Biographical Encyclopedia of Astronomers

Boulliau, Ismaël

Born Loudun, (Vienne), France, 28 September 1605

Died Paris, France, 25 November 1694

An early Copernican and Keplerian, Ismaël Boulliau was the most noted astronomer of his generation The first surviving child of Calvinist parents, Ismael Boulliau (1583–1625), a notary and city official, and Susanna Motet (1582–1634), Boulliau began his studies in the humanities at Loudun and, after obtaining a law degree at Poitiers, completed his studies in philosophy in Paris. Following his father's death in 1625, Boulliau converted to Catholicism and moved permanently to Paris in 1632. For the next 30 years, Boulliau enjoyed the patronage of the De Thou family and assisted the Dupuy brothers at the Bibliothèque du Roi, home of the famous *Cabinet Dupuy*. Here, Boulliau forged lifelong friendships with Pierre Gassendi and Marin Mersenne, met René Descartes, Gilles Roberval, and Blaise Pascal, and established long-term relationships with learned Visitors among them were Johannes Hevelius, Henry Oldenburg, and Christiaan Huygens, many becoming major correspondents.

Although he published numerous books and traveled widely in Holland, Germany, Poland, Italy, and the Levant, Boulliau's reputation as an astronomer, mathematician, and classical scholar was largely due to his correspondence network. A pivotal figure in the Republic of Letters, Boulliau extended the humanist tradition of *intelligencer* to the New Science. His correspondence network, which rivaled the combined efforts of Mersenne and Oldenburg, tells us much about the New Science, much about the reception of Nicolaus Copernicus, Johannes Kepler, Galileo Galilei, Descartes, and much about the complex communities that gave science shape.

Boulliau inherited an interest in astronomy from his father. Good evidence suggests Boulliau made astronomical observations by the age of 12, became enamored with astrology in adolescence, and by age 20 converted to Copernicanism Mersenne proclaimed that Boulliau, by age 30, was "one of the most excellent astronomers of the century." When Boulliau reached the age of 45, Gassendi bestowed upon him the singular title "premiere astronomer of the century." Nominated *astronomus profundæ indaginis* by Giovanni Riccioli in 1651, Boulliau enjoyed a remarkable reputation throughout his career. Since that time, however, his contributions have been viewed more critically. While he acknowledged Boulliau's historical importance, Jean-Baptiste Delambre, for example, dismissed Boulliau's planetary theory as ingenious but useless, concluding that it was a "retrograde step" for science. Similar views—still linked to the "retrograde" metaphor—have appeared in more recent works.

From the beginning of his career, Boulliau sought to reform and restore astronomy. This meant improving astronomical tables and perfecting the principles of planetary motion. Despite his much-discussed Platonism, Boulliau believed this reformation required fresh—not necessarily new—observations. Boulliau began by applying his skills as a classical scholar, by unearthing ancient observations of the Egyptians, Babylonians, Greeks, and others. His strategy—at once historical, empirical, and mathematical—was to establish a long baseline of observations and, from these "general circumstances" of planetary motion, to determine their mean motions, thus exposing their deepest uniformities and most subtle inequalities.

In addition to his historical studies, Boulliau was a dedicated observer, maintaining detailed records from 1623 to 1687. Over the course of his career, Boulliau owned several of the best telescopes in Europe. More valuable than "diamonds and rubies," they included an 11-ft A telescope was given to him by the Grand Duke of Tuscany in 1651, and later, thanks to friends, he obtained lenses from Huygens (a 22-footer in 1659), T. L. Burattini (10- and 12-footers in 1666), and Giuseppe Campani (1670). Active for over 60 years, Boulliau's long-term interests, beyond the usual concern for eclipses and conjunctions, focused on the variable star Mira Ceti and lunar libration. Boulliau called the Moon's second (synodic) inequality "evection," a term still in use. Although he was not a first-rate observer, Boulliau was unrivaled in the Republic of Letters for coordinating astronomical observations, communicating data, and comparing results.

Despite his passion for observation, Boulliau is best remembered as a theorist. An outspoken Copernican and critical student of Kepler, Boulliau's first book in astronomy aimed to supply new arguments for the motion of the Earth based on "Astronomy,

Geometry, and Optics" and not "physical conjecture." Although his Philolaus (Amsterdam, 1639) was published anonymously, the author was never in doubt, as Boulliau's manuscript (*De motu telluris*, 1634) had circulated privately in the years immediately following Galileo's condemnation. When the book finally appeared, it exerted an immense influence, spawning controversy across Europe that ranged from praise and envy to anger and rage.

