Stars and Stellar Systems

Homework Set No. 3 Due

Due March 10, 2011

Please type up or print out your homework and staple the pages together. Leave a blank space to write in mathematical equations or diagrams. Make sure you **show your work** for any calculations – "magical" answers will receive no credit. Problems are **due at the beginning of the lecture**.

Review questions, Problems, etc. which have a chapter and number noted are from your text *Stars and Galaxies, 7th edition.*

- 1. Why is it difficult to find out how common the most luminous stars are ? The least luminous stars ? (Chapt. 9, Review Question 13)
- 2. The parallax of the bright star Vega is 0.129 seconds of arc. What is the distance of Vega in parsecs ? In light-years ?

By how much, during the year, does the position of Vega shift relative to distant background stars? If an astronomer were observing from the surface of Jupiter's moon Europa, by how much would Vega shift during the Jovian year? (Hint: Jupiter is 5.2 AU from the sun.)

- 3. A binary star system contains one star of mass $0.8 M_{\odot}$ and another of mass $2.2 M_{\odot}$. They are in circular orbits and the distance between the centers of the stars is 1.5 AU.
 - (a) What is the period *P* of the binary?
 - (b) Find the location of the center of mass (i.e., how far is it from the center of the more massive star?).
 - (c) Compare the gravitational force of the two stars on a small mass *m* located at the center of mass. Are the forces equal?
- 4. A double-lined spectroscopic binary has a period of 30 days and the velocities of the two stars are 70 km/s and 200 km/s.
 - (a) What is the ratio of the masses of the stars?
 - (b) Assume we are in the plane of the orbit. What is the total separation of the stars? What is the total mass and the individual masses of the stars?
 - (c) If instead, the orbit is inclined at an angle of 45 degrees, what are the true velocities of the stars? In this case, what is their separation? What is the total mass and the individual masses?
- 5. If the orbital velocity of the eclipsing binary in Figure 9-20 of your text is 153 km/s and the smaller star becomes completely eclipsed in 2.50 hours, what is its diameter ? (Problem 14, chapter 9)

6. Use the table below to answer the following questions. You may also consult a standard H-R diagram. For each question, give a brief explanation (in one sentence).

Star	Spectral Type
Aldebaran	K5 III
Alpha Centauri A	G2 V
Antares	M1 I
Canopus	F0 II
Fomalhaut	A3 V
Regulus	B7 V
Sirius	A1 V
Spica	B1 V

(a) Which star has the greatest luminosity ?

(b) Which star has the highest surface temperature ?

(c) Which star has the lowest surface temperature ?

(d) Which star is the most similar to the Sun ?

(e) Which star is a red supergiant ?

(f) Which star has the largest radius ?

(g) Which star has the smallest radius ?