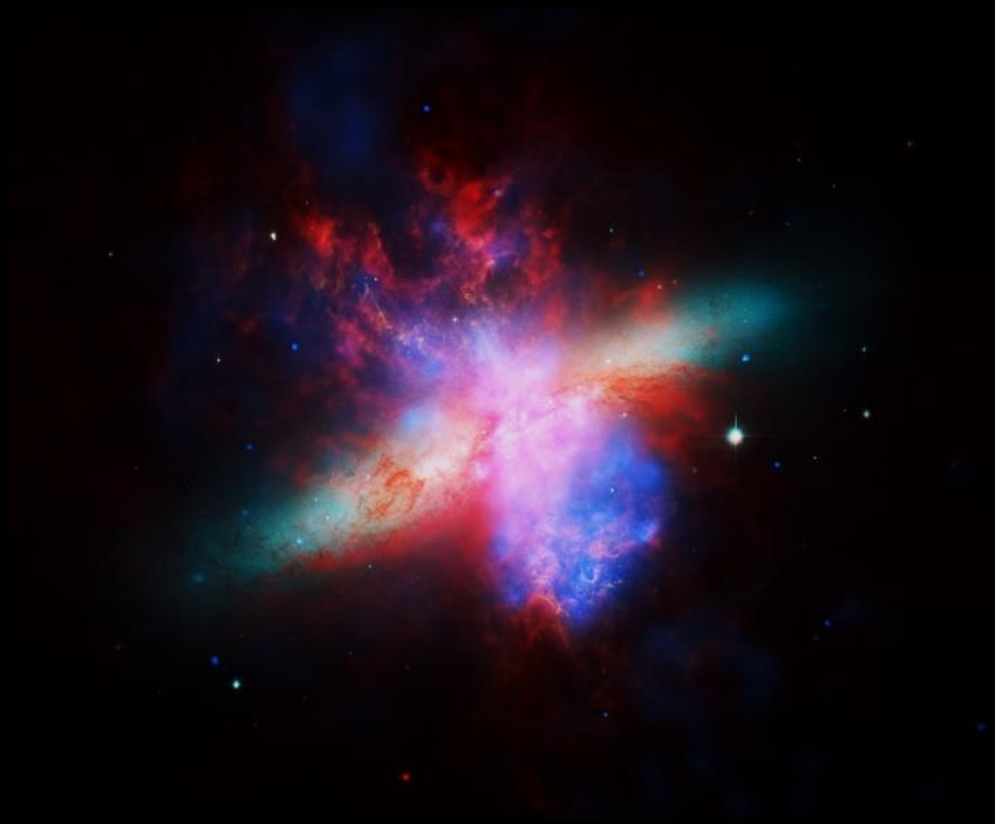
University of Glasgow | School of Physics & Astronomy



ASTRO4008 Galaxies

Course Information Guide

Course Details

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		Schedule:	GALI - 11 lectures, semester 1 GALII - 11 lectures, semester 2
Credits:	15	ECTS Credits:	7.5
Assessment:	2 hour exam (100%)	Exam Diet:	April/May
Level:	Honours	SCQF Level:	10
Year Cycle:	A (odd years)	Course website:	Moodle Link

Course Aims

To provide students with an opportunity to develop knowledge and understanding of the key principles and applications of Galaxies, and their relevance to current developments in astronomy.

Intended Learning Outcomes

By the end of the course students should be able to:

- Demonstrate a knowledge and broad understanding of Galaxies.
- Describe and analyse quantitatively processes, relationships and techniques relevant to the topics included in the course outline, applying these ideas and techniques to solve general classes of problems which may include straightforward unseen elements.
- Write down and, where appropriate, either prove or explain the underlying basis of astrophysical laws relevant to the course topics, discussing their applications and appreciating their relation to the topics of other courses taken.

Semester 1 Course Outline

- *History of Galactic Astronomy*: Early models of the Milky Way. Herschel and the star gauging method. Kapteyn Universe. Integral equation with star luminosity function as kernel. Schwartzschilds solution. Absorption; Shapley model - data and analysis. The nature of spiral nebulae Shapley and Curtis models. Van Maanens and Hales data. The solution of the debate. Position of the Sun with respect to the Galactic centre.
- *Kinematics of the Milky Way*: Lindblads theory. Stellar motion in the solar neighbourhood; the local standard of rest; effect of stellar spectral classification and its interpretation. Oort's theory - Calculation of line of sight velocity for a generic speed distribution, and for circular motion on a plane. Oort's constant and determination of the speed of the LSR with respect to the Galactic Centre.
- *Galaxy Morphology*: Morphological classification; the Hubble sequence; the effect of environment on morphology. Surface photometry: observational issues; definition of the surface brightness; problem of seeing and the background luminosity. Profiles of ellipticals and spirals: the $R^{1/4}$ law, the deprojection of the surface brightness, data from HST and new

NGC 1300 barred spiral galaxy.
Credit: **Hubble, ESA, NASA**

model for the surface brightness of ellipticals.

- *Luminosity Functions*: Definition of the luminosity function (LF), the Schechter function. LF in clusters and field galaxies. Dependence of galaxy LF on morphological type.
- *The Interstellar Medium*: The detection of interstellar matter, absorption spectra in the visible and UV band, optical depth and curve of growth, simple model of propagation of radiation through an absorbing media, absorption line shape and determination of the gas temperature and density.

Semester 2 Course Outline

- *Galaxy Kinematics*: Measuring mean velocities and velocity dispersions. Rotation curves for disk systems. Evidence for dark matter halos and non-baryonic dark matter. Derivation of the Tully-Fisher relation and Fundamental Plane relation.
- *Abnormal and Active Galaxies*: Using spectra to classify disk systems. Starburst galaxies. Introduction to star formation models. Galaxies with active nuclei: Seyferts, radio galaxies, quasars and blazars. The unified model of active galactic nuclei: evidence supporting it. Superluminal motion in AGN jets.
- *Galaxy Formation and Evolution*: Hierarchical clustering theories. Galaxy mergers and interactions; derivation of expression for dynamical friction. Virial theorem arguments for the origin of polar ring galaxies. Tidal stripping, dust lanes and cannibalism of early disks. Star formation and feedback mechanisms. Spectral synthesis models. Star formation models. Chemical evolution models.
- *Galaxies and Cosmology*: Links between galaxy formation, cosmology and large-scale structure. Galaxy clusters as sensitive probes of the background cosmological model. Damped Lyman alpha systems and the Gunn-Petersen test. When was the Universe re-ionised?

Galaxy mega-merger imaged by Hubble.
Credit: ***ESA/Hubble & NASA***

Further Information

Recommended texts

Binney & Merrifield	Galactic Astronomy	Princeton	1998
Sparke & Gallagher	Galaxies in the Universe	Cambridge	2012 (2nd)
Carroll & Ostlie	An Introduction to Modern Astrophysics	Pearson	2014 (2nd)
Binney & Tremaine	Galactic Dynamics	Princeton	2008 (2nd)
Whittet	Dust in the Galactic Environment	IoP	2003 (2nd)

Physics & Astronomy reading lists.

Course specifications - More details about the course in relation to other courses and degree paths on the course catalogue website.
Time and location of lectures - will be available during term time on the course website via Moodle.
Enrolment - Through MyCampus, details on the Astronomy 345 Moodle page.