Boulliau's *magnum opus* appeared 6 years later Arguably the most important work on planetary systems between Kepler and Isaac Newton, the Astronomia philolaïca (Paris, 1645) clearly extended awareness of planetary ellipses. Here, Boulliau offered an entirely new cosmology, a "newer than new" alternative to Kepler's Astronomia nova. Boulliau began by attacking Kepler's cosmology at its very foundation, systematically undermining the physical principles on which Kepler based his calculations. Boulliau concluded that Kepler's celestial physics and calculational procedures were conjectural and cumbersome, unworthy of Kepler's genius. Critical of Kepler's assumptions and conclusions, Boulliau embraced elliptical orbits but insisted they could not be demonstrated by calculation alone. In place of Kepler's *anima mortrix* and "celestial figments," Boulliau argued it was simpler to assume that planets were self-moving, that their motion, imparted at creation, was conserved. In place of Kepler's indirect "a-geometrical methods," Boulliau proposed direct calculation based on mean motion.

Boulliau's solution to the "problem of the planets" was the conic hypothesis (1645). Because circles and ellipses are conic sections, Boulliau imagined that the planets moved along the surface of an oblique cone, each revolving in an elliptical orbit around the Sun located at the lower focus. By construction, the axis of the cone bisected the base, which at once defined the upper (empty) focus of the ellipse as well as an infinite number of circles parallel to the base The position of a planet on the ellipse at any given time (Kepler's problem) was thus defined by an intersecting circle, and hence, at any given instant, the motion of the planet was uniform and circular around its center (Plato's *Dictum*). Where Kepler invoked a complex interplay of forces, Boulliau explained elliptical motion by reason of geometry; the planets naturally accelerated or decelerated due to the differing size of circles. Where Kepler employed indirect trial-and-error methods based on physics, Boulliau provided direct procedures based on geometrical principles. In context, Boulliau's conical hypothesis was elegant and practical. Kepler's construction by contrast was ingenious but useless.

The foundations of Boulliau's cosmology, however, were soon called into question; the result was the "Boulliau-Ward debate." Prompted by Sir Paul Neile, Seth Ward published several treatises (1653; 1656) attacking Boulliau. In these treatises, Ward claimed to offer not only a more accurate alternative to the conical hypothesis (the "simple elliptical" model) but also to demonstrate that the two models were geometrically equivalent. Boulliau responded with his *Astromia philolaica fundamenta clarius explicata* (Paris, 1657). After acknowledging his earlier error in his *Philolaic Tables* (1645), Boulliau shrewdly refuted Ward's claims. The real error, Boulliau maintained, lay with Ward, who erroneously identified the conical hypothesis with his "simple elliptical" alternative—that is, an ellipse where the empty (nonsolar) focus served as an equant point. The two hypotheses were not, in fact, *observationally* equivalent. If Ward's model were applied to the planet Mars, it would result in a maximum error of almost 8 arcminutes in heliocentric longitude, not the 2.5 arcminutes calculated from the conical hypothesis. Ward failed to note the difference; Delambre, a century later, repeated the error. Boulliau then supplied a more refined model, the "modified elliptical" hypothesis. Boulliau compared the new model with Kepler's calculations (using the same Tychonic data) and found it more accurate, having reduced the error to less than 50 arcseconds, clearly within the limits of observational error. If the issue was empirical accuracy and ease of calculation, Boulliau had clearly won the day.

Boulliau's reputation reached its zenith during the 1660s in England. Cited in learned works and the popular press, Boulliau's name was widely linked to mathematical models and various astronomical tables. But his vision of a New Cosmology was lost. During this time, Boulliau's *Philolaic Tables* were widely copied, adapted, or imitated In England, Jeremy Shakerley, among others, believed they were more accurate than Kepler's, while in Italy, Riccioli demonstrated the claim for Saturn, Jupiter, and Mercury. Boulliau's modified elliptical hypothesis also received accolades. Although he had proposed his own method, Nicolaus Kauffman (Mercator) continued to praise Boulliau's model, claiming it could hardly be improved for accuracy. Not least, the "Ornament of the Century" offered praise. In his *Principia* (1687, Book III), Newton claimed that Kepler and Boulliau "above all others" had determined the periodic times of the planets with the greatest accuracy. As the century drew to a close, Boulliau's reputation—by all appearances—had yet to undergo its "retrograde" phase.

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