

Four Problems in the Big-bang theory

- Horizon Problem
 - Why do galaxies look alike?
 - Why is the CMB so isotropic?
- Flatness Problem
 - Why is the geometry of the observable universe so flat?
 - In fact, the Friedmann equation tells us that it is very unnatural to have a flat universe.
- Monopole Problem
 - Why is there no monopole in the universe?
 - The grand unified theories tell us that there should be many monopoles.
- The origin of galaxies
 - Where did the irregularities come from?

- Accelerated expansion in the early universe solves all the problems.

- Alan Guth, 1981

- What causes inflation?

- Dark energy in the early universe
 - C.f., dark energy at late times

- Horizon Problem Solved

- Observable universe is only a tiny fraction of inflated patch

- Flatness Problem Solved

- The pre-existing curvature is stretched out by inflation

- Monopole Problem Solved

- The abundance is diluted to negligible amount

- The origin of galaxies

- Quantum mechanical fluctuations → Next topic



Inflation