Homework 3, Astro 1

Due October 18, 2019

1. (U11-5.26) **Box 5-2 in both U10 & U11** The bright star Sirius in the constellation of Canis Major (the Large Dog) has a radius of 1.67 $R_\odot$ and a luminosity of 25 $L_\odot$. **(a)** Use this information to calculate the energy flux at the surface of Sirius. **(b)** Use your answer in part (a) to calculate the surface temperature of Sirius. How does your answer compare to the value given in Box 5-2?

2. (U11-5.38) **(a)** Calculate the wavelength of P_Δ (P-delta), the fourth wavelength in the Paschen series. **(b)** Draw a schematic diagram of the hydrogen atom and indicate the electron transition that gives rise to this spectral line. **(c)** In what part of the electromagnetic spectrum does this wavelength lie?

3. (U11-5.46) You are given a traffic ticket for going through a red light (wavelength 700 nm). You tell the police officer that because you were approaching the light, the Doppler effect cause a blueshift that made the light appear green (wavelength 500 nm). How fast would you have had to be going for this to be true? Would the speeding ticket be justified? Explain your answer.

4. (U11-6.33) The Institute of Space and Astronautical Science in Japan proposes to place a radio telescope into an even higher orbit than the HALCA telescope. Using this telescope in concert with a ground-based radio telescope, baselines as long as 25,000 km may be obtainable. Astronomers want to use this combination to study radio emission at a frequency of 43 GHz from the molecule silicon monoxide, which is found in the interstellar clouds from which stars form. (1 GHz = 1 gigahertz = 10^9 Hz.) **(a)** What is the wavelength of this emission? **(b)** Taking the baseline to be the effective diameter of this radio-telescope array, what angular resolution can be achieved?

5. (U11-6.42) To search for ionized oxygen gas surrounding our Milky Way Galaxy, astronomers aimed the ultraviolet telescope of the FUSE spacecraft at a distant galaxy far beyond the Milky Way. They then looked for an ultraviolet spectral line of ionized oxygen in that galaxy's spectrum. Were they looking for an emission line or an absorption line? Explain your answer.