

PHAS3136: Cosmology and Extragalactic Astronomy

Part I: Galaxies

- Our galaxy, populations. Spiral structure; rotation curves (21 cm); mass distribution (dark matter). [4]
- Morphology, luminosity function; Tully-Fisher & Faber-Jackson relations; mass-to-light ratios; fundamental plane. [1]
- Galactic chemical evolution; the 'G-dwarf problem' and possible solutions [2]
- Measurements of the Hubble Constant [1]
- Clusters of galaxies. Morphology; mass indicators (Virial theorem, X-ray emission, gravitational lensing). [3]

Part II: Active Galactic Nuclei

- Taxonomy and principal observational characteristics; the central engine (mass, luminosity, nature). [1]
- The broad-line region; reverberation mapping. Broad and narrow absorption-line systems in quasars; Mass estimates. [2]
- Gunn-Peterson test. Quasar luminosity function (survey techniques, selection effects); the $\log N - \log S$ and V/V_{\max} tests. [1]

Part III: Cosmology

- Introduction; the observational basis of cosmological models; a brief history of the Universe, from $t = 10^{-43}$ s to the present. [2]
- The Friedmann equation; evolution of density and scale factor with time (the fluid equation and acceleration equation). [3]
- Derivation and meaning of the cosmological parameters.
- Specific models (Einstein-de Sitter, Milne, etc.) [2]
- Formation and evolution of the Cosmic Microwave Background (CMB); production of the light elements. Baryogenesis. [4]
- Problems with the traditional Big Bang model (flatness, horizon, monopoles, structure); inflation; [1]
- Large-scale structure and CMB power spectra. [3]

Teaching method:

The course is based on 30 lectures plus 3 sessions which are used for reviewing homeworks and for supplementary material (summaries of important recent papers in the field, slides, etc.).

There are 4 problem sheets, which include both essay work and calculation of numerical results for different cosmological models.

The principal recommended book is:

An introduction to galaxies and cosmology (Jones & Lambourne, Cambridge)

Additional recommended books are:

An Introduction to Modern Cosmology (Liddle, Wiley)

An Introduction to Active Galactic Nuclei (Peterson, CUP)

The course is assessed by written examination (90% of total course marks) and by problem sheets (10%).