One of the earliest recorded astronomical observations is the Nebra sky disk from northern Europe dating approximately 1,600 BC. This 30 cm bronze disk depicts the Sun, a lunar crescent and stars (including the Pleiades star cluster)

The disk is probably a religious symbol as well as a crude astronomical instrument or calendar.

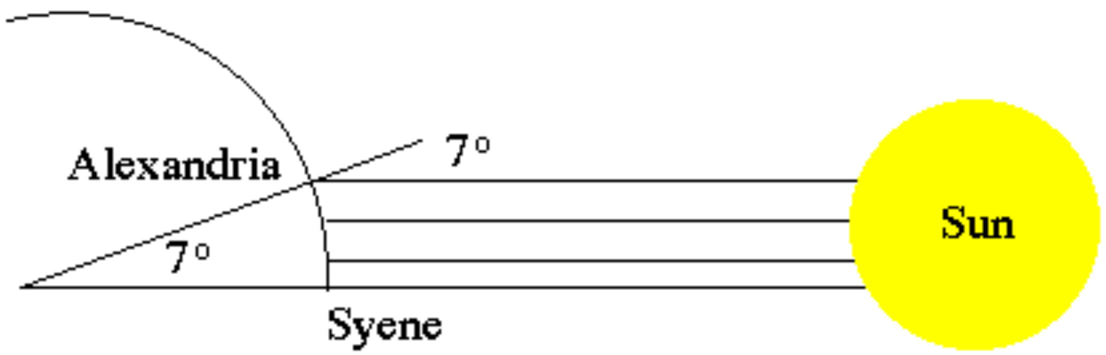
Native American culture around the same time were leaving rock drawings, or petroglyphs, of astronomical phenomenon. The clearest example is found below, a petroglyph which depicts the 1,006 AD supernova that resulted in the Crab Nebula.

There is also evidence of interest in astronomical phenomenon from early Chinese, Central American and North European cultures such as Stonehenge (above), which is a big computer for calculating the position of planets and the Sun

Astronomy was the 1st science, as it was the first thing we recorded observations for.

Later in history, 5,000 to 20,000 years ago, humankind begins to organize themselves and develop what we now call culture. A greater sense of permanence in your daily existences leads to the development of culture, where people develop narrative stories for cultural unity which we now call myths.

Eratosthenes



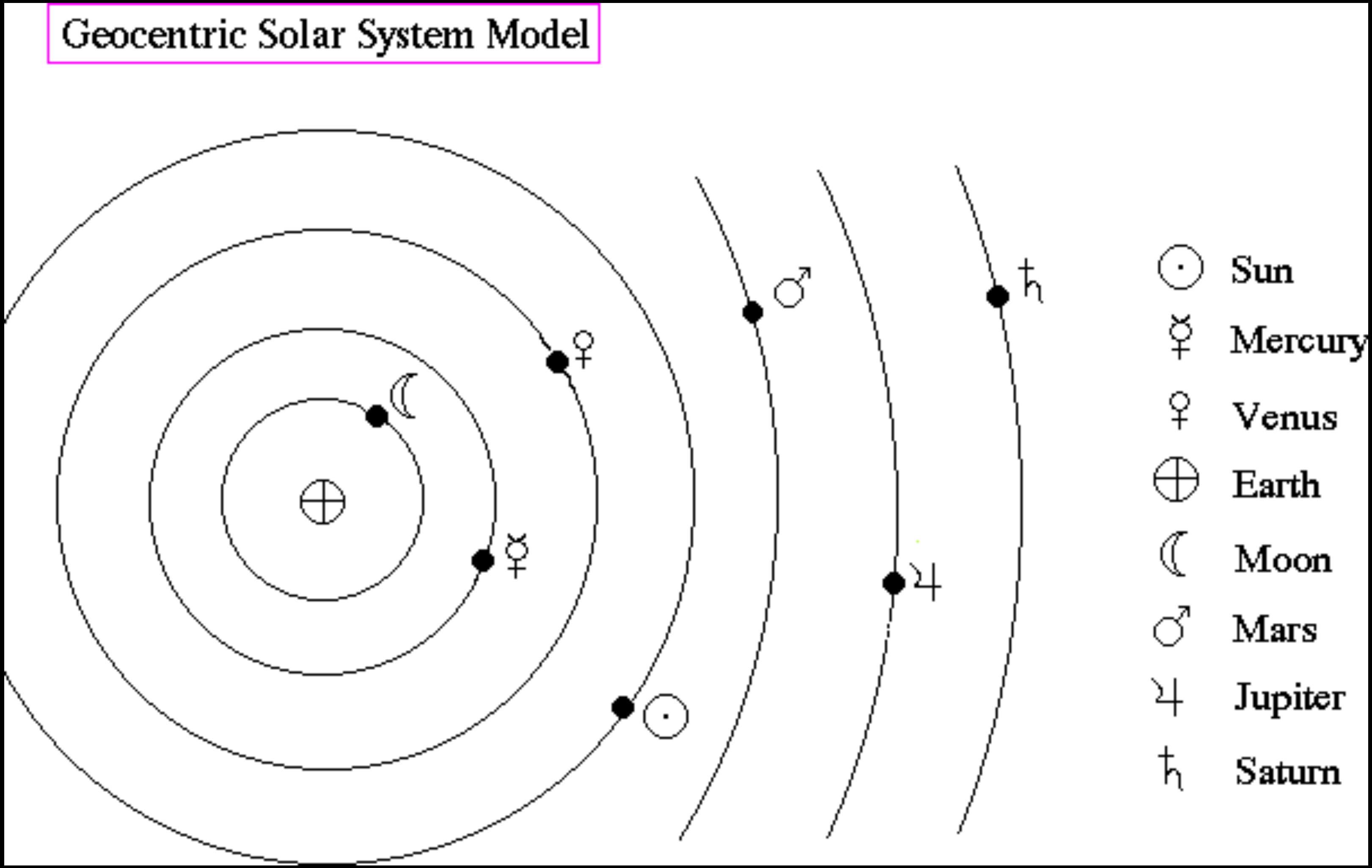
the distance from Alexandria to Syene was 4900 stadia, so the ratio of that distance to the circumference of the Earth, C is given by:

