AST 207 Homework 5 Due 12 October 2005

No late papers.

Answers will be passed out on 12 Oct.

The Sun and the Twenty Brightest Stars.

Star	App mag	Abs mag	Spectral type	Distance (pc)
Sun	-26.74	4.83	G2	1/200,000
Sirius	-1.45	1.41	A1	2.7
Canopus	-0.73	-4.7	F0	60
Rigel Kentaurus	-0.1	4.3	G2	1.33
Arcturus	-0.6	-0.2	K0	11
Vega	0.04	0.5	A0	8.1
Capella	0.08	-0.6	G8	14
Rigel	0.11	-7.0	B8	93
Procyon	0.35	2.65	F5	3.5
Betelgeuse	0.8	-6	M2	200
Achernar	0.48	-2.2	B5	39
Hadar	0.60	-5.0	B1	120
Altair	0.77		A7	5.0
Aldebaran	0.85	-0.7	K5	21
Acrux	0.9	-3.5	B2	80
Spica	0.96	-3.4	B1	80
Antares	1.0	-4.7	M1	130
Fomalhaut	1.16	1.9	A3	7.0
Pollux	1.15	0.95	K0	11
Deneb	1.25	-7.3	A2	500
Mimosa	1.26	-4.7	B0	150

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. **Hertzsprung-Russell Diagram**. You will need the information on the sun and the twenty brightest stars in the table.
    a. (5 pts) Find the absolute magnitude of Altair.
    b. (5 pts) Why would a diagram of *apparent* magnitude and spectral type be useless?
    c. (5 pts) Plot all of the stars in the table on an H-R diagram. Use the spectral type for the horizontal axis and the absolute magnitude for the vertical axis. Make certain your axes run the right way.
    d. (1 pts) From the H-R diagram, determine whether Arcturus is a dwarf or a giant. (2 pts) How did you figure this out?

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3. **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.

    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 Sirius if both are placed at the same distance?

    b. (5 pts) Sirius and Deneb have approximately the same temperature. How much larger is Deneb than Sirius.

    c. (5 pts) The temperature of the sun is 5700K, and the temperature of Sirius is 9800K. How much larger is Sirius than the sun?

    d. (2 pts) If Deneb replaced the sun, how long would sunrise take? The diameter of the real sun is 0.5°. With the real sun, 2min (24hr*0.5°/360°) elapse from when the edge of the sun is just visible to when the full sun is visible.