Dr. Bob's Notes for Week 1

1.1 Speed of Light

Light moves at a *very* fast speed! Compare the speed of light to the speed of some other moving objects.

Moving Thing	Top Speed
Bob's lame Car	50 MPH
Funny Car	325 MPH
747 Jet	630 MPH
F-18 Jet	1,200 MPH
Space Shuttle	25,000 MPH
Saturn V Rocket	40,000 MPH
Light	671,000,000 MPH

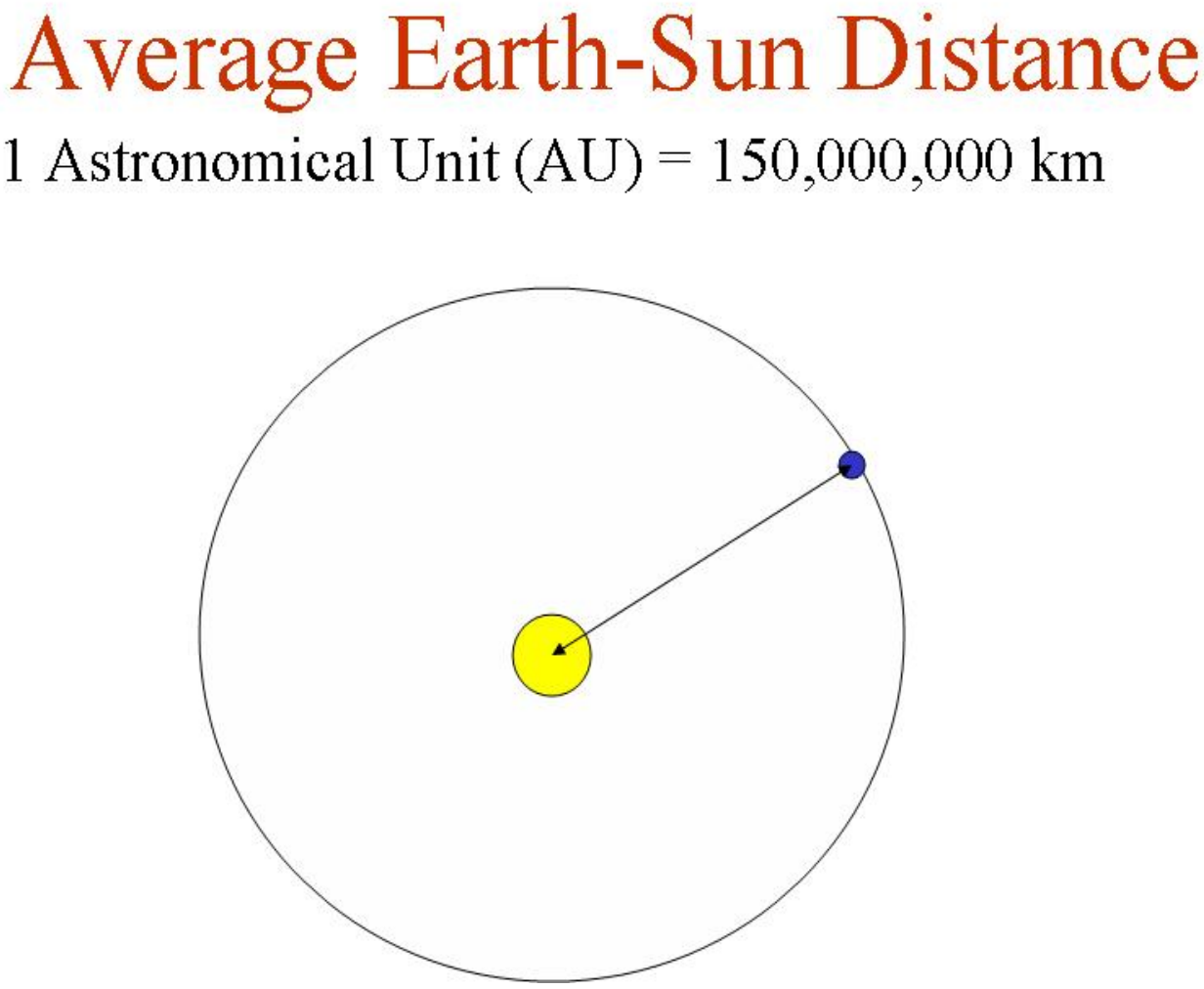
Wow! Light really does move fast! Now we will not be using the speed of light in MPH ... we will need the speed of light in metric units: in meters per second m/s and sometimes in kilometers per second km/s.

$$\underline{c = \text{Speed of Light}}$$

$$c = 300{,}000{,}000 \ m/s$$

$$c = 300{,}000 \ km/s$$

1.2 Distance



How much time does it take light to travel from the Sun to the Earth?

To answer this question we will need to use the equation:

$$\text{Distance} = \text{Speed x Time}$$

This can be written more compactly in symbols using d for distance, c for the speed of light, and t for time.

$$d = c\,t$$

Solving this equation for time and plugging in the Sun-Earth distance and the speed of light we get

$$t = \frac{d}{c} = \frac{150,000,000\,km}{300,000\,km/s} = 500\,s \approx 8.33\ minutes$$

1.2.1 Light-Years (ly)

We could use this method to a define a different way to measure distances: How much time would it take light to travel a certain distance? For instance we could say that the distance between the Sun and the Earth is about 8.33 light-minutes (Note: inside the Solar System Astronomical Units (AU) or kilometers (km) are prefered).

Objects in space are large distances apart. In the Solar System Mars can be as far 20 light-minutes from the Earth. Neptune is more than 4 light-hours from the Sun. The nearest star is so far away that it would take light 4.2 years to travel the distance! We say this star is 4.2 ly (light-years) away from the Earth. Our galaxy is so large that it would take light 100,000 years to cross the galaxy $\rightarrow$ the galaxy is 100,000 ly across.

1.2.2 Looking at the past

This means that when you watch the sunset the light you see actually left the Sun about 8.33 minutes earlier! Every time you look at objects in the sky you are looking at the past. When you look at the Sun you see it as it *was* 8.33 minutes before. When you look at the nearest star you see it as it was 4.2 years ago. If you look at a star that is 100,000 ly away you see it as it was 100,000 years ago.