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# Birth of the Universe

evidence, on-going experiments, fate

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### Learning Goals for this Lecture

- Describe the empirical data (the observations) that led to the assumption that there was a "Big Bang."
- Outline the events that led to the discovery of the cosmic microwave background radiation.
- Explain why it is that we will never be able to use "look-back time" to witness the Big Bang.
- Summarize the main points in the current theory of the birth of the Universe and the supporting observational evidence:
  - Inflationary period
  - Particle era
- Explain what experiments the Large Hadron Collider is conducting that will simulate the conditions at the Big Bang.

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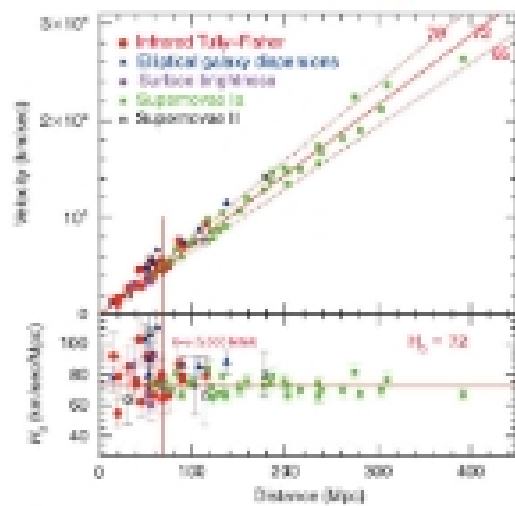
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The Universe is Expanding -  $v = H_0 d$




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Discovery of cosmic microwave background radiation




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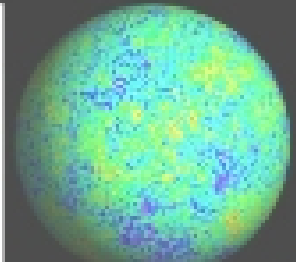
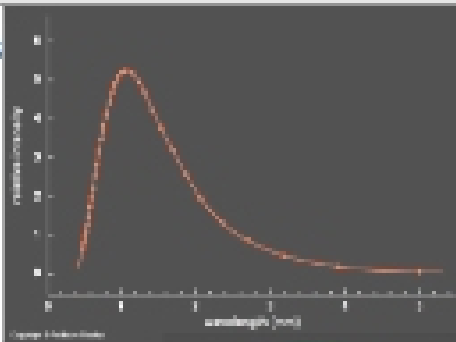
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Observational Foundations

Consensus for this model brought about by the presence of empirical data

- Recession of distant galaxies
- Evolution of galaxies - look back time
- Weak radio static that fills the Universe: Heat of the birth
- A dark night sky




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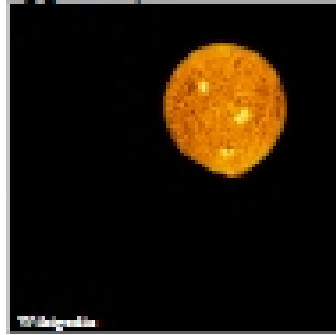
**Olber's Paradox: Why isn't the night sky uniformly bright?**

Why do we expect the night sky to appear uniformly bright in a Steady State Universe? This theory is based on three assumptions:

Universe is

- 1. Uniform  
(will observe no differences among galaxies)
- 2. not expanding  
(will observe no redshifts)
- 3. of infinite proportions  
(in both time and space)

In ALL directions, our eyes would fall upon a star. If not a star, then a galaxy.  
Solution: Universe had a beginning. Light from distant galaxies hasn't reached us yet.  
Stars die.



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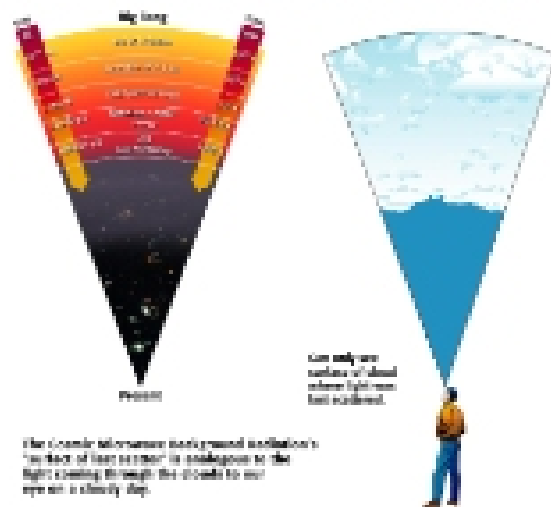
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**The CMBR is a curtain that prevents our seeing farther**

(Explain why it is that we will never be able to see "back-back time" to witness the Big Bang.)



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