VNIVERSITAT DE VALÈNCIA

Course Guide
43297 Observational astrophysics

COURSE DATA

Data Subject	
Code	43297
Name	Observational astrophysics
Cycle	Master's degree
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
2150 - M.D. in Advanced Physics	Faculty of Physics	1	First term

Subject-matter

Degree	Subject-matter	Character
2150 - M.D. in Advanced Physics	3 - Advanced astrophysics	Optional

Coordination

Name	Department
FABREGAT LLUECA, JUAN BAUTISTA	16 - Astronomy and Astrophysics
GUIRADO PUERTA, JOSE CARLOS	16 - Astronomy and Astrophysics
MARCAIDE OSORO, JUAN MARIA	16 - Astronomy and Astrophysics

SUMMARY

Observational astronomy as a science. Atmospheric windows in the optical and infrared. Astronomical spectroscopy and photometry. Mechanisms of generation and extinction cosmic X-ray and gamma. Tools for Astrophysics. X and gamma rays. The high-energy universe. The observation in radio astronomy. Intensity and radiance. Antennas and receivers. Networks and interferometric image reconstruction by Fourier techniques.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

OUTCOMES

2150 - M.D. in Advanced Physics

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- Ser capaces de obtener y de seleccionar la información y las fuentes relevantes para la resolución de problemas, elaboración de estrategias y asesoramiento a clientes.
- Ser capaz de gestionar información de distintas fuentes bibliográficas especializadas utilizando principalmente bases de datos y publicaciones internacionales en lengua inglesa.
- Saber organizarse para planificar y desarrollar el trabajo dentro de un equipo con eficacia y eficiencia.
- Ostentar la preparación para tomar decisiones correctas en la elección de tareas y en su ordenación temporal en su labor investigadora y/o profesional.
- Poseer la capacidad para el desarrollo de una aptitud crítica ante el aprendizaje que le lleve a plantearse nuevos problemas desde perspectivas no convencionales.
- Estar en disposición para seguir los estudios de doctorado y la realización de un proyecto de tesis doctoral.
- Comprender de una forma sistemática el campo de estudio de la Física y el dominio de las habilidades y métodos de investigación relacionados con dicho campo.

- Concebir, diseñar, poner en práctica y adoptar un proceso sustancial de investigación con seriedad académica.
- Realizar un análisis crítico, evaluación y síntesis de ideas nuevas y complejas en el área de la Física.
- Analizar una situación compleja extrayendo cuales son las cantidades físicas relevantes y ser capaz de reducirla a un modelo parametrizado.
- Evaluar la validez de un modelo o teoría propuesto por otros miembros de la comunidad científica.
- Saber modelizar matemáticamente los problemas físicos sencillos nuevos, conectados con problemas conocidos. Ser capaz de expresar en términos matemáticos nuevas ideas.
- Elaborar una memoria clara y concisa de los resultados de su trabajo y de las conclusiones obtenidas en el área de la Física.
- Exponer y defender públicamente el desarrollo, resultados y conclusiones de su trabajo en el área de la Física.
- Conocer los procesos físicos que dan lugar a los mecanismos de emisión a lo largo del espectro electromagnético y a partir de ahí estudiar las técnicas observacionales para la detección de esta radiación, sea en el rango de radiofrecuencia mediante radiotelescopios sencillos e interferómetros, sea en el área tradicional de la óptica para la radiación en el infrarrojo, visible y ultravioleta, sea con los distintos mecanismos para registrar la radiación en rayos X y gamma.
- Conocer los aspectos fundamentales de la cosmología observacional, incluyendo el estudio de galaxias por tipos y estructuras complejas y también la radiación de fondo de microondas y su estructura y anisotropías.

LEARNING OUTCOMES

At the end of the teaching-learning process the student will have learned to:

1. Select and correctly use various sources of information in both traditional and electronic format.
2. Know the basics of databases and bibliographic resources typica of the field: inspire, spiers, arXiv.
3. Properly handle and interpret qualitative and quantitative physical data, which validate the known theories in the field.
4. Analyze information from physical systems.
5. Prepare written documents and reports in an understandable and organized way. Document and illustrate such documents.
6. Articulate structured, consistent, oral speech, with a good diction and use of technical vocabulary.
7. Understand the arguments used in the field of Astronomy and Astrophysics.
8. Understanding the mathematical description of physical processes governing the formation and evolution of celestial objects at both stellar and cosmological scales.

Being able to develop and manage the mathematical techniques and skills for their application in simple cases of the Einstein equations of gravitation.

DESCRIPTION OF CONTENTS

1. Introduction

Introduction: Astronomy as a Observatioanal Science

2. Optical and Infrared Astronomy

The optical and infrared atmospheric windows. Astronomical Spectroscopy. Astronomical Photometry

3. High energy astrophysics

Cosmic mechanisms of X- and gamma-ray generation and extinction. Instruments for X- and gamma-ray astrophysics. The high energy universe.

4. Radioastronomy

Observing at radio wavelengths. Radiance and Intensity. Antennas and receivers. Interferometric arrays and image reconstruction by Fourier Techniques. Radiation mecanisms. Examples.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	23,00	100
Laboratory practices	16,00	100
Other activities	4,00	100
Seminars	3,00	100
Preparing lectures	69,00	0
Preparation of practical classes and problem	35,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

MD1 – Standard theory lecture.
MD3 – Problem solving.
MD4 – Problems.
MD5 – Seminars.
MD8 – Conferences of experts.

EVALUATION

SE1 - Written exam on the theory and practical lectures: based on the results of learning and the specific objectives of each subject (20%).
SE3 - Continuous evaluation of students in the classes of theory and practice: participatory assistance and exercises in the classroom (20%).
SE5 - Evaluation of non-presential activities related to theory and practical lectures: reports (and problems) submitted (20%).
SE7 - Oral presentation and exhibition of works in the classroom (40%).

REFERENCES

Basic

- The observation and analysis of stellar photospheres. David F. Gray
  Cambridge University Press, U.K., 2005 (3rd edition).
- Astronomical Photometry. Chris Sterken & Jean Manfroid
  Kluwer Academic Publishers, Holland, 1992
- High Energy Astrophysics. Malcolm S. Longair
  Cambridge University Press, U.K., 1992, 1994. (2nd edition, Vols. 1 & 2)
- The Universe in Gamma Rays. Volker Schönfelder (Ed.)
  A&A Library, Springer-Verlag, Germany, 2001.
- Tools of Radio Astronomy. Rohlfs and Wilson,
  4th edition, 2004
- An Introduction to Radio Astronomy. Burke and Graham-Smith,
  2nd edition, 2002

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available