

Astronomy 321  
Homework 3  
Due: Friday, 25 April 2008

1. Chapter 3, Problem 1
2. Chapter 3, Problem 2
3. Using the radiation flux formula (in the diffusion limit) found in class, show that

$$L_* \propto \frac{M_*^3}{\kappa},$$

where  $\kappa$  is the cross-section in units of  $\text{cm}^2 \text{g}^{-1}$ .

4. Suppose that rotation cannot be ignored in a star.
  - a. Write down an expression for the equilibrium condition for material in the equatorial plane of the star.
  - b. A  $1 M_\odot$  star is observed to rotate with a period of 30 milliseconds. If this rapidly rotating star is stable (that is, the star does not fly apart due to the rotation), estimate the minimum mass density allowed for the star. Consider the centripetal acceleration on a test mass at the equator of the star to arrive at your estimate.
  - c. How does this mass density compare to the average mass density for the Sun,  $1.4 \text{ g cm}^{-3}$ ?
5. Chapter 3, Problem 4