PLASMA PHYSICS

Duration: **20 h**
Dates: **half May / half June**
Total credits: **3**

The Lectures are devoted to describe basic concepts of Plasma Physics, both in the fluid representation and in kinetic theory. After discussing the magneto-hydrodynamical theory and some of its applications, it is introduced the concept of plasma as a dielectric medium and the Landau damping is analyzed in some detail. Finally, two topics close to the current research in Plasma Physics are faced, i.e. the quasi-linear model and the beam-plasma instability.

Arguments

- Plasma fundamental quantities
- Magneto-hydrodynamics as fluid approach
- Equilibrium and plasma waves
- Boltzman equation for ions and electrons
- Plasma as dielectric medium
- Landau damping
- Quasi-linear model
- Beam-plasma interaction

PRIMORDIAL COSMOLOGY

Duration: **20 h**
Dates: **half April / half May**
Total credits: **3**

These Lectures face basic themes in Theoretical Cosmology, both on a classical and a quantum level. First, the morphology of the early Universe is analyzed in the framework of the Standard Cosmological Model, discussing all the fundamental phases of its thermal history. Then, a consistent picture of the Inflationary Scenario is provided, including the generation of density inhomogeneities. The second part of the Course is dedicated to trace the most important open questions in Early Cosmology, up to the possibility of a quantum treatment of the primordial Universe dynamics. After the characterization of the Mini-superspace in terms of the homogeneous Bianchi Universe, the canonical quantum procedure is implemented on the cosmological dynamics and the concept of Bouncing Cosmology is outlined.

Arguments

- Einsteinian physics
- Isotropic Universe geometry and dynamics
- Thermal history
- Standard Model paradoxes
- Inflation paradigm
- Homogeneous cosmological models
- Hamiltonian formulation of the Bianchi Universes
- Chaotic cosmologies
- Canonical quantum cosmology
- Big-Bounce cosmology