University of the Balearic Islands

Teaching guide

Academic year	2014-15
Subject	11267 - Applications of Solar Magnetohydrodynamics
Group	Group 1, 2S
Teaching guide	A
Language	English

Subject identification

Subject	11267 - Applications of Solar Magnetohydrodynamics
Credits	1 de presencials (25 hours) 2 de no presencials (50 hours) 3 de totals (75 hours).
Group	Group 1, 2S (Campus Extens)
Teaching period	2nd semester
Teaching language	Catalan

Professors

Lecturers	Horari d'atenció alumnes					
	Starting time	Finishing time	Day	Start date	Finish date	Office
Roberto José Soler Juan roberto.soler@uib.es	You need to book a date with the professor in order to attend a tutorial.					

Contextualisation

"Applications of Solar Magnetohydrodynamics" is a subject within the section on Astrophyics and Relativity of the Master in Advanced Physics and Applied Mathematics. This subject and "Fundamentals of Solar Magnetohydrodynamics" complement each other, although the subject on "Fundamentals" is not a necessary prerequisite for the subject on "Applications". This subject is also related to "Introduction to Solar Physics" and "Numerical Simulations in Magnetohydrodynamics".

In this subject, the Magnetohydrodynamic theory is applied to study waves and oscillations in the solar atmosphere. Specifically, the syllabus is organized around the theoretical study of a particular phenomenon, namely transverse oscillations of coronal loops. The contents of the subject will be introduced step by step as the various aspects of that phenomenon are analized.

The lecturer, Dr. Roberto Soler, is a Doctor in Physics by the UIB. Currently, he is a researcher at the Physics Department. Previously, he was a "Marie Curie" fellow at the University of Leuven (KU Leuven, Belgium). His area of expertise is the theoretical study of magnetohydrodynamic waves and instabilities in the solar atmosphere. He has published more than 36 research papers on this topic in international peer-reviewed journals and has contributed in more than 30 national and international scientific conferences. The lecturer's profile is ideal for this subject.

Requirements

There are no specific prerequisites.

Recommendable

Basic knowledge in fluid mechanics and electromagnetism.

Basic knowledge in applied mathematical methods for physicists.

Date of publication: 24/07/2014

Use of symbolic mathematics software (e.g., Mathematica)

Skills

Students will obtain the following general and specific competencies.

Specific

* Ability to apply the magnetohydrodynamic formalism to plasma physics for the solution of problems in Solar Physics..
* Ability to use and adapt mathematical models to describe physical phenomena in the solar atmosphere..

Generic

* Ability to set up a process of advanced research and to show a deep knowledge of both theoretical and practical aspects of the scientific method..
* Ability to apply learned knowledge to solve problems in new environments and to establish links with his/her own area of expertise..

Basic

* You may consult the basic competencies students will have to achieve by the end of the Master's degree at the following address: http://estudis.uib.cat/master/comp_basiques/

Content

Theme content

1. Introduction

   Waves and oscillations in the solar atmosphere.

   Interpretation in terms of magnetohydrodynamic (MHD) waves.

   Effects of plasma structuring on MHD waves.

2.. MHD waves in magnetic flux tubes

   Magnetic flux tube model.

   Dispersion relation.

   Wave modes. Phase diagrams.

   Thin tube approximation.

   Additional effects: mass flows, stratification, etc.

3. Damping of MHD waves in magnetic flux tubes

   Resonant absorption.

   Thin boundary approximation. Connection formulae.

   Damping rate. Physical interpretation.

   Phase mixing.

Date of publication: 24/07/2014

4. Local seismology of the solar atmosphere
   Coronal loop seismology.

   Seismology scheme.

   Other examples of seismology applications.

Teaching methodology

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lessons	Large group (G)	Theory lessons. Lessons can be given in Catalan, Spanish, or English. Notes will be provided.	25

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Exercises	Delivery of proposed exercises. The exercises will be marked.	10
Individual self-study	Project	Short dissertation (report) on a topic related to the contents of the subject. The topic will be set jointly by the student and the lecturer. The project will be marked.	40

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

Date of publication: 24/07/2014

Lessons

Modality	Theory classes
Technique	Other methods **(non-retrievable)**
Description	Theory lessons. Lessons can be given in Catalan, Spanish, or English. Notes will be provided.
Assessment criteria	A minimum attendance of 50% (12.5 hours) is required. The maximum score in this part will be given for an attendance of 80% (20 hours) or larger.

Final grade percentage: 20% with minimum grade 0

Exercises

Modality	Individual self-study
Technique	Student internship dissertation **(retrievable)**
Description	Delivery of proposed exercises. The exercises will be marked.
Assessment criteria	Delivered exercises will be marked according to their correctness and the use of theoretical concepts. Exercises could be retrieved is the minimum score (5) is not achieved.

Final grade percentage: 30% with minimum grade 5

Project

Modality	Individual self-study
Technique	Papers and projects **(retrievable)**
Description	Short dissertation (report) on a topic related to the contents of the subject. The topic will be set jointly by the student and the lecturer. The project will be marked.
Assessment criteria	The short dissertation (report) will be marked according to the topic and contents previously agreed between the student and the lecturer. The report will be marked according to their correctness and the use of theoretical concepts. The report could be retrieved is the minimum score (5) is not achieved.

Final grade percentage: 50% with minimum grade 5

Resources, bibliography and additional documentation

Basic bibliography

Notes provided by the lecturer.

Complementary bibliography

1. An Introduction to Plasma Astrophysics and Magnetohydrodynamics. M. Goossens. Kluwer Academic Publishers. 2003.
2. Principles of Magnetohydrodynamics (with applications to Laboratory and Astrophysical Plasmas). H. Goedbloed & S. Poedts. Cambridge University Press. 2004.
3. Magnetohydrodynamcs of the Sun (2nd Revised edition). E. Priest. Cambridge University Press. 2014.

Date of publication: 24/07/2014