ASTR121 Homework #9 - (Hamilton)
due Thursday Apr. 24 (15 Points)

Finishing reading Chapter 22. These first few problems are from that chapter.

38. Find the total mass of the neutron star binary system discovered by Hulse and Taylor (Section 22-2), for which the orbital period is 7.75 hours and the average distance between the neutron stars is 2.8 solar radii. Is your result reasonable for a pair of neutron stars? Explain.

*46. What is the Schwarzschild radius of a black hole whose mass is that of (a) the Earth, (b) the Sun, (c) the supermassive black hole in NGC 4261 (Section 22-5)? In each case, also calculate what the density would be if the matter were spread uniformly throughout the volume of the event horizon.

Finishing reading Chapter 23. These next problems are from that chapter.

29. Explain why globular clusters spend most of their time in the galactic halo, even though their eccentric orbits take them close to the galactic center.

30. The disk of the Galaxy is about 50 kpc in diameter and 600 pc thick. (a) Find the volume of the disk in cubic parsecs. (b) Find the volume (in cubic parsecs) of a sphere 300 pc in radius centered on the Sun. (c) If supernovae occur randomly throughout the volume of the Galaxy, what is the probability that a given supernova will occur within 300 pc of the Sun? If there are about three supernovae each century in our Galaxy, how often, on average, should we expect to see one within 300 pc of the Sun?

39. According to the Galaxy's rotation curve in Figure 23-18, a star 16 kpc from the galactic center has an orbital speed of about 270 km/s. Calculate the mass within that star's orbit.

*41. Show that the form of Kepler's third law stated in Box 23-2, $P^2 = 4\pi^2 a^3/G(M + M_\odot)$, is equivalent to $M = rv^2/G$, provided the orbit is a circle. (Hint: The mass of the Sun ($M_\odot$) is much less than the mass of the Galaxy inside the Sun's orbit (M).)