Physic 325:Astrophysics. HW 2 Due Wed Nov 1.

In general, I expect you to work problems out from first principles—the goal is to develop the skills of applying your basic physics to astrophysical situations, not to apply random formulas. I expect you to be clear and justify any assumptions you make in working out these problems. I expect you to show all steps. If you look up any quantities, you must provide references.

1. The Hipparcos satellite made high precision measurements of stars positions from observation points on opposite sides of earth's orbit around the sun. How far away is a star that has a parallax angle equal to the smallest angle Hipparcos could measure (0.002 arc seconds)?

2. Find a reliable estimate (cite source) for global human power production. How many times larger than that is the total solar energy hitting the earth? How many times larger than that is the total power output of the sun (=solar luminosity)?

3. Show that the classical radius of the electron is the separation two electrons would have to have to have an electrostatic potential energy equal to the rest mass of an electron.

4. Using the energy balance arguments, determine the effective temperature of the Kuiper Belt object that the New Horizons space probe will visit next. Cite any data sources.

5. Using your favorite plotting software (ask me if you need a recommendation) plot B_nu(T) and (separately of course) B_lambda(T) for (the same) temperatures of 5000K, 10,000K, 20,000K which you might reasonably find for stars. For each temperature on each graph find the wavelength or frequency of the maximum of the emission. Compare the results for the same temperatures (e.g. from B_nu(5000) the max occurs at some frequency, find it's lamda, for B_lambda(5000) the peak occurs at some lambda (different!), find it's nu. Note bene: If we are just interested in the relative behavior (which we are here) then all the overall multiplicative constants in the equations don't matter and you can set them to 1. This makes plotting much easier….