Astro 205. Problem set 3. October 1 2003, due October 8, 2003

1. Compute the Sun's orbital speed about the center of mass of the solar system (just consider the effect of Jupiter). Does Jupiter really produce the largest wobble? Check by calculating the effect for a couple of other planets, assuming a system of one planet only each time.

2. Remember that at the atomic level, motion is heat. Suppose there is a star of temperature 6,000 K (this is the photospheric temperature). What is the average speed of the atoms in the photosphere? Remember that E = kT per atom, and that kinetic energy = 3/2 m V^2. k is Boltzmann's constant, 1.4×10^{-16} erg/K, and m is the mass of the hydrogen atom, 1.7×10^{-24} gm. Compare this speed with the Sun's orbital speed from Problem 1. Comments?

3. The police are measuring your speed on the NJ Turnpike by radar. If the radar wavelength is 10.000000 cm, what's the largest wavelength shift that they'll observe if you're not speeding? (I think the speed limit on the turnpike is 65 m.p.h.).

4. Consider two objects, both at the same temperature, one a brown dwarf of mass 40 M(Jupiter) and the other a planet of mass 2 M(Jupiter). Assume each radiates like a perfect black body and that there are no sources of outside heat. Which will cool the fastest?