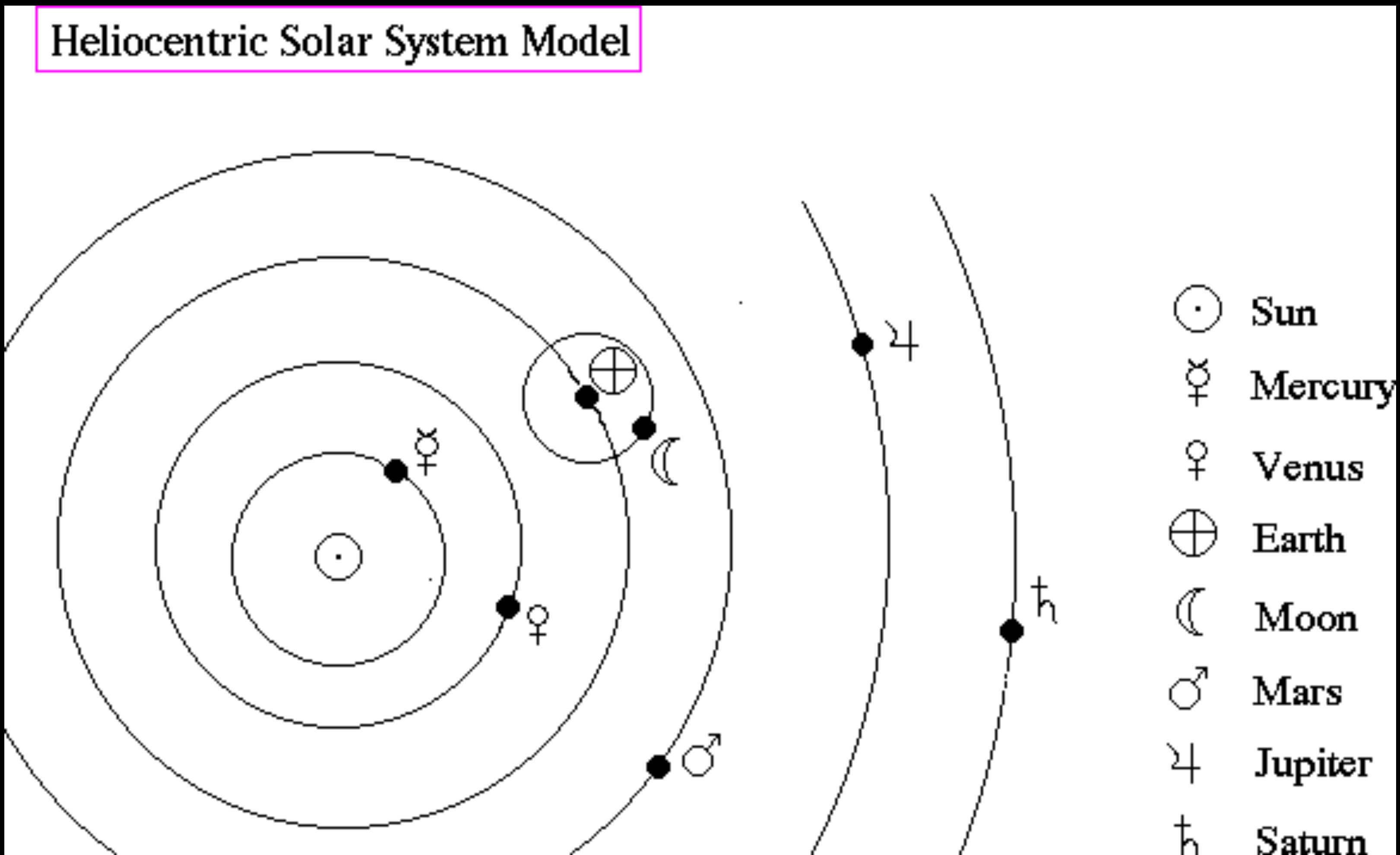
$$\frac{C}{4900\ \text{stadia}} = \frac{360^{\circ}}{7^{\circ}}$$

