Universidad Zaragoza

Year : 2019/20

60029 - Relativistic Astrophysics, Astroparticles and Cosmology

Syllabus Information

Academic Year: 2019/20
Subject: 60029 - Relativistic Astrophysics, Astroparticles and Cosmology
Faculty / School: 100 - Facultad de Ciencias
Degree: 538 - Master's in Physics and Physical Technologies
589 - Master's in Physics and Physical Technologies
ECTS: 5.0
Year: 1
Semester: First semester
Subject Type: Optional
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning activities of the course have been designed in order to achieve a deep understanding of physics phenomena in the field of relativistic astrophysics, astroparticles and cosmology. These activities try to encourage the implication of the student in her/his learning process.

The course consists of three well separated training activities: deepening on course topics including lectures, discussions, small problem solving or a visit to the LSC (3 ECTS); case base learning and selected problem solving (1 ECTS); elaboration and defense of a guided project on some of the topics of the course (1 ECTS).

4.2.Learning tasks

The course includes the following learning tasks:

- Lectures on the main topics of the course to face the study of physics problems in the context of relativistic astrophysics, astroparticles and cosmology. These sessions will be supported by audiovisual material and complementary information, available for the students at the virtual platform Moodle.
- Exercises and case analysis in small groups in the classroom, guided by the teacher aimed at the application of the acquired theoretical knowledge.
- Visit to the Canfranc Underground Laboratory, participation in some proposed activities and preparation of the corresponding report.

- Preparation of an oral presentation and discussion with the class, of a guided research work on one of the topics of the course.

4.3.Syllabus

The course will address the following topics:

1. General relativity. Observational cosmology.
2. Standard model of modern cosmology: Cosmological principle. The Friedmann-Lemaître-Robertson-Walker (FLRW) metric. Causal structure.
3. Inflation: Problems of the standard model. Inflationary paradigm. Cosmological constant.
4. Chronology of the universe: Big Bang. Nucleosynthesis. Cosmic gravitational wave background (GWB). Cosmic microwave background (CMB). Structure formation. Reionization. Galaxy formation. Future of the universe.
5. Cosmic rays: History. Energy range. Sources and types of cosmic rays. Sea level spectra and fluxes. Production and detection methods. Ultra-high-energy cosmic rays, antimatter searches.
6. High energy neutrinos and neutrino telescopes.
7. Dark matter: Theories. Dark matter candidates. Direct and indirect searches.
8. Dark energy: Friedmann equation and acceleration parameter. Recent studies and experiments.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Faculty of Science http://ciencias.unizar.es/

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=60029&year=2019