Monday, Nov. 3

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

Reading for this week: chapter 12

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

Topics for this week

Describe the Milky Way Galaxy

Describe the Standard Candle method of determining distances and how Cepheid variable stars are used as standard candles.

Describe how astronomers measure the distribution of mass in the Milky Way and what they find.

Explain why we might expect the spiral arms in the Milky Way to become more tightly wrapped and how density wave theory solves this problem.

Describe the various types of galaxies, both normal and active, and how they differ from the Milky Way

The Milky Way

A hazy band of light across the sky

Latin: Via Lactea, or Road of Milk

Astronomy: Galaxy

Galileo saw that it was made of many stars.

The stars form a band across the sky because they are in a flat distribution, like people in this room.

Could you determine the distribution of people in this room, and your position in that distribution from observations without leaving your seat?

Mapping out the Milky Way

William Herschel (early 1800s)

- Used two methods to map out the stars in the Milky Way
- star counting: more stars should be seen in the directions where the distribution extends farther
- star brightnesses: more distant stars should appear fainter (assuming all stars have the same luminosity)
- Concluded that we are near the center.

Why didn't Herschel use parallax to measure the distances to stars?

Doing the Math

The flux (or apparent brightness) of a star is the light power collected by a telescope divided by the collecting area of the telescope.

Flux depends on distance from the star because as the light goes away from the star it spreads out over a larger area.

$$F = \frac{L}{4\pi\, d^2}$$

If you can measure the flux, F, and can somehow figure out the luminosity, L, you can solve for the distance.

