

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. (2 pts.) If you moved the hot plate to a greater distance, how would its place on the HR diagram change?
  - b. (2 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  $L = R^2 T^4$  of a star, where  $T$  is its temperature and  $R$  is its radius.

Star	App. Mag.	Abs. mag.	Distance (pc)
Sun	-26.74	4.83	1/200,000
Deneb	1.25	-7.3	500

- a. 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  $m_A - m_B = -2.5 \log(f_A / f_B)$ . (not graded) How much brighter is Deneb than the sun if both are placed at the same distance? (2 pts.) What quantity makes this comparison in the most direct manner? Explain.
  - b. The temperature of the sun is 5700K, and the temperature of Deneb is 9800K. (1 pt.) How much larger is Deneb than the sun? (2 pts.) Explain the principle(s) that you use and where you got the values.
3. **M15.** Figure 1 is the Hertzsprung-Russell diagram of the star cluster M15.
    - a. (not graded) What is the absolute magnitude of the hottest main-sequence stars?
    - b. (not graded) Why are there no hotter main-sequence stars?
    - c. Stars with a color  $B-V=0.6$  span a range of 5 magnitudes. (not graded) What property of the stars accounts for this observation? (not graded) What is the range of this property?

4. **Sirius B.** Adams discovered the first white dwarf. In a sentence, answer each question. Not graded.
  - a. In terms of the hot-plate model, what is a white dwarf?
  - b. What was Adams’ evidence that Sirius B is a white dwarf? What hypothesis of Sirius B did Adams disprove?

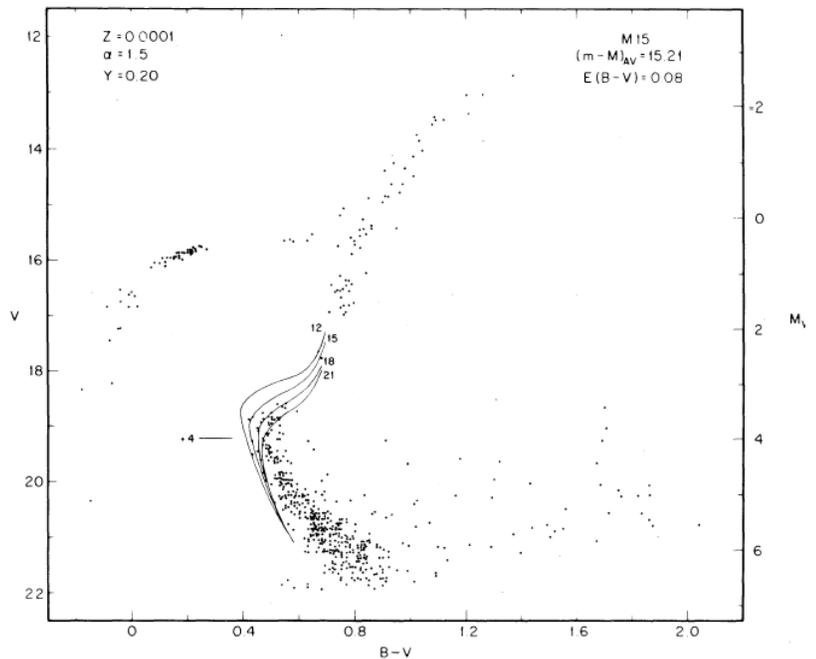


Figure 1 Hertzsprung-Russell diagram of the star cluster M15.  $B-V$  is a measure of color. The vertical scale on the left is apparent magnitude, and the scale on the right is absolute magnitude.