

Models of the Solar System

Geocentric Models and the Ptolemaic Model

Though geocentrism has its roots in the ancient Greece well before Aristotle's time, Aristotle played a key role in developing ideas towards a geocentric model in order to explain the objects in the sky. After Aristotle, many other astronomers carried on working on improving the models and eventually about 500 years after Aristotle, Claudius Ptolemy from the Roman province of Egypt published a highly developed standard model based on geocentrism. While any model which explains the solar system assuming the Earth to be at the centre of the system is called a Geocentric model, Ptolemy's highly developed geocentric model is specially called the Ptolemaic model or Ptolemaic system.

In Ptolemy's model, the Sun, planets and the stars all move along circular paths around the stationary Earth, which is at the centre of the universe. For the Sun and the planets, the centre of their circular orbits was slightly away from the Earth. This explained the changes in the brightness of the planets as observed from the Earth.

Observations of the movements of the planets on the sky sometimes show a change in direction. This means they sometimes appear to move backwards from their usual direction of motion. Their usual motion is called the prograde motion and when they appear to change direction and move backwards, we call their motion retrograde motion. This is shown in Figure 1.

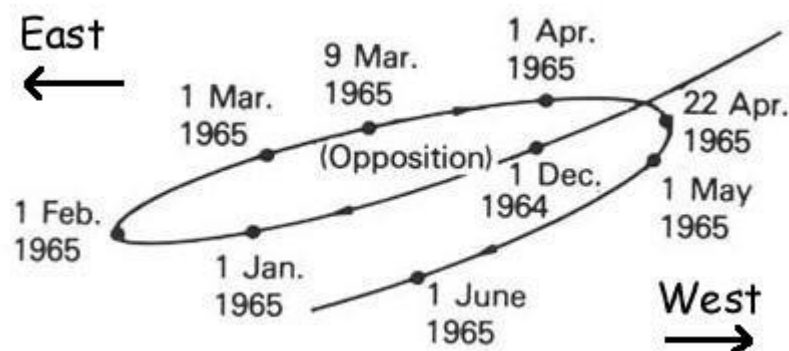


Figure 1

Ancient Greek astronomers who believed in geocentrism were first puzzled by the retrograde motion of the planets and then introduced epicycles to explain this retrograde motion.

With the introduction of epicycles, the movement of planets involved two circles. One of them was called the deferent and the other was the epicycle. Each planet orbited in a small circle called the epicycle and the centre of the epicycle moved along a large circle around the Earth as shown in Figure 2.

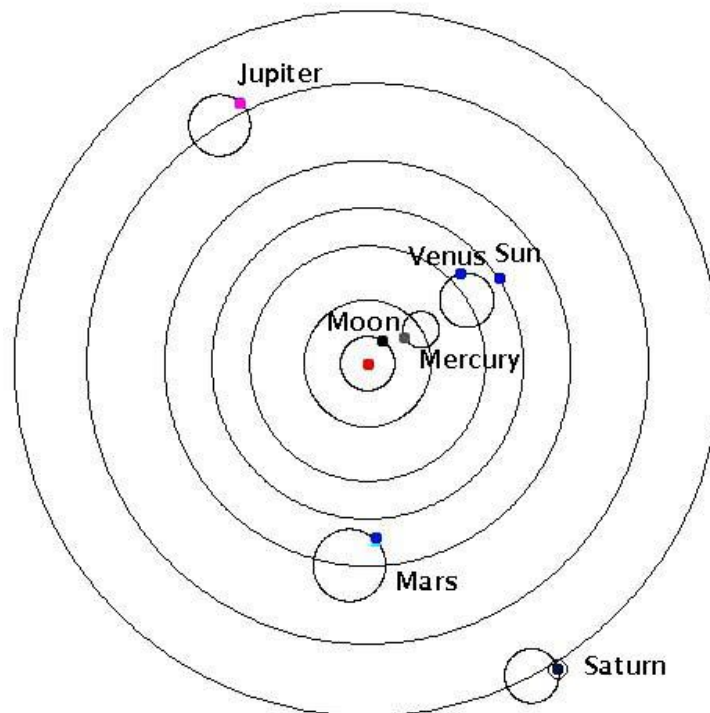


Figure 2

There were several other issues with the geocentric models and Ptolemy used many more epicycles and introduced some more additional ideas in his model to make the system explain the observations up to his time. His model was able to fairly accurately predict the locations of the planets at any given time and was the widely accepted model for many centuries to follow, until the 16th century.

Some of the reasons that most of the early astronomers believed in geocentrism are:

- No perpetual wind experienced due to any movement of the Earth
- A ball thrown upwards lands directly at the point from which it was thrown
- There was no parallax of stars observed