The moon stays close to the ecliptic, therefore the moon also moves through the zodiac making a complete circuit once a month.

This motion of the Sun and Moon against the stars was observed by ancient astronomers, but they thought the Earth was still and both the Sun and Moon went around the Earth.

There are other bright star-like objects which move through the zodiac. These are the planets (from the Greek word for wandering). Ptolemy (~140 AD) tried to explain all these motions in a geocentric (Earth-centered) cosmology.

Cosmology = conception of the universe

Sun, Moon, Mercury, Venus, Mars, Jupiter, Saturn

"Planets" known to ancient astronomers
The motions of the planets can show retrograde motion. We now know this is due to the orbital motion of the earth.

The apparent path of outer planet against the sky changes direction because the earth is moving faster in its orbit than the outer planet.

A → B  "normal" motion  (Mars, Jupiter)
B → D  retrograde motion  (Saturn)
D → E  resume normal motion
An inner planet always appears near the sun.

Earth's orbit

Apparent position of the inner planet against the sky near sunset. It reach a maximum angle from sun at point B.

( Venus, Mercury )
1. Ptolemy's geocentric cosmology was complicated but made accurate predictions using combinations of circular motions (show slides).

2. Copernicus introduced a heliocentric (sun centered) cosmology in 1543 A.D., but it was slow to be accepted. (show slides)

3. Galileo used a telescope to observe the phases of a planet closer to the sun than the earth: Venus. This helped prove the heliocentric hypothesis of Copernicus.

[Diagram of phases seen from earth with labels: superior conjunction, inferior conjunction, greatest brilliancy, crescent, greatest brilliancy]
Figure 10.
Explanation of an inferior planet's apparition.
This was not possible in the geocentric system and eventually the heliocentric system (modified by Kepler and Newton) was accepted.

Any system that had Venus going around the earth between the earth and the sun could not show these phases. Venus would always be a crescent phase with that geometry.
§. I. Of the eighth Sphere.

The eighth Sphere, which is the starry Heaven, is represented by the Celestial Globe, because upon the Convexity of it, all the Stars and visible appearances are placed according to the order that they are situated in the concavity of the eighth Sphere. It is called the eighth Sphere, because between it and us are contained seven other Heavens, or Spheres: as 1. the Moon, 2. Mercury, 3. Venus, 4. the Sun, 5. Mars, 6. Jupiter, 7. Saturn, and eighthly the Starry Heaven. The Ancients have made the Systeme of the World to consist of two other Spheres, called the Chrysaline Heaven, and the Primum Mobile, or first Mover: as in the following Figure is represented.

Moxon A tutor to Astronomy and Geography (1674)
A perfect description of the Celestial Orbes, according to the most ancients doctrine of the Pythagoreans, &c.

Figure 45. The infinite Copernican universe of Thomas Digges, reproduced from his *Perfit Description of the Celestiall Orbes*, published in 1576. The diagram is like all other early sketches of the Copernican universe except that the stars are no longer restricted to the surface of the celestial sphere. No stars occur within the sphere (if they did, there would be observable stellar parallax), but the infinite space beyond the sphere is studded with them. Notice, however, that the sun still retains a privileged position and that the distance between neighboring stars is far less than that between the sun and the celestial sphere. In Digges's universe the sun is not just another star.

Copernicus (1473 - 1543)