Introduction

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

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

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

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

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

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

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

Youthful Audacity

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Prior to this, along with the famous Viennese astronomer Georg Peurbach (1423–61), Regiomontanus was engaged in the reform of geocentric astronomy and, following the former's death, he completed the summary of Ptolemy's *Almagest* – the *Epitome in Almagestum Ptolemaei* (Venice 1496) which was later also used by Copernicus. Significantly enough, the *Epitome* was more than an abbreviated version of the ancient treatise as it included a comprehensive explanation of ancient mathematical procedures, the description of intruments and observational methods and was additionally appended with materials abstracted from the works of Islamic astronomers. The *Epitome* was a supplement to the modern presentation of geocentric astronomy which Peurbach included in his *Theorice novae planetarum* (*New Theories*

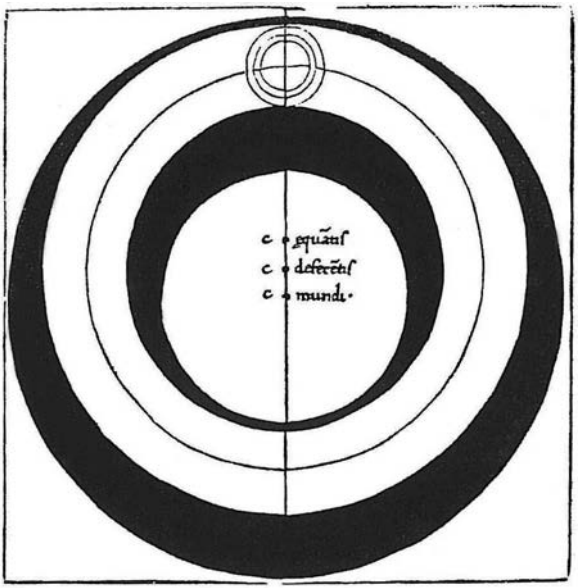

Figure 1. The model of material spheres which sustain a planet according to Peurbach's *Theorice novae planetarum*. The epicycle sphere is placed in the deferent sphere. There are three designated centres: equant which in Ptolemy's astronomy was the point of reference for the uniform revolution of the epicycle, the deferent centre and the centre of the Earth. Courtesy of the Ludwik and Aleksander Birkenmajer Institute for the History of Science at the Polish Academy of Sciences in Warsaw.

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

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

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

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

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

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

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