Essay Review

A Copernican Renaissance? by Robert S. Westman

Matjaž Vesel. *Copernicus: Platonist Astronomer-Philosopher: Cosmic Order, the Movement of the Earth, and the Scientific Revolution.* 451 pp., figs., bibl., indexes. Frankfurt am Main: Peter Lang, 2014. $100.95 (cloth).

Jeremy Brown. *New Heavens and a New Earth: The Jewish Reception of Copernican Thought.* xviii + 394 pp., app., notes, illus., bibl., index. New York: Oxford University Press, 2013. $78 (cloth).

Copernicus continues to attract an unusual level of historiographical interest. Since 2009, to choose an arbitrary date, at least nine books have appeared, including Dava Sobel's play about Copernicus and his disciple Georg Joachim Rheticus, in addition to the two books here under review.[1] In November 2015 a much-anticipated French edition of Copernicus's works was published under the editorship of a distinguished team of French scholars led by Michel-Pierre Lerner, Alain-Philippe Segonds, and Jean-Pierre Verdet, adding still another layer of significant, fine-grained commentary and textual analysis to the English, Polish, German, Russian, Portuguese, Italian, and Spanish editions already available.[2] With such a welcome stream of scholarship, it is hardly surprising that our students' textbooks cannot possibly keep up with all the late-breaking discoveries, attractive hypotheses, rival narratives, and subtle conceptual distinctions generated in the specialist literature. And these highlights do not even include the immense volume of writings devoted to well-known figures like Galileo, Bruno, Kepler, and Newton that commonly figure in Copernican narratives.

In one sense, this intense focus reflects nothing more surprising than an advanced stage in the maturation of a historiography that once absorbed the energies of much of our discipline.

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[1] Anna De Pace, *Niccolò Copernico e la fondazione del cosmo eliocentrico: Con testo, traduzione e commentario del Libro I de* Le rivoluzioni celesti (Milan: Mondadori, 2009); André Goddu, *Copernicus and the Aristotelian Tradition: Education, Reading, and Philosophy in Copernicus's Path to Heliocentrism* (Leiden: Brill, 2010); Robert S. Westman, *The Copernican Question: Prognostication, Skepticism, and Celestial Order* (Berkeley: Univ. California Press, 2011); Dava Sobel, *A More Perfect Heaven: How Copernicus Revolutionized the Cosmos* (New York: Walker, 2011); Sobel, *And the Sun Stood Still* (New York: Bloomsbury, 2016); John Freely, *Celestial Revolutionary: Copernicus, the Man and His Universe* (London: Taurus, 2014); Pietro Daniel Omodeo, *Copernicus in the Cultural Debates of the Renaissance: Reception, Legacy, Transformation* (Leiden: Brill, 2014); Wolfgang Neuber, Thomas Rahn, and Claus Zittel, eds., *The Making of Copernicus: Early Modern Transformations of a Scientist and His Science* (Leiden: Brill, 2014); and Anthony Millevolte, *The Copernican Revolution: Putting the Earth into Motion* (Tuscobia, Wisc.: Tuscobia, 2014).

[2] Nicolas Copernic, *De revolutionibus orbium coelestium / Des révolutions des orbes célestes*, ed. Michel-Pierre Lerner, Alain-Philippe Segonds, and Jean-Pierre Verdet, 3 vols. (Paris: Les Belles Lettres, 2015).

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Yet, from another perspective, it also testifies to the persistent undertow of various competing narratives of scientific origins, change, rationality, progress, and the nature of knowledge. Was Copernicus's moment truly the birth of Modern Science, the beginning of the Scientific Revolution, or the first revolutionary paradigm shift in science? What role did Copernicus himself play in the larger story? Did he merely trigger a development that was initially conservative in its effects yet radical in the long-term implications it opened for others? Or was his proposal itself the crucial revolutionary act that others subsequently confirmed, developed, and extended? Was his hypothesis motivated by a crisis that involved the astronomical foundations of astrology (as I have argued)—a problem situation largely of the late fifteenth and sixteenth centuries? Or were his motivating concerns located primarily in the physical principles underlying his calculating models? And, apart from Copernicus's own motivations, does the Copernican episode—whether taken narrowly or broadly—exemplify something unique about The West? Did Copernicus depend on technical resources crucial to his project that were inherited from medieval Islamic astronomers or were they already available to him from European sources? Finally, what sorts of closures did later versions of his proposal achieve? In what sorts of communities, in which genres of writing, and with what epistemic standards did the central Copernican insight win—or fail to win—the cultural authority of a scientific truth? These questions are by no means exhaustive, but they call attention to the larger issues at stake in this evolving literature.

