ASTR121 Homework #10 – (Hamilton)
due Thursday May 1 (15 Points)

Finishing reading Chapter 24. These next three problems are from that chapter.

34. As Figure 19-19 shows, there are two types of Cepheid variables. Type I Cepheids are metal-rich stars of Population I, while Type II Cepheids are metal-poor stars of Population II. (a) Which type of Cepheid variables would you expect to be found in globular clusters? Which type would you expect to be found in the disk of a spiral galaxy? Explain your reasoning. (b) When Hubble discovered Cepheid variables in M31, the distinction between Type I and Type II Cepheids was not yet known. Hence, Hubble thought that the Cepheids seen in the disk of M31 were identical to those seen in globular clusters in our own Galaxy. As a result, his calculations of the distance to M31 were in error. Using Figure 19-19, explain whether Hubble's calculated distance was too small or too large.

42. It is estimated that the Coma cluster (see Figure 24-21) contains about $10^{13} M_{\odot}$ of intracluster gas. (a) Assuming that this gas is made of hydrogen atoms, calculate the total number of intracluster gas atoms in the Coma cluster. (b) The Coma cluster is roughly spherical in shape, with a radius of about 3 Mpc. Calculate the number of intracluster gas atoms per cubic centimeter in the Coma cluster. Assume that the gas fills the cluster uniformly. (c) Compare the intracluster gas in the Coma cluster with the gas in our atmosphere (3×10^{19} molecules per cubic centimeter, temperature 300 K); a typical gas cloud within our own Galaxy (a few hundred molecules per cubic centimeter, temperature 50 K or less); and the corona of the Sun (10^5 atoms per cubic centimeter, temperature 10^6 K).

45. How might you determine what part of a galaxy's redshift is caused by the galaxy's orbital motion about the center of mass of its cluster?

48. According to Figure 24-34c, elliptical galaxies continue to form stars for about a billion years after they form. Give an argument why we might expect to find some Population I stars in an elliptical galaxy. (Hint: Table 19-1 gives the main-sequence lifetimes for stars of different masses.)

Finishing reading Chapter 25. These problems are from that chapter.

26. When we observe a quasar with redshift $z = 0.75$, how far into its past are we looking? If we could see that quasar as it really is right now (that is, if the light from the quasar could somehow reach us instantaneously), would it still look like a quasar? Explain why or why not.

35. (a) Calculate the maximum luminosity that could be generated by accretion onto a black hole of 3.7×10^6 solar masses. (This is the size of the black hole found at the center of the Milky Way, as described in Section 25-6.) Compare this to the total luminosity of the Milky Way, about $2.5 \times 10^{10} L_{\odot}$. (b) Speculate on what we might see if the center of our Galaxy became an active galactic nucleus with the luminosity you calculated in (a).