The Origins and Organization of the Universe

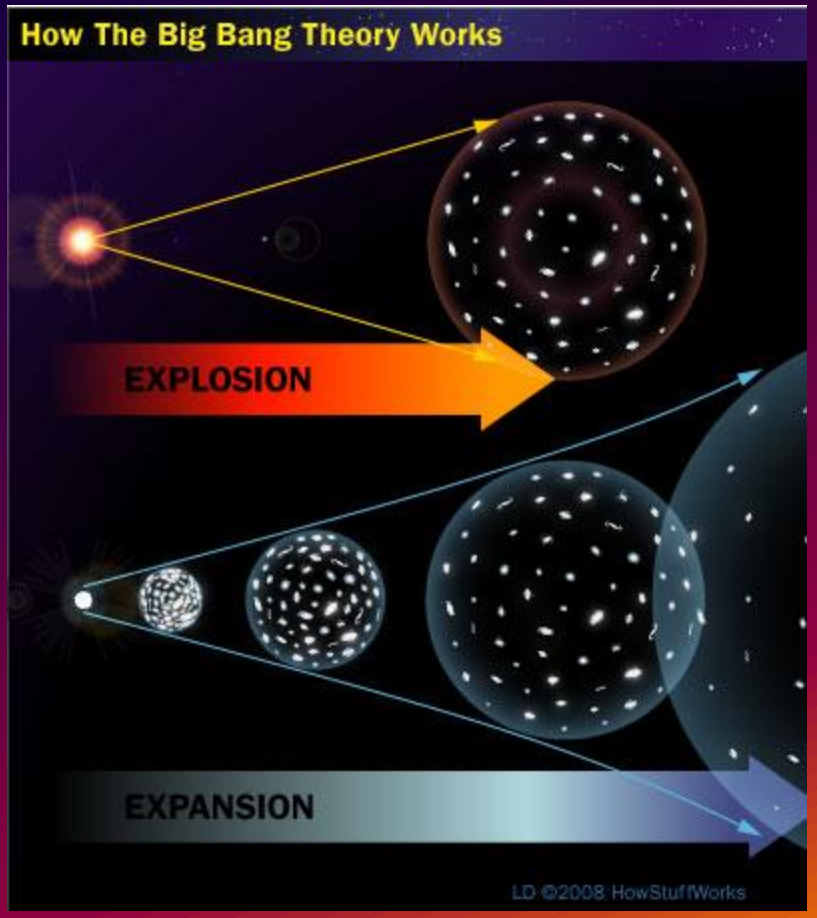
Astronomy

What is Astronomy?

- **Astronomy** – Study of universe (planets, stars, solar systems, galaxies, etc)
- It is **NOT Astrology!** (Study of human affairs tied to movements of astronomical bodies . . . horoscopes)

How did the universe begin?

- Current theory of how the universe began: Big Bang Theory—
  it wasn't big and there wasn't a bang!



http://science.howstuffworks.com/dictionary/astronomy-terms/big-bang-theory1.htm

Big Bang Theory

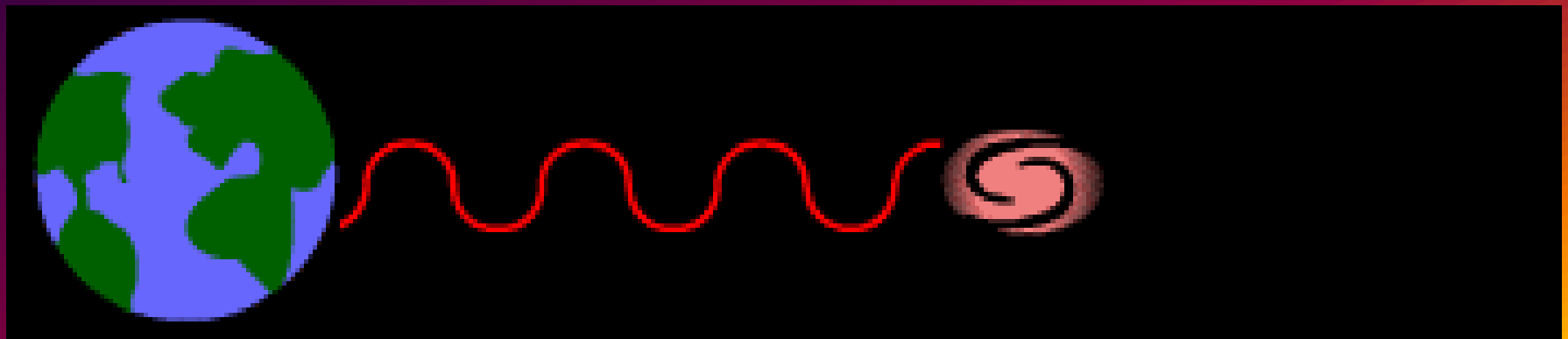
- "Big Bang" occurred about 13.7 billion years ago .
- This single instant began the entire universe (including time and space).
- Evidence:
  - Cosmic Background Radiation
  - Doppler Effect

Big Bang Evidence: Cosmic Background Radiation

- 1% of static noise (like between TV channels) is interference from microwave radiation.
  - Detected everywhere but no source . . .
  - Believed to be extra energy from the Big Bang (think of an oven that was recently turned off)

Big Bang Evidence: Doppler Effect

- Doppler Effect (on light)—a change in the color of light when its source moves toward or away from an observer.
  - Stars moving away appear redder.
  - Stars moving toward appear bluer.



Big Bang Evidence: Doppler Effect

- Distant stars have a red tinge . . .
  - The distant galaxies must be moving away from us.
  - The faster they move away, the redder they are.
- Therefore, our universe is expanding outward from the center.

How did the solar systems form?

- Nebular Theory—most widely accepted explanation of solar system formation
- Solar Systems formed after the Big Bang.
- All solar systems include:
  - Star(s)
  - Satellite planet(s) orbiting the star (aka sun)
- Our solar system is about 4.8 billion years old.

Forming Our Solar System

Nebular Theory

- After the Big Bang . . .
  1. Massive amounts of cosmic dust expanded outward.
  2. Particles of cosmic dust collided.
  3. Some particles stuck together, and their gravity pulled in more cosmic dust, creating nebulas (clusters of cosmic dust).
  4. Nebulas enlarge, spin, and flatten out to form solar systems.

What is the difference between the Solar System, Galaxy, and Universe?

- Basically, it's **SIZE** !
- We live on one small planet . . .
  One small part of our solar system . . .
  One of many solar systems in the Milky Way Galaxy . . .
  One of many galaxies in the universe

Where are we in the universe?: Start Local

We're on North America on planet Earth.

Where are we in the universe?: Off our planet

Earth is one of 4 small, solid Terrestrial planets: Mercury, Venus, Earth, and Mars.

There are also 4 large, gaseous Jovian planets: Jupiter, Saturn, Uranus, and Neptune.

Where are we in the universe?: Off our planet

Earth is the 3rd planet in this **heliocentric** solar system (planets orbit the sun).

Where are we in the universe?: Outside our solar system

Our solar system is located in the Milky Way Galaxy:
within one arm of this clockwise-spinning, spiral-shaped galaxy.