papal gardens to discuss Copernicus' theory, Johann Albrecht Widmannstetter, the papal secretary, presented and commented on Copernicus' heliocentrism to Pope Clemens VII. The Pope, in turn, favored Copernicus' revolutionary theory. Two years later, Widmannstetter assumed the role of secretary to Cardinal Nikolaus von Schönberg, the archbishop crucial in urging Copernicus to make his theories public and providing financial support.[13]

Schönberg's support is evident in the preface of Copernicus' work, De Revolutionibus, known as "The Letter of Nicholas Schönberg." In this letter, Schönberg expresses his earnestness and encourages Copernicus to share his groundbreaking postulation with scholars. He writes, "Therefore, with the utmost earnestness, I entreat you, most learned sir, unless I inconvenience you, to communicate this discovery of yours to scholars, and at the earliest possible moment, to send me your writings on the sphere of the universe together with the tables and whatever else you have that is relevant to this subject."[14] This quote highlights Schönberg's recognition of the value and significance of Copernicus' revolutionary discovery and his willingness to embrace it.

Furthermore, Schönberg's willingness to support Copernicus is emphasized by his offer to bear the publication expenses. He states, "Moreover, I have instructed Theodoric of Reden to have everything copied in your quarters at my expense and dispatched to me." This statement underscores Schönberg's enthusiasm and commitment to ensuring that Copernicus' work reaches a wider audience, in disregard of the large economic investment.

Moreover, the phrase "if you gratify my desire in this matter, you will see that you are dealing with a man who is zealous for your reputation and eager to do justice to so fine a talent" demonstrates Schönberg's admiration for Copernicus' talent and his recognition of the significance and benefits of Copernicus' work.

The support of the Church was sustained throughout Copernicus' life. In the 16th century, it was typically not allowed to dedicate a publication to someone without permission. Although Pope Paul III did not publicly back up Copernicus, he did not condemn him, symbolizing implicit consent.[15] Copernicus received no formal criticism before 1616, when Monsignor Francesco Ingoli sent an essay disputing the Copernican system in a debate with Galileo.[16] This silent approval from Pope Paul III indicates

12 "Rhetoric of Narrative." How Writers Read. https://howwritersread.weebly.com/rhetoric-of-narrative.html.

13 "Responses to Copernicus." Before Newton. Accessed July 8, 2023. https://beforenewton.blog/daily-readings/responses-to-copernicus/.

14 Edward Rosen, translator, De revolutionibus orbium coelestium (Baltimore: Johns Hopkins University Press, 1992).

15 Rosen, Edward. "Was Copernicus' Revolutions Approved by the Pope?" Proceedings of the American Philosophical Society, vol. 107, no. 6, 1963, pp. 557-564. JSTOR, www.jstor.org/stable/2708661.

16 "What the Story of Galileo Gets Wrong About the Church and Science." America Magazine, September

that the Catholic Church acknowledged Copernicus' vision of a heliocentric universe since the Church would not allow a heretical book to be associated with its leader. Such support signifies the backing Copernicus received in response to initiating the Commentariolus.[17]

Copernicus also received considerable support from the scientific community regarding his speculation of heliocentrism. Among the support he received, the most essential was Georg Joachim Rheticus's arrival. Rheticus was a professor of mathematics at the University of Wittenberg, a well-known institution for mathematics and Lutheran theology. Although it remains ambiguous how Rheticus became aware of Copernicus and his heliocentric ideas, his upholding of Copernicus' ideology was apparent. His visit and collaboration with Copernicus, along with the mathematical and astronomical volumes he brought, were crucial for the publication of De Revolutionibus.[18]

Rheticus even published the work "Narratio Prima" in 1540 in Gdansk. This work, written in 1539, was a letter addressed to Johann Schöner. It announced Copernicus' discoveries, discussing concepts such as the fixed stars, the tropical year, the obliquity of the ecliptic, and many other contents found in De Revolutionibus. In the work, Rheticus defended his belief that the heliocentric universe provided a more accurate description of the cosmos than traditional geocentric ideals, presenting its merits. "Narratio Prima" is the first-ever printed and publicly disseminated copy of the heliocentric cosmos. As this work did not generate significant opposition against the heliocentric model, Copernicus was encouraged to publish his De Revolutionibus at his death.

