Unit 1: History of the Universe

Lecture 1: Big Bang Theory

Cosmology

- Study of the universe
  - It’s nature, origin, and evolution

Big Bang Theory

- Humans have always gazed towards the stars and wondered how the universe developed into what it is today.
- One of the most famous and widely accepted models for the universe’s development is the big bang theory.

Origin of Big Bang Theory

Energy
Relativity
Matter
Density
Acceleration

Big Bang Theory

True or False?

- Big Bang Theory describes the origin of the universe
- The Big Bang was an explosion
**Big Bang Theory**

- Describes an *expansion* of space itself while gravity holds matter in check.

**Outward Expansion**

- The Universe has two opposing forces
  - Force of Gravity
  - Momentum of expansion

**Rate of expansion?**

- Rate = speed at which something moves = distance/time
- When rate is known:
  - Can calculate time since expansion started
  - Which leads to age of the universe

**Hubble (Expansion) Constant**

- Also known as H
- If known, then the age of the universe can be determined

**Age of the Universe**

*Best value of H by Hubble Space Telescope data + Data on the cosmic background radiation =*

Age of the Universe = 13.7 billion years

**An Accidental Discovery**

- 1965
- Scientists heard constant background noise in their radio antenna
- Noise = weak radiation

*Cosmic Background Radiation*
Cosmic Background Radiation

- Came from all directions in space and matched with another emitting object having a temp. of 2.725 K (-270°C)
- So the radiation is leftover from the Big Bang...

Map of CBR

Cosmic Pie

Outcomes of the Universe

- Open
  - Expansion never stops
  - Gravity can't stop it
- Closed
  - Expansion stops
  - Starts to contract
- Flat
  - Expansion slows to a halt in an infinite amount of time