

# The Big Bang Model of the Universe

# What are the “Space Sciences”?

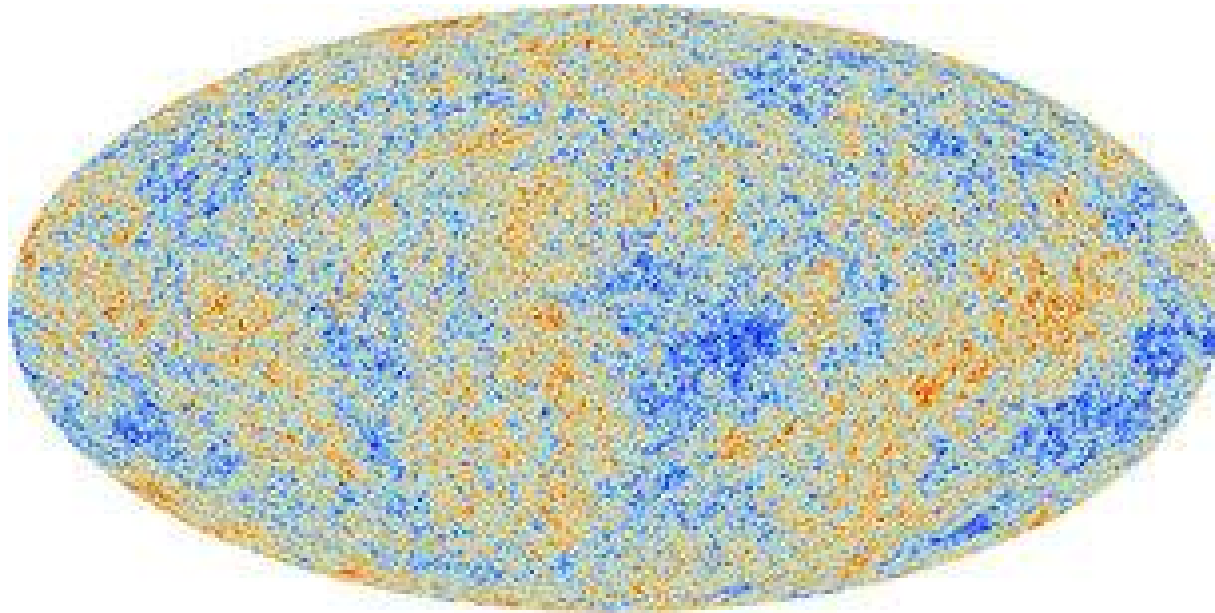
- **Astronomy**
  - The study of celestial objects (stars, moons, planets, etc.), space, and the physical universe
- **Cosmology**
  - The study of the universe as a whole
  - Study things such as Dark Matter, Dark Energy, and the possibility of a Multiverse
- **Astrophysics**
  - The science concerned with the application of Physics to Astronomical observations
- The lines between these three fields tend to blur quite a bit

# What Was The Big Bang?

- The widely accepted theory of how our universe came to be
- States that our entire universe was compacted into a miniscule ball with infinite density and intense heat (called a **Singularity**) which started expanding into the universe we know now 13.8 billion years ago
- Not the only modern model of the universe
  - Steady State Theory
  - Oscillating Universe Theory

# What Evidence Supports The Big Bang?

- **Observational Verification of Expansion**
  - Edwin Hubble and Vesto Slipher determined that most galaxies are moving away from us and their velocity is proportionate to their distance (galaxies that are farther have higher velocities and vice versa)
  - Commonly referred to as Hubble Expansion; The Hubble Constant is equal to the proportionality of a galaxy's distance to its velocity
  - No stars older than 13.8 billion years
- **Abundance of Elements**
  - Big Bang Nucleosynthesis (like a star!)
- **Cosmic Microwave Background (CMB)**
  - First predicted by Ralph Alpherin in 1948 and then observed by Arno Penzias and Robert Wilson in 1965



- 2.726 degrees Kelvin
- 13.7 billion years old
- Leftover radiation from the Big Bang (needed for nucleosynthesis)

# Wait... So Is The Universe Gonna Stop Expanding?

- **Big Crunch**
  - States that the Universe will reach a certain size and then collapse in on itself (mass density is greater than critical density)
- **Heat Death**
  - States that expansion will slow down but never stop, inhibiting star and galaxy formation until everything dies and the Universe will be unable to create organized energy (mass density equal to or greater than critical density)
- **Big Rip**
  - States that eventually continued expansion will “rip” galaxies apart

# Sources and Stuff

- <http://www.universetoday.com/54756/what-is-the-big-bang-theory/>
- <http://astronomy.swin.edu.au/~gmackie/BigBang/universe.htm>
- [http://map.gsfc.nasa.gov/universe/bb\\_tests\\_cmb.html](http://map.gsfc.nasa.gov/universe/bb_tests_cmb.html)
- [http://www.esa.int/Our\\_Activities/Space\\_Science/Planck/Planck\\_and\\_the\\_cosmic\\_microwave\\_background](http://www.esa.int/Our_Activities/Space_Science/Planck/Planck_and_the_cosmic_microwave_background)