

Astrophysics

(Physics Yr 2)

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Lectures:	Weekly – 2 hours
Tutorials:	Bi-weekly starting in Week 3.
Assessment:	Exam plus 2 (short) class tests in Weeks 7 & 11.

Introduction

This is an introductory course and assumes no previous knowledge of either astrophysics or astronomy.

Astrophysics is sometimes referred to as ‘the physics of the Universe’ and unlike many other branches of physics it involves the application of physical laws under extreme conditions; e.g. of temperature, density & sheer scale. The result is that many phenomena which would never be observed in a terrestrial physics lab are quite common out there in the Universe; indeed the Universe itself is the astrophysicist’s ‘laboratory’. A good example is the appearance of forbidden line radiation seen in the spectra of interstellar clouds of ionised gas such as the Orion Nebula. There is also of course the ‘exotic’ element most famously in the problems that black holes and the origin & evolution of the Universe are posing for our most fundamental ideas about physics.

This course then is intended to hopefully whet your appetite as physicists.

Syllabus

- 1) Introduction; electromagnetic radiation; astronomical telescopes.
- 2) The celestial sphere; spherical astronomy; how the sky appears to ‘work’ from our observatory the Earth.
- 3) Orbits & the Solar System 1; Main bodies of the Solar System; apparent motions of planets; Introduction to Kepler’s laws & properties of the ellipse.
- 4) Orbits & the Solar System 2; Using Kepler’s laws & Newton’s law of gravitation. Newton’s version of Kepler’s 3rd law – binary stars.

- 5) Observational properties of stars; motion; distance; brightness – the magnitude scale & astronomical photometry; stellar spectra & the Hertzsprung-Russell diagram.
- 6) Astronomical spectroscopy; electron transitions in atoms; selection rules – forbidden radiation. Line profiles & line broadening. Emission line regions in astrophysics.
- 7) Stellar structure; stability & instability in stars; stellar pulsation; stellar energy sources.
- 8) Stellar evolution; star formation; main sequence evolution; death of stars; white dwarfs; neutron stars; black holes.
- 9) Interstellar material; radiative transfer; interstellar reddening.
- 10) The Milky Way and other galaxies; active galaxies; supermassive black holes; quasars.
- 11) Introduction to cosmology; the expanding Universe; the Big Bang; dark matter & dark energy.
- 12) Revision.