**UNIVERSITY OF GLASGOW**

**Department of Physics and Astronomy**

# Astronomy 2 Session 2004-05

*Observational Astrophysics:* 10 Lectures, beginning Autumn 2004

See also: **http://www.astro.gla.ac.uk/users/martin/teaching/a2obsast/index.html**

## Summary of Course Aims:

Expanding on Astronomy 1, these 10 lectures will investigate quantitatively the observational tools and methods of data collection and reduction that underpin modern astrophysical observations. We will study how we detect celestial objects and the factors that limit what, and how well, we can observe. Topics covered:

- Ideas of radiant energy
- Detectors and Telescopes
- Examples of Optical Detectors
- Ideas of Sensitivity
- The Atmosphere
- Spectral Techniques
- Resolving Power and Interferometry
- Radio Interferometry (if time permits)

## Learning Objectives:

On completion of the course students should understand and be able to explain or quantify

- the concepts and units of: luminosity; radiant flux; flux density; solid angle; specific intensity; brightness temperature; apparent and absolute magnitude; bolometric and colour magnitudes; distance modulus; bolometric correction
- simple telescope optics, including the concepts of image intensity and illumination and the basic principles of operation of telescopes at different wavelengths – from gamma rays to radio waves
- the operation of photomultipliers, microchannel image intensifiers and charge-coupled devices
- the concept of noise and bandwidth as the limits of sensitivity
- the statistical properties of Poisson noise and its relation to background and dark current noise in charge-coupled devices and the quantum efficiency of photon detectors
- the signal-to-noise ratio of astronomical observations
- absorption and transmission windows in the electromagnetic spectrum
- optical depth and zenith extinction – Bouget's Law
- scattering, including Rayleigh scattering
- refraction and scintillation
- the importance of spectroscopy in astrophysics; spectral resolving power
- prisms, Fraunhofer diffraction and diffraction gratings
- design of a slit spectrometer
- diffraction and the $\lambda/D$ relation
- 'seeing', speckle patterns and speckle interferometry
- the Michelson stellar interferometer and its foundations in optics theory
- interferometric measurements of stellar diameters and resolving of double stars
- the method of Very Long Baseline Interferometry in radio astronomy and how it can be used to resolve structure in astronomical sources

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