Homework #10, ASTR 314, Spring 2013

Due Thursday, April 11, during class

Please turn in answers to the following problems. To receive full credit you must show all your work. Remember that while you may discuss how to solve problems with your classmates, the work you submit must be your own and never copied. Work that is copied will receive zero credit.

1. Suppose the Milky Way Galaxy consists of 100 billion stars \(10^{11}\) stars each exactly like our Sun, with Solar bolometric magnitude, \(M_{\text{bol}} = 4.74\). For this case, calculate the absolute bolometric magnitude of the whole Galaxy.

2. The star S0-2 has as spectral class B1 V with a mass \(M = 15M_{\odot}\) and \(R = 7R_{\odot}\). It orbits the central black hole at the center of the Milky Way Galaxy (with mass \(M_{\text{BH}} = 3.7 \times 10^6M_{\odot}\)) with a semimajor axis \(a = 920\) AU and eccentricity \(e = 0.867\).

   (a) What is the star S0-2’s distance to the black hole at pericenter?

   (b) What is the Roche limit? Assume that both the star S0-2 and the black hole have a constant density. Will the star S0-2 cross over the Roche limit during its orbit (how close does the star get to the Roche limit)?

3. Carroll & Ostlie 24.2

4. Carroll & Ostlie 24.24

5. Carroll & Ostlie 24.25