Friday, Nov. 7

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

Reading for next week: chapter 13.1, 13.2, 15

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

Spiral arms

The brightest stars, and most young stars, in spiral galaxies are arranged in a spiral pattern in their disks.

Could the stars in spiral arms be moving along the arms toward the centers of their galaxies?

Or could stars stay where they are in spiral arms as a spiral galaxy rotates?

The Doppler shifts of the stars give us information about their motions.

Doppler shifts show that stars in disks of spiral galaxies follow nearly circular orbits – they do not spiral in along the arms.

Rotation of spiral arms

Doppler shifts also show that stars in a spiral galaxy all orbit with about the same speed.

Would this allow stars to remain in spiral arms, and the galaxy to rotate like a pinwheel?

If a galaxy rotated like a pinwheel, how would the speeds of stars as they orbit depend on distance from the center of the galaxy?

Think it over and discuss the question with your neighbors.

Rotation of spiral arms

If spiral galaxies rotated like pinwheels, the stars near the ends of the arms would have to move faster than stars near the center of the galaxies, so they would all get around in the same time.

But that's not what we see.

Doppler shift show that all stars in a galaxy orbit around the center at about the same speed.

That means that the stars near the center take less time to get around their orbits than stars at the ends of the arms do.

The density wave explanation for spiral arms

Since stars near the center of a galaxy take less time to orbit the galaxy than stars farther out, the arms would wrap up if stars stayed in the spiral arms.

Stars near the center orbit faster than the pattern rotates.

Stars far from the center orbit slower than the pattern rotates.

Lin & Shu explained how stars could move through the spiral pattern.

If stars slow down as they move through the arms, they would spend more time there, so we would see more stars there at any one time.

In addition, shock waves cause new stars to form as molecular clouds move through spiral arms.

Types of Galaxies

Spiral Galaxies

- flat disk with spiral arm pattern with old and young stars
- bulge in center of disk
- halo around disk with old stars and little gas
- may have bars and rings

Elliptical Galaxies

- just a halo with old stars and little gas
- can be small or very large (in mass and size)

Irregular Galaxies

- disorganized – no flat disk or smooth halo
- generally small mass and size
- perhaps relatively recently formed or disrupted