HW 6 A2020 Out 3/18/2010 Due 03/25/2010

1. (4 pts).

http://www.cfht.hawaii.edu/HawaiianStarlight/AIOM/English/CFHT-Coelum-AIOM-Jan2006.html

Identify on this diagram:
a. a pair of interacting galaxies.
b. four elliptical galaxies
c a barred spiral galaxy.
d. a nearly edge on spiral galaxy

2. (3 pts) In the online version of this image– why are the elliptical galaxies reddish while the spiral galaxies are blue?

3. (3 pts) You decide to simulate the expansion of the Universe with four cars driven by you and your friends. The cars will drive along a straight road following Hubble's law. You pretend to be the Milky Way. Then you station your friend's cars 100 meters from each other – i.e. Friend 1 is 100 meters away from you, Friend 2 is 200 meters away from you, Friend 3 is 300 meters away:

   You Friend 1 Friend 2 Friend 3

   Part 1: your friends start their cars and begin to drive away from you to simulate galaxies moving away from the Milky Way. What should their speeds be in order to simulate Hubble's law:

   a. *friend 1* goes 10 km/hour, *friend 2* goes 20 km/hour, *friend 3* goes 30 km/hour

   b. all of your friends go 10 km/hour

   c. *friend 1* goes 10 km/hour, *friend 2* goes 100 km/hour, *friend 3* goes 1000 km/hour

   Part II: *Friend 1* thinks that he should be the center of the Universe. If he measures the velocities of the other cars relative to his, would he also see the cars following Hubble's law? Why or why not?

4 (4 pts extra credit)

a. You find a Cepheid variable in a galaxy that varies with a period of 10 days. Find the luminosity of the Cepheid using the plot in the lecture relating the periods and luminosities of Cepheids.

b. The flux observed from the Cepheid is 1.3×10^{-14} erg s^{-1} cm^{-2}. Derive the distance from the luminosity and flux. Remember from the inverse square law: Flux = Luminosity/(4 π Distance^2). First, write the equation for distance in terms of flux and luminosity. Next, convert the luminosity you found in part a, which is in units of solar luminosities, into erg s^{-1} by multiplying the luminosity by 3.8×10^{33} ergs s^{-1} per solar luminosity. After doing this conversion, solve for the distance in centimeters. Finally, convert centimeters into light years by dividing by the number of centimeters in a light year (1 l.y. = 9.4×10^{17} cm).
   (note: an *erg* is a unit of energy, *ergs per second* is a unit of power, and *ergs per second per square centimeter* is a unit of flux. Also, 5 ergs s^{-1} cm^{-2} is the same as saying *5 ergs per second per square centimeter*)