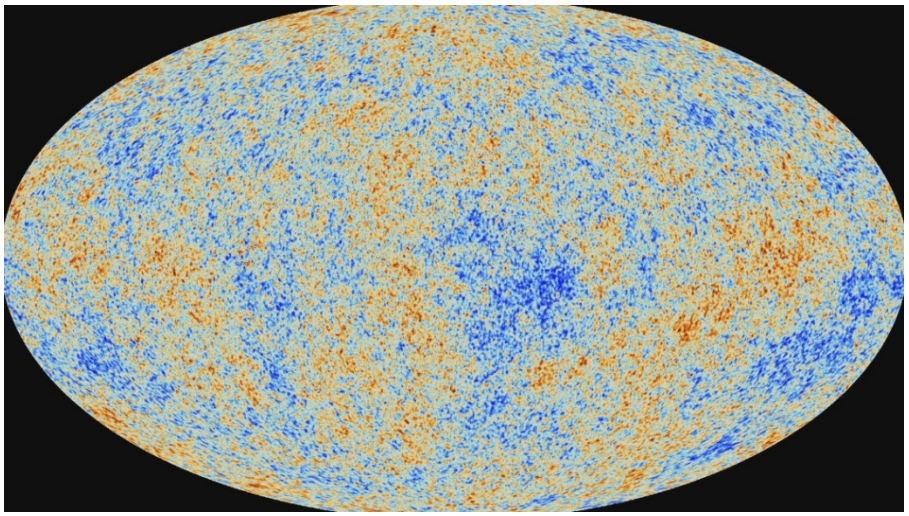
ADVANCED COSMOLOGY

Màster:

ASTROFÍSICA FÍSICA DE PARTÍCULES I COSMOLOGIA

Universitat de Barcelona

Jordi Miralda and Cristiano Germani



PURPOSE

Introduce modern cosmology at an advanced enough level to prepare you for research.

1. Understand the basic elements of the expanding Universe, the Big Bang, and the Friedman-Robertson-Walker space-time metric.
2. Observational basis and theoretical framework of large-scale structure, dark matter and dark energy.
3. Origin of the Cosmic Microwave Background and the light element abundances.
4. Early Universe physics, phase transitions in cosmology.
5. Problems that lead to the inflationary paradigm, main features of cosmic inflation and origin of fluctuations.

HOURS

The course is delivered over 13 weeks,
4 days per week, in lectures of one hour.
First part (J. Miralda): Sep 13th – Oct 26th. Exam: Oct. 27th.
Second part (C. Germani) starts Nov 2nd, exam Dec. 21st.

EVALUATION

50 % by written exams (two, one each part)
50 % by assigned exercises

RECOMMENDED BACKGROUND

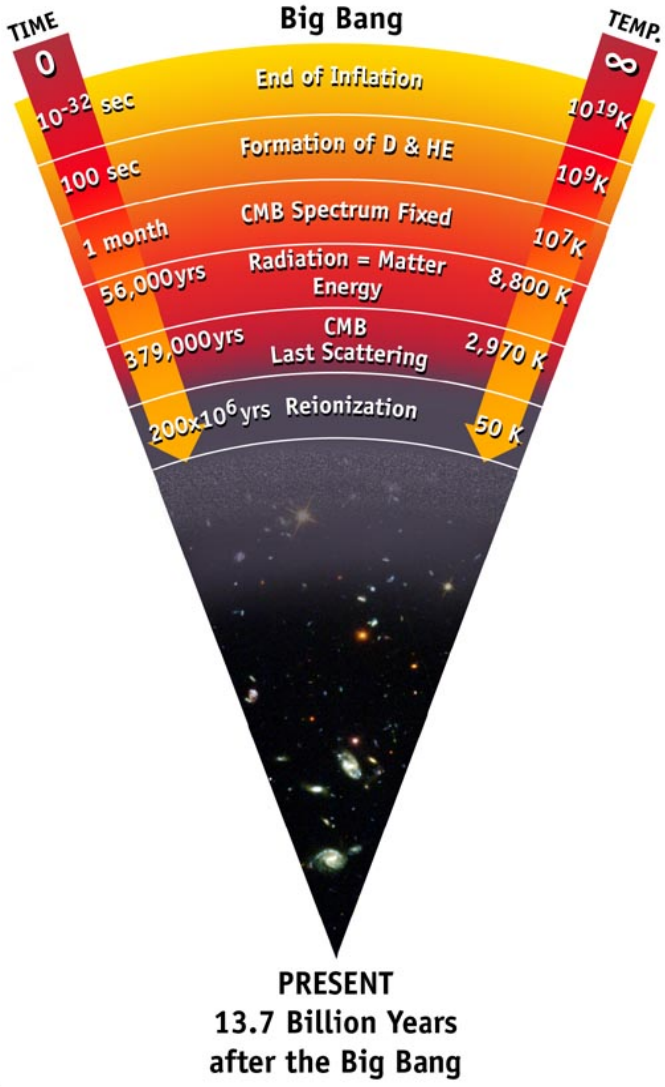
Essential background in basic physics:

Classical Mechanics, Special Relativity
Electromagnetism,
Thermodynamics, Statistical Mechanics

Some working knowledge at undergraduate level of:

Astrophysics and Cosmology
General Relativity
Quantum Mechanics

FIRST PART



1. The expansion of the Universe

Spacetime geometry, expansion, Friedman equations, radiation, matter and cosmological constant

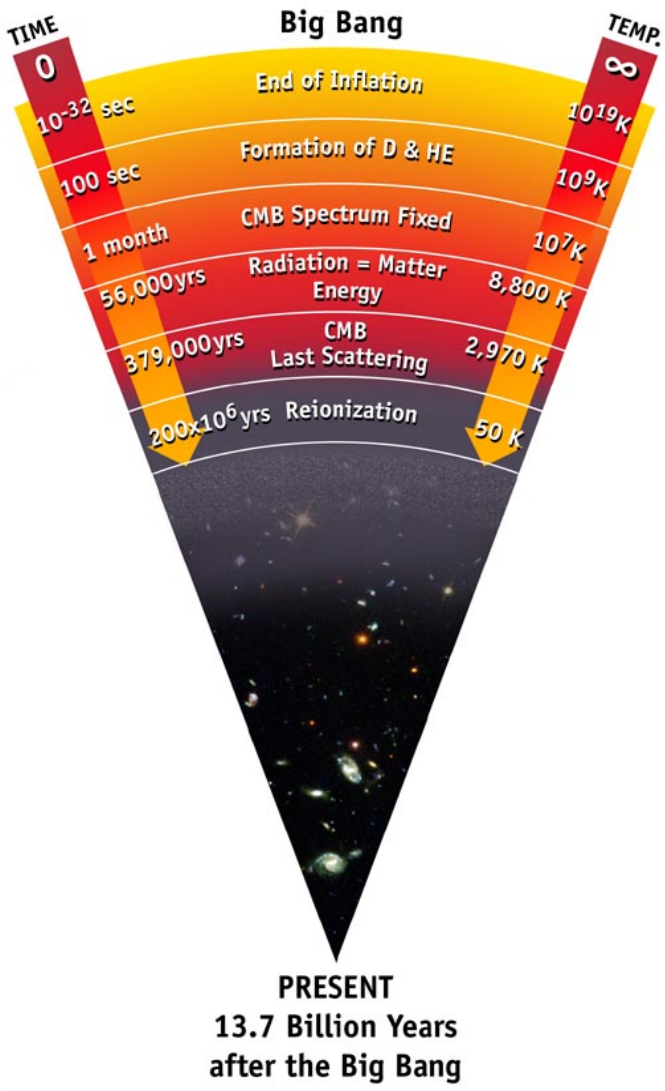
2. Observational cosmology and cosmic budget

Ages, cosmic abundances, baryon content, dark matter, dark energy, standard Lambda CDM model

3. Cosmic microwave background

Fluctuations and power spectrum, dipole anisotropies, acoustic peaks, large-scale structure

SECOND PART



4. Thermal history, nucleo-synthesis and recombination

Neutrino decoupling, neutron freeze-out, deuterium bottleneck, helium, recombination