For Matjaž Vesel, there was both a Copernican and a Scientific Revolution, and its critical elements are already contained in Copernicus's writings, directly in his Platonic sources rather than, as argued by Thomas Kuhn and Alexandre Koyré, in the consequences of his ideas worked out by later thinkers. Based on a close reading and paraphrase of Copernicus's main writings, his central questions are: Why did Copernicus turn to the heliocentric arrangement as a solution to problems that had troubled astronomers for centuries—problems like uncertainties of the calendar, inaccurate planetary tables, the equant model, and disagreement about the ordering of Mercury and Venus? And how did Copernicus justify his solution to those problems? In Vesel's account, following but amplifying Anna De Pace's recent reading along the same lines, Copernicus was a new kind of astronomer, a hybrid figure—both a philosopher and an astronomer. Vesel's hyphenated designator "Platonist astronomer-philosopher" (something of a riff on Galileo's later phrase "*filosofo astronomo*") is a key that for him opens all doors. He believes that "Platonism" and "the Platonic Tradition"—terms used repeatedly and often interchangeably—solve all the puzzles with which historians have struggled—Copernicus's initial motivation as well as the justification for his final arrangement (pp. 19–20).

Vesel's Platonist Copernicus is first and foremost a philosopher committed to a prior metaphysical claim that the structure of the universe is both coherent and a reflection of The Good or, in its later Christianized form, God (pp. 28–29, 74). Because the universe was created "for our sake," it must be accessible to human understanding. The problem for the metaphysician Copernicus was then to find evidence of these divine principles of coherence (*harmonia*, *symmetria*) in the planetary motions themselves. And, as an astronomer, he found them embodied in the assumption of uniform, circular motion, in the relationship of the periods of revolution increasing with distance from the sun, and in the special importance that many writers attributed to the sun.

While many of Vesel's exegeses of Copernicus's ideas are interesting and useful, at least three major difficulties should be noted. That there are Platonic elements in Copernicus's project will hardly surprise readers familiar with at least the earlier studies of Edwin A. Burtt, Thomas S. Kuhn, and Alexandre Koyré. But, as Gary Hatfield perceptively pointed out more than twenty-five years ago, a distinction should be drawn between implicit or hidden presuppositions teased out by the historian—especially philosophically minded historians with their own, broader agendas—and those that an author makes and explicitly grounds in his or her own temporally bound categories and arguments.[3] Criteria of simplicity and harmony can be regarded as metaphysical. But Copernicus's scattered phrases and allusions do not add up to the sort of explicit theological-metaphysical argument found in Kepler's *Mysterium cosmographicum*, where the planetary arrangement is justified by its resemblance to the Holy Trinity. Rather, as Rheticus stated in his *Narratio Prima*, Copernicus modeled *De revolutionibus* after Ptolemy's *Almagest*, the major astronomical work of Greek antiquity. In 1543, when Copernicus famously wrote that "mathematics is written for mathematicians," he was signaling that his book should be read by those familiar with the *Almagest* as well as its astrological companion the *Tetrabiblos*. Failure to take these points of reference into account makes Vesel's overall effort to make Copernicus into a metaphysician at best strained, at worst unconvincing.[4]