therefore, C = 252,000 stadia (1 stadia = 0.16 km)
= 40,320 km (textbook gives circumference of Earth as 40,030 km)

The ancient Greeks inherited astronomical records from the Babylonians and applied the data to construct a cosmological framework. Data was not just used for practical goals, such as navigation, but also to think of new experiments, the origin of what we call natural philosophers.

Ancient astronomers could see with their eyes that the Sun and the Moon were round. And the shadow of the Earth, cast on the lunar surface during a lunar eclipse, is curved. A sphere is the simplest shape to explain the Earth's shadow (a disk would sometimes display a shadow shaped like a line or oval).

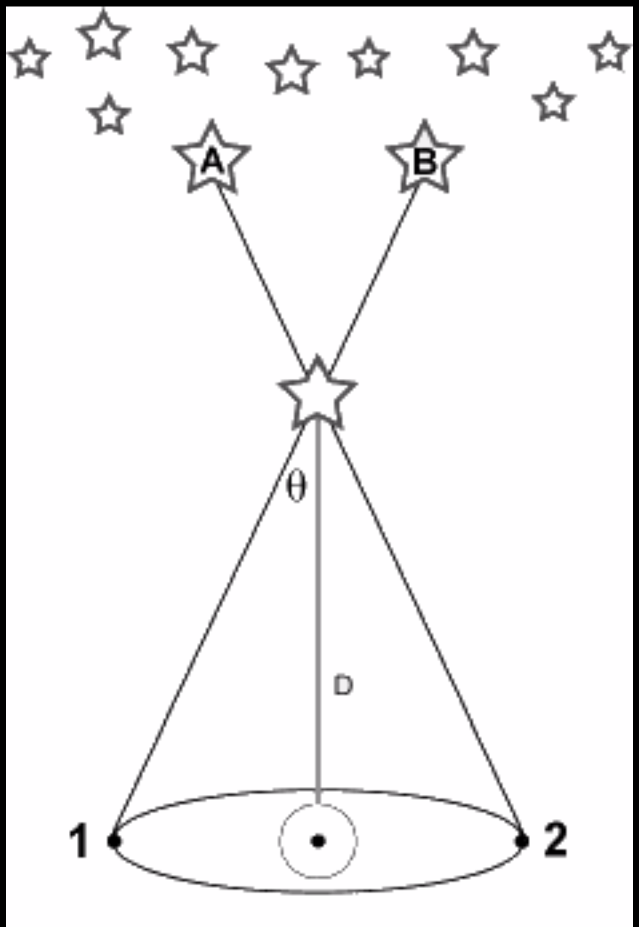




Plato first proposed that the planets followed perfect circular orbits around the Earth (for the circle is the most perfect shape). Later, Heraclides (330 B.C.) developed the first Solar System model, placing the planets in order from the Earth it was is now called the geocentric solar system model and the beginning of the geocentric versus heliocentric debate.

