Astronomy S120 "Galaxies and the Universe" Summer 2018
Homework Assignment #1 DUE: Wednesday 30May2018

READING ASSIGNMENT FOR THIS HOMEWORK:
UNIVERSE Ch. 1, Ch. 2, 3.6, 4.3-4.7

HOMEWORK PROBLEMS:

1. (15 points) A scientific theory is fundamentally different than the everyday use of the word "theory". Briefly explain the difference.

2. (20 points) Why do we have seasons? Briefly explain the 2 main reasons. Use diagrams. You must talk about energy, and say more than "tilt of axis".

3. (10 points) Suppose you are building a scale model of the nearby stars in our Galaxy. The Sun, which has a radius of 696,000 km, is represented by a tennis ball with a radius of 6 cm. On this scale, how far away would the nearest star, Proxima Centauri, be? Proxima Centauri, which is probably part of the Alpha Centauri star system, is located 4.2 light years away. Express your answer in km.

4. (15 points) The brightest star in the sky is Sirius, which is located at a distance of 2.6 pc.
a.) What is the distance to Sirius in units of light-years?
b.) How long does it take light to reach earth from Sirius?
c.) If a planet were orbiting Sirius at the same distance that earth is from the Sun, what would be the angular separation on the sky between Sirius and this hypothesized planet, as viewed from earth?
[HINT: Use the small angle formula, as described in Universe Box 1-1
and see "Radians and the Small Angle Formula" on the website.]

5. (40 points) One earth year is 365.244 (solar) days (or 365.2 solar days, to 4 significant figures). The professor of this course would be much happier if there were an integral number of days in a year. Using Newton's form of Kepler's Third Law, figure out 3 ways to make the length of earth's year exactly 354.0 (solar) days. (This would also make the months be more coordinated with the phases of the moon! We could have 6 months of 29 days and 6 months of 30 days. Since the orbital period of the moon is about 29.5 days, and 12 months x 29.5 days/month = 354 days, I think this would make a great calendar!)

a.) What would the mass of the sun have to be changed to, if nothing else were changed?
b.) What would the mass of the earth have to be changed to, if nothing else were changed?
c.) What would the orbital radius of the earth have to be changed to, if nothing else were changed?
[HINT: Check your answers experimentally by actually changing the mass of the Sun and earth, and the orbital radius of the earth.]
[REAL HINT: Take care with significant figures for this problem. See help on the website.]

CONSTANTS

1 solar radius = 6.955×10^{8} m
1 solar mass = 1.989×10^{30} kg
1 earth mass = 5.974×10^{24} kg
1 AU = 1 astronomical unit = 1.496×10^{11} m
1 LY = 1 light year = 9.461×10^{15} m
G = gravitational constant = 6.674×10^{-11} m^3 kg^{-1} s^{-2}
c = speed of light = 2.998×10^{8} m s^{-1}