A second difficulty concerns the logic and sourcing of Copernicus's major argument. Vesel rightly stresses the weight Copernicus ascribed to his claim about the ordering of the planets according to the distance-period relation—the harmonious bond or *symmetria* that connects the planets' increasing distances from the sun with their increasing periods of revolution. But then, without any textual reference, he contends that this planetary coherence "entails [the] movement of the earth around the stationary sun." "This," he proclaims, "is the ultimate reason why Copernicus believes that [the] earth moves and can move also around its axis" (pp. 235, 374). But in his preface to *De revolutionibus* Copernicus says that he found the claim about the earth's mobility attributed to the Pythagoreans by Cicero and Plutarch, and in his *Narratio Prima* Rheticus said that his teacher had found it in Aristotle's *De caelo*—undoubtedly quite early, when he was a student at the University of Krakow (1491–1495).[5] "Hence," Copernicus wrote, again in his 1543 preface, "I thought that I too would be readily permitted to ascertain whether explanations sounder than those of my predecessors could be found for the revolution of the celestial spheres *on the assumption of some motion of the earth*." And in the next sentence: "Having thus *assumed* the motions which I ascribe to the earth later on in the volume. . . ."[6] So, it appears that in his final statement Copernicus treated the earth's annual motion as a hypothesis already known to the ancients and the ordering as a logical entailment of that hypothesis—an explanation or, even better, a new explanation for the ordering based on their periods of revolution—but certainly not a logical proof of the main premise. The remaining burden of his presentation was then to demonstrate that the moving earth could be shown to be consistent with all known physical and observational effects. Indeed, had Copernicus

[3] E. A. Burtt, *The Metaphysical Foundations of Modern Science* (1924; New York: Doubleday, 1932), pp. 52–56; Thomas S. Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* (New York: Vintage, 1957), pp. 128–133; Alexandre Koyré, *The Astronomical Revolution: Copernicus—Kepler—Borelli* (1961; New York: Dover, 1992), pp. 22, 80; and Gary Hatfield, "Metaphysics and the New Science," in *Reappraisals of the Scientific Revolution*, ed. David C. Lindberg and Robert S. Westman (Cambridge: Cambridge Univ. Press, 1990), pp. 93–166.

[4] Vesel fails to engage either with Hatfield's article or with Curtis Wilson's reconstruction of Copernicus's route to the heliocentric hypothesis. Both appeared in edited volumes listed in his own bibliography and are, unfortunately, not isolated instances of ignoring arguments that do not comport with his thesis. See Curtis A. Wilson, "Rheticus, Ravetz, and the 'Necessity' of Copernicus' Innovation," in *The Copernican Achievement*, ed. Robert S. Westman (Berkeley: Univ. California Press, 1975), pp. 17–39.

[5] Georg Joachim Rheticus, *Narratio Prima* (1540), in *Three Copernican Treatises*, ed. and trans. Edward Rosen (1939; New York: Octagon, 1971), p. 148: "He saw (as Aristotle also points out) that when one motion is assigned to the earth, it may properly have other motions, by analogy with the planets. He therefore decided to begin with the assumption that the earth has three motions, by far the most important of all." See Aristotle, *De caelo*, Bk. 2, Ch. 14, trans. W. K. C. Guthrie (Cambridge, Mass.: Harvard Univ. Press, 1960), pp. 217–219.

[6] Nicolaus Copernicus, *On the Revolutions of the Heavenly Spheres*, in *Complete Works*, Vol. 2, trans. Edward Rosen, ed. Jerzy Dobrzycki, p. 5, ll. 10–12 (emphasis added), 13–14.

presented an incontrovertible proof, Platonic or otherwise, there would have been little argument about his major premise for the next century or so.