1) Earth in orbit around Sun means that the Earth is in motion. Before the discovery of Newton's law of motion, it was impossible to imagine motion without being able to `feel' it. Clearly, no motion is detected (although trade winds are due to the Earth's rotation).

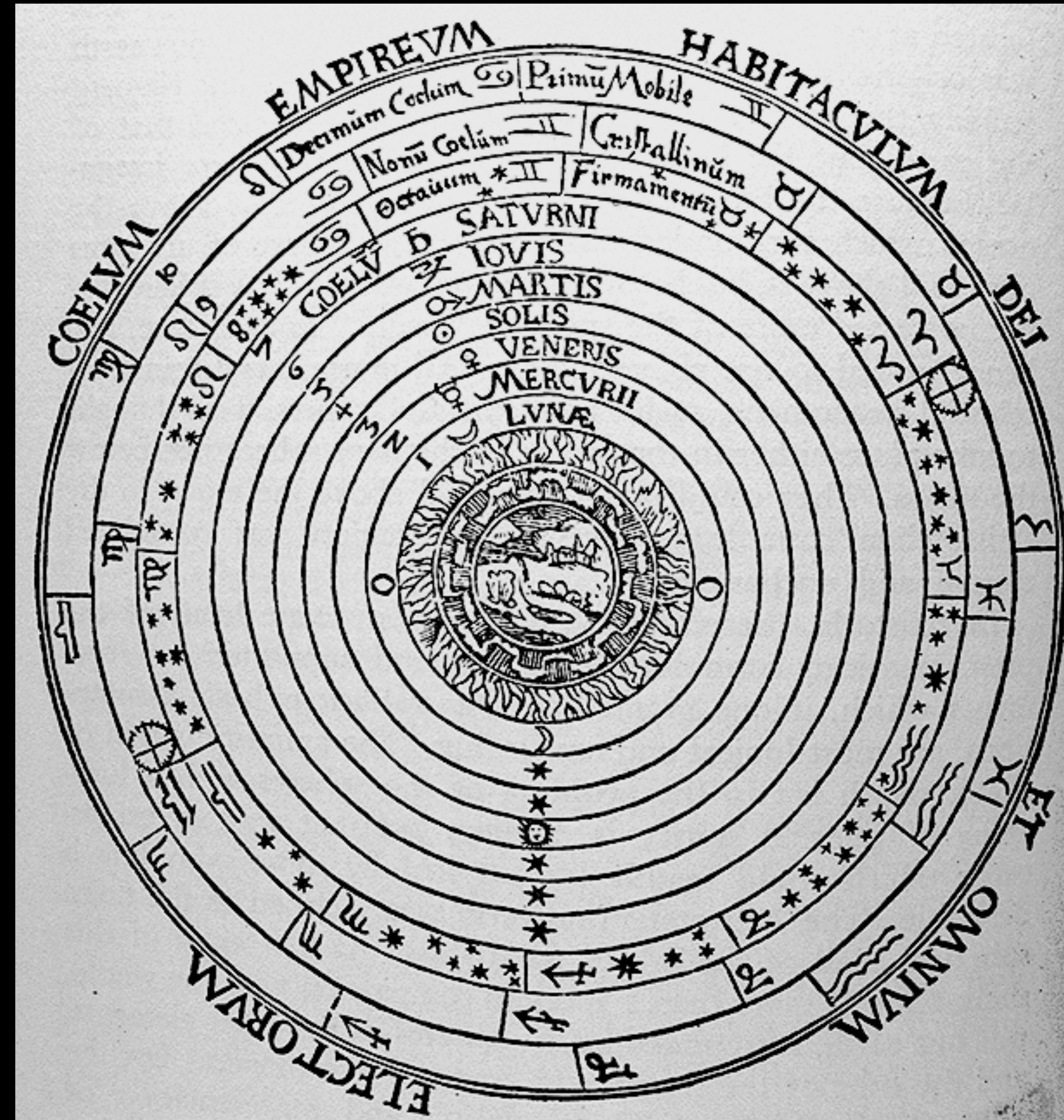
2) If the Earth undergoes a circular orbit, then nearby stars would have a parallax. A parallax is an apparent shift in the position of nearby stars relative to distant stars.



