

Biographical Encyclopedia of Astronomers

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Clavius, Christoph

Born Bamberg, (Bavaria, Germany), 25 March 1538

Died Rome, (Italy), 6 February 1612

Christoph Clavius was one of the most respected and widely published authors in the fields of mathematics and astronomy during the late 16th and early 17th centuries. His books were widely used, especially in the pervasive network of Jesuit colleges, and through them he was recognized as an authoritative interpreter and commentator on such fundamental ancient authors as Ptolemy and Euclid, as well as on contemporary authors and issues, including the early debates over Copernican cosmology. Clavius also served as one of the two astronomers on Pope Gregory XIII's commission to reform the Western calendar. As such, he was the primary architect of the technical aspects of the reform, which was promulgated in 1582. Clavius subsequently became the most prolific defender of that reform against its critics

Little is known of Clavius's early life apart from his birth date and place. In 1555, he entered the Society of Jesus in Rome and was sent to study at the Jesuit College of the University of Coimbra, Portugal. He remained there long enough to observe the total solar eclipse of August 1560, which he later wrote about. By mid-1561, Clavius had returned to Rome to pursue theological studies at the Jesuit Collegio Romano; he began teaching mathematics there by 1563 and was ordained in 1564. By 1570, he had published the first edition of his *Commentary on the "Sphere" of Sacrobosco*, and in 1574 his edition of Euclid's *Elements* appeared, both of which he revised and republished multiple times. Clavius observed the nova of 1572 and published (in his *Sphere* commentary) observations showing that it must have been located among the fixed stars, which led him to announce that the heavens could not be completely unchanging.

In the mid-1570s, Clavius began serving on the pope's calendar reform commission, where he helped review the details and explain the technical merits and deficiencies of the various possible reform schemes. In the end, it was his recommendation that determined the reformed calendar adopted by the commission

In the course of his career, Clavius published textbooks for nearly every subject in the mathematical curriculum (into which category astronomy and astronomical instruments fell), including works on arithmetic, algebra, spherical and plane geometry, and gnomonics, as well as practical books on the sundial and astrolabe. In addition to his prolific publications, Clavius trained several generations of influential scholars and thus made astronomy a field in which the Jesuits of the 17th century could justly claim expertise

Clavius's identity as the great defender of Ptolemaic cosmology derives entirely from his textbook on basic astronomy, the *Commentary on the "Sphere" of John of Holywood*, which underwent seven revisions and over 16 printings between 1570 and 1618. In addition to presenting a complete treatment of the spherical and observational astronomy of his day, Clavius introduced the basics of planetary theory and expounded and vigorously defended the Ptolemaic/Aristotelian cosmos. He also critically reviewed several alternatives to Ptolemaic theory, including homocentric, Copernican, and some other contenders, less well known today, though not the Tychonic. Clavius's popular textbook makes clear that the diversity and vitality of competing cosmological theories went well beyond the Ptolemaic-Copernican debate even

before Galileo Galilei's entry into the arena. Thus, Clavius's criticisms of the Copernican theory set the astronomical terms for the debates into which Galileo would soon wade. Clavius's response to Nicolaus Copernicus, which appeared virtually unchanged in all editions of his *Sphere* commentary from 1581 onward, rested on astronomical, physical, scriptural, and methodological arguments. The first three categories of arguments are part of his general case for the centrality and stability of the Earth and do not explicitly name Copernicus, although they are clearly intended to apply to him. The astronomical and physical arguments are, generally speaking, repetitions of the traditional arguments intended to show that astronomical appearances would differ from what we observe were the Earth not central and stationary, providing observational arguments showing that the Earth must be motionless, and citing physical arguments that a moving Earth is impossible. Clavius also quoted scriptural passages attesting to the centrality and immobility of the Earth. He specifically stated that Copernican cosmology contradicted Scripture, but he did not state or imply that theories inconsistent with scriptural evidence were heretical or dangerous. They

were simply wrong. When he did confront Copernicus's theory directly, Clavius admitted that it was, unlike all of the other cosmological alternatives, as astronomically viable and technically useful as the Ptolemaic. But his critique then took a novel methodological turn in which he argued that the Copernican approach is logically equivalent to a false syllogism, in which false premises (e.g., the motion of the Earth) can lead to true conclusions. False syllogisms, Clavius observed, work only because the correct outcome is known ahead of time, and such reasoning is incapable of producing certainty in conclusions based on it

Clavius and Galileo were acquainted with one another and had corresponded occasionally from at least 1587. Indeed, in his own university lectures, Galileo drew heavily on Clavius's work. Clavius's "academy" of mathematicians at the Collegio Romano took an ongoing interest in astronomical matters and made occasional observations; some of them had even been experimenting with primitive astronomical telescopes and observing with them as early as the summer of 1610. So Clavius and his colleagues were well prepared when Cardinal Bellarmine asked them, in April 1611, for their opinion on Galileo's telescopic discoveries. Their reply was a strong endorsement of the accuracy of his observations, though not of the Copernican interpretations that Galileo drew. Clavius showed nearly the same attitude in his announcement of Galileo's discoveries in the final revision of his *Sphere* commentary, published in 1612. This ringing endorsement was one of the earliest and most authoritative published affirmations of the truth of Galileo's discoveries. In his published statement, Clavius cautiously went beyond the report to Bellarmine and, although declining to pursue their full implications, admitted that the impact of the new discoveries obliged astronomers to reconsider accepted planetary theories.

James M. Lattis

Selected References

Baldini, Ugo. "The Academy of Mathematics of the Collegio Romano from 1553 to 1612." In *Feingold*, pp. 47-98. (The most important studies of Clavius and the mathematical scholars of the Collegio Romano are thanks to Baldini.)

—— (1992). *Legem impone subactis: Studi sul filosofia e scienza dei Gesuiti in Italia, 1540–1632*. Rome: Bulzoni Editore. (Modern editions of primary sources for Clavius's work are rare. Clavius's previously unpublished treatise on the theory of solar motion is one example.)

Baldini, Ugo, and Pier Daniele Napolitani (eds.) (1992). *Christoph Clavius: Corrispondenza*. Pisa: Dipartimento di Matematica, Università di Pisa. (Clavius's surviving correspondence has

been admirably edited and published, but at present, only in a typescript edition that is not widely available.)

Coyne, G. V., S. J., M. A. Hoskin, and O. Pedersen (eds.) (1983). *Gregorian Reform of the Calendar*. Vatican City: Pontificia Academia Scientiarum, Specola Vaticana. (There exists no complete study of Clavius's work on the Gregorian calendar reform.)

Feingold, Mordechai (ed.) (2003). *Jesuit Science and the Republic of Letters*. Cambridge, Massachusetts: MIT Press.

Grant, Edward. "The Partial Transformation of Medieval Cosmology by Jesuits in the Sixteenth and Seventeenth Centuries." In *Feingold*, pp. 127–155.

Lattis, James M. (1994). *Between Copernicus and Galileo: Christoph Clavius and the Collapse of Ptolemaic Cosmology*. Chicago: University of Chicago Press. (The only monographic study of Clavius as an astronomer.)

Wallace, William A. (1984). *Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science*. Princeton, New Jersey: Princeton University Press. (Wallace has explained in considerable detail the many connections between Galileo, Clavius, and other Jesuit authors.)