Reading Guide: The Copernican System

As we saw in our week on Ptolemy, astronomers weren't entirely satisfied with Ptolemaic astronomy. For example, both Proclus and Maimonides argued convincingly that by saving Aristotelian commitments to the changelessness of the heavens by such contraptions as eccentrics and epicycles, astronomers were breaking away from other fundamental Aristotelian beliefs. But there was no other theory to which they could turn – that is why both Proclus and Maimonides end their writings on such a different and much less critical note. The perplexing fact was that there was clearly something wrong with Ptolemy's astronomy (especially perhaps when interpreted in realist terms) but no other system was able to predict the observed phenomena nearly as well. Ptolemy's *Almagest* was published in or around 150 AD; finally, in 1543, Copernicus published the first serious rival theory. The next two weeks are devoted to the study of the Copernican revolution, and the three weeks after that focus on various developments of this theory (culminating in the Newtonian revolution).

Note: When you're doing this reading, if you have trouble understanding how Copernicus's system is able to explain the retrograde motion of the planets, don't worry. We'll discuss it in class. If you cannot wait until then, or if you just want to see a very nice visual illustration of this explanation, check out http://www.lasalle.edu/~smithsc/Astronomy/retrograd.html.

Recommended order of reading

1. Dewitt, ch. 14 (required; there are actually some very serious problems with this chapter of Dewitt in my opinion. We'll talk about some of them in class.)
2. PS, pp. 95-98 (required; this is a much better introduction to Copernicus, his theory, and its relation to the Ptolemaic astronomy than Dewitt's chapter. I suggest that, when you read this section, you compare some of McGrew et al.'s claims to Dewitt's and try to detect where Dewitt has gone wrong.)
3. PS, 2.1, 2.3 (required; excerpts from Rheticus's *Narratio Prima* and Copernicus's *On the Revolutions*)
4. PS, pp. 8-9, 2.2; SEP: "Nicolaus Copernicus" (recommended supplemental material for those who cannot get enough of this stuff!)

Rheticus's *Narratio Prima* (PS 2.1)

This is a fantastic bit of historical writing about Copernicus, and it is not often discussed amongst philosophers of science. Nonetheless, Rheticus's case for Copernican astronomy provides grist for the mill of several important and popular contemporary issues in philosophy of science.

Note that Rheticus's *Narratio Prima* was written after Rheticus spent some time with Copernicus but before Copernicus published his *On the Revolutions*. That's the main reason why I recommend reading this before you read directly from Copernicus.

1. Starting at the beginning of p. 109, Rheticus makes his strongest case for Copernicus's system as preferable to Ptolemy's (what we call the "golden chain argument"). Study this argument carefully. Try to put it into your own words. This is the most important thing to get out of this reading.
2. What is the "relation which nature abhors" that Rheticus speaks of on p. 109?
3. What does the quote from the *Phaedrus* (at the very end of this reading) have to do with Copernicus?

Copernicus's *On the Revolutions* (PS 2.3)

1. General issue: can you find any passages in which Copernicus communicates something like the same argument as Rheticus, as you've formulated it above? If so, in what passages do you find Copernicus's version of this same argument?
2. In what way is Ptolemy's theory like a monster, according to Copernicus (don't just repeat his words, but do you best to understand the underlying meaning and criticism)?
3. Do you think Copernicus takes a more realist-ic or instrumentalist-ic attitude toward his own theory? Find some passages to cite in defense of your opinion.
4. In one short paragraph, Copernicus gives four arguments to the conclusion that the universe is spherical. Find and understand all four arguments.
5. Compare and contrast Copernicus's arguments for the sphericity of the earth to those given by Aristotle and Ptolemy.
6. In Chapter 4, Copernicus argues that the heavenly motions must be made up of various circular motions. What are some of his reasons for believing this? Are these arguments similar to any that we have seen before from Aristotle or Ptolemy?
7. What explanation does the Copernican system provide for the various celestial phenomena (motion of the sun, moon, stars, planets, irregular motion, perigee, etc.)
8. Chapter 8 is important because Copernicus here counters the objection (given by both Aristotle and Ptolemy and based fundamentally on Aristotle's dynamics of forced motion) that the earth cannot be moving otherwise "all things terrestrial would be flying apart". What is Copernicus's response?
9. What is the point of the quote from Virgil at then end of Chapter 8?
10. What is gravity, according to Copernicus? And what various explananda does Copernicus explain using this notion of gravity?
11. What principle does Copernicus use in order to order the celestial spheres and in order to estimate the magnitude of each particular sphere? (Note also here Copernicus's appeal to the sizes and frequencies of the retrograde motions of each planet.)