Episodes from the Early History of Astronomy by Asger Aaboe
New York/Berlin: Springer, 2001. Pp. xiv + 172, 50 figures. ISBN 0–387–95136–9. Paper $74.95

Reviewed by
John P. Britton
Wilson, Wyoming
Brittonjp@cs.com

This slim, elegantly written volume by Asger Aaboe might have been more accurately titled, '*Highlights of Planetary Theory from Babylon to Kepler*', since that is in fact its subject. Lunar theory is mentioned in passing, but mainly to explain its absence. The book begins with an introductory description, characterized as 'Chapter 0', of the principal phenomena of naked eye astronomy necessary to understand what follows.

Chapter 1 describes the arithmetical models and methods employed by astronomical scribes from Babylon and Uruk to depict the dates and positions of the planets' main synodic phenomena—appearances, disappearances, stations, and (for outer planets) oppositions. Especially noteworthy, since they are not published elsewhere, are the reconstruction of Jupiter's daily motion in Table 5, and the illustration in Figure 4 of the interrelations of the functions comprising Lunar System A. This is an area of the author's particular expertise; and his account, which emphasizes the crucial role of period relations in Babylonian theory, is uncommonly readable as well as authoritative.

In many respects the crux of the book is chapter 2, which surveys the kinematic models depicting planetary motions, from their qualitative origins in the homocentric spheres of Eudoxus, through Ptolemy's first simplified and then detailed quantitative models, to the improvements introduced by Islamic astronomers, and finally to the transformations of these models by Copernicus and Tycho Brahe. This ambitious survey focuses on the geometrical relationships of the several models, and combines clear yet rigorous descriptions with novel and uniquely instructive illustrations of the fine details of Ptolemy's equant models and their modifications by al-Tusi, Qutb al-Din,

ISSN 1549–4497 (online) ISSN 1549–4470 (print) ISSN 1549–4489 (CD-ROM)
Aestimatio 3 (2006) 106–107

and Ibn al-Shatir. Of particular note is the author's discussion of efforts to circumvent the philosophically distasteful equant motion. In all, the chapter comprises an admirably clear survey of the essential elements and evolution of kinematic planetary theory.

Two points are emphasized here and subsequently. The first is that Ptolemy's models yield planetary positions—where the planet is if you look for it—as well as any later models until Kepler's. The second is that while Copernicus' transformation of Ptolemy has the singular advantage of establishing the relative distances of the planets, it has no sensible advantage over the Tychonic system, which—as depicted in the splendid frontispiece [see Figure 20 and the book cover] to Riccioli's *Almagestum novum* [1651]—was preferred to Copernicus' by contemporary astronomers, perhaps because it is how we actually see the planets from the Earth.

After extended immersion in the mathematical details of kinematic planetary theory, chapter 3 presents a less mathematically demanding description of the fine structure of the Ptolemaic cosmological system of nested spheres, a system much maligned in conventional commentaries, but which, as the author notes, 'prevailed for nearly a millennium and a half in the West, and for longer in the Near East'. The account illustrates the internal consistency of this system with clarity and economy, adding little-known details about the recovery of its textual underpinnings in Ptolemy's *Planetary Hypotheses*.

In the fourth and last chapter, the author leads the reader gently (only two integrals) through the properties of 'Kepler Motion [viewed from] from Either Focus', to show that, but for second order differences, the angular motion of a planet moving about the Sun in one focus of an ellipse is very nearly uniform about the empty focus. This paves the way for an original answer to the question of whether the vector sum of the eccentricities of Earth and planet can be extended rigorously to a vector sum of eccentricity plus equant, as implied in Ptolemy's models. The answer is presented exquisitely in Figure 15 towards the end of the chapter.

In short, Aaboe's book provides a clear, authoritative, and frequently original introduction to the principal elements of mathematical planetary theory before Newton, which experts will find rewarding and novices accessible. It deserves and will repay a wider audience, despite its unfortunate mispricing by its publisher.