Confronting alternative ΛCDM models against cosmological observations

Instructor

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Objectives

1.1 Learn about the ΛCDM Model

1.1.1 Get introduced to the basic General Relativity in an abstract sense to know the defaults that produce the dark matter and dark energy theories

1.1.2 Get introduced to the Friedmann Equation and the various densities from Amendola's book (second Chapter)

1.1.3 Deriving Friedmann Equations and getting familiar with the various formulas in the context of dark matter and dark energy

1.2 The statistical construction for the problem

1.2.1 Learn about Maximum Likelihood Estimation by setting up the likelihood for the normal distribution

1.2.2 Get introduced to Bayesian statistics in the context of maximizing the likelihood

1.2.3 Getting introduced to the method of numerically finding the best-fit parameter through the Markov Chain Monte Carlo using the Metropolis-Hastings algorithm

1.3 Programming technicalities with Python

1.3.1 Reading a text file and making some modifications on the rows and columns

1.3.2 Learning about the implementation of the various formulas using different libraries and making plots to visualize and simulate the process

1.4 Things to be learned

1.4.1 Going through the General Relativity Analysis rigorously in a separate course

1.4.2 Understanding the pure mathematical ideas behind the MCMC analysis and better understanding the implementation and using it in various scenarios