Dark energy models

Rafael Santos - 51140

Primordial Universe

Professor: António Silva

Introduction

- Einstein's cosmological constant
- Hubble proves that the universe is expanding
- Riess et. al.(1998) Perlmutter et. al. (1999) discovered that the universe is in an accelerated expansion.

Observational evidences

- Type Ia Supernova
- Cosmic Microwave background
- Baryonic Acoustic Oscillations

Observational evidence

Type Ia supernova

- Standard candles
- Luminosity distance

Observational evidences

Cosmic Microwave Background

- Acoustic peaks
- Baryon decoupling
- Galaxy clusters

Observational evidences

Baryon Acoustic Oscilations

- BAO signal
- Large Scale Structure

Theoretical Models of dark energy

- Cosmological constant
- Quintessence
- K-essence
- Coupled dark energy

Theoretical Models of dark energy

Cosmological constant

- Dark energy would be the vacuum energy
- perfect fit to observations
- Fine-tuning problem
- Coincidence problem

Theoretical Models of dark energy

Quintessence

- Dark energy is a scalar field with a time varying equation of state.
- Tracker solution
- Does not solve the problems associated with the cosmological constant

Theoretical Models of dark energy

K-essence

- Non canonical kinetic energy term
- Solves the fine tuning and the coincidence problems
- Does not explain the smallness of the vacuum energy

Theoretical Models of dark energy

Coupled Dark energy

- Dark energy and Dark matter are connected
- Coupling type 1
- Coupling type 2
- Chameleon mechanism

Conclusion

- Universe is expanding
- Data show that the universe contains 73% dark energy
- The K essence is model is one of the most self consistent