

29:52 Exploration of the Solar System
Notes for February 8, 2008
The Year, Periodic Motions of the Moon

Another main unit of time is the year. As we discussed before, the astronomical significance of the year is that it is the period of revolution of the Earth about the Sun. To be precise, the astronomical definition of the year is that of the *tropical year* which is the time it takes the Sun to move from the vernal equinox, completely around the sky, and back to the vernal equinox.

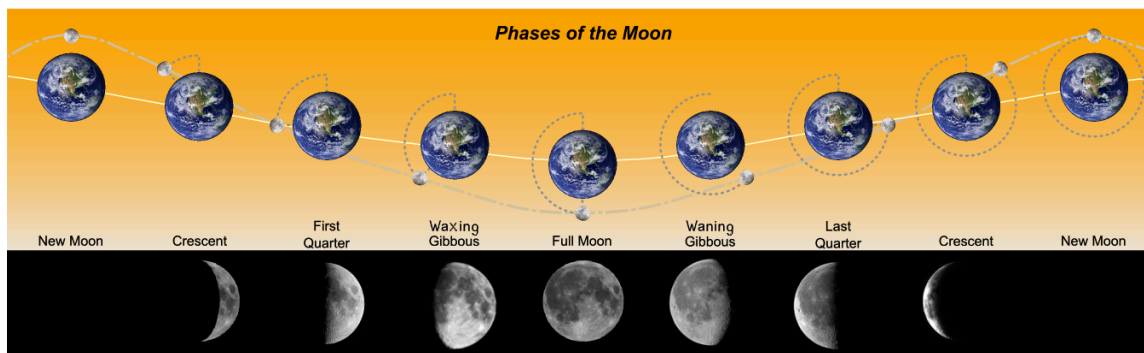
The tropical year is equal to 365.242199 mean solar days.

The fact that the tropical year is not an integral number of mean solar days means if you define the year as a certain number of days, the position of the Sun on new years will “slip” relatively to the stars by $\frac{1}{4}$ of a day of solar travel against the stars. To keep the months in the same seasons, we have the practice of leap years, in which an extra day is inserted in the calendar.

Motion of the Moon

The Moon is the second brightest astronomical object. It shows periodic variations in two ways.

1. It shows *phases*, in which it changes from a barely illuminated sliver, called a *crescent*, to a fully illuminated disk, called *full moon*. The phases are new moon, waxing crescent, first quarter moon, waxing gibbous, full moon, waning gibbous, third quarter moon, waning crescent, and back to new moon. A diagram with the phases is shown below. An explanation of the phases is given in Figure 2.19.
2. The Moon moves on a path against the stars, and at the end of a period, returns to nearly the same point against the stars.



Both the phases and the motion against the background stars are periodic, and each has its own period.

The *synodic period* of the Moon is the period for it to go through its phases, from new Moon to new Moon. The synodic period of the Moon is 29.5 days. The *sidereal period* of the Moon is the time for it to complete its path among the stars and return to the same place. The sidereal period of the Moon is 27.3 days.

Question: Why do you think these two periods are different? Shouldn't they be the same? What is going on to make them different.

Next time: the path of the Moon against the stars.