PX282-15 Stars and the Solar System

22/23

Department
Physics
Level
Undergraduate Level 2
Module leader
Don Pollacco
Credit value
15
Module duration
20 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Our sky is dominated by the Sun and the Moon, the planets and stars, as well as occasional spectacular events that are associated with eclipses, comets, meteorites and supernovae. These objects are bright enough to be visible to the naked eye - they have been the subject of wonder and study for thousands of years. In this module, we will see how modern observations and advanced space probes are changing our knowledge of stars and Solar System objects. Our physical understanding is advancing rapidly and providing us with a basis for the exploration of exoplanetary systems and the more distant Universe.

Module web page

Module aims

To describe and explain the key physical properties of stars and Solar System objects, and to explain how these properties are observed.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Fundamental properties of stars, spectral classification and the H-R diagram. The Sun as a star.

The physical structure of the stellar interiors: basic equations, nuclear energy production, mass/radius/luminosity relations.

Stellar formation and evolution, including mass loss and stellar remnants (white dwarfs, neutron stars, black holes).

Stellar atmospheres: where does the light that we observe originate? Interaction between radiation and matter, radiation transfer. Stellar spectra across the H-R diagram.

Solar activity and the solar atmosphere: photosphere, chromosphere, corona. The solar cycle, sunspots, solar flares and the solar wind.

Constituents of the Solar System. Definition of a planet. Fundamental properties of key Solar System objects.

The motion of the planets. Keplerian orbits, the three-body problem, resonances, tides and rotation.

The terrestrial planets. Interiors, surfaces, atmospheres and magnetospheres of Mercury, Venus, Earth, Mars and the Moon. The greenhouse effect, why are Earth and Venus so different? Origin of water. Atmospheric escape.

The giant planets. Composition, interior structure, atmospheres and magnetospheres. Moons and rings.

Dwarf planets and small Solar System bodies. Asteroids, meteorites, Kuiper Belt Objects and comets.

Formation of the planets. Nebular hypothesis, protoplanetary disc, core-accretion scenario.

The habitability of Solar System objects and the potential for extra-terrestrial life.

Exoplanetary systems: discovery, characterisation and the habitable zone.

Learning outcomes

By the end of the module, students should be able to:

- Identify the main features of the Hertzsprung-Russell diagram (H-R diagram)
- Describe radiation processes influencing the spectra of stars
- Explain the physical principles controlling the internal structure and evolution of stars
- Describe and explain the motion of Solar System objects
- Compare the interior, surface and atmospheric properties of Solar System objects and explain how differences are thought to have arisen
- Describe Solar/stellar activity and explain its effect on planetary atmospheres
- Outline the physical processes by which stars and planets are thought to form

Indicative reading list

An introduction to modern astrophysics Book by Bradley W. Carroll; Dale A. Ostlie 2007

An introduction to the theory of stellar structure and evolution Book by Dina Prialnik c2010

Fundamental planetary science: physics, chemistry and habitability Book by Jack Jonathan Lissauer; Imke De Pater 2019

View reading list on Talis Aspire

Subject specific skills

Knowledge of mathematics and physics. Skills in modelling, reasoning, thinking.

Transferable skills

Analytical, communication, problem-solving, self-study

Study

Study time

Type	Required
Lectures	40 sessions of 1 hour (27%)
Private study	110 hours (73%)
Total	150 hours

Private study description

Working through lecture notes, solving problems, revising for exams, practising on past exam papers

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B

	Weighting	Study time
In-person Examination	100%	
Answer 4 questions		

	Weighting	Study time

- Answerbook Pink (12 page)
- Students may use a calculator

Feedback on assessment

Meeting with personal tutors, group feedback

Past exam papers for PX282

Availability

Courses

This module is Core for:

- UPXA-F3F5 Undergraduate Physics with Astrophysics (BSc)
  - Year 2 of F3F5 Physics with Astrophysics
  - Year 2 of F3F5 Physics with Astrophysics
- Year 2 of UPXA-F3FA Undergraduate Physics with Astrophysics (MPhys)

This module is Optional for:

- Year 2 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
  - Year 2 of GG14 Mathematics and Statistics
  - Year 2 of GG14 Mathematics and Statistics

This module is Option list A for:

- UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
  - Year 2 of GF13 Mathematics and Physics
  - Year 2 of GF13 Mathematics and Physics
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
  - Year 2 of GF13 Mathematics and Physics
  - Year 2 of FG31 Mathematics and Physics (MMathPhys)
  - Year 2 of FG31 Mathematics and Physics (MMathPhys)
- UPXA-F300 Undergraduate Physics (BSc)
  - Year 2 of F300 Physics
  - Year 2 of F300 Physics
  - Year 2 of F300 Physics
- UPXA-F303 Undergraduate Physics (MPhys)
  - Year 2 of F300 Physics

    - Year 2 of F303 Physics (MPhys)

This module is Option list B for:

- Year 2 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- UMAA-G100 Undergraduate Mathematics (BSc)
    - Year 2 of G100 Mathematics
    - Year 2 of G100 Mathematics
    - Year 2 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
    - Year 2 of G100 Mathematics
    - Year 2 of G103 Mathematics (MMath)
    - Year 2 of G103 Mathematics (MMath)
- Year 2 of UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
- Year 2 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 2 of UMAA-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)
- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- Year 2 of UMAA-G101 Undergraduate Mathematics with Intercalated Year
- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics