

# Lecture 31

## Descartes's Astronomy

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Scientific Thought I  
Fall 2009

# Descartes's objection to Ptolemy

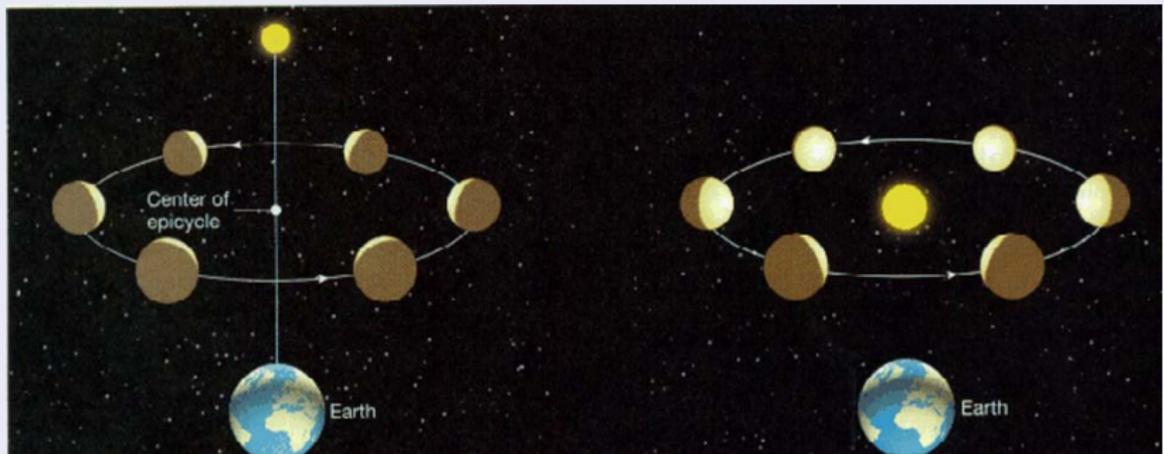
## What Descartes said [16]

*Ptolemy's hypothesis is not in conformity with appearances.*

*Ptolemy devised the first [hypothesis to explain the phenomena of the planets]; but as it is commonly rejected by all philosophers, because it is contrary to several recent observations (especially to the changes in light, similar to those which occur on the Moon, which we observe on Venus), I shall not speak further of it here.*

## Explanation

In 1610, Galileo observed with a telescope that Venus goes through all phases from full to horned. Assuming Venus shines by reflected light from the Sun, this is expected on Copernicus's theory but on Ptolemy's theory Venus should never be even half lit. And the phases show it does shine by reflected light.



From Parvis Ansari <http://artsci.shu.edu/physics/1007/historylv.html>.

Descartes said there can't be a vacuum so all space is filled with matter. Hence the heavens are completely full of matter.

## The heavens are fluid [24]

- *It must be thought that the matter of the heaven, like that which forms the Sun and the fixed stars, is fluid. This is an opinion which is now commonly held by all Astronomers, because they see that otherwise it is almost impossible to give a satisfactory explanation of the phenomena of the planets.*
- Descartes is here denying the solid spheres that had been supposed to carry the planets around. Kepler had shown that the orbits of the planets are elliptical, not spherical.

## Earth is at rest in this fluid [26]

*Since we see that the Earth is not supported by columns or suspended in the air by means of cables but is surrounded on all sides by a very fluid heaven, let us assume that it is at rest and has no innate tendency to motion, since we see no such propensity in it. However, we must not at the same time assume that this prevents it from being carried along by the current of that heaven or from following the motion of the heaven without however moving itself: in the same way as a vessel, which is neither driven by the wind or by oars, nor restrained by anchors, remains at rest in the middle of the ocean; although it may perhaps be imperceptibly carried along by the ebb and flow of this great mass of water.*

## So are all the planets [27]

*And just as the other planets resemble the Earth in being opaque and reflecting the rays of the Sun, we have reason to believe that they also resemble it in remaining at rest, each in its own part of the heaven, and that the variation we observe in their position results solely from the motion of the matter of the heaven which contains them.*

## Neither Earth nor planets has motion properly speaking [28]

- Motion, properly speaking, is change of place relative to contiguous bodies considered to be at rest.
- What is contiguous to the Earth and planets is the fluid of the heavens, and the Earth and planets don't move relative to it.
- So the Earth and planets are, properly speaking, not moving.

