Other Worlds within a Hand's Reach: Planetary Models from the Sixteenth Century through the Early Twentieth Century

Introduction

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Efforts to model and visualize the planets, their orbits, their motions, and their physical features have had a longstanding and important place in the visual and material cultures of astronomy. But their cultural significance goes well beyond the confines of astronomical science and its communities of practitioners. Be it as mythological deities, bearers of omens and portents, ethereal globes attached to crystalline spheres, or worlds on their own right, the planets have long exerted a fascination over the human mind. Once the wandering stars of a neatly ordained cosmos, then the Earth's counterparts in its orbital journey around the Sun, and more recently the abundant companions of many more stars besides the Sun, they have defied the intellectual stamina of astronomers and mathematicians with the idiosyncrasies of their apparent motion.¹ They equally fostered the race for improved telescopes and observing techniques,² and propelled inquiries on the size and scale of the celestial bodies and of our own cosmic backyard.³

- 1 Michael Hoskin, René Taton, Curtis Wilson (eds.), *The General History of Astronomy*. Vol. 2, *Planetary Astronomy from the Renaissance to the Rise of Astrophysics, Part A, Tycho Brahe to Newton, Part 1* (Cambridge: Cambridge University Press, 2003); David Leverington, *Babylon to Voyager and Beyond: A History of Planetary Astronomy* (Cambridge: Cambridge University Press, 2003).
- 2 See, for example: William Sheehan, *Planet Mars: A History of Observation and Discovery* (Tucson: University of Arizona Press, 1996), and Id., *Planets & Perception: Telescopic Views and Interpretations, 1609–1909* (Tucson: University of Arizona Press, 1988); Thomas Hockey, *Galileo's Planet: Observing Jupiter Before Photography* (Bristol: Institute of Physics Publishing, 1999).
- 3 Albert Van Helden, *Measuring the Universe: Cosmic Dimensions from Aristarchus to Halley* (Chicago-London: University of Chicago Press, 1985).

The planets also fueled debates about extra-terrestrial life, raising questions about the very place of earthlings in the broader scheme of things.⁴ They served as currency in the complex game of patronage; newly found orbs were dedicated to, even temporarily named after, sovereigns and prospective patrons, who symbolically took possession of far off-worlds in exchange for their support to astronomical endeavors.⁵ The arrangement and regularity of planetary orbits and motions were presented as a token of the divine, used as a metaphor for social hierarchy and order, and regarded as a moral appeal to a righteous life mirroring the harmony of nature. But they were equally used for the purposes of spectacle and entertainment.⁶

It is thus very appropriate to revisit artifacts that symbolically brought other worlds down to Earth, making them tangible to the hand, intelligible to the mind, and it may be added, dear to the heart (as suggested by the strong emotional reactions triggered by the reclassification of Pluto as a dwarf planet in 2006⁷). This thematic issue brings a varied array of tridimensional planetary models under a new light. It includes five original contributions addressing artifacts produced over a period that spans from the sixteenth century through the early twentieth century. All papers are grounded on a close scrutiny of actual artifacts and on a thorough analysis of complementary sources. The contributors situate their object-based research by revisiting reference work⁸ and

4 Michael Crowe, *The Extraterrestrial Life Debate, 1750–1900: The Idea of a Plurality of Worlds from Kant to Lowell* (Cambridge: Cambridge University Press, 1988), and *The Extraterrestrial Life Debate, Antiquity to 1915: A Source Book* (Notre Dame: Notre Dame University Press, 2008).

5 On patronage and symbolic appropriations in astronomy, see, for example: Inga Elmquist Söderlund, *Taking Possession of Astronomy: Frontispieces and Illustrated Title-pages in 17th-Century Books on Astronomy* (Stockholm: Center for History of Science, Royal Swedish Academy of Sciences, 2010); Mario Biagioli, *Galileo Courtier: The Practice of Science in the Culture of Absolutism* (Chicago: University of Chicago Press, 1993).

