Universitat Autònoma de Barcelona

2019/2020

Introduction to the Physics of the Cosmos

Code: 44078
ECTS Credits: 6

Degree	Type	Year	Semester
4313861 High Energy Physics, Astrophysics and Cosmology	OB	0	1

Contact

Name: Jordi Isern Vilaboy

Email: Jordi.Isern.Vilaboy@uab.cat

Use of Languages

Principal working language: english (eng)

Teachers

Enrique Gaztañaga Balbas

Francisco Javier Castander Serentill

Josep Maria Trigo Rodríguez

Oriol Pujolas Boix

Prerequisites

None

Objectives and Contextualisation

The course is intended to provide students with a complete and thorough introductory course to Particle Physics, Astrophysics and Cosmology, who should be able to use such knowledge as a solid basis for the following more specialized courses. Since it is a transversal course for all students who choose the specific programs on High Energy Physics, Astrophysics and Cosmology, it provides basic knowledge on the alternative itinerary the student has not chosen. Finally, since students come from different academic backgrounds, this course tends to unify and balance out the students' academic skills and abilities.

Competences

- Continue the learning process, to a large extent autonomously
- Understand the basics in the main areas of high energy physics, astrophysics and cosmology
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use mathematics to describe the physical world, select the appropriate equations, construct adequate models, interpret mathematical results and make critical comparisons with experimentation and observation.

Learning Outcomes

1. Understand the basics of astrophysics: coordinates, distances, magnitudes.
2. Understand the basics of astrophysics: structure and evolution of stars and galaxies.
3. Understand the basics of cosmology: distance ladder, expansion of the universe.

4. Understand the basics of cosmology: large scale structure.
5. Understand the basics of particle physics: cross sections, relativistic kinematics.
6. Understand the basics of particle physics: symmetries and interactions.
7. Use group theory to understand the SU(2) and SU(3) symmetries in hadrons.
8. Use online, English bibliographic tools to get more detailed information about the content of the course.

Content

Outline of the Course General

Introduction to Particle Physics Mass, spin and Poincaré group

Relativistic kinematics

Interaction amplitudes and cross section

Discrete symmetries

Continuous symmetries

Hadrons and the Quark Model

General concepts of Astronomy

Structure and evolution of stars and planets

Structure and evolution of galaxies

Introduction to General Relativity

Introduction to Cosmology

Methodology

Theory lectures and exercises.

Class-work and Homework

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory Lectures	45	1.8	2, 1, 3, 5, 8
Type: Supervised			
Study of theoretical foundations	45	1.8	2, 1, 3, 5, 8
Type: Autonomous			
Discussion, work groups, group exercises	45	1.8	2, 1, 3, 5, 8

Assessment

One exam on High Energy Physics and on Astrophysics/Cosmology (fifty fifty weighted)

One homework on High Energy Physics

One homework on Astrophysics/Cosmology

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Homework Astrophysics and Cosmology	25%	6	0.24	4, 2, 1, 3, 8
Homework on High Energy Physics	25%	6	0.24	6, 5, 8
Written exam (multiquestion test)	50%	3	0.12	4, 6, 2, 1, 3, 5, 7

Bibliography

"Particle Physics" - Third Edition, B. R. Martin and G. Shaw, Wiley and Sons 2008

"Quantum Field Theory in a Nutshell" A. Zee, Princeton University Press 2003

"The Standard Model: A Primer", C. P. Burgess and G. D. Moore, CUP 2007

"An Introduction to Quantum Field Theory", M. E. Peskin and D. V. Schroeder, Addison-Wesley 1995

"An introduction to modern astrophysics" D A Ostlie, BW Carroll CUP 2017

"Introduction to paticle and astroparticle physics" A. de Angelis, M. Pimenta Springer 2018

"Physical Foundations of Cosmology" V. Mukhanov, CUP 2005