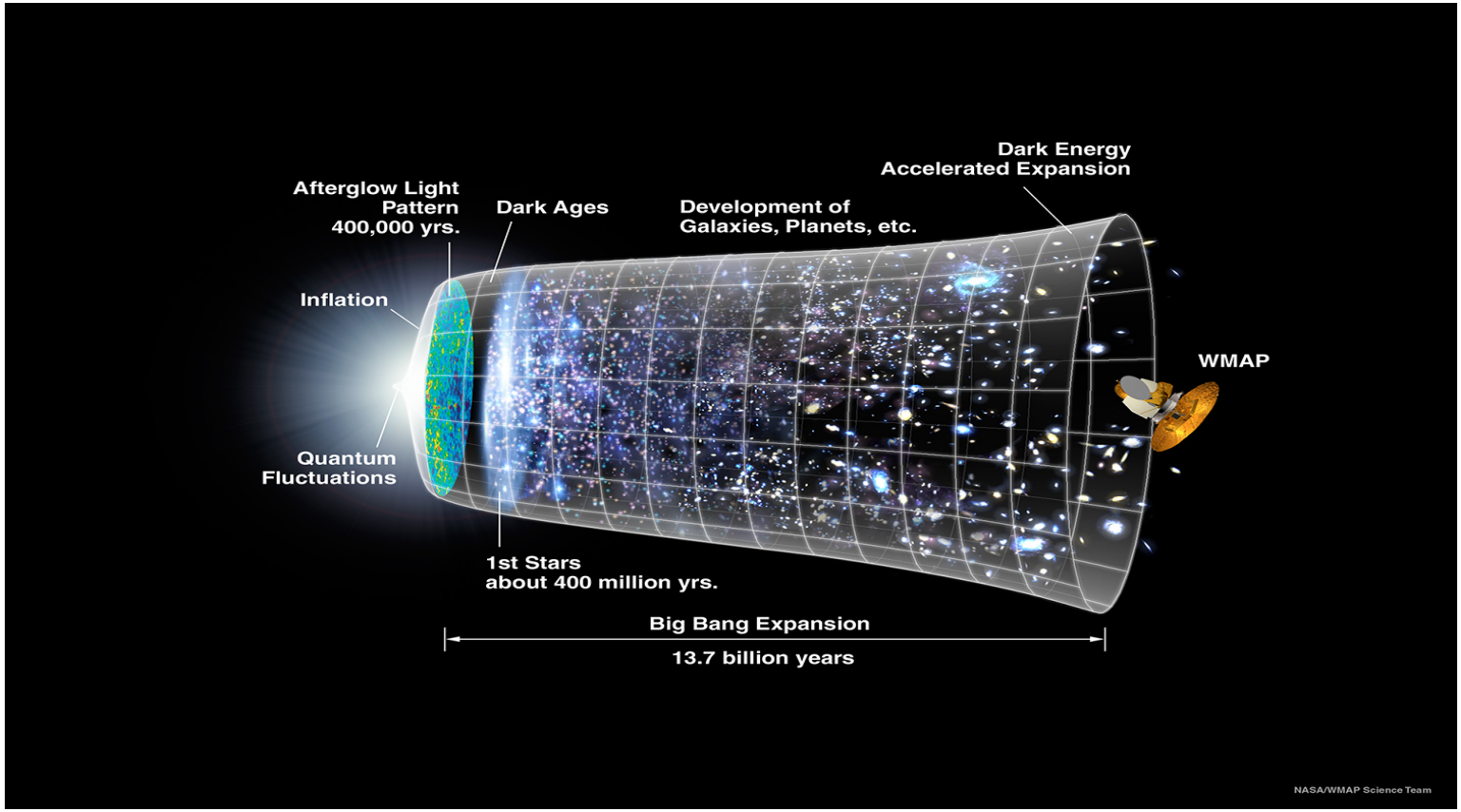
5. The very early universe

Standard model of particle physics, phase transitions, baryogenesis and leptogenesis, dark matter candidates.

6. Inflation

Flatness, horizon problems, quintessence, slow roll inflation, thermalization.

BIBLIOGRAPHY



V. Mukhanov, *Physical foundations of cosmology, CUP, 2005*

J.A. Peacock, *Cosmological physics, CUP, 1990*

B. Ryden, *Introduction to cosmology, Addison Wesley, 2003*