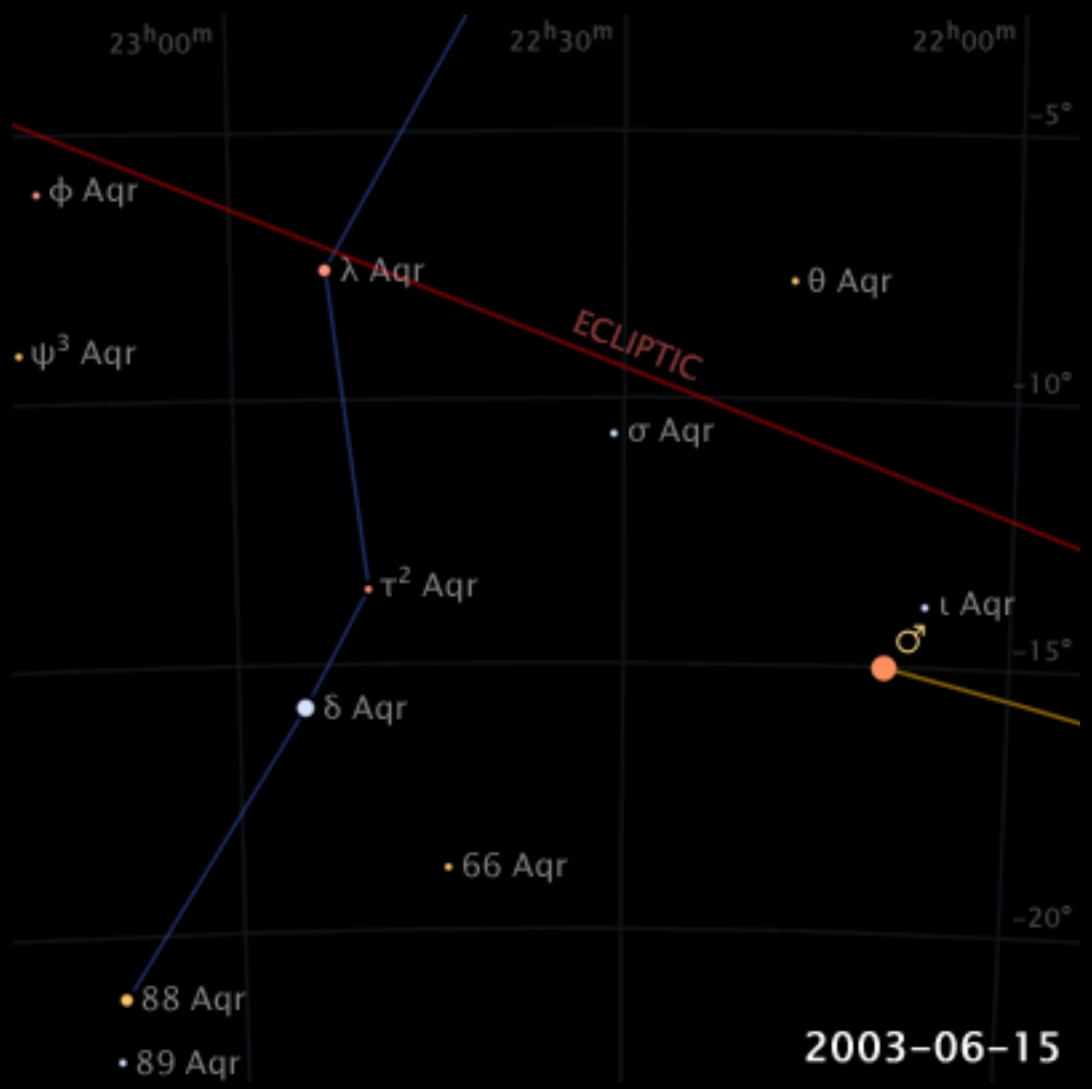
Parallax

3) Lastly, geocentric ideas seem more `natural' to a philosopher. Earth at the center of the Universe is a very ego-centric idea, and has an aesthetic appeal.

Ptolemy (200 A.D.) was an ancient astronomer, geographer, and mathematician who took the geocentric theory of the solar system and gave it a mathematical foundation (called the "Ptolemaic system").

