Astronomy 120 "Galaxies and the Universe" Summer 2018
Homework Assignment #2 DUE: Friday 1June2018

READING ASSIGNMENT FOR THIS HOMEWORK: UNIVERSE Ch. 5 sec 1-5; Ch 6.7

1. (24 points) Compare these properties of the radio stations WFOX (95.9 FM) and WINE (940 AM).
   a.) What is the of wavelength the radio waves transmitted by each station?
   b.) What is the frequency of the radio waves transmitted by each station?
   c.) What is the speed of the radio waves transmitted by each station?
   d.) What is the energy of the radio photons transmitted by each station?
   e.) What is the quality of the programming transmitted by each station?
   [HINT: part e is a JOKE]

2. (24 points) Imagine a star the same size as the sun but with a spectrum that peaks at 0.100 microns.
   a.) What is the surface temperature of this star?
   b.) What color would the star appear? Explain your answer.
   c.) How much more or less energy is emitted each second from each square meter of the surface of this star?
   d.) How many times more or less luminous than the sun would that star be?

3. (14 points)
   a.) The bright star Rigel (in the constellation of Orion) has a surface temperature of 12,000 K. What is the ratio of the energy flux of Rigel compared to the Sun?
   [HINT: Use ratio method. You don't need to calculate the flux!]
   b.) Rigel is a supergiant star with a luminosity 120,000 times greater than that of our sun. What is the radius of Rigel, in solar units?

4. (20 points) One of the nearest stars is Sirius B, a white dwarf star which orbits Sirius A, the brightest star in the sky. Sirius B has a radius of 0.0084 R_{sun} and a luminosity of 0.026 L_{sun}.
   a.) What is its surface temperature?
   b.) At what wavelength would that star emit most of its radiation?
   c.) What is the radius of the star compared to that of the earth?
   (express your answer as a ratio, i.e. calculate the radius of the star divided by the radius of the earth)

5.) (18 points) Black holes are objects whose gravity is so strong that not even an object moving at the speed of light can escape from them. Hence black holes themselves do not emit light. But it is possible to detect electromagnetic radiation from material falling toward a black hole. Some of this material is compressed and heated to temperatures around 10^6 K.
   a.) Calculate the wavelength of maximum emission for this temperature.
   b.) In what part of the electromagnetic spectrum does this wavelength lie?
   c.) Do these photons reach the earth's surface? If not, what happens to them?