

29:52 Exploration of the Solar System
Notes for February 11, 2008
The Moon's Path in the Sky; the Path of the Planets

It is easy to track the Moon's path against the stars. You can do it with just your eyes and an SC1 chart. What do you find? Is the path the same as the ecliptic?

It turns out the Moon's path is close to the ecliptic, but is not quite the same. The two paths are inclined at 5 degrees. To see this visualized, look at Figure 2.25 and 2.26.

Think of 2 planes, one defined by the ecliptic, and the other defined the orbit of the Moon. When 2 planes intersect, they form a line. The line is called *the line of nodes*. The line of nodes points at a certain direction in space. Observations show that the line of nodes rotates, going making a complete turn in space once every 18.6 years.

The Motion of the Planets

In deep antiquity, it was realized that in addition to the Sun and Moon, there were 5 other objects that moved with respect to the stars. In Roman-influenced countries, these have been known by the names of the major Roman deities, Mercury, Venus, Mars, Jupiter, and Saturn. We now know these to be major astronomical objects like the Earth, which are also orbiting around the Sun.

The ancients noticed that these objects also moved across the sky, on paths which are very close to the ecliptic. Their paths are inclined to the ecliptic by angles which are similar to, or even smaller than, the inclination of the Moon's orbit. See Appendix 5 of your textbook.

The physical reason for this is that the orbital planes of the other planets are very close to the orbital plane of the Earth. The major planets are nearly moving in a 2 dimensional space. Later in the semester we will find out that this is a major hint about conditions in the early solar system when the Earth and planets formed.

When we observe the motion of the planets against the stars, most of the time they are moving in *prograde* manner, that is, in the same direction as the Sun and Moon, from west to east against the stars. However, there are times when they will stop their prograde motion and move in a *retrograde manner*, from east to west. This caused people in antiquity to make very complicated models for the motion of the planets in space, but we now know this is due to the relative motion of planets moving at different speeds in their orbits.

Orientation of the Planets Relative to the Sun

There are some special times as regards the location of the planets relative to the Sun.

- (a) *Inferior Planets*. These are planets inside the orbit of the Earth. The special times for these planets are called *conjunction*, when the planet is in the same direction as the Sun. *Inferior conjunction* is when the planet is in the same

- direction as the Sun, but is between Earth and the Sun. *Superior conjunction* is when the planet is on the other side of the Sun.
- (b) Superior planets are ones outside the orbit of the Earth. For these planets, *conjunction* occurs when they are in the same direction as the Sun. *Opposition* is when they are in the opposite direction in space from the Sun. Look at Figure 3.2 of your book for an illustration of these events.

Think about when planets will be closest to or furthest from Earth in terms of conjunctions and opposition.