Universo Primordial
2024-2025 (1º Semestre)

Mestrado em Física e Astrofísica

Universo Primordial / Primordial Universe

Regent:

Prof. António da Silva (ajosilva@ciencias.ul.pt, gab. 8.1.42):

Teórica: T11

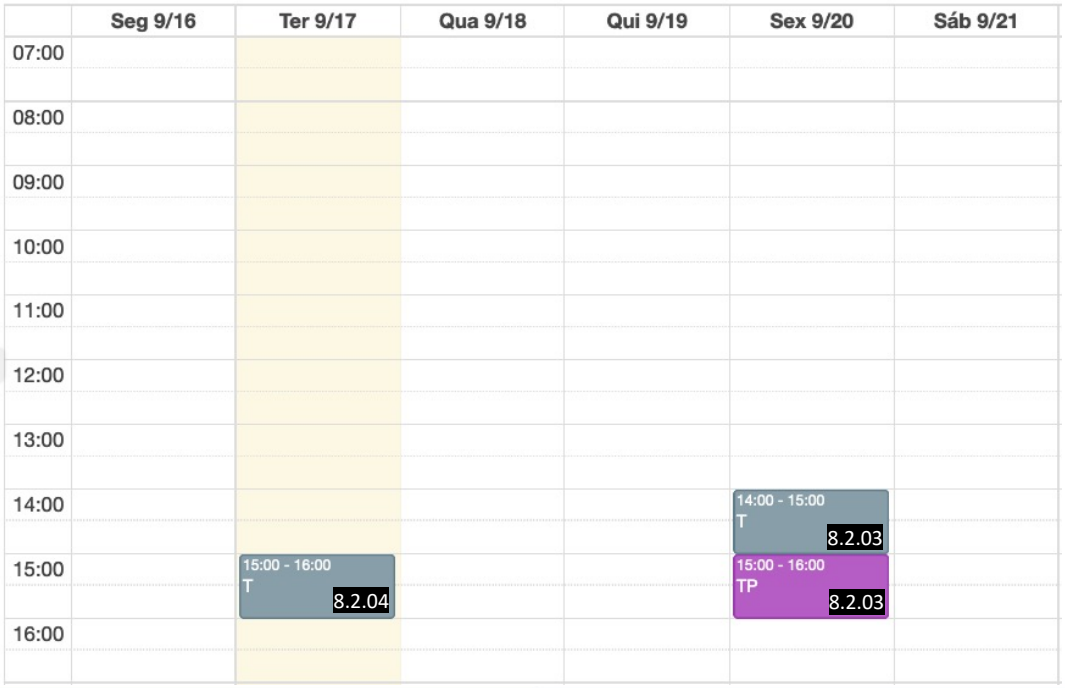
Tutorial: TP11

UC information and contents:

Fenix: https://fenix.ciencias.ulisboa.pt/courses/up-2254879305242943

Universo Primitivo / Primordial Universe

HORÁRIO



Universo Primordial / Primordial Universe

OBJECTIVES

The study of the physics of the Primordial Universe in the context of the **Standard Model of Cosmology** – the **Hot Big-Bang theory**. The students are presented with the key concepts of the model and are expected to learn how to apply these concepts to solve problems related with the physics of the Primordial Universe, Cosmology and Astroparticle physics.

TP lectures are primarily used to support **student's autonomous study** but may also be used to provide extended insights of topics discussed during the T lectures. In the TPs students are expected to interact with the lecturer and colleagues to find ways of solving the proposed exercises and discuss subjects and questions that may arise in their individual studies of the course's topics.

Universo Primordial / Primordial Universe

PROGRAMA

1. The observed Universe
2. The Standard Model of Cosmology
3. Thermodynamics in an expanding Universe
4. Neutrino Decoupling
5. Dark Matter and WIMP relics
6. Big-Bang Nucleosynthesis
7. Recombination and CMB decoupling
8. The theory of Inflation
9. Perturbation theory during inflation
10. Evolution of perturbations after inflation: CMB and matter power spectrum observables
11. Baryogenesis

Universo Primitivo / Primordial Universe

BIBLIOGRAPHY

Main:

- **Daniel Boumann, Cosmology, Cambridge University Press, 2022.**
- **Edward Kolb and Michael Turner -'The early universe' - Addison Wesley 1990**.
- Patrick Peter and Jean-Philippe Uzan, "Primordial Cosmology", Oxford U. Press, 2009;
- Scott Dodelson - 'Modern Cosmology' - Academic Press, Elsevier, 2003;

Other:

- **Daniel Boumann, Cosmology, Part III Mathematical Tripos, Course Lectures**
- A Liddle and D. Lyth - 'Cosmological inflation and large-scale structure' - CUP 2000
- Barbara Ryden - "Introduction to Cosmology" - Addison Wesley, 2003
- Inflation and the theory of Cosmological Perturbations, A. Riotto, Lectures on Astroparticle , Physics and Cosmology

EVALUATION

Final grades will be computed as a weighted score of the grades obtained by the student in the following proposed activities:

- **Exercise sheets** (40%);
- Individual research work (50%) on a topic (chosen from a proposed list or an accepted topic proposed by the student). This research work has two components:
  - ***Written article*** (25%): to be submitted electronically (using a latex based platform such as Overleaf – Word based docs are to be avoided as much as possible) for the book of "proceedings" of the Primordial Universe 2021/2022 course)
  - ***Presentation*** (25%): Maximum duration is 30 minutes.
- "**Continuous assessment**" (10 %): e.g., participation in the discussion of topics in the theoretical and practical lectures, quizzes.