Near the end of *Copernicus: Platonist Astronomer-Philosopher*, Vesel admits to difficulties. Although he regards Copernicus's physics as "Platonist," that physics is "not very coherent," "sometimes . . . even contradictory," and "far from being thoroughly elaborated" (p. 372). How can this be? The explanation is that "Copernicus's fundamental preoccupation is not natural philosophy, but [the] Pythagorean-Platonist idea of a mathematically ordered universe." Here, in his effort to emphasize the radical character of Copernicus's "epistemological break" (p. 372), Vesel overlooks the extent to which Copernicus was simply tracking the dialectical structure of Aristotle's arguments. For example, although Vesel rehearses Aristotle's well-known arguments against the earth's motion, he systematically overlooks that Aristotle directed these key arguments explicitly against the Pythagoreans (pp. 384–385).[7] Copernicus thus seems to have taken as his starting point the very position that Aristotle rejected, then adding to it the further removal of Ptolemy's equant model when he countenanced the details of the planetary models. Beginning with the Pythagorean assumption of the moving earth, Copernicus would then have had to confront the consequences of removing the (no longer necessary) sun's motion from each of the planetary models—exactly the opposite route of development as that conjectured by Vesel. Thus, while few would deny the presence of Platonic elements in Copernicus's thought, Vesel makes them do too much work.

Jeremy Brown's contribution is of an entirely different order. A professor of emergency medicine at George Washington University, Brown avidly pursued an unusual side interest: Jewish reactions to Copernicus's proposal as a case study in the broader question of the encounter between scientific innovation and religious thought. His overall results are both novel and enlightening. To my knowledge, *New Heavens and a New Earth* is the first attempt to write a systematic history of Jewish responses to Copernicus's theory—one that ambitiously covers the period from the early seventeenth century to the very recent past. Organized as the study of a succession of thinkers—with occasional gestures at social contextualization—the narrative might be regarded as something of a preliminary mapping of the historical terrain. The numerous writings that Brown has unearthed are overwhelmingly in Hebrew, often composed by rabbis trained in Jewish schools (*yeshivas*) but with occasional access to the universities (often Padua), their works for the most part available only to the local communities they served and sometimes published only long after they were written. Only in his final chapter does Brown step back to draw some "tentative conclusions" (p. 275) within the framework of the science-and-religion literature, engaging with larger themes, notably patterns of diversity, dispersed local reactions, and close master–disciple relationships.[8]

In view of the image of Jews as major contributors to science in the twentieth century, exemplified by figures like Einstein and Freud, one of Brown's surprising findings is the extent of long-term Jewish resistance to Copernicus's proposal. The earliest known Jewish writer to mention Copernicus was David Gans (1541–1613), in Prague. Gans came to know Tycho Brahe personally and aligned himself with his geoheliocentric arrangement. Yet Gans's *Nehmad Vena'im* (*Delightful and Pleasant*) would not gain any widespread recognition until well after 1743, when it appeared in print. The rabbi Joseph Solomon Delmedigo (1591–1655), designated by Brown as "the first Jewish Copernican," owned a manuscript copy of Gans's work and, as one of a handful of Jews who gained entry to a university (Padua), he also knew Galileo,

[7] Aristotle, *De caelo*, Bk. 2, pp. 13–14, 86, 89 f., 155.

[8] Brown stresses David Livingstone's four "imperatives": pluralize, localize, hybridize, and politicize. See David Livingstone, *Putting Science in Its Place: Geographies of Scientific Knowledge* (Chicago: Univ. Chicago Press, 2003).

although evidence about their relationship is slim. Nonetheless, while the references in Delmedigo's *Sefer Elim* (*The Book of Palms* [1628]) are favorable to Copernicus, Brown does not indicate whether the work included the numerous arguments that, by then, were in circulation among leading Protestant and Catholic supporters of Copernicus. On the other hand, Tuviah Cohen (1652–1729), who studied at universities in Frankfurt and Padua, was familiar with many of the main arguments in the Copernican controversies but concluded in his influential *Ma'aseh Tuviah* (*The Work of Tuviah* [1708]) that Copernicus was the "Son of Satan." David Nieto (1654–1728), the Venetian-born Sephardic rabbi of the Spanish-Portuguese synagogue in London, was another consequential figure. In 1701 Nieto concluded against Copernicus in his *Matteh Dan* (*Rod of Judgment* [1714]) that any scientific claim was acceptable only if it did not contradict the laws of God as interpreted by the ancient rabbis. And he rejected as "abominable" the principle advanced by Galileo (although without naming him) whereby biblical passages referring to the natural world were to be read as accommodated to the understanding of ordinary people. This hesitation to apply the principle of accommodation, like the hard-line standard Cardinal Bellarmine laid down on Galileo and the upstart Carmelite Paolo Foscarini in 1615, points not to the power of a centralized authority but to the inflexible conservatism of a tradition-bound religious community. Indeed, all of Brown's late seventeenth- and eighteenth-century Jewish writers carefully ignored the dangerous Baruch Spinoza (1632–1677), excommunicated from the Amsterdam synagogue (although not for his Copernican views).