6 See, for example: Charlotte Bigg, Kurt Vanhoutte (eds.), "Spectacular Astronomy," special issue, *Early Popular Visual Culture*, 2017, 15/2; Jan Golinski, "Sublime Astronomy: The Eidouranion of Adam Walker and His Sons," *Huntington Library Quartet*, 2017, 80:137–157; Hsiang-Fu Huang, "When Urania Meets Terpsichore: A Theatrical Turn for Astronomy Lectures in Early Nineteenth-Century Britain," *History of Science*, 2016, 54/1:45–70.

7 See Steven J. Dick, *Discovery and Classification in Astronomy: Controversy and Consensus* (New York: Cambridge University Press, 2013).

8 These include, among others: Elly Dekker, *Globes at Greenwich: A Catalogue of the Globes and Armillary Spheres in the National Maritime Museum* (Oxford-New York: Oxford University Press and the National Maritime Museum, 1999); Klaus Maurice, Otto Mayer, *Clockwork Universe: German Clocks and Automata, 1550–1650* (Washington, D.C., New York: Smithsonian Institution and Neale Watson Academic, 1980); Henry C. King, John R. Millbum, *Geared to the Stars: The Evolution of Planetariums, Orreries, and Astronomical Clocks* (Toronto, Buffalo: University of Toronto Press, 1978).

exploring more recent historiographical angles on the material culture of science and scientific visualization.⁹

Samuel Gessner, Michael Korey, and Karsten Gaulke write about Renaissance planetary automata designed and built in accordance with the tenets of Ptolemaic astronomy, but embodying different solutions for the problem of the non-uniform motion of the Sun. Through their meticulous analysis of surviving automata, the authors go beyond the common approach to these machines as demonstration and performance devices in order to explore their meaning and role in the search of mechanical solutions for the aforementioned problem. Rory McEvoy revisits the early history of the orrery by analyzing two instruments made by George Graham (c. 1673–1751), respectively in the collections of the History of Science Museum in Oxford and the Adler Planetarium in Chicago. McEvoy analyzes the relations between the two instruments and explores their influence on subsequent machines, providing solid evidence for a longstanding assertion according to which the Adler device was a first prototype in the British tradition of orrery making. Luís Tirapicos and Thomas Horst address the origins of planetary globes, focusing on the Venus globes produced by Francesco Bianchini (1662–1729). The authors place the design and production of these globes in the courtly cultures and the intellectual and diplomatic networks of Bianchini's time, showing how his globes were informed by conceptual and technological changes in the domain of astronomical observation. Pedro M.P. Raposo explores the idea of discovery and its uses in the design, production, and trade of planetary models for the educational market in the period 1780–1850. Raposo's contribution highlights both the commercial advantages and the challenges posed by an evolving picture of the solar system, arguing that discovery was used in this context in a gradual and nuanced fashion. Finally, Louise Devoy analyzes the efforts of James Nasmyth (1808–1890) and James Carpenter (1840–1899) to simulate lunar features and landscapes through the combined use of plaster models and photography, addressing their work in the context of other extant models, and showing how astronomers used these artifacts to disseminate ideas, skills, and knowledge.

9 See, for example: *Tangible Things: Making History Through Objects*, edited by Laurel Thatcher Ulrich, Ivan Gaskell, Sara Schechner, Sarah Anne Carter (Oxford: Oxford University Press, 2015); Omar W. Nasim, *Observing by Hand: Sketching the Nebulae in the Nineteenth Century* (Chicago-London: University of Chicago Press, 2013); Liba Taub (ed.), "On Scientific Instruments," special issue, *Studies in History and Philosophy of Science*, 2009, 40/4; Luc Pauwels (ed.), *Visual Cultures of Science: Rethinking Representational Practices in Knowledge Building and Science Communication* (Hanover, New Hampshire: Dartmouth College Press, 2006).

All contributions place the objects under focus in the broader contexts and networks in which they emerged, circulated, and gained varied uses and social meanings. Overall, the articles in this thematic issue revisit and expand on the idea that tridimensional models embody and display knowledge, serving as a medium between the sciences and wider culture,¹⁰ thus constituting important material instances of knowledge in transit.¹¹

10 Nick Hopwood, Soraya de Chadarevian (eds.), *Models: The Third Dimension of Science* (Stanford: Stanford University Press, 2004).

11 James A. Secord, "Knowledge in Transit," *Isis*, 2004, 95/4:654–672.