Physics 310/610 – Cosmology

Homework Set A

1. Using the small-angle approximation, find the angular size of the
   (a) Sun, with a distance 1.000 AU and diameter $2.000\,R_\odot$, in arc-minutes
   (b) The nearest star (α Cen A), at a distance of 1.325 pc and diameter $2.446\,R_\odot$, in mas.
   (c) A telescope with diameter d observing light of wavelength λ can resolve objects with angular size $\alpha \sim \lambda/d$. Explain why even the largest telescopes on Earth ($d \sim 10$ m) have difficulty directly measuring the diameter of even the nearest stars (besides the Sun) using visible light ($\lambda \sim 5{,}000$ Å).

2. When an electron in hydrogen falls from level n to level m, the energy emitted is

$$\Delta E = (13.6\text{ eV})\left(\frac{1}{m^2} - \frac{1}{n^2}\right)$$

Wavelength	Classification
7,000 – 10^7 Å	Infrared
4,000 – 7,000 Å	Visible
100 – 4,000 Å	Ultraviolet

   Assuming the light is emitted as a single photon of light, find the energy (in eV), frequency (Hz), wavelength (Å) and classification of the energy for each of the following transitions:
   (a) 2 → 1 (b) 3 → 2 (c) 4 → 3

Graduate Problem – no graduate problem for this homework