Besides his contributions to knowledge, Rheticus showcased the exceptional quality of mathematical publications at the German centers for Publications to Copernicus. He took the manuscript of De Revolutionibus to Petreius for publication in Nuremberg and supervised most of the printing process before entrusting the remainder to Andrew Osiander.[19]

The Ethos and Pathos of Heliocentrism: De Revolutionibus (1543)

De Revolutionibus, or its full title De Revolutionibus Orbium Coelestium, is the final publication of Copernicus regarding his innovative heliocentrism ideals. It is a comprehensive description, explanation, and proof of his ideals published in 1543, and on May 24, 1543, Copernicus held a copy of De Revolutionibus on his deathbed. It is a specific milestone in astronomy as it marks the initiation of a departure from the geocentric ideals that confined the innovation within natural philosophy for centuries, paving the way for future understanding of the solar system. [20]

In the preface dedication to Pope Paul III, Copernicus states, "Therefore, I debated with myself for a long time whether to publish the volume which I wrote to proof the Earth's motion or rather to follow the example of the Pythagoreans and certain others, who used to transmit philosophy's secrets only to kinsmen and friends, not in writing but by word of mouth, as is shown by Lysis' letter to Hipparchus. And they did so, it seems to me, not, as some suppose, because they were in some way jealous about their teachings, which would be spread around; on the contrary, they wanted the very beautiful thoughts attained by great men of deep devotion not to be ridiculed by those who are reluctant to exert themselves vigorously in any literary pursuit unless it is lucrative; or if they are stimulated to the nonacquisitive study of philosophy by the appeal and example of others, yet because of their dullness of mind, they play the same part among philosophers as drones among bees."[21]

In this dedication, Copernicus expresses that he merely follows in the footsteps of Ptolemy and other talented astronomers. He cleverly packages his work as an innovation to what was previously investigated, as innovations are often regarded as light and insubstantial. Furthermore, the explicit phrase "their dullness of mind they play the same part among philosophers as drones among bees" strongly condemns those who stubbornly believe in old and existing ideals without considering new approaches that are seemingly more accurate. It even states that the general public at his time was a burden to philosophical innovation.

18, 2020. https://www.americamagazine.org/arts-culture/2020/09/18/what-story-galileo-gets-wrong-about-church-and-science.

17 Rosen, Edward. "Was Copernicus' Revolutions Approved by the Pope?" Proceedings of the American Philosophical Society, vol. 107, no. 6, 1963, pp. 557-564. JSTOR, www.jstor.org/stable/2708661.

18 Dear Peter. Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700. Princeton University Press, 2001.

19 "Nicolaus Copernicus." Stanford Encyclopedia of Philosophy, 2004. Accessed July 8, 2023. plato.stanford.edu/archives/win2021/entries/copernicus/.

20 "Nicolaus Copernicus." Stanford Encyclopedia of Philosophy, 2004. Accessed July 8, 2023. plato.stanford.edu/archives/win2021/entries/copernicus/.

21 Edward Rosen, translator, De revolutionibus orbium coelestium (Baltimore: Johns Hopkins University Press, 1992).

By incorporating pathos within his argument, Copernicus induces a stronger connection with the audience, evokes sympathy, and inspires them to respond emotionally to his criticism of stubborn beliefs.

Furthermore, dedicating his work to Pope Paul III adds significant ethos to Copernicus' argument. As mentioned before, this dedication signifies Pope Paul III's implicit consent regarding Copernicus' heliocentrism. However, Copernicus effectively packaged this implicit agreement as public support by incorporating the dedication letter as the preface. At a time when the Catholic Church is seen as authoritative, he establishes himself as a reliable source of information and strengthens his argument for heliocentrism through this preface.

On a side note, the success of such an action likely raised awareness of the same strategy for the times following Copernicus. It was called noble patronage. In the 17th and 18th centuries, natural philosophy did not receive the same authoritative recognition as natural sciences today. In other words, philosophers' discoveries and reasonings were still prone to challenges or despise. Additionally, nobles' and aristocrats' status was highly upheld in the era, primarily due to the idea of "divine rights" that glorified those positions as appointed by God. Therefore, approval from renowned nobles could have led to philosophers' publications being taken seriously. This benefit incentivized many prominent natural philosophers to obtain affiliation with nobles in court, as private tutors, or more.[22]

In comparison with the Commentariolus, it is easy to see that rhetoric has played a larger role within De Revolutionibus. Such a phenomenon could be largely attributed to the nature of the two works. Commentariolus, as a manuscript, is primarily intended to cultivate awareness with authorities and the scientific community, seeking an anticipated response for the actual publication.[23] Therefore, the need to convince using rhetorical tactics is less profound than De Revolutionibus, which is aimed at a large readership for the present and future.