$$d = \sqrt{\frac{L}{4\pi\, F}}$$

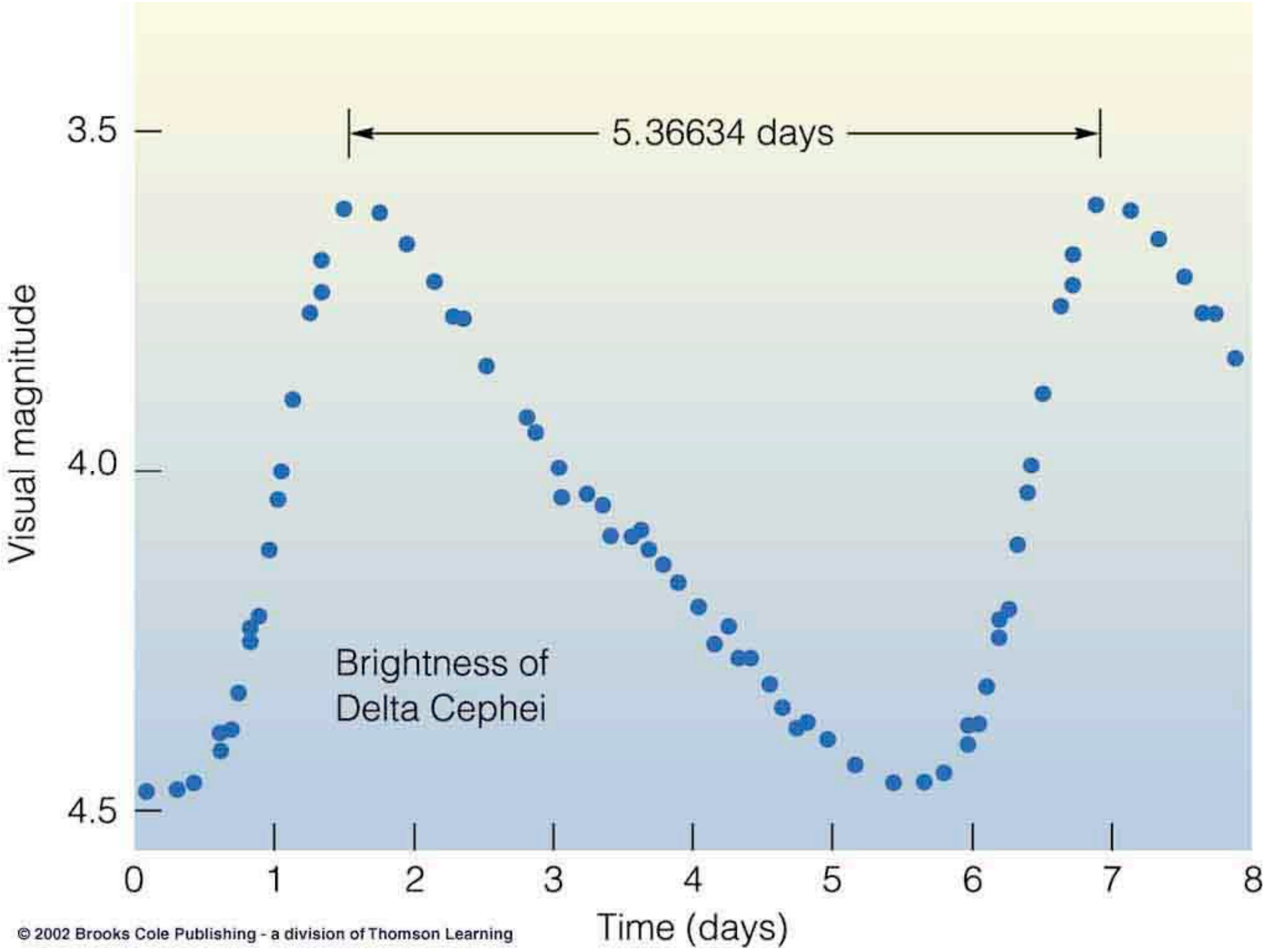
Mapping out the Milky Way

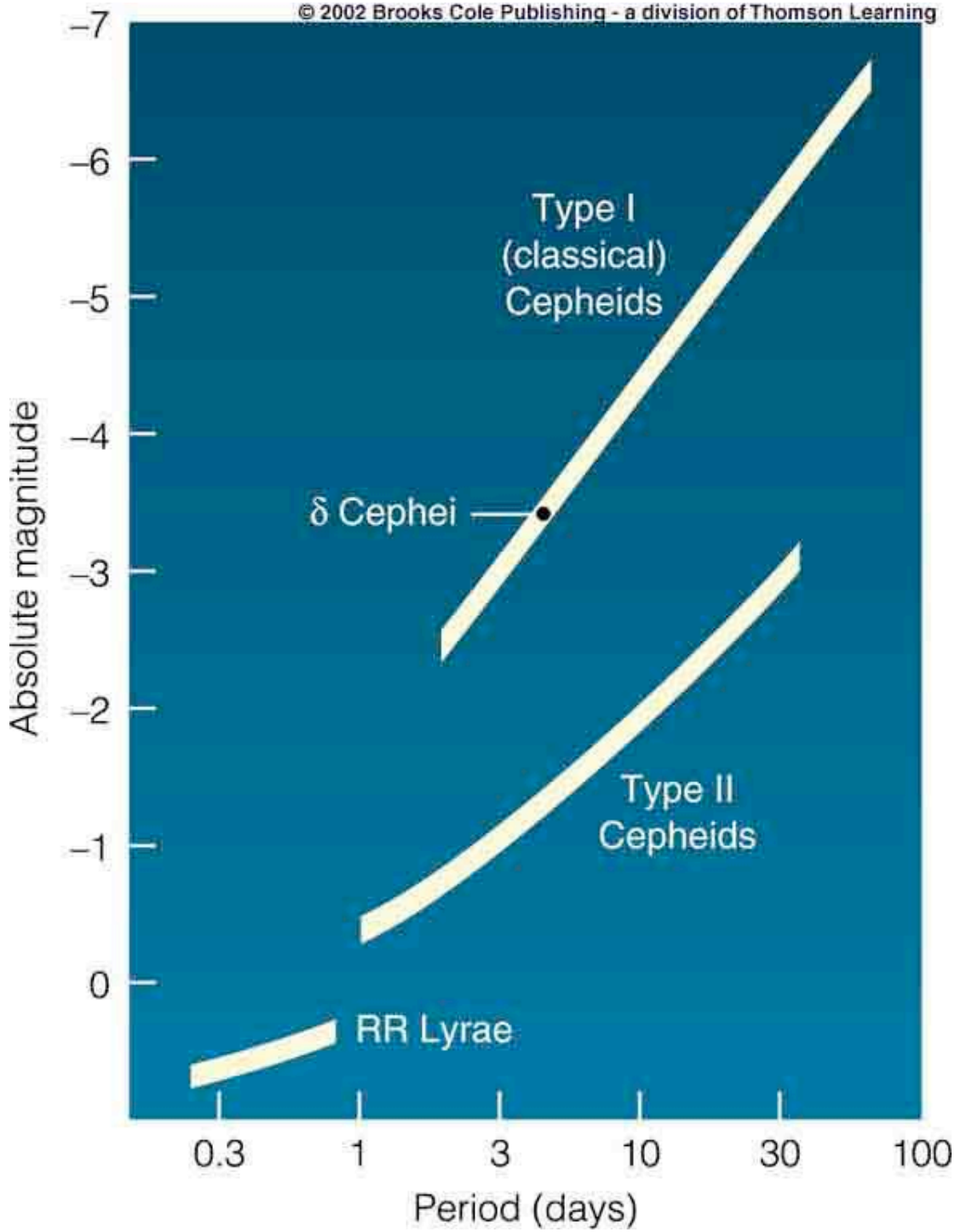
If we know how much light a star puts out (its luminosity) and we measure how bright it appears (its flux), we can calculate its distance.

This is referred to as the standard candle method of measuring the distance to a star.

Henrietta Leavitt (early 1900s)

- Studied variable stars in the Small Magellanic Cloud.
- Found that flux and period are proportional.
- Since all of her stars were about equally distant, this means that luminosity α period of variation.





Our place in the Milky Way

Harlow Shapley (about 1920)

- Determined the constant of proportionality between period of variation and luminosity, so the luminosity of a Cepheid variable star could be determined from its period.
- Then he could use Cepheid variables as standard candles.
- He mapped out the distribution of globular clusters.
- He found that they formed a distribution centered some distance from us in the direction of Sagittarius.
- He concluded that we are not at the center of the Milky Way and that the Milky Way is more than 10,000 ly across.