ASTR121 Homework #7 – (Hamilton)
due Thursday Apr. 3 (15 Points)

Finishing reading Chapter 20. These problems are from that chapter.

41. (a) Calculate the wavelength of maximum emission of the white dwarf Sirius B. In what part of the electromagnetic spectrum does this wavelength lie? (b) In a visible-light photograph such as Figure 20-8, Sirius B appears much fainter than its primary star. But in an image made with an X-ray telescope, Sirius B is the brighter star. Explain the difference.

43. (a) Find the average density of a 1-$M_\odot$ white dwarf having the same diameter as the Earth. (b) What speed is required to eject gas from the white dwarf's surface? (This is also the speed with which interstellar gas falling from a great distance would strike the star's surface.)

47. (a) What kinds of stars would you monitor if you wished to observe a core-collapse supernova explosion from its very beginning? (b) Examine Appendices 4 and 5, which list the nearest and brightest stars, respectively. Which, if any, of these stars are possible supernova candidates? Explain.

*48. Consider a high-mass star just prior to a supernova explosion, with a core of diameter 20 km and density 4×10^{17} kg/m^3. (a) Calculate the mass of the core. Give your answer in kilograms and in solar masses. (b) Calculate the force of gravity on a 1-kg object at the surface of the core. How many times larger is this than the gravitational force on such an object at the surface of the Earth, which is about 10 newtons? (c) Calculate the escape speed from the surface of the star's core. Give your answer in m/s and as a fraction of the speed of light. What does this tell you about how powerful a supernova explosion must be in order to blow material away from the star's core?

*54. In July 1997, a supernova named SN 1997cw exploded in the galaxy NGC 105 in the constellation Cetus (the Whale). It reached an apparent magnitude of +16.5 at maximum brilliance, and its spectrum showed an absorption line of ionized silicon. Use this information to find the distance to NGC 105. (Hint: Inspect the light curves in Figure 20-22 to find the absolute magnitudes of typical supernovae at peak brightness.)

56. The images that open this chapter show two kinds of glowing gas clouds: a planetary nebula and a supernova remnant. (a) Explain what makes the planetary nebula glow and what makes the supernova remnant glow. (Hint: The explanations are different for the two kinds of gas clouds.) (b) Which of these two kinds of gas clouds continues to glow for a longer time? Why?