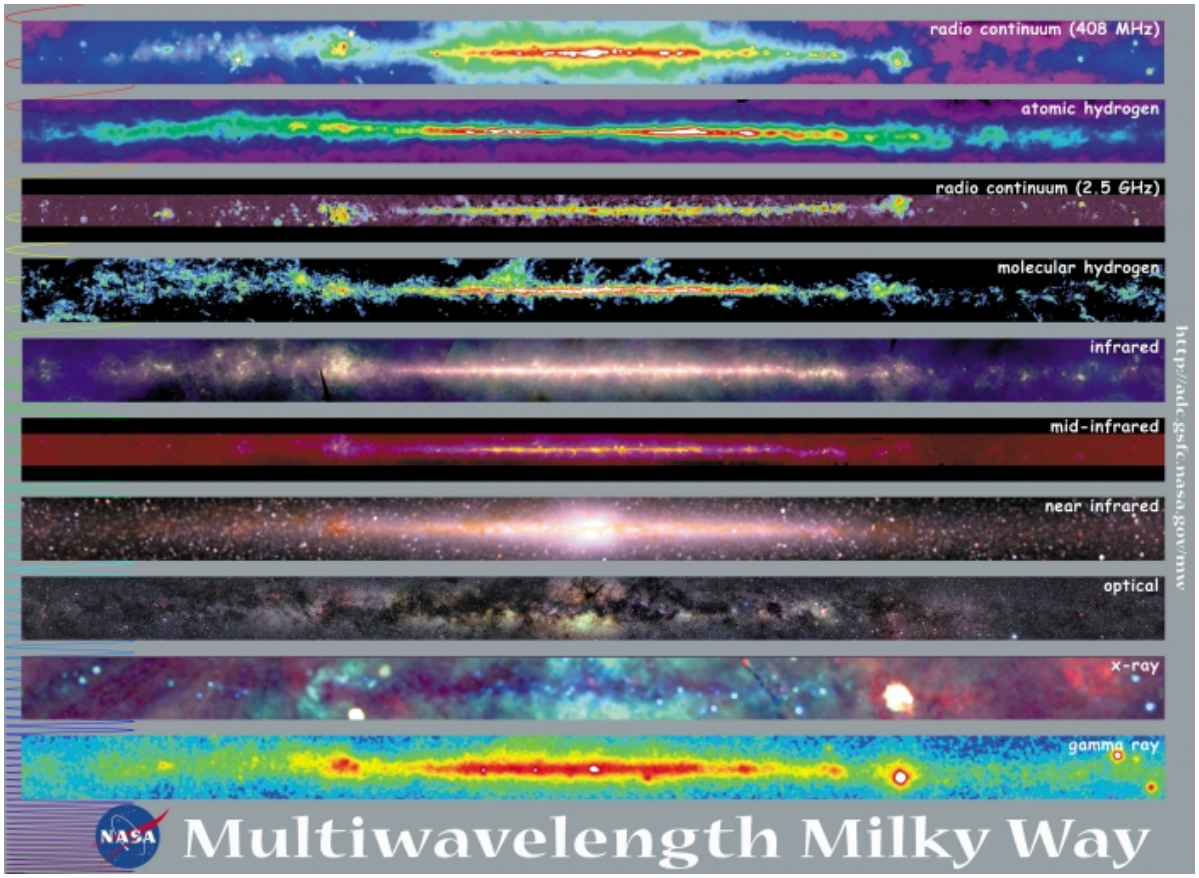
AST 250 – Spring 2019
Homework Due: Monday January 28

8. Complete the following table of wavelengths, frequencies, and energies in the units requested. Also say which region of the electromagnetic spectrum (i.e. gamma ray, xray, UV, optical, IR, radio) that the light is emitted in.

	Wavlength	Frequency	Energy
Yellow light	550 nm	_____THz	_____eV
Hydrogen Spin-Flip Transition	_____cm	1420 MHz	_____μeV
Hydrogen Ionization Energy	_____Angstroms	xxx ignore xxxx	13.6 eV



9. A telescope has an angular resolution, θ, given by the formula $\theta \sim 1.2\,\lambda / D$ where D is the diameter of the telescope. What is the angular resolution of the Hubble Space Telescope (D = 2.4m) observing at the wavelength of atomic hydrogen emission where the electron drops from the n=3 level to n=2 level (labeled Hα and called "H-alpha" emission). Give your answer in milli-arcseconds (mas). The electronic energy levels of Hydrogen are given by the formula:
$E(n) \sim -13.5984\ \text{eV} / n^2$ where the energy levels are labeled by the "principle quantum number" n (n = 1,2,3,… positive integers).

HINT: if you calculate λ and D in the same units, the units of θ are radians.

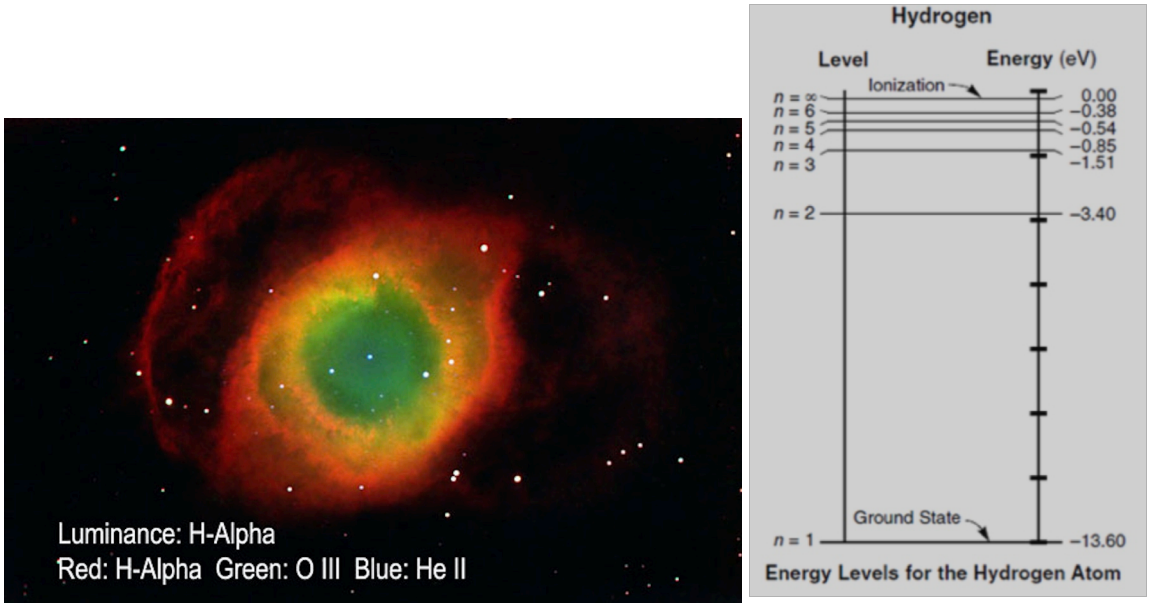


Figure 2: LEFT: The color image of the Helix Nebula is constructed from 3 narrow band filters that are centered on different transitions of Hydrogen (HI), Doubly-Ionized Oxygen (OIII), and Singly-Ionized Helium (HeII). The red in the color image is due to Hα emission from Hydrogen where the electron jumps from level n=3 down to level n=2 and the difference in energy is emitted as a photon with that energy. RIGHT: The energy levels of Hydrogen. For a more accurate calculation, don't use the energy level values (in electron volts) in the figure – instead use the equation given above in the problem.