Universidad Zaragoza

Academic Year/course: 2024/25

68350 - Frontier topics in cosmology, astrophysics and particle physics

Syllabus Information

Academic year: 2024/25
Subject: 68350 - Frontier topics in cosmology, astrophysics and particle physics
Faculty / School: 100 - Facultad de Ciencias
Degree: 628 - Master's Degree in Physics of the Universe: Cosmology, Astrophysics, Particles and Astroparticles
ECTS: 6.0
Year: 01
Semester: Annual
Subject type: Compulsory
Module:

1. General information

The objective of the subject is to provide the student with a set of essential knowledge to approach the field of research in the lines proposed in the master. This subject will introduce students to current leading research fields with the help of renowned experts in cosmology, astrophysics, particle physics and astroparticle physics. In addition, students will be able to stay for short periods in two unique scientific facilities such as the Canfranc Underground Laboratory (LSC) and the Centre for the Study of the Physics of the Cosmos of Aragon (CEFCA).

2. Learning results

Upon completion of this subject, the student will be able to:

- Know the cutting-edge research lines in cosmology, astrophysics, particle physics and astroparticle physics.
- Get to know the large centres and facilities where this type of research is conducted.
- Delve into the evolution of the universe.
- Deepen into the Standard Model of particle physics, extensions and theories beyond this model.
- Deepen into cosmology and gravitation.
- Deepen into dark matter and dark energy.
- Deepen into cosmic multimessengers.
- Have contact and be able to discuss with experts in this type of research.
- Have an overview of the different research methodologies used.
- Initiate in the divulgation of topics related to the degree.

3. Syllabus

There are six topics, which may vary depending on the status of the research. Some current examples:

- Evolution of the Universe
- Black holes and gravitational waves
- Exoplanets and exoearths
- Simulation techniques in astrophysics
- Test of the Standard Model and beyond in large accelerators
- Dark matter detection and candidates
- Cosmic multimessengers
- Neutrino mass
- Particle physics in the lattice
- Large facilities for particle physics and astrophysics

4. Academic activities

1. Participation in and attendance to lectures
2. Participation in and attendance to seminars given by experts
3. In-depth study of subjects related to the contents of the master´s program.
4. Visits to laboratories, observatories and research centres
5. Guided project development
6. Tutorials
7. Individual study
8. Written or oral assessment tests

9. Outreach activities
10. Discussions in forum

5. Assessment system

The student must demonstrate achievement of the intended learning results through the following assessment activities:

- Assessment of reports and written work: 40%.
- Assessment of oral presentations of work: 20%.
- Assessment of the evaluation tests: 30%.
- Assessment of participation in debates or discussion forum: 5%.
- Assessment of participation in outreach activities: 5%.

The final grade will be obtained according to the percentage assigned to each assessment activity. In order to pass the subject, this final grade must be equal or higher than 5.

The subject has been designed for students who attend the classroom classes and perform the assessment activities described above. However, there will also be an assessment test for those students who have not taken the evaluation activities or have not passed them.

6. Sustainable Development Goals

4 - Quality Education
9 - Industry, Innovation and Infrastructure
17 - Partnerships for the Goals