PX456-15 Solar and Space Physics

23/24

Department
Physics
Level
Undergraduate Level 4
Module leader
Valery Nakariakov
Credit value
15
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module starts by introducing a hydrodynamic model of the Sun, which treats the solar matter as a fluid. It discusses how this theory, called magnetohydrodynamics, is used to model and understand phenomena like sunspots, coronal loops, prominences, solar flares, coronal mass ejections and space weather. The Sun also emits a stream of energetic charged particles in what is called the solar wind. The module will look at how the solar wind interacts with the Earth and other planets in the Solar System.

Module web page

Module aims

To review the physics underlying the structure and the dynamics of the Sun using magnetohydrodynamics. It should discuss its ejections including the solar wind and how this interacts with planets in the Solar System.

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.

Introduction to the Sun, magnetohydrodynamics (MHD), magnetostatic equilibria, coronal loops, potential and force-free magnetic fields, application to prominences, magnetic reconnection, MHD coronal waves, helioseismology;

Structure of the solar wind, Parker solution, Parker spirals and co-rotating interaction regions, Heliosphere and heliopause;

Transients in the solar wind, coronal mass ejections, MHD shocks, Turbulence;

Earth's magnetosphere, structure, co-rotating region: plasmasphere, radiation belts; Advective region: plasmapause, magnetotail, Dungey cycle; Substorms, aurora, ionosphere, concepts of space weather;

Comparative solar wind/planet interaction: Earth, Venus, Mars, Jupiter, outlook beyond the solar system

Learning outcomes

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

- Explain structure of the Sun and the main features and phenomena observed on the solar surface and in the solar atmosphere
- Describe the physical processes at work in the Sun
- Describe the dynamic processes operating in the Sun, in terms of MHD
- Explain the solar wind and its interactions with planets in the Solar System

Indicative reading list

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	30 sessions of 1 hour (20%)
Total	150 hours

Type	Required
Private study	120 hours (80%)
Total	150 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 B

Assessment component	Weighting	Study time	Eligible for self-certification
Solar and Space Physics Answer 3 questions	100%		No

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

Reassessment component is the same

Feedback on assessment

Personal tutor, group feedback

Past exam papers for PX456

Availability

Courses

This module is Optional for:

- Year 4 of UPXA-F303 Undergraduate Physics (MPhys)

This module is Option list B for:

- Year 4 of UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)