

Astro 500 Homework #1  
*Due Thursday 26 Jan, 2017 8:32 AM*

*Use definitions and numbers given in the class notes. Show all work.*

1. Show the steps in deriving the identify:  $1 \mu\text{Jy} = 15.1 \text{ photons sec}^{-1} \text{ m}^{-2} \text{ neper}^{-1}$ .
2. On earth the night sky has the color of  $(V-I) = 1.7 \text{ mag}$  in the Johnson system. What is the  $(V-I)$  color of the sky in AB mag?
3. What is the  $u-R$  color (Johnson) of a source with a spectrum that is flat (constant) in  $f_\nu$ ? (Hint: Start by defining the relation between  $f_\lambda$  and  $f_\nu$ .)
- 4.(a) What is the effective spectral index ( $\alpha$ ) of Vega between  $H$  and  $K$  bands such that  $f_\nu \propto \nu^\alpha$ ? (b) What is the corresponding  $H-K$  color in the AB system?
5. (a) What is  $S_{10}$  in the  $I$  band in  $\text{Jy arcsec}^{-2}$ ? (b) How does this compare to the brightness of the night sky?
6. Calculate the number of photons per second per  $\text{arcsec}^2$  incident at the top of the atmosphere on a 3.5m diameter telescope from the sky in the  $I$  band.
7. Estimate the equivalent number of solar-mass stars  $\text{parsec}^{-2}$  corresponding to the  $I$ -band sky surface brightness.