AST 301
Homework #6
Due Friday Oct. 22

1. a) Estimate very roughly the surface area of your body. Give the answer in $m^2$.
b) Assuming your skin radiates like a blackbody (or thermal radiator) at a temperature of 300 K, calculate how much power (in Watts) you are radiating. You can look up the value of the constant $\sigma$ in a table in the back of your book.
c) Calculate the amount of energy (in Joules) you radiate in a day.
d) One Calorie in the food you eat can generate 4200 Joules of heat energy inside of your body. Find a rough number for the number of Calories a typical person eats in a day, and multiply that number by 4200 to convert it to Joules.
e) Your answer to part d should come out to less than the energy you radiate in a day. Where might the rest of the energy you radiate come from? Hint: the answer is similar to the explanation of why the greenhouse effect makes the surface of the Earth warm enough that it radiates more infrared radiation than the amount of visible sunlight it absorbs.

2. Jupiter orbits at a distance of 5.2 AU from the Sun, with a speed of 13 km/sec. It has a mass of 1/1000 that of the Sun.
a) Using Newton's 3rd law, how does the force of Jupiter's gravity on the Sun compare to the force of the Sun's gravity on Jupiter?
b) Using Newton's 2nd law, how does the acceleration of the Sun caused by Jupiter compare to the acceleration of Jupiter caused by the Sun?
c) The ratio of the speed of the Sun to the speed of Jupiter, due to the gravitational forces between them, is the same as the ratio of their accelerations. What is the speed of the motion of the Sun caused by Jupiter's gravity?
d) If we tried to measure the motion of the Sun caused by Jupiter's gravity by measuring the Doppler shift of light emitted by the Sun at a wavelength of 500 nm, by how much would the wavelength be shifted?