3C36: Cosmology and Extragalactic Astronomy

Part I: 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).
Derivation and meaning of the cosmological parameters (H, q, Ω, Λ).
Specific models (Einstein-de Sitter, Milne, etc.) **[3]**

Formation and evolution of the microwave background; production of the light elements. **[2]**

Problems with the traditional Big Bang model (flatness, horizon, monopoles, structure); inflation; large-scale structure and dark matter. **[3]**

Part II: Galaxies

Morphology, luminosity function, populations. Passive evolutionary models. **[3]**

Galactic chemical evolution; the 'G-dwarf problem' and possible solutions **[2]**

Spiral structure; rotation curves (21 cm); mass distribution (dark matter).
Tully-Fisher & Faber-Jackson relations; mass-to-light ratios; fundamental plane. **[3]**

Clusters of galaxies. Morphology; mass indicators (Virial theorem, X-ray emission, gravitational lensing). **[2]**

Part III: Active Galactic Nuclei

Taxonomy and principal observational characteristics; the central engine (mass, luminosity, nature). **[3]**

The broad-line region; reverberation mapping **[2]**

Broad and narrow absorption-line systems in quasars; Gunn-Peterson test. **[2]**

Quasar luminosity function (survey techniques, selection effects); the $\log N - \log S$ and $V/V_{\max}$ tests; evolution of the luminosity function. Star-formation history of the Universe. **[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 3 problem sheets, which include both essay work and calculation of numerical results for different cosmological models.

Principal 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%).