Extragalactic astronomy and cosmology

Educational subject description sheet

Basic information

Study programme Astronomia **Speciality** - **Organizational unit** Faculty of Physics and Astronomy **Study level** Second-cycle programme **Study form** Full-time **Education profile** General academic	**Didactic cycle** 2024/25 **Subject code** 04ASTS.24K.02193.24 **Lecture languages** English **Course type** Obligatory **Block** Major subjects

Subject coordinator	Justyna Gołębiewska, Michał Michałowski
Lecturer	Michał Michałowski

Period	**Activities and hours**	**Number of ECTS points**
Semester 3	• Lecture: 30, Exam; including sub-activities: ◦ Synchronous lecture: 30 • Classes: 30, Graded credit	6

Goals

Code	Goal
G1	To familiarise students with research methods used in astronomy to study galaxies
G2	Transfer of knowledge on basic dynamic characteristics and physical properties of the Galaxy and other galaxies
G3	Transfer of knowledge about the structure and evolution of the Universe

Subject learning outcomes

Code	Outcomes in terms of	Learning outcomes	Examination methods
Knowledge – Student:			
W1	knows the history of the research on the Galaxy and galaxies	AST_K2_W02	Oral exam
W2	knows the dynamic and physical properties of the Galaxy and other galaxies	AST_K2_W01, AST_K2_W02	Oral exam, Written colloquium
W3	knows the Big Bang theory	AST_K2_W02	Oral exam, Written colloquium
W4	knows theories describing the structure and evolution of the Universe	AST_K2_W02, AST_K2_W05	Oral exam, Written colloquium
W5	knows current research directions in extragalactic astrophysics and cosmology	AST_K2_W02, AST_K2_W04, AST_K2_W05	Oral exam
Skills – Student:			
U1	can read and understand literature on extragalactic astrophysics and cosmology	AST_K2_U05, AST_K2_U06	Oral exam
U2	can make basic calculations connected with extragalactic astronomy and cosmology	AST_K2_U05, AST_K2_U06	Written colloquium
Social competences – Student:			
K1	can critically evaluate scientific publications	AST_K2_K01	Oral exam

Study content

No.	Course content	Subject learning outcomes	Activities
1.	Morphological classification of galaxies The structure of the Galaxy The Local Group of galaxies	W1, W2, U2	Lecture, Classes, Synchronous lecture
2.	Properties of elliptical and spiral galaxies	W1, W2, W5, U1, U2, K1	Lecture, Classes, Synchronous lecture
3.	The large-scale structure of the Universe The expansion of the universe The Hubble's law	W1, W3, W4, W5, U1, U2, K1	Lecture, Classes, Synchronous lecture
4.	The Big Bang Theory Cosmic Microwave Background	W1, W3, W4, W5, U1, U2, K1	Lecture, Classes, Synchronous lecture
5.	Gravitational lensing	W1, W5	Lecture, Synchronous lecture
6.	General Theory of Relativity, curvature of space-time and the metric of the Universe Friedmann equation	W1, W3, W4, W5, U2	Lecture, Classes, Synchronous lecture

No.	Course content	Subject learning outcomes	Activities
7.	Cosmological constant Models of the Universe The standard model of the Universe	W1, W3, W4, W5, U1, U2, K1	Lecture, Classes, Synchronous lecture
8.	Dark matter Acceleration of the expansion of the Universe Nucleosynthesis in the early universe Inflationary Universe	W1, W3, W4, W5, U1, U2, K1	Lecture, Classes, Synchronous lecture

Additional information

Activities	Teaching and learning methods and activities
Lecture	Lecture with a multimedia presentation of selected issues, Discussion
Classes	Solving tasks (e.g. computational, artistic, practical)

Activities	Credit conditions
Lecture	Knowledge and ability to discuss topics discussed during the lecture
Classes	Correct solving of problems

Literature

Obligatory

1. L.S. Sparke, J.S. Gallagher, 2000, Galaxies in the Universe. An Introduction, Cambridge University Press

Optional

1. B. Ryden, 2003, Introduction to Cosmology