Types of Galaxies
Types of Galaxies

• Edwin Hubble was the first to show that there are other galaxies besides our own.

• Hubble telescope estimated that there are 10,000 galaxies within its field of view.
Size of Hubble eXtreme Deep Field on the Sky

Digitized Sky Survey (ground-based image) for comparison
Definition of a Galaxy

• A galaxy is group of **stars, dust and gases** held together by **gravity**.

• Types are defined by the **shape** and the **size** of the galaxy.
There are three types of galaxies classified by scientists:

Spiral

Elliptical

Irregular
Spiral Galaxies

- These make up 66% of all galaxies.
- Have a nucleus of bright stars and flattened arms that curl around the nucleus.
- The spiral arms wind out from inner section.
- Some spiral galaxies are barred spiral galaxies— they have a bright bar of stars running through the center.
Spiral Galaxy
Spiral Galaxy
Barred Spiral Galaxy
Barred Spiral Galaxy
Our Solar System

- The **Milky Way** Galaxy contains our Solar System
- It is a **Barred Spiral** galaxy
  - Thin disk with a central bulge
  - Central bulge = older stars
  - Also, a massive black hole containing millions of times the mass of the Sun.
- The sun is one of the **hundreds of billions** of stars. 100 – 400 BILLION STARS in the Milky Way!
- Diameter of Milky Way is **100,000** light years across.
The Milky Way Galaxy

- We are located in the Orion Arm
- We rotate – but only once every 250 million years
- Our solar system is about 26,000 light years (ly) from the center of the galaxy
Elliptical Galaxies

- Large, **three-dimensional** ellipses
- Made up of **older** stars.
- No **spiral** arms.
- Do not rotate like a spiral galaxy.
More Elliptical Galaxies

This elliptical galaxy is 2.9 million light-years away from us in the constellation of Andromeda.

The Sombrero Galaxy - 28 million light years away.

This elliptical galaxy is in the Virgo cluster – 60 mil light years.
Irregular galaxies are smaller, less common.

About 3% of the brightest galaxies are irregular.

They have an irregular appearance.

There is no trace of circular or rotational motion.
Galaxy Clusters

Most **galaxies** are located in **groups** or clusters and are NOT spread evenly through the universe.

A typical **super-cluster** contains **thousands** of galaxies!

The **Milky Way** is part of a small group of **35 galaxies** called the “**Local Group**”.
The Local Group

• Andromeda galaxy and Milky Way galaxy are the largest galaxies in a cluster of 35 galaxies.
Colliding Galaxies
More Irregular Galaxies
Expanding Universe because of the Big Bang!

- Same number of raisins in picture B
- Now farther apart from each other.
Important Concepts…

1. The Universe is expanding
2. Galaxies are moving away from each other.
3. The Milky Way is a Barred Spiral Galaxy
4. There are up to 400 Billion stars in the Milky Way
5. The Milky Way is 100,000 Light Years across in diameter
6. The Milky Way is part of a group of 35 galaxies called the Local Group.
Draw the Milky Way
Label Earth and the Sun
The Universe

- The Universe is **expanding** (moving farther away from us)
- How do we know this?
  - By looking at the **colors** of the **stars** and **galaxies**
- **Electromagnetic Spectrum**
  - Red shift tells astronomers that if a star or galaxy is closer to the **Red** end of the spectrum, then it is moving **away** from Earth
  - If a star or galaxy is closer to the **Blue** end of the spectrum, then it is moving **toward** Earth.
The Doppler Effect

• Doppler Effect – an observed change in the frequency of a wave when the source or observer is constant.

• Waves are compressed in the direction of motion.
• When an object is moving **AWAY** from us, we call it a **RED SHIFT**
• When an object is moving **TOWARDS** us, we call it a **BLUE SHIFT**