As leading Christian philosophers of the first half of the eighteenth century debated the merits of Newton's achievement, views like those of Nieto continued to prevail. Brown points to a detectable but very slow shift only in the second half of the century, with the beginning of the *Haskalah*, or Jewish Enlightenment, a movement centered in Berlin. Its leaders (known as *maskilim*) quickly established a new school (the Jüdische Freischule, founded in 1778) and set up a Jewish printing house intended to bring secular knowledge into the traditional curriculum, although it was restricted by the state to publishing only in Hebrew. Brown exposes the stark tensions and differential successes within the *Haskalah* movement as poor, self-educated East European Jews left their constraining traditional communities for the relatively more open intellectual worlds of cities like Berlin, Frankfurt, Amsterdam, and London. A striking example is that of Shlomo ben Yehoshua (1753–1800), from Niesweiz in Lithuania. Married at the age of eleven (!), he taught the Talmud to schoolchildren and then, after suffering a crisis of faith, abandoned his wife and children and traveled to Berlin. Changing his name to Solomon Maimon, after the medieval philosopher Maimonides, he read Copernicus in the original, composed a Hebrew textbook on Newtonian physics (never published), engaged in correspondence with Kant, and published significant commentaries on the *Critique of Pure Reason* as well as on Maimonides' *Guide of the Perplexed* that contained extensive discussions of Copernicus, Kepler, Newton, Descartes, Kant, and Leibniz. Never fully accepted by the Berlin *maskilim*, Maimon sadly, but revealingly, wrote that the educated could easily read the original scientific works, whereas "the unenlightened, on the other hand—and these form the majority—are so swayed by rabbinical prejudices that they regard the study of the sciences, even in Hebrew, as forbidden fruit, and persistently occupy themselves only with the Talmud and the enormous number of commentaries" (p. 133). Maimon died a heretic, buried outside the perimeter of the Jewish cemetery of Głogów in Poland.

Like Maimon, Pinhas Hurwitz (or Horowitz) (1765–?) was a self-educated East European Jew, but unlike the former he was accepted by the *maskilim* of Frankfurt as well as those of Amsterdam and London. He published the highly successful *Sefer Haberit* (*Book of the Covenant* [1797]), an encyclopedia that combined a Talmudic and kabbalistic account of the universe with both the latest scientific discoveries (for example, the discovery of Uranus) and what Brown characterizes as a description of Copernicus's arrangement "in more detail than had any previous Jewish text" (p. 138). However, Hurwitz ultimately rejected the earth's motion in favor of Tycho Brahe's geoheliocentric ordering on the basis of the claim that "when a stone is dropped from a tall mast on a moving ship, it fell a small distance from the base of the mast" (p. 140). In 1934, a young Polish *yeshiva* student mentioned in an essay about his life that

> I obtained a copy of the *Book of the Covenant* . . . and virtually committed it to memory, reading it in the bathroom for fear of being caught and confronted with a whole new series of accusations. [It] gave me a sound foundation in anatomy, physics, geography and the like. I had a weakness, however, for showing off my scientific learning to my friends (without telling them about its source). This led to my becoming known as a person of wide-ranging knowledge, and I was sought after by those who were drawn to the *Haskalah*. [P. 134.]

Brown reports that he easily obtained a recent edition of *Sefer Haberit* in a small bookshop in the ultra-Orthodox section of Jerusalem: "Without moving from his position behind the counter, [the owner] reached behind his shoulder and handed me a copy that had been published in Jerusalem in 1990" (p. 326 n 43).

