



Name: _____

Background: How Are Galaxies Classified? What Do They Look Like?

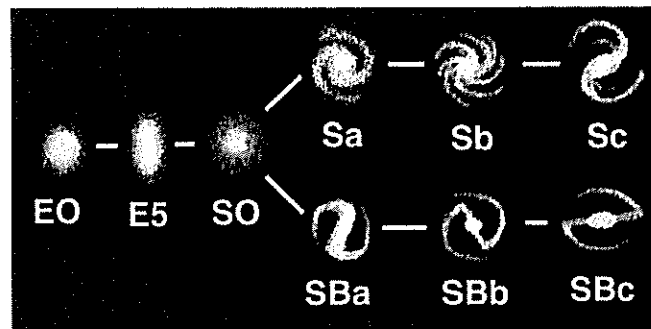
Edwin Hubble classified galaxies into four major types: **spiral**, **barred spiral**, **elliptical**, and **irregular**. Most galaxies are spirals, barred spirals, or ellipticals.

Spiral galaxies are made up of a flattened disk containing spiral (pinwheel-shaped) arms, a bulge at its center, and a halo. Spiral galaxies have a variety of shapes and are classified according to the size of the bulge and the tightness and appearance of the arms. The spiral arms, which wrap around the bulge, contain numerous young blue stars and lots of gas and dust. Stars in the bulge tend to be older and redder. Yellow stars like our Sun are found throughout the disk of a spiral galaxy. These galaxies rotate somewhat like a hurricane or a whirlpool.

Barred spiral galaxies are spirals that have a bar running across the center of the galaxy.

Elliptical galaxies do not have a disk or arms. Instead, they are characterized by a smooth, ball-shaped appearance. Ellipticals contain old stars, and possess little gas or dust. They are classified by the shape of the ball, which can range from round to oval (baseball-shaped to football-shaped). The smallest elliptical galaxies (called "dwarf ellipticals") are probably the most common type of galaxy in the nearby universe. In contrast to spirals, the stars in ellipticals do not revolve around the center in an organized way. The stars move on randomly oriented orbits within the galaxy like a swarm of bees.

Irregular galaxies are galaxies that are neither spiral nor elliptical. They tend to be smaller objects that are without definite shape and tend to have very hot newer stars mixed in with lots of gas and dust. These galaxies often have active regions of star formation. Sometimes the irregular shape of these galaxies results from interactions or collisions between galaxies. Observations such as the Hubble Deep Fields show that irregular galaxies were more common in the distant (early) universe.



How Do You Classify Galaxies Today?

Today we classify galaxies mainly into two major groups following Hubble's examples (*top of next page*). Elliptical galaxies range from round shapes (**E0**) to oval shapes (**E7**). Spiral galaxies have a pinwheel shape and are classified according to their bulge, as well as how tightly their arms are wrapped around the bulge. They range from (**Sa**), which has a large bulge and tight, smooth arms, to (**Sc**), which has a small bulge and loose, lumpy arms.

Barred spiral galaxies classified as (**SB**) are pinwheel-shaped and have a distinct "bar" of stars, dust and gas across their bulge. They range from an (**SBa**), which has a bar across its large bulge and tight, smooth arms, to an (**SBc**), which has a bar across its small bulge and loose, lumpy arms. Irregular galaxies have no definite shape but still contain new stars, gas, and dust. The chart below summarizes the properties of the main classes of galaxies.

	SPIRAL / BARRED SPIRAL (S, SB)	ELLIPTICAL (E)	IRREGULAR (Irr)
Shape and Structural Properties	Disks of stars, gas, and dust containing spiral arms that thicken to central bulge. Sa and SBa have largest bulge. SB galaxies have central bar.	No disk and no arms. Stars distributed evenly from near circular to oval (football).	No structure.
Stellar Content	Have both young and old stars. Halos consist of old stars only.	Contain mostly old stars.	Contain both young and old stars.
Gas and Dust	Disks contain gas and dust. Halos contain little gas or dust.	Little or no gas or dust.	A lot of gas and dust.
Star Formation	Stars form in arms.	No formation seen.	A lot of star formation.
Stellar Motion	Gas and stars rotate around the center of the galaxy.	Stars swarm like bees.	Stars and gas have irregular orbits.