

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	10EK401	SEMESTER	7
COURSE TITLE	Astroparticle Physics and Cosmic Rays		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		WEEKLY TEACHING HOURS	CREDITS
Lectures (theory and exercises)		4	6
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Specialised Knowledge		
PREREQUISITE COURSES:	No		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in the English language for Erasmus students		
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS219/		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

In this course the student acquires the necessary knowledge for the understanding of several physical quantities related to Astroparticle Physics and Cosmic Rays Physics.

With the completion of the course the student is able to

- Define what cosmic rays are, as well as nucleosynthesis, dark energy and dark matter and describe the basic properties of hadronic/electromagnetic showers.
- Explain the basic methods of cosmic ray detection and recognize the basic detection experiments.
- Explain the recent experimental results and conclusions (hadronic showers, neutrinos, γ -rays, dark matter)

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
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Others...
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The course aims at the following general competences

Analysis and synthesis of data and information
 Decision-making
 Working independently
 Team work
 Project planning and management
 Analytical and synthetic thinking
 Critical thinking
 Taking initiative/responsibility
 New Technology skills
 Learning word/excel/ppt/ origin/spss
 Communication skills
 Information management
 Meeting Deadlines and Keeping Schedules
 Flexibility / Adaptability
 Problem solving

(3) SYLLABUS

- Introduction: What is Astroparticle Physics. The Role of Elementary Particle Physics in the Understanding of the Universe.
- Cosmology - Early Universe:
- Expansion of the Universe. Hubble's Law. Thermodynamics of the early universe. Big Bang. Cosmic Background Radiation. Neutron - proton ratio. Primary nucleosynthesis.
- Microwave background measurements and effects on cosmology. Recent developments. Dark matter. Dark energy.
- Cosmic rays
- Primary cosmic rays . Basic features of Primary cosmic rays (composition, energy spectrum). Secondary cosmic radiation: hard and soft component. Sources and acceleration of cosmic rays. Cosmic Ray modulation. Forbush decreases, Ground Level Enhancements (GLEs) , Magnetospheric Events.
- Cosmic rays detection methods and devices. Space born and ground based measurements. Hadronic shower detection experiments.
- Recent development in basic research and applications : Warning signals for high energy solar energetic particles. Estimation of cosmic ray radiation dose.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Yes Electronic communication with the students using ICT (Information and Communications Technology) Computer-aided lectures, use of Overhead Projectors, eclass platform	
TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i> <i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i>	Activity	Semester workload
	Lectures	26
	Exercises	26
	Individual Study/ Study and Analysis of bibliography / Preparation	98
	Course Total	150
STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i> <i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	Final written exams in Greek	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography

- Κοσμική Ακτινοβολία , Ε. Χριστοπούλου-Μαυρομιχαλάκη, ΕΚΔΟΣΕΙΣ Μ. ΑΘΑΝΑΣΟΠΟΥΛΟΥ-Σ. ΑΘΑΝΑΣΟΠΟΥΛΟΥ Ο.Ε, 2009 , ΑΘΗΝΑ
- Cosmic rays and Particle Physics , Thomas Gaisser, Ralph Engel and Elisa Resconi,,Cambridge University press.