

Title: Cosmology:

Lecturers: N. Bartolo (8 hours) & S. Matarrese (16 hours)

Contents:

* Standard cosmology: Fundamentals of General Relativity for cosmology; Cosmological models; Friedmann-Robertson-Walker metric (2 hrs.)

* Thermodynamics of the Universe: elements of kinetic theory in the expanding Universe; evolution of the entropy and of the main thermodynamical quantities; photon and neutrino decoupling; relic particles (4 hrs.)

* Inflation: problems of the standard cosmological model; kinematics and dynamics of inflation models; generation of primordial perturbations and their effects on the Cosmic Microwave Background. (6 hrs.)

* Gravitational Instability: linear evolution of perturbations; Jeans scale; free-streaming, models with dark matter and baryons; cold dark matter, hot dark matter, etc.. (5 hrs.)

* Statistics of cosmological perturbations: power-spectrum; transfer function; filter functions; higher-order statistics (2 hrs.)

* Non-linear evolution of perturbations: N-body techniques; spherical model; Ze'dovich approximation and adhesion theory. (3 hrs.)

* Dark Energy: observational aspects; models. (2 hrs.)

Bibliography:

- P. Coles and F. Lucchin, 2001. *Cosmology: the Origin and Evolution of Cosmic Structure*, Wiley.
- S. Dodelson, 2003. *Modern Cosmology*, Academic Press.
- E.W. Kolb and M.S. Turner, 1990. *The Early Universe*, Addison-Wesley.
- A.R. Liddle and D.H. Lyth, 2000. *Cosmological Inflation and Large-Scale Structure*, Cambridge University Press.
- P.J.E. Peebles, 1993. *Principles of Physical Cosmology*, Princeton Univ. Press.
- N. Vittorio, 2018. *Cosmology*, CRC Press, Taylor & Francis Group.
- S. Weinberg 2008, *Cosmology*, Oxford Univ. Press.