*The planets are carried around the Sun by the heaven [30]*

*Now that we have, by this reasoning, removed any possible doubts about the motion of the Earth, let us assume that the matter of the heaven, in which the planets are situated, unceasingly revolves, like a vortex having the Sun as its center, and that those of its parts which are close to the Sun move more quickly than those further away; and that all the planets (among which we shall from now on include the Earth) always remain suspended among the same parts of this heavenly matter. For by that alone, and without any other devices, all their phenomena are very easily explained.*

## Analogy with river eddies [30]

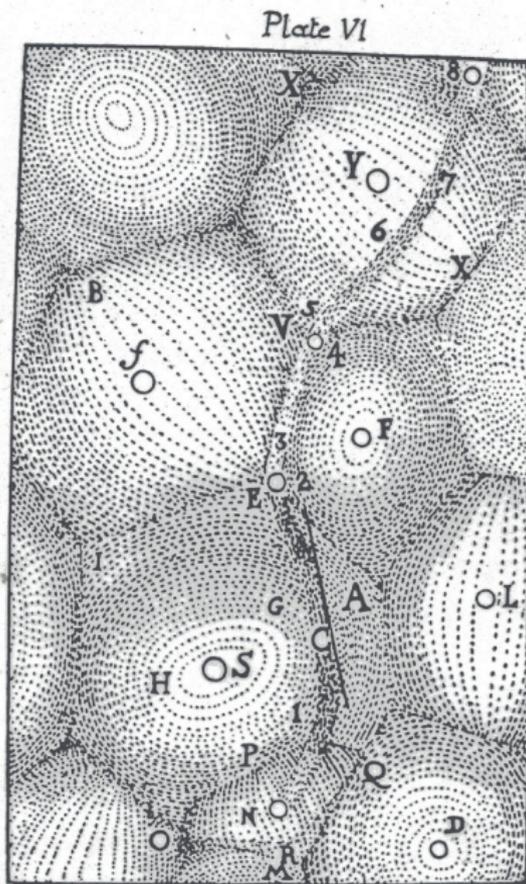
*Thus, if some straws or other light bodies are floating in the eddy of a river, where the water doubles back on itself and forms a vortex as it swirls; we can see that it carries them along and makes them move in circles with it. Further, we can often see that some of these straws rotate about their own centers, and that those which are closer to the center of the vortex which contains them complete their circle more rapidly than those which are further away from it. Finally, we see that, although these whirlpools always attempt a circular motion, they practically never describe perfect circles, but sometimes become too great in width or in length, so that all the parts of the circumference which they describe are not equidistant from the center. Thus we can easily imagine that all the same things happen to the planets; and this is all we need to explain all their remaining phenomena.*

## Smaller vortices within the large one [33]

*In addition to the great vortex which forms a heaven having the Sun as its center, there are other smaller ones which we can compare to those I have often seen in eddies of rivers where they all follow the current of the larger vortex which carries them, and move in the direction in which it moves. One of these has Jupiter as its center, and moves with it the four satellites which revolve around Jupiter . . . Similarly, the vortex which has the Earth as its center carries the Moon around the Earth in the space of a month, while the Earth turns on its own axis in the space of twenty-four hours.*

# The fixed stars

*The fixed stars do not all turn on the same sphere . . . Rather, just as the Sun is surrounded by a vast space in which there is no fixed star, so also each fixed star must be very distant from all others, and some of these stars must be more distant from us and from the Sun than others are. So that, if S, for example, is the Sun, F, f will be fixed Stars, and we will understand that numerous others exist, above, below, and beyond the plane of this figure, scattered throughout all the dimensions of space. [23]*



- 1 What did Descartes cite as an objection to Ptolemy's astronomy? Why is it an objection?
- 2 Does Descartes hold that the earth moves? Does he hold that it orbits the sun? Explain how he reconciles his answers to these questions.
- 3 State one respect in which Descartes's astronomy agrees with Copernicus (and differs from Ptolemy). State four respects in which Descartes's astronomy differs from Copernicus.



René Descartes.

*Principles of Philosophy.*

D. Reidel Publishing Company, 1983.

Translated by Valentine Rodger Miller and Reese P. Miller.

This is the only English translation of the whole book.

Numbers in brackets are section numbers of Part III.