Homework 7

Please write all your work and answers on separate paper. (You can turn in this page with the questions or not, as you wish). Show all your work on calculations and explain your reasoning whenever you can.

1. **Peppercorns and parsecs:** The star nearest us, after the Sun, is Proxima Centauri, which is only 1.3 pc away. In the peppercorn model of the Solar System, where the sun is the size of a bowling ball and the distance from the Earth to the Sun is 26 yards, how far is Proxima Centauri from the bowling ball, measured in miles?

2. **Light day:** A light year is the distance light travels in one year. What is a "light day," as measured in
     a. meters (m),
     b. Astronomical Units (AU)

3. **50% Binaries:** About half the stars we see in the sky are actually binaries – two stars orbiting their common center of mass. If we can determine the orbital period of the pair and their distances from the center of mass, what important piece of information can be derived from those measurements?

4. **Solar/Planetary Nebula?** What is the difference between the *Solar Nebula* and a *Planetary* nebula?

5. **Scales of the Universe** Answer the following questions based on your own visit to the interactive demonstration "Scales of the Universe 2" (`http://htwins.net/scales2/`).
     a. What does a water molecule look like (at least according to Cary Huang)?
     b. Comparing the Sun and α Centauri, what object should be used to represent the latter in the peppercorn model (eg. a beach ball, a golf ball, or another bowling ball)?
     c. What star is shown directly above Betelgeuse?

6. **Opposition and Retrograde** Mars is currently "in opposition," which means it is on the opposite side of the Earth from the Sun. This means that Earth is catching up to Mars in its orbit, which also means that Mars is or will be exhibiting retrograde motion.
   Using Stellarium (or other planetarium software), find Mars and use the fast forward and reverse controls to watch how Mars moves relative to nearby stars. Do not pay attention to how mars moves relative to the Moon or other planets.
     a. When did/does the retrograde motion begin?
     b. When did/does the retrograde motion end?
   Be careful with the direction of motion. When time is running backwards Mars will appear to move in the opposite direction in the sky from how it actually moves when time runs forward.