29:52 Exploration of the Solar System
Notes for February 1, 2008
Apparent Motion of the Sun in the Sky

On the first day of Spring the Sun is on the celestial equator, at 0h right ascension. This statement implies that the rest of the year, it is somewhere else in the sky. Where is it?

Do a thought experiment of turning of the Sun, and seeing what stars it is projected against. You can't do this, but you can do what is indicated in Figure 2.9 of the textbook. Look at this figure and Figure 2.10. During the year, the Sun moves against the *zodiacal constellations.*

The path of the Sun through the sky is a line, or more correctly, a *great circle* on the celestial sphere. This great circle is called the **ecliptic.**

The ecliptic doesn't have to be the same great circle as the celestial equator, and it isn't. The two are inclined by an angle of 23.5 degrees. (See Figure 2.11). These two great circles intersect at two points, the *vernal equinox* (position of the Sun on the first day of Spring) and the *autumnal equinox* (position of the Sun on the first day of Fall).

Questions to ask yourself

1. What is going on that makes us see the Sun projected against different constellations at different times of the year?
2. Why are the ecliptic and the celestial equator inclined at 23.5 degrees?

Find the ecliptic on your SC1 constellation chart. Note that at some times of the year the Sun is above the celestial equator, and that other times it is below the celestial equator. This is important. Read the quote from the book on p23 about the effect of the changing declination of the Sun.

Consequences of the Changing Declination of the Sun

The fact that the declination of the Sun changes during the year has three consequences. Let's start with two of them.

1. The azimuth at which the sun rises changes through the year. It is furthest to the north (smallest azimuth) on the summer solstice. It is due east (90 degrees azimuth) on the equinoxes, and is the furthest south (largest azimuth) on the winter solstice. Similar statements pertain to the azimuth of the setting Sun. Look at Figrure 2.12 of the book.
2. The duration of daylight changes as well. The length of time an astronomical object is above the horizon depends on its declination (and the latitude of the observer). This statement holds for the Sun as well as stars. Look at Figure 2.5 to help you understand this statement.

To appreciate the 3rd consequence of the changing declination of the Sun, we need to talk about the *altitude of an astronomical object at transit.* From previous discussion in class, we saw that the altitude angle of the north celestial pole above the northern horizon is equal to the latitude of the observer. Using this, you can figure out that the altitude angle of the celestial equator above the southern horizon is *the complement of the latitude.* With this fact, we can deduce that the altitude angle of any celestial object (Sun and Moon included) at transit is given by

$$ALT = LC + D$$

Where ALT is the altitude angle at transit (on the meridian), LC is the complement of the latitude, and D is the declination of the object.