Stellar and Planetary Astrophysics

Code: 42857
ECTS Credits: 9

2024/2025

Degree	Type	Year
4313861 High Energy Physics, Astrophysics and Cosmology	OT	0

Contact

Name: Fabio Del Sordo

Email: fabio.delsordo@uab.cat

Teachers

Jordi Isern Vilaboy

Fabio Del Sordo

Konstantinos Kovlakas

Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is assumed that students have a basic knowledge of Mechanics, Classic and Quantum, Thermodynamics, Statistical Mechanics and Atomic and Nuclear Physics. Several specific aspects, like energy transport, will be introduced during lectures.

Objectives and Contextualisation

The goal of this module is to provide the basic knowledge on two funfamental branches of Modern Astrophysics: structure and evolution of stars and structure and evolution of planets.

Competences

- Apply the main principles to specific areas such as particle physics, astrophysics of stars, planets and galaxies, cosmology and physics beyond the Standard Model.
- Formulate and tackle problems, both open and more defined, identifying the most relevant principles and using approaches where necessary to reach a solution, which should be presented with an explanation of the suppositions and approaches.
- Understand the bases of advanced topics selected at the frontier of high energy physics, astrophysics and cosmology and apply them consistently.

- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use critical reasoning, analytical capacity and the correct technical language and formulate logical arguments.

Learning Outcomes

1. Calculate the evolution of a star type.
2. Make a detailed analysis of the evolution of compact binary systems.
3. Recognise the different states of stellar evolution.
4. Understand the basics of stellar and planetary astrophysics.
5. Understand the interior details of the sun.
6. Understand the mechanisms of the formation of planetary systems.
7. Understand the processes of star formation.

Content

- Fundamental properties of stars
- Stellar atmospheres and stellar coronae
- Stellar interiors
- Stellar evolution
- Variable stars
- The Sun
- Planets and basics of planetary structure

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory Lectures	56	2.24	1, 2, 3, 4, 5, 6, 7
Type: Autonomous			
Discussions, Work Groups, Group Exercises	62	2.48	1, 2, 3, 4, 5, 6, 7
Study of the Theoretical Foundations	64	2.56	1, 2, 3, 4, 5, 6, 7

Theory Lectures and Exercises

Classwork and Homework

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam on all the topics (2 opportunities)	50%	3	0.12	1, 2, 3, 4, 5, 6, 7
Homework	25%	20	0.8	1, 2, 3, 4, 5, 6, 7
Oral exposition on a selected topic	25%	20	0.8	1, 2, 3, 4, 5, 6, 7

One exam of all the contents, homework on all the contents, oral exposition on a selected topic.

There is a second chance to take the written exam, in case you fail the first. The oral exam will be organized by agreement between the student and the teacher.

This subject/module does not foresee the single assessment system.

Bibliography

Stellar Structure and Evolution. R. Kippenhahn, R. Weigert, A. Weiss. Springer.

Physics, formation and evolution of rotating stars. A. Maeder. Springer

Stellar interiors. Physical principles, structure and evolution. C. J. Hansen & S. D. Kawaler. Springer-Verlag

The physics of stars. A. C. Phillips. John Wiley & Sons

Black Holes, White Dwarfs and Neutron Stars. S. Shapiro and S. Teukolsky. Wiley

An introduction to Modern Astrophysics, B.W. Carrol, D.A. Ostlie ,Addison Wesley

Software

We do not use specific programs.

Language list

Name	Group	Language	Semester	Turn
(TEm) Theory (master)	1	English	first semester	morning-mixed