AST 207 Homework 5 (36pts.) Due 19 October 2009
No late papers.

1. **Hot-plate model of a star**. Imagine that you have made "stars" out of hot plates and you are plotting them on a Hertzsprung-Russell diagram
    a. (3 pts.) How can you make two hot plates with the same spectral class and differing absolute magnitude?
    b. (3 pts.) If you moved the hot plate to a greater distance, how would its place on the HR diagram change?
    c. (3 pts.) If you turned the setting on the hot plate from "high" to "medium," how would its place in the HR diagram change?
2. **Life on Deneb**. Here you will find out what it means to live near a giant like Deneb. Recall that the luminosity of a star L=const T^4 R^2, where T is its temperature, R is its radius, and const is a constant.

Star	App mag	Abs mag	Spectral type	Distance (pc)
Sun	-26.74	4.83	G2	1/200,000
Deneb	1.25	-7.3	A2	500

    a. (5 pts.) In class we found that a star 10 times fainter has a magnitude +2.5 greater. This relationship between the flux f_A and f_B of two stars A and B and their magnitudes can be expressed mathematically as $m_A - m_B = -2.5 \log(f_A / f_B)$. How much brighter is Deneb than the sun if both are placed at the same distance?
    b. (5 pts.) The temperature of the sun is 5700K, and the temperature of Deneb is 9800K. How much larger is Deneb than the sun?
    c. (2 pts.) The sun subtends ½ degree in the sky. If Deneb replaced the sun, what angle would our replacement subtend?
3. **M15.** Figure 1 is the Hertzsprung-Russell diagram of the star cluster M15.
    a. (2 pts.) What is the absolute magnitude of the hottest main-sequence stars?
    b. (3 pts.) Why are there no hotter main-sequence stars?
    c. Stars with a color B-V=0.6 span a range of 5 magnitudes. (2 pts.) What property of the stars accounts for this observation? (3 pts.) What is the range of this property?
    d. (3 pts.) The apparent magnitude of a star is 5 magnitudes fainter than the absolute magnitude. Find its distance. (Recall that the absolute magnitude is the apparent magnitude if the object is moved to a distance of 10 pc.)
    e. (2 pts.) Suppose the apparent magnitude of M15 is exactly 15 magnitudes fainter than the absolute magnitude. Find its distance.

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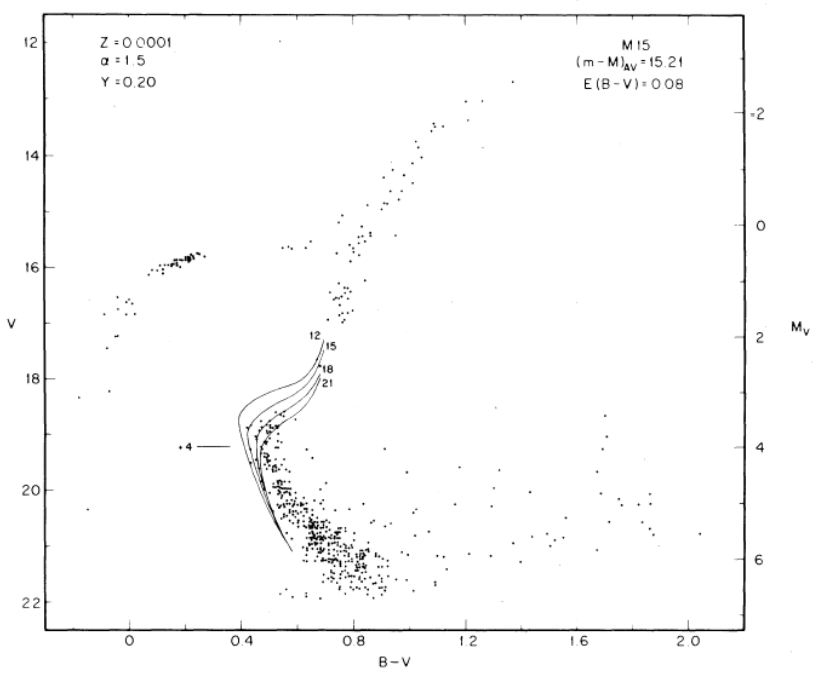

Figure 1 Hertzsprung-Russell diagram of the star cluster M15. B-V is a measure of color. The vertical scale on the left is apparent magnitude, and the scale on the right is absolute magnitude.