PX268-7.5 Stars

21/22

Department
Physics
Level
Undergraduate Level 2
Module leader
Don Pollacco
Credit value
7.5
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

People have been studying stars for as long as anything else in science. Yet the subject is advancing faster now than almost every other branch of physics. With the arrival of space-based instruments, gravitational wave detectors and other ground-based instruments, the prospects are that the field will continue to advance and that some of the most exciting discoveries reported in physics during our lifetimes will be in astrophysics.

The module deals with the physics of the observation of stars and with the understanding of their behaviour and properties that the observations lead to. The module covers the main classifications of stars by size, age and distance from the earth and the relationships between them. It also looks at what the observations of stars' behaviour tell us about the evolutionary history of galaxies and of the Universe as a whole.

Module web page

Module aims

The module should introduce the methods used to measure the distances between stars, their brightness and colour and provide evidence for the large variability of stars found in our Galaxy. It should show how fundamental concepts of physics are used to quantitatively describe the structure and evolution of stars. The module should also explain how observational methods, such

as imaging and spectroscopy, can be used to test our understanding of the origin, life, and death of stars.

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.

1. Observational facilities - the optical/IR window - space based astronomy
2. Coordinate systems: how to define the position of a star. What stars are visible during a night, a month, a year
3. Trigonometric Parallax. The parsec and parallax angles. Statistical parallax
4. Fundamental properties of stars - colour, luminosity, apparent and absolute magnitude, stellar radius
5. Blackbody radiation, thermal equilibrium, effective temperature
6. Different types of stars - spectral classification - the Harvard spectral classification
7. Stellar atmospheres - where does the light that we observe originate - interaction between radiation and matter - radiation transfer
8. The structure of stars -basic equations - nuclear energy production - mass/radius/luminosity relation - understanding the observed Hertzsprung-Russell diagram
   9 Stellar evolution - main sequence life time - from birth to death - young stellar objects, stellar remnants: white dwarfs, neutron stars, black holes
9. Using stellar populations as test beds for stellar evolution open and globular clusters
10. Exoplanets: discovery and characteristics. Equilibrium temperature and the habitable zone

Learning outcomes

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

- Define the position of a star and to describe the techniques used to determine their distance from us
- Relate quantities such as apparent magnitude, absolute magnitude, flux, luminosity, stellar radius, effective temperature and distance
- Identify the main features of the Hertzsprung-Russell diagram and explain the characteristics of stellar spectra along the main sequence
- Explain the mechanisms of interaction between photons and matter occurring in the atmosphere of a star
- Explain the physical principles behind the structure and evolution of stars

Indicative reading list

B.W. Carroll and DA Ostlie, An Introduction to Modern Astrophysics, Addison-Wesley; Prialnik, D, An introduction to the theory of stellar structure and evolution., CUP.

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	20 sessions of 1 hour (27%)
Private study	55 hours (73%)
Total	75 hours

Private study description

Working through lecture notes, solving problems, wider reading, discussing with others taking the module, revising for exam, 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 B1

	Weighting	Study time
Online Examination Answer 2 questions	100%	

- Answerbook Green (8 page)
- Students may use a calculator

Feedback on assessment

Personal tutor, group feedback

Past exam papers for PX268

Availability

Courses

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
- 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

This module is Option list A for:

- Year 2 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- Year 2 of UPXA-F3N1 Undergraduate Physics and Business Studies

This module is Option list B for:

- Year 2 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- 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