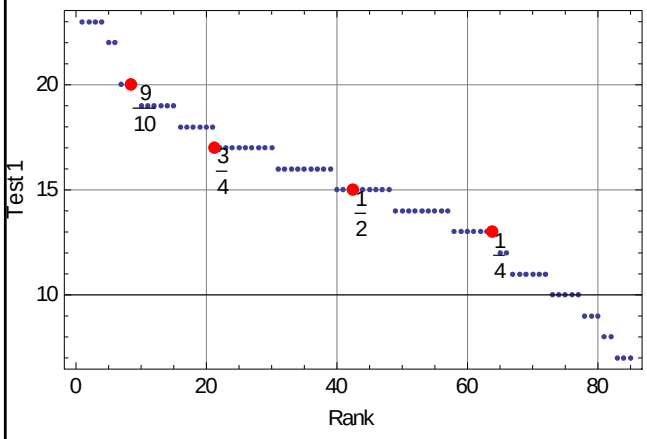
Model of Stars—5 Oct

- Outline
  - Test 1
    - Missouri Club on Fri
  - Questions on parallax
  - Hot-plate model of a star
  - Thermal radiation
  - Hertzsprung-Russell diagram
  - Missouri Club for Hwk 4

Test 1:
Average 15 (60%)

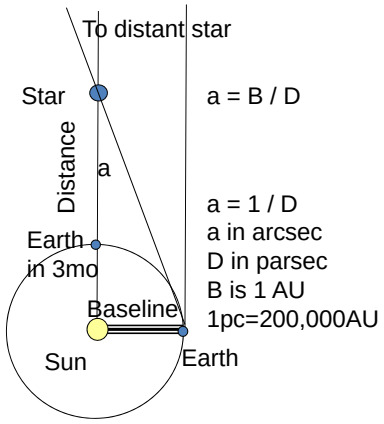


- If your score in in the top quartile (≥17), congratulations.
- If you got less than 10, you need to identify what went wrong.

Questions on parallax

1. The parallactic angle a changes over the year because
   A. the distance to the star changes.
   B. the length of the baseline changes.
   C. both A and B are important.

2. You want to measure the distance of a star at right ascension 0hr. When are two times of the year between which the change in the parallactic angle is the greatest?
   A. March & June
   B. March & Sept
   C. June & Sept
   D. June & Dec



Knowing distance

1. You do not know the distance to a binary star system. S1: You can measure the period. S2: You can measure the distance between the two stars.
   A. TT
   B. TF
   C. FT
   D. FF
2. Without knowing the distance, can you measure the mass of a binary star system? (K's 3rd law $P^2=R^3/M$)
   A. Yes
   B. No

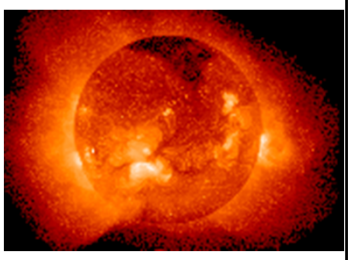
Knowing distance

1. You do not know the distance to a binary star system. S1: You can measure the period. S2: You can measure the distance between the two stars.
   A. TT
   B. TF
   C. FT
   D. FF
2. Without knowing the, can you measure the mass of a binary star system? (K's 3rd law $P^2=R^3/M$)
   A. Yes
   B. No

- Measuring distances enabled astronomers to study the physics of stars.

Model of a star

- How much light do I receive from a star?
- What parameters determine the amount of light from a star?



The sun in x-rays

The Hot-plate Model of a Star

- The surface of a star is made of tiles of hot plates.
- How does the energy from the hot-plate get to my hand?
  - Key observation: I can hold my hand much closer to the hot plate when it faces to the side, rather than up.

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

The Hot-plate Model of a Star

- How does the energy from the hot-plate get to my hand?
  - Key observation: I can hold my hand much closer to the hot plate when it faces to the side, rather than up.
- Energy moves from the hot plate to my hand by
  - movement of hot air
  - by radiation (mostly infrared light)
- Energy leaves stars primarily by radiation.
  - For the sun, the radiation is mostly ultraviolet light, visible light and infrared light.

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

The Hot-plate Model of a Star

- The surface of a star is made of tiles of hot plates.
- We concentrate on the radiation produced by the hot plate.

1. How can you make hot plates produce more energy per second? (The same question applies to a star: What (is) are way(s)s to make a star brighter or more luminous?) Make hot plates bigger. Make plates hotter.
   A. Make the plates hotter only.
   B. Make the plates bigger only.
   C. Make plates hotter & bigger.

- The luminosity of a star (the energy produced every second) depends on temperature and size.

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

The Hot-plate Model of a Star

- The luminosity of a star (the energy produced every second) depends on temperature and size.

1. What can I do to make the same hot-plate at the same setting burn my hand and not burn my hand? (Without modifying the sun, what can I do to make the sun brighter or fainter?)
   A. Move my hand closer or farther.
   B. It is not possible.

- The flux of a star (the energy received at the earth every second) depends on temperature, size, and distance to the star.

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

Thermal radiation (Blackbody Radiation)

- Any object that absorbs light also emits light.
- Do people emit light?
  - People emit light in the "thermal infrared" part of the spectrum.
  - Your eyes cannot see infrared radiation. 8000< λ<12000nm
  - You can see visible light
    - Blue 440nm
    - Green 550nm
    - Red 620nm
- A perfect absorber (perfectly black) emits a characteristic spectrum of light. (Called thermal or black-body radiation.)
  - Intensity depends only on
    - Temperature
    - Area
- A non-perfect absorber (grey body) with emissivity ε absorbs a fraction ε and reflects a fraction (1-ε).
  - Intensity is ε that of thermal radiation.

Picture taken with an infrared camera
ornitorinko.org:8080/.../portrait-bits.jpg