Galaxies
Questions to be addressed

1. What are the key characteristics of the four basic types of galaxies?
2. What is the *Hubble Tuning Fork Scheme*?
3. Does the scheme really tell you a formation sequence of galaxies?
Galaxies seem to take one of four different appearances

Spirals
Galaxies seem to take one of four different appearances

SPIRALS
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SPIRALS
The tightness of a spiral galaxy’s arms is correlated to the size of its nuclear bulge.
Variety of Spiral Arms

Flocculent spirals  
(fleecy)  

Grand-design spirals  
(highly organized)
We easily see these spiral arms because they contain numerous bright O and B stars which illuminate dust in the arms.

However, stars in total seem to be evenly distributed throughout the disk.
Galaxies seem to take one of four different appearances

BARRED SPIRALS
Galaxies seem to take one of four different appearances.

BARRED SPIRALS
Bars of stars run through the nuclear bulges of barred spiral galaxies
Galaxies seem to take one of four different appearances.
Galaxies seem to take one of four different appearances

ELLIPticals
Discussion Question

Given their color, do you expect elliptical galaxies to have more or less new star formation than spirals? Why?

1) ellipticals have more new star formation
2) ellipticals have less new star formation
Elliptical galaxies display a variety of sizes and masses

- *Giant elliptical galaxies* can be 20 times larger than the Milky Way

- *Dwarf elliptical galaxies* are extremely common and can contain as few as a million stars
Galaxies seem to take one of four different appearances

IRREGULAR
Galaxies seem to take one of four different appearances

- Spirals
- Barred Spirals
- Ellipticals
- Irregulars
This classification scheme is known as the **Hubble Tuning Fork Scheme**.
Old stars (early type)
- Gas and dust poor
- Current star formation rate low

More young stars
- Gas richer

Diagram showing the evolution from elliptical galaxies (EO, E4, E7) to spiral galaxies (Sa, Sb, Sc), with SO or SBO lenticular galaxy and barred spirals (SBa, SBB, SBC).
M81 group
Billions of stars all tug on each other instead of just one planet tugged by the gravity of the Sun.
The ideas of galaxy formation

- Spiral galaxies form from the collapse of spinning gas cloud
- Elliptical galaxies form from the mergers of disk galaxies, or from clouds with low spinning
- Peculiar galaxies are formed through the interaction of galaxies
How two spirals collide, making tidal tails and an elliptical galaxy

Movie. Click to play.
Review Questions

1. What are the key characteristics of the four basic types of galaxies?
2. What is the *Hubble Tuning Fork Scheme*?
3. Does the scheme really tell you a formation sequence of galaxies?