M306 (Cosmology)

Year:	2014–2015
Code:	MATHM306
Level:	Masters
Value:	Half unit (= 7.5 ECTS credits)
Term:	2
Structure:	3 hours per week. Assessed coursework.
Assessment:	90% examination, 10% coursework
Normal Pre-requisites:	MATH3305
Lecturer:	Dr C Böhmer

Course Description

Cosmology studies the history and the structure of the universe. Observations show the homogeneity and isotropy of the universe on large scales. For the homogenous and isotropic spacetimes, the equations of general relativity reduce to two ordinary differential equations. These cosmological equations govern the evolution of the universe. We study these equations in detail, and show how observations are affected by the expansion and curvature of the universe. The course covers the astronomical methods used to determine the expansion rate (i.e., the Hubble constant) and the mass density of the universe. Physical processes in the early universe such as nucleosynthesis, the formation of the microwave background, and galaxy formation will also be studied. The course begins with a concise introduction to the differential-geometric methods and ends with advanced topics including inflation and cosmological perturbations.

Recommended Texts

A Liddle, *An Introduction to Modern Cosmology* (2003); M Rowan-Robinson, *Cosmology* (1996); S Weinberg, *Cosmology* (2008); J Silk, *The Big Bang* (1989).

Detailed Syllabus

- Mathematical introduction.
- Cosmological models of Friedman-Robertson-Walker-Lemaitre.
- Cosmic matter: energy-momentum and equation of state.
- Density parameters.
- The big bang model: exact cosmological solutions.
- Observations in an expanding universe.
- The redshift versus distance relation.
- The cosmic microwave background.
- Modern cosmology.
- Early universe: Inflation and cosmological perturbations.