Brown characterizes the nineteenth century as "Copernicus without Hesitation." Copernicus had become something of a stand-in for secular learning and modernity, and the Hebrew literature from the 1820s onward, although still deeply religious, began to reflect a much greater openness to new scientific evidence. In explaining this shift, Brown ascribes an important role both to Friedrich Bessel's measurement of stellar parallax in 1838 and to the impression left on the general public by Leon Foucault's pendulum experiment of 1851, which visually demonstrated that the earth's surface was turning as the pendulum maintained its direction. He reframes the matter more generally in his conclusion, where he characterizes the question as one of scientific and religious rationality. Here Brown argues that prior to Bessel and Foucault the scientific evidence for Copernicus was insufficient—"not fully persuasive": "Anyone, Jew or Gentile, who accepted the model before then, did so with relatively little scientific support" (pp. 281–282). Of course, such a positivistic view creates a mystery: explaining why anyone from Copernicus to Newton and Laplace could have accepted the heliocentric arrangement as a reality.[9]

For the Jews of the early modern period, the question seems not to have involved the Copernican theory's lack of sufficient scientific evidence in its favor. Rather, most Jews simply could not follow, let alone participate in, the major scientific debates of their time because, as Brown acknowledges, they lived in legally and socially marginalized communities, their male-gendered schools dominated by study of the Talmud and its commentaries (p. 283). Precious few had access to the Greco-Latinate learning of the universities and to the libraries and communication networks that sustained the foremost innovators of the Scientific Revolution. Much later, new obstacles to entry into the universities came about in response to the large-scale immigration of East European Jews to America between 1880 and 1924. Quotas restricting admission of Jews were introduced in the 1920s and were in effect throughout the

[9] Imre Lakatos and Elie Zahar contest the view that it was scientifically irrational to support Copernicus's proposal before Bessel in "Why Did Copernicus' Research Program Supersede Ptolemy's?" in *Copernican Achievement*, ed. Westman (cit. n. 4), pp. 354–383. Citing David Wootton's judgment that "Galileo's Copernicanism was premature, and that an explanation of his position must be psychological rather than scientific" (p. 283), Brown conjectures that "the same conclusion likely applies to the early Jewish Copernicans, like Delmedigo, Levi of Hannover, and Levison" (pp. 283–284).

Ivy League when, for example, the brilliant physics student (and future Nobel Prize winner) Richard Feynman (1918–1988) was rejected by Columbia University in the mid-1930s.[10]

Brown does not cover the entry of Jews, especially secular Jews, into twentieth-century academic science—or even their role in helping to build the discipline of the history of science, in which the Scientific Revolution was the prevailing narrative in the profession's early decades.[11] But in a fascinating penultimate chapter he shows that, more than four hundred years after the publication of Copernicus's *De revolutionibus*, opposition to heliocentrism persisted among some elements of the ultra-Orthodox (*Haredi*) community in Israel. In 1967, one year before *Apollo 8* orbited the moon, a Jerusalem author named Pinhas Vaberman wrote that Copernicus was a "liar and a cheat" and his model the "work of the devil." He also expressed his regret that some Orthodox schools "teach this heretical material to young children, and this is most damaging to a pure belief [in Judaism]" (p. 255). A "neo-geocentric" approach to heliocentrism was taken by the leader of the Lubavitch movement, Rabbi Menachem Mendel Schneerson (1902–1994). Schneerson invoked the authority of Einstein's theory of relativity in arguing that "regarding a 'system' of two objects which are in relative motion, *it is impossible* to determine which is at rest and which is in motion" (p. 256). Ignoring the fact that the solar system consists of more than two bodies and that a coordinate system connected with the sun resembles an inertial system, Schneerson concluded that science was unable to render a decisive verdict, thereby opening the way for the Torah alone to decide the matter.

[10] Feynman was accepted at MIT. For the "Jewish Problem" at Harvard, Yale, and Princeton see Jerome Karabel, *The Chosen: The Hidden History of Admission and Exclusion at Harvard, Yale, and Princeton* (Boston: Houghton Mifflin, 2006).

[11] For the historiography of the Scientific Revolution see H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry* (Chicago: Univ. Chicago Press, 1994).