Osiander's Anonymous Preface

As mentioned, Rheticus did not oversee the printing process and delegated the responsibility to Andreas Osiander. Osiander assisted with proofreading and liaised with the printer. However, not content with solely examining the work, Osiander added an anonymous preface without the consent of Copernicus or Rheticus. This preface, titled "Ad lecture (to the readers," was assumed to be written by Copernicus himself and included, among other dedications, as it was anonymous and not explicitly attributed to another author.[24] However, in Johannes Kepler's 1609 work Astronomis Nova, he emphasized that Osiander was the one who penned the preface, contrary to the common assumption that Copernicus wrote it.[25]

To begin with, it is necessary to state that it is unknown what is the intention of the Osiander, either to slander the work or to assist Copernicus's argument.[26] But it has certainly substantially impacted the conveying of Copernicus' heliocentric cosmos.

Copernicus wanted to present his heliocentric universe as a competitor or a replacement for the pre-established geocentric universe. However, upon reading De Revolutionibus, Osiander formulated the idea that it is merely a hypothesis that better describes the cosmos, by the duty of astronomers. In the preface, he states, "For an astronomer must compose the history of the celestial motions through careful and expert study. Then he must conceive and devise the causes or hypotheses about these motions. Since he cannot in any way attain to the true causes, he will adopt whatever suppositions enable the motions to be computed correctly from the principles of geometry for the future and the past." Through this, Osiander suggests that, as an astronomer, Copernicus is merely attempting to devise an astronomical system that more accurately captures the cosmos, setting aside the actual philosophical reasoning and support. Such a statement, although seemingly used to defend Copernicus, undermines Copernicus' purpose of creating a new system that could potentially replace the erroneous and inconvenient geocentric universe.[27]

Furthermore, Osiander also added the phrase, "For these hypotheses need not be true nor even probable." This

22 Dear Peter. Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700. Princeton University Press, 2001.

23 "Nicolaus Copernicus." Biography.com. A&E Television Networks, LLC, n.d. Accessed July 8, 2023. https://www.biography.com/scientists/nicolaus-copernicus.

24 "Nicolaus Copernicus." Glasgow University Library, Special Collections Department, n.d. Accessed July 8, 2023. https://www.gla.ac.uk/myglasgow/library/files/special/exhibns/month/apr2008.html.

25 Hockey, Thomas, ed. Biographical Encyclopedia of Astronomers. 2nd ed., Springer, 2014.

26 Dear Peter. Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700. Princeton University Press, 2001.

27 Edward Rosen, translator, De revolutionibus orbium coelestium (Baltimore: Johns Hopkins University Press, 1992).

phrase diminishes the significance of Copernicus' well-developed and accurate heliocentric model, reducing it to a superficial hypothesis that is unlikely to truly capture the universe, as it is written in the voice of Copernicus. With this preface, it could be said that Osiander has changed the whole nature of the work, shifting it from a true account of the world to a thoughtful fantasy.

Despite Rheticus' anger toward such a preface and the apparent undermining of Copernicus' argument, the actual net effect of the preface is ambiguous. For instance, Bruce Wrightsman has argued that the "Ad lectorem" preface has "actually permitted the work to be used and pondered during an extremely tense period of ideological and political conflict." Such an argument is certainly not unfounded, as the eventual censorship of the work came later when commentators such as Galileo and Kepler reaffirmed its significance as a true account of the cosmos.[28]

This preface has led to the phenomenon in which the scientific community and research universities have adopted Copernicus' geometric models and astronomical tables but not fully embraced the heliocentric universe. For example, at the University of Wittenberg, there was a strong distinction between mathematical astronomy and the physics of the heavens. The University of Wittenberg freely incorporated the astronomical observations from "De Revolutionibus" while disregarding heliocentrism's physical and cosmological implications, aligning with the ideal proposed by the "Ad lectorem."[29]

Conclusion

In summary, rhetoric, although seemingly unaligned with the scientific mission, is deeply intertwined with scientific discoveries. Copernicus' employment of a narrative account, pathos, and ethos, in addition to his mathematical and observational proofs within Commentariolus and De Revolutionibus, assisted him in bringing forward his revolutionary ideals and arguably changed the future of astronomy. With this in mind, it truly leaves one pondering how the interplay between science and rhetoric shapes our understanding of truth, knowledge, and the dissemination of scientific ideas in society.

28 "Nicolaus Copernicus." Glasgow University Library, Special Collections Department, n.d. Accessed July 8, 2023. https://www.gla.ac.uk/myglasgow/library/files/special/exhibns/month/apr2008.html.

29 Dear, Peter. Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700. Princeton University Press, 2001.

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