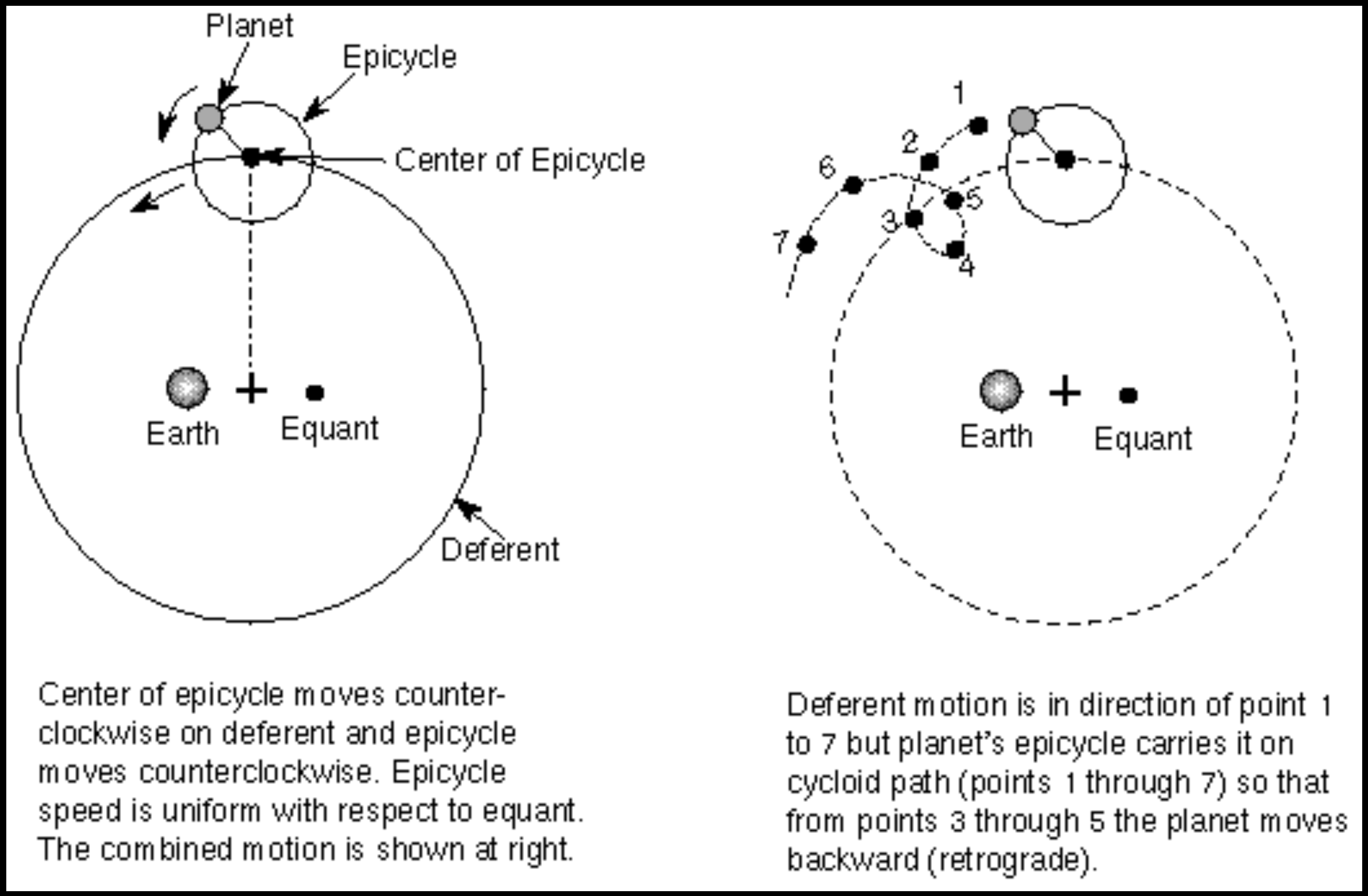


Ptolemy's system is one of the first examples of scientists attempting to "save the phenomena", to develop a combination of perfect circles to match the irregular motion of the planets, i.e., using concepts asserted by pure reason that match the observed phenomenon.



When the detailed observations of the planets in the skies is examined, the planets undergo motion which is impossible to explain in the geocentric model, a backward track for the outer planets. This behavior is called retrograde motion.

