**Hot-plate model of stars—March 14**

- Test 2 will be "unhidden" on loncapa.msu.edu before end of day.
- Public viewing sessions at MSU campus observatory:
  - Fri & Sat, 9-11pm, if it is not cloudy.
  - Mar 18 & 19
  - Apr 15 & 16
  - May 13 & 14
  - 24-inch telescope in dome
  - small telescopes outside
- Game questions: 100% on hwk, 25% on test. How should homework be changed to make it more useful?
  - Study guide.
  - Write explanation for hwk.
  - If wording in unclear on test question, ask during test.

**Observed properties of stars**

- Mass
  - Measured in kg or $M_\odot$
  - $0.08-30$ $M_\odot$
- Surface temperature
  - 5800K for sun
  - 3000K for cool star
- Luminosity is amount of energy the star produces in a second
  - Watts=$\text{Joules/s}$ or $L$ for Betelgeuse
  - Flux or apparent brightness is amount of energy received from the star by a detector in a second
  - Depends on distance
  - Composition: abundances of elements.

**Finding luminosity from flux**

- We measure flux incident on detector on Earth
  - Energy received/unit time /unit area
- We want to know luminosity
  - Energy produced by star/unit time
- Q1: Suppose Betelgeuse is moved closer. S1: Its flux increases. S2: Its luminosity increases. Statements S1 & S2 are
  - a. TT
  - b. TF
  - c. FT
  - d. FF

**Finding luminosity from flux**

- We measure flux incident on detector on Earth
  - Energy/unit time /unit area
- We want to know luminosity
  - Energy/unit time
- We need to also know the distance $D$
  - For nearby stars, use method of parallax. (Read about parallax in 11.1)

\[
F = \frac{L}{4\pi D^2}
\]

\[
L = 4\pi D^2 F
\]
Hot-plate Model of a Star

- A hot plate emits light as a blackbody. The key parameters are:
  - Temperature
  - Area
- A star is a really hot and really big hot plate.
- Ingredients:
  - Radius: R. Area = $4\pi R^2$
  - Temperature: T
  - Distance: D

**Q2:** Should T, D, & R be in the numerator or denominator?

a. NNN  
b. NND  
c. NDN  
d. DNN

Emitted energy per unit surface area $\propto$ Wavelength $\propto$ Energy

Hertzsprung-Russell (H-R) Diagram  [p. 292]

- H-R plotted luminosity vs. surface temperature (1905) & discovered a surprise.
- Spectral class is a proxy for temperature
  - OBAFGKM. O is hottest
- Q3 Sirius A & Sirius B (companion of Sirius A) have about the same temperature. How can Sirius B be 10,000 times fainter?
  a. Sirius B is 100 times farther away.
  b. Sirius B is 100 times smaller
  c. Sirius A took away the mass
  d. Sirius A took away the light

[see Fig. 11.10]