

**UNIVERSO PRIMITIVO**  
**Mestrado em Física Astronomia**  
**2023-2024**

**Main subjects list**

The list below is a selection of “general subjects” for the student’s investigation project. Students may choose to review one of these main subjects or focus on a specific topic within a main subject. Note that the maximum number of pages is always limited to 14 pages (including images, tables and references). Students may propose to write about a topic not included in the list below (for approval by the U.C. responsible). All students need to identify their topic of investigation. Please send an email to [ajosilva@fc.ul.pt](mailto:ajosilva@fc.ul.pt) with the proposed title of your research essay, by the 8<sup>th</sup> of January 2023.

- Baryogenesis
- Big Bang Nucleosynthesis
- Boltzmann Equations (general formalism, for radiation, CDM, baryons, etc)
- Cosmic Microwave Background radiation
- Cosmic Neutrino Background
- Dark Energy theory
- Dark Matter (model candidates, observational evidence, detection, etc)
- Density perturbations from inflation
- Electroweak phase transition and the Higgs mechanism
- Grand Unification Theory phase transition
- Gravitational waves from inflation
- General Relativity perturbation theory
- Inflation: models and predictions
- Inflation and Reheating
- Inflation: Quantum Fluctuations in the de Sitter space
- Modified Gravity theories
- Quantum Cosmology: towards the Planck time
- QCD phase transition: the “origin” of protons and neutrons
- Primordial Non-Gaussianities
- Primordial Black Holes
- Recombination and Decoupling
- Structure Formation: Evolution of perturbations after inflation

