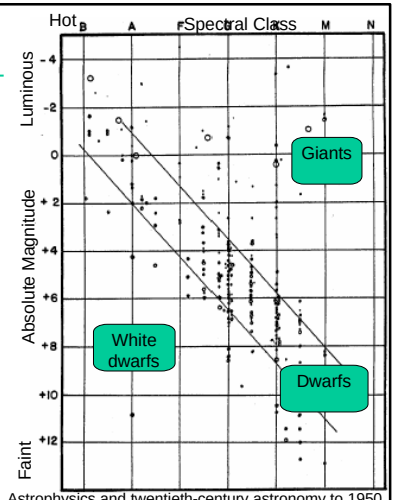
Model of Stars—3 Oct

- Spectral Class
  - OBeAFineGirlKissMe.
  - Hottest stars on left
- Absolute magnitude measures brightness with all stars placed at same distance
  - Brightest stars on top
  - An increase of 2.5 magnitudes ⇒ star is a factor of 10 fainter.
- Model
  - Temperature
  - Size (therefore names dwarfs & giants)



Astrophysics and twentieth-century astronomy to 1950, O Gingerich, ed., Cambridge, 1984

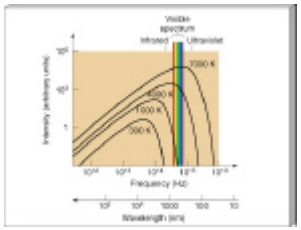
The Hot-plate Model of a Star

1. How does the energy from the hot-plate get to my hand?
2. What are two ways to make a hot plate produce more energy per second? (The same question applies to a star: What are two ways to make a star brighter or more luminous?)
3. What can I do to make the same hot-plate at the same setting burn my hand and not burn my hand?

http://www.acemart.com/graphics/00000001/products/WELLh70_01.jpg

Model of a Star: Temperature

- Thermal radiation, also called black-body radiation
  - Emitted by anything warm
  - Brighter for hotter objects
  - Wavelength changes with temperature
    - $\lambda_{peak} \times T = 2.9\text{mm K}$ (Wien's Law)
    - For the sun, $T = 5700\text{K}$ and $\lambda_{peak} = 2.9\text{mm}/5700\text{K} = .0005\text{mm} = 500\text{nm}$
    - For a person, $T = 273+37 = 310\text{K}$. $\lambda_{peak} = 2.9\text{mm}/310\text{K} = .01\text{mm}$ (infrared)
- A star or hot plate emits radiation. Energy emitted per second depends on Area$\times T^4$.



Luminosity & Flux of Stars

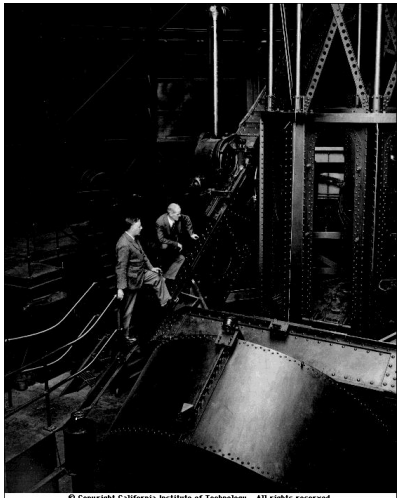
- Luminosity = amount of energy per second produced by the star
  - $L = R^2T^4$
- Flux = energy per second received by a detector on earth
  - $F = L/D^2$

Supernova 1987a in the Magellanic Cloud
What quantity or quantities have changed?

Magnitudes of Stars

- Definition of apparent magnitude
  - The magnitude of Vega is 0.
  - For every factor of 10 fainter, the magnitude is 2.5 greater.
  - More generally
    - $m=-2.5 \log (\text{flux}/\text{flux}_{\text{Vega}})$
- Absolute magnitude is apparent magnitude if the distance of the star is 10 pc.

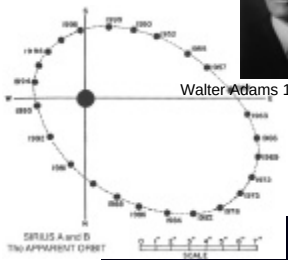
http://obswww.unige.ch/~cramer/images.jpg/sirius-l.jpg

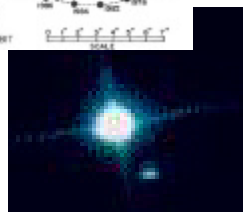


Sirius A and Sirius B

Walter Adams 1876-1956

- Apparent mag of Sirius A is -1.5
- Apparent mag of Sirius B is 8.7
- Sirius A & B orbit each other.
- In 1914, Walter Adams measured the colors of A and B to be about the same. What did he discover?





http://chandra.harvard.edu/photo/2000/0065/0065_optical.jpg

Summarizing question

- How can a star at the same temperature and the same distance as the sun be much brighter?