

Reading Guide: Ptolemaic Astronomy and Challenges

This week's goal is to get acquainted with the basic workings of Ptolemaic astronomy and some of the important implications of that system (including some unappealing implications that get exploited as weaknesses). This astronomical system, though criticized, dominated Western science until roughly the time of Galileo. By examining Ptolemaic astronomy, we will see some very interesting philosophical issues arise – especially the questions of what a scientific theory ought to do for us, and when we should judge a theory to be successful. As usual, this reading guide will only cover the primary source readings (in this case, the readings from Proclus and Maimonides). ENJOY!

Recommended order of reading

1. Dewitt, chs. 11-13 (required; we won't actually read directly from Ptolemy this week; thus, you are primarily learning about his astronomical system from this secondary source reading.)
2. PS, pp. 18-20 (recommended; a nice, brief summary of Ptolemy's astronomical system and some of the criticisms of that system.)
3. PS, 1.13, 1.16 – Proclus and Maimonides against Ptolemaic astronomy (required.)

Proclus, "The Weaknesses of the Hypotheses" (PS 1.13).

NOTE: The really substantive material in this reading doesn't begin until about half way through (beginning with the phrase "Before I end...").

1. What do you think Proclus means by the question, "Are [the eccentrics and the epicycles] only conceptual notions or do they have a substantial existence in the spheres with which they are connected?"
2. What is the mistake of the astronomers, if it is assumed that these things merely have "conceptual existence"?
3. What are the mistakes of the astronomers, if it is assumed that eccentrics and epicycles "have a real, substantial existence"? (Don't just repeat verbatim what Proclus writes – really work to understand what he is saying!)
4. What does Proclus mean when he writes, "sometimes the circles come together in one plane, at other times they stand apart, and cut each other."
5. Proclus thinks that astronomers are doing things backwards methodologically. How are they doing it, and how should they – according to Proclus?
6. Note how Proclus ends. Right up to the last paragraph, he sounds pretty critical. There is a definite change in tone in the final paragraph however. What do you make of this?

Maimonides, "Against the Reality of Epicycles and Eccentrics" (PS 1.16).

Maimonides argues against the reality of epicycles and eccentrics in this passage by giving four critical arguments (four "impossibilities" that follow from the assumption of these things). Each of these arguments assumes, in some way, the Aristotelian dynamics. Thus, Maimonides is effectively arguing against Ptolemy's astronomy by appeal to Aristotle's dynamics (which Ptolemy fully accepted of course!). Your main task in this reading is to find the four main objections that Maimonides puts forward and to understand them well.

NOTE: Maimonides gives a very quick and opaque summary of the first "impossibility" on p. 82. I have included below a figure (taken from a nice textbook by David Lindberg titled *The*

revolution of the epicycles...". What is the argument and what does it assume? Is this an a priori or an a posteriori argument?

2. The next longish paragraph contains the third argument. What feature of Aristotle's dynamics is Maimonides assuming here? Did we ever see Aristotle stating this as part of his dynamical system? If so, where? If not, do you think that this is indeed part of Aristotle's dynamics?
3. What is the fourth "impossibility" Maimonides presents against epicycles and eccentrics? (it is found in the paragraph beginning "Even more incongruous...").
4. The remaining text where Maimonides describes his perplexity is **great** reading. What is his attitude toward knowledge of the heavens?
5. Note that this text, just like that of Proclus, ends on a very different note than the rest of it. Both of these writings are, on the whole, very critical of Ptolemy's system, but both then end on a non-critical, perplexed note.

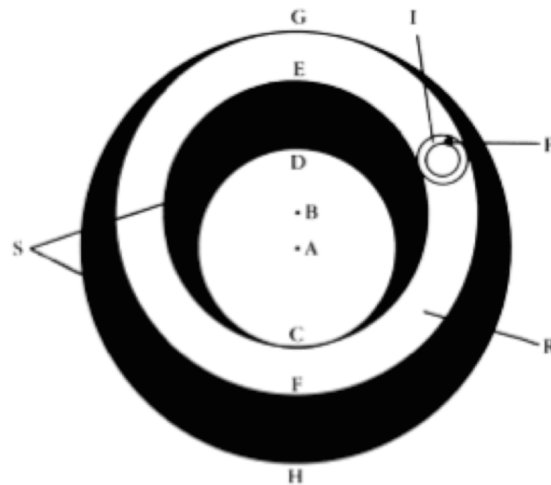


Fig. 11.9. Ibn al-Haytham's physical-sphere model of the Ptolemaic deferent and epicycle. The thickened space, S, is bounded by spherical surfaces CD and GH. A is the center of the universe, where the earth is situated. Cutting through the sphere and eccentric to it is a ring R, centered on B and bounded by surfaces CE and FG. Situated within the ring is the epicycle I, bearing the planet P. The entire sphere rotates about its center A on a daily basis, carrying the ring with it; meanwhile, the epicycle "rolls" through the ring in the sidereal period of the planet (the time required for the planet to complete one circuit of the ecliptic), and through it all the planet is carried around the rotating epicycle. Similar thickened spheres are required for each of the remaining planets.