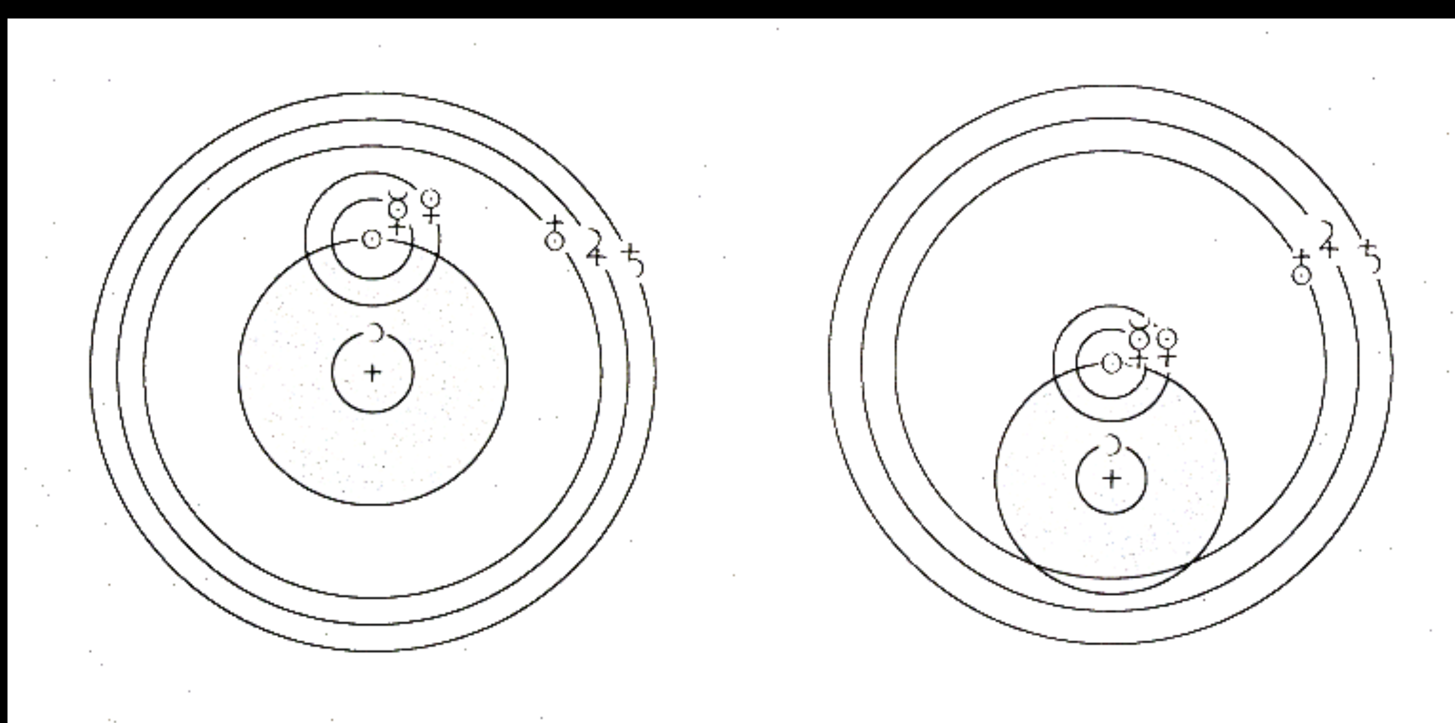
The solution to retrograde motion was to use a system of circles on circles to explain the orbits of the planets called epicycles and deferents. The main orbit is the deferent, the smaller orbit is the epicycle. Although only one epicycle is shown in the figure below, over 28 were required to explain the actual orbits of the planets.



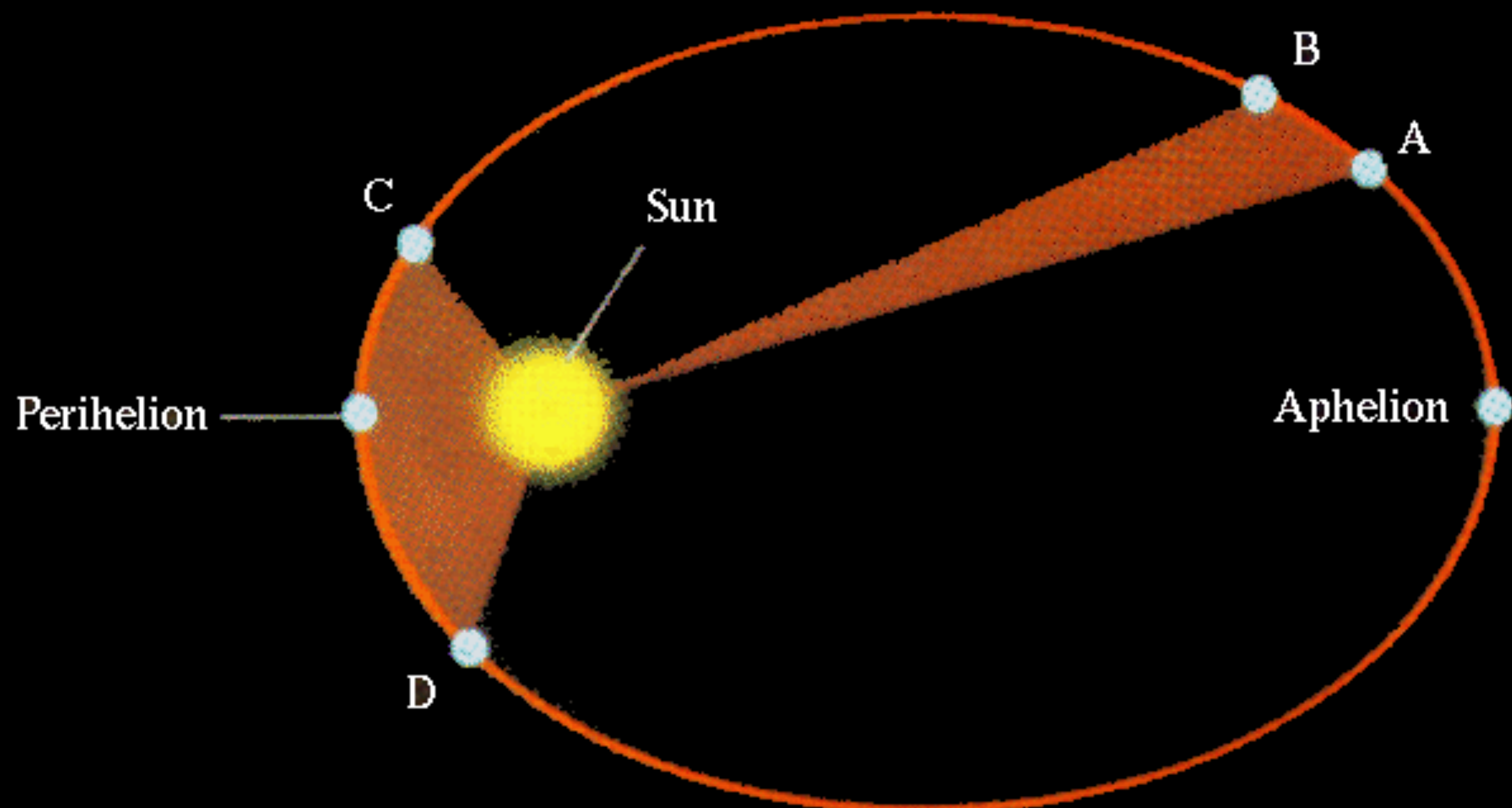
Retrograde Motion in the Copernican System

Copernicus (1500's) reinvented the heliocentric theory and challenged Church doctrine. Copernicus (c. 1520) was not the first astronomer to challenge the geocentric model of Ptolemy, but he was the first to successfully formulate a heliocentric model and publish his model.

Tycho Brahe (1580's) was astronomy's 1st true observer. He built the Danish Observatory (using sextant's since telescopes had not been invented yet) from which he measured positions of planets and stars to the highest degree of accuracy for that time period (1st modern database).



Kepler (1600's) a student of Tycho who used Brahe's database to formulate the Laws of Planetary Motion which corrects the problems of epicycles in the heliocentric theory by using ellipses instead of circles for orbits of the planets.



The pioneer of astronomical observation in a modern context is Galileo. Galileo (1620's) developed laws of motion (natural versus forced motion, rest versus uniform motion). Then, with a small refracting telescope (3-inches), destroyed the the idea of a "perfect", geocentric Universe