Physics 20083 – Spring 2007 Exam #3a

Instructions:

1. Answer the following four questions in the space provided. If you need extra space, please use the back of the page and make an appropriate notation on the front of the page so that I will know where to look for your complete answer.

2. Each question is worth a total of 25 points.

3. Each questions requires an answer that is typically no more than two or three sentences long or perhaps a diagram and one or two sentences. Some questions do not require explanations. This will always be explicitly stated.

4. You may **not** use your own paper, book, notes or a calculator for this exam.

5. You will have 30 minutes to complete and turn in the exam.

Density Equation: $\text{Density } (\rho) \quad \alpha \quad \frac{\text{Mass (M)}}{R^3}$

Inverse Square Law: $L_{app} \alpha \frac{L_{abs}}{r^2} - X$

Pressure: $P \alpha \rho T$

Mass-Luminosity Relation: $L_{Abs} \alpha M^3$

Self-Gravity and Gravity:

$$F_{SG} \alpha \frac{\text{Mass (M)}}{R^2} \qquad F_{grav} \alpha \frac{M^*}{r^2}$$

Period Equation: $2\pi r_{orbit} = v_{orbit} * \text{Period}$

$$v_{orbit} = \sqrt{\frac{G M}{r_{orbit}}}$$

M = Mass of central object

r_{orbit} = distance from center

1. Suppose we are trying to create a representative catalog of stars, and it includes the two brightest stars in the constellation Canis Major.

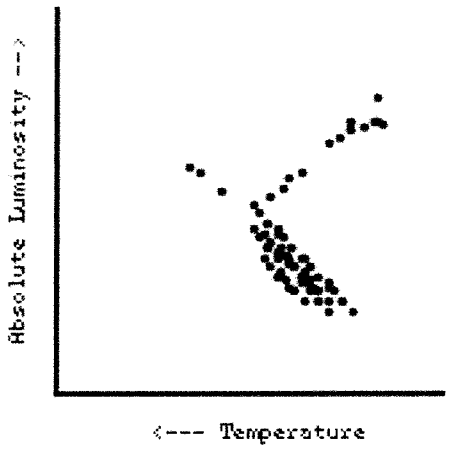
a) (12 pts) Give the altitude and azimuth of Canis Major in the evening sky at this time of year, and also name the two brightest stars in Canis Major.

b) (13 pts) Suppose our sample of stars includes the 1000 stars that have the smallest distances from Earth as measured with the parallax or standard candle method. Explain why this sample would or would not be representative, and include a description of and reference to the Copernican Principle.

2. Astronomers have two theories regarding the formation of brown dwarfs, the "turbulence" theory and the "ejection" theory. (a) Briefly describe each theory and (b) explain what two properties found in binary systems lead us to believe the turbulence scenario is correct. For each property, explain why the turbulence scenario favors it or the ejection scenario opposes it.

3. As stars evolve during their main sequence (Hydrogen-burning) lifetime, they slowly grow larger and redder until they finally run out of Hydrogen altogether. Explain (a) why these stars grow larger by discussing what is going on in the core and using the principles of Hydrostatic Equilibrium (HSE) and (b) why these stars appear cooler despite their overall increase in luminosity.

4. Below is the H-R diagram for a cluster of stars, complete with a few "blue stragglers". (a) In the space to the right of the diagram, briefly explain what blue stragglers are and explain what causes this phenomenon. Then, (b) either by sketching a diagram of your own or by explaining it, describe what the H-R diagram of a younger cluster would look like. Explain your answer.



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