

# Axions in Cosmology

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## Abstract

*First Part: Lorenzo Ubaldi:* I first introduce the axion as a solution to the strong CP problem, and then explain how such a light boson would be produced via the misalignment mechanism in the early universe and contribute to the energy density of cold dark matter. String theoretic or supersymmetric frameworks further predict the existence of moduli, that can decay into relativistic axions. The latter would contribute to the cosmological relativistic degrees of freedom, the so-called dark radiation. I discuss briefly the bounds on this scenario from cosmic microwave background measurements.

*Second Part: Francisco Pedro:* In this talk I will discuss some aspects of axions in the early universe, with particular emphasis on the various models of inflationary cosmology based on axionic fields. I will discuss natural inflation, aligned inflation in its various guises, N-flation and monodromy models. Throughout the talk I will make the connection between the field theoretic mechanisms for axion inflation and their embedding into string compactifications. I will review the Weak Gravity Conjecture and its potential impact on axion inflation in string theory.

## References

- Strong CP and axion dark matter: Kolb and Turner, “The early universe” (chapter 10), [1301.1123](#)
- Axion dark radiation:
  - [1208.3562v2](#)
  - [1107.4319](#)
  - [1212.4160](#)
- Natural inflation: Phys.Rev.Lett. 65 (1990) 3233-3236
- N-flation:
  - [hep-th/0507205](#)
  - [hep-th/0512102](#)
  - [1401.2579](#)
- Aligned inflation:
  - [hep-ph/0409138](#)

- 0912.1341
- 1404.7773
- 1404.6988
- 1404.7496

- Monodromy:

- 0803.3085
- 0808.0706
- 0811.1989