

PHYS1160 — Modules and Video Lectures

PHYS1160 lectures are provided in the form of video lectures. The video lectures will be found in the Module pages on Vista. They run for about 25-40 minutes. They are provided in several window sizes and formats. The large size videos have file sizes of about 100 MB. They should be fine if you are working on campus or have a fast broadband (i.e. ADSL2) link. If you have a slower connection it would be better to use the smaller versions, which have smaller files (about 40-50 MB).

Mac users should be able to play the MPEG4 and QT versions of the videos. PC users should also be able to play these versions if you have the QuickTime plugin. If you don't have this it is a free download and can be found at www.apple.com/quicktime/download. PC users can also play the wmv versions using Windows Media Player. The files for these are a bit larger than the QuickTime versions however.

The lectures are also provided as PowerPoint slides in pdf format. These version will not include animations and video clips that are included in the video versions. However, most of these animations can be found in the Mastering Astronomy Study Area (Interactive figures and Self-guided tutorials), and videos are on the course resources area on Vista.

Module 1 — Introduction

Lecture 1 — Introduction to Astronomy

The components of the universe (stars, planets and galaxies), the scale of the universe, a brief historical guide to the study of astronomy.

Lecture 2 — Introduction to Astrobiology

Why life might be common, or might be rare. The science of astrobiology. Where and how can we search for life in the universe?

Lecture 3 — Key Concepts

Gravity, orbits and Kepler's laws. Atoms and nuclei. Light and other electromagnetic waves. Spectra and the Doppler shift.

Lecture 4 — Techniques of Astronomy

Telescopes and instruments for different wavelength regions. Observing methods. Effect of the atmosphere. Observations from space.

Module 2 — The Solar System

Lecture 5 — The Solar System

Introduction to the solar system. Terrestrial and giant planets, satellites, dwarf planets., small solar system bodies. The formation of the solar system.

Lecture 6 — The Earth – Evolution of a habitable planet

Formation of the Earth and Moon. Age of the Earth. The heavy bombardment. Plate tectonics. Formation of oceans and continents. Evolution of the atmosphere. The faint-young Sun paradox and its resolution.

Lecture 7 — Exploring the Solar System

Getting to a planet. Types of space missions. The key planetary exploration mission and what we have learnt from them. Ground-based studies of the planets.

Lecture 8 — Habitability in the Solar System

Definition of a habitable planet. Follow the Water. Past water on Venus. Evidence for water on Mars in the past and now. Evidence for oceans beneath the ice of Jupiter's moons and Enceladus.

Module 3 — Life on Earth and in the Solar System

Lecture 9 — What is Life?

Properties of life. Classification of living organisms, Evolution and heredity. The molecular basis for life, DNA, RNA and proteins.

Lecture 10 — The History of Life on Earth

Methods for studying life's history. The fossil record. The earliest evidence for life. Molecular methods and the "tree of life". Extremophiles. Life and the Earth's atmosphere.

Lecture 11 — The Origin of Life

Historical ideas on life's origin. The fundamental problem. The RNA World. Possible pre-RNA worlds. Origin of the building blocks of life. The timing of life's origin relative to the late heavy bombardment. Could life have come from another planet?

Lecture 12 — Life in the Solar System

Ideas on life on Mars. Percival Lowell's canals. Early Mars missions. The Viking missions. The martian meteorite ALH84001. Methane on Mars, Future Mars missions. Life on the giant planet moons and how we could search for it.

Module 4 — Stars

Lecture 13 — Our Star, the Sun

The Sun's energy source. Nuclear fusion. Structure of the Sun. Solar activity. The Sun-Earth connection.

Lecture 14 — Properties and Evolution of Stars

Properties of stars. Spectroscopic classification. The Hertzsprung-Russell diagram. Types of stars. Evolution of low and high mass stars. Multiple stars. Star clusters.

Lecture 15 — Stellar Birth and Death

The interstellar medium. Molecular clouds. Star formation. Planetary nebulae. White Dwarfs. Supernovae. Neutron stars and black holes.

Module 5 — Other Worlds

Lecture 16 — Extrasolar Planets

Detection of exoplanets. Doppler, transit, microlensing methods. Types of and properties of exoplanets (e.g. hot Jupiters, eccentric planets). Comparison with our solar system.

Lecture 17 — Habitability and life on exoplanets

The problem of directly detecting exoplanets. Direct detection methods (giant ground-based telescope, nulling interferometers, coronagraphs, Occulters). Signatures of habitability. Biosignatures.

Lecture 18 — The Search for Extraterrestrial Intelligence (SETI)

Brief history of SETI. The Drake Equation. Radio SETI techniques. SETI at optical and other wavelengths. Messages to the Stars. The Fermi Paradox.

Module 6 — Galaxies and Cosmology

Lecture 19 — Our Milky Way Galaxy

Size and structure of the Milky Way. The disk, bulge and halo. Orbits of stars. Gas in the galaxy and recycling of gas. The galactic centre.

Lecture 20 — Galaxies and their Evolution

Types of galaxies. Distances of galaxies. Looking back in time. The Hubble deep field. Galaxy formation and evolution. Active galaxies and quasars.

Lecture 21 — Cosmology

The expanding universe and Hubble's law. The Big Bang theory. The cosmic microwave background. Dark matter and the evidence for it. The accelerating universe and dark energy, The standard model of the universe.