Wednesday, Oct. 8

Syllabus, class notes, and homeworks are at:
www.as.utexas.edu → courses → AST 301, Lacy

Reading for this week: chapter 8

The Wednesday help session is in GRG 424 at 5:00 (for the entire semester).

New Schedule

Aug 27:	Ch 1+App A	The Scale of the Cosmos
Sep 3:	Ch 2+3	The Sky, Cycles in the Sky
Sep 8:	Ch 4	The Origin of Modern Astronomy
Sep 15:	Ch 5	Telescopes
		Sep 19: Exam #1, Ch 1-5
Sep 22:	Ch 6	Starlight and Atoms
Sep 29:	Ch 7	The Sun
Oct 6:	Ch 8	The Family of Stars
Oct 13:	Ch 9	The Formation and Structure of Stars
Oct 20:	Ch 10	The Lives and Deaths of Stars
		Oct 24: Exam #2, Ch 6-10
Oct 27:	Ch 11	Neutron Stars and Black Holes
Nov 3:	Ch 12	The Milky Way Galaxy
Nov 10:	Ch 15	Cosmology
Nov 17:	Ch 16	The Origin of the Solar System
Nov 24:	Ch 17	The Terrestrial Planets
Dec 1:	Ch 18	The Outer Solar System
		Dec 5: Exam #3, Ch 11,12,15-19

Parallax and Distance

You judge the distance to objects (depth perception) from the fact that your two eyes view an object from two different locations, so have to look in different directions to look at an object.

The different direction to an object from different positions is called parallax.

Astronomers use the change in the direction to a star during a year, as the Earth orbits around the Sun, to judge the distance to the star.

Nearer stars have bigger parallaxes, or

parallax α 1 / distance

Stellar parallax

What is the parallax of a star with a distance of 2 pc?

A. ½ arcsecond

B. 2 arcseconds

C. 10^2 arcseconds

parallax α 1/distance, so if you increase the distance from 1 pc to 2 pc, the parallax decreases by a factor of 2, from 1 arcsecond to ½ arcsecond.

p = 1/d if you measure p in arcseconds and d in parsecs.

Another question

What is the distance to a star with a parallax of 0.1 arcseconds?

A. 0.1 pc

B. 1 pc

C. 10 pc

$$d(pc) = \frac{1}{p(arc\,\sec)} = \frac{1}{0.1} = \frac{1}{\left(\frac{1}{10}\right)} = 10$$

Apparent brightness

How bright a star appears is determined by how much light from that star enters your eye.

That is given by the product of the area of your pupil and the light power per unit area reaching you from the star.

We refer to the power per unit area as the flux or apparent brightness of the star.

Flux = Power / Area

You can calculate the flux of light from a star by dividing the power emitted by the star by the area it has spread over by the time it gets to you.

Because all areas vary as the square of the size of the object, the area the light has spread over varies as the square of the distance it has traveled.

Flux or Apparent Brightness

In traveling a distance of 1 pc from a star, light spreads out over some area.

When the light has traveled a distance of 2 pc from the star, it has spread out over 4 times as much area.

Since the flux of starlight is the power emitted divided by the area it has spread over, the flux is 4 times smaller

2 pc from the star than it is at 1 pc.

The formula is: Flux α 1 / distance^2

Or if the stars we are comparing have different luminosities (power emitted), the formula becomes:

Flux α Luminosity / distance^2

Quiz

Sirius and Vega are very similar stars.

They emit about the same amount of light power.

But Vega is about 3 times farther from us than Sirius is.

Which star appears brighter?

A. Sirius It is closer to us.

B. Vega

How many times brighter?

A. 3

B. 6

C. 9 Tripling the distance multiplies the area the light is spread over by $3^2 = 9$ times.

Combine parallax and brightness

Canopus has twice the parallax of Spica.

Since distance α 1 / parallax, Spica must be at twice the distance of Canopus. (The numbers are 100 pc and 200 pc, but you don't need to know that.)

The more distant star (Spica) appears fainter.

Since it is twice as distant as Canopus, it appears 4 times fainter, or ¼ as bright.

We could use the magnitude system to describe how much fainter Spica is than Canopus, but I prefer to talk about fluxes instead of magnitudes.