ASTR 300B – Fall 2024

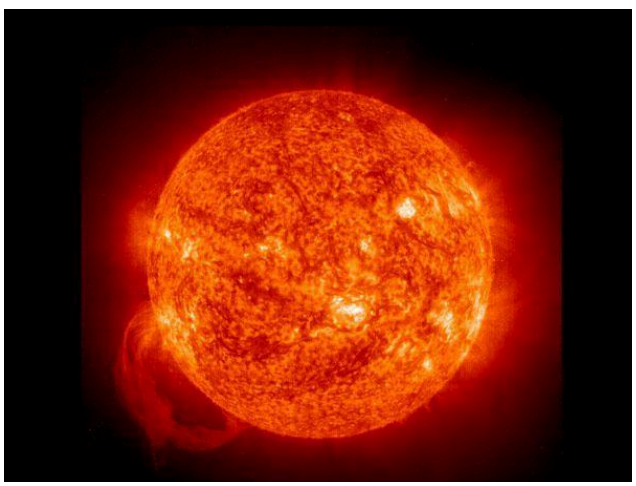
<u>Due: Thurs. Sept. 5</u>

3. Assume that the Sun radiates with luminosity L. Let R be the radius of the Sun, let F be the flux emerging from the surface of the Sun, and let f be the flux observed at a distance D away from the Sun.

(a) Derive an expression for how f depends on D? HINT: assume no energy is lost between the surface of the Sun and a sphere, centered on the Sun, with a radius of D.

(b) Derive a formula for the average surface brightness, B, of the Sun. It is defined as the observed flux at a distance D divided by the observed solid angle of the Sun from a distance D ($B = f/\Omega$). Assume $D >> R$.

(c) What are the (cgs) units of B and therefore which photometric quantity (i.e. power, flux, intensity) is B really equal to? Also, how does the surface brightness of the Sun depend on D? This result is ***fundamental*** to why we use this photometric quantity in radiative transfer calculations.



4. Consider the following problems with a constant (isotropic) specific intensity.

(a) Assume that a spherical object radiates isotropically with specific intensity = I. Calculate the flux emerging from the surface of the object. This flux is sometimes called the "astrophysical flux" or emergent flux. Remember this result - it comes up a lot.

(b) Now assume you are at the center of an isotropic radiation field with specific intensity = I that surrounds you in all directions. Calculate the flux passing through the center. HINT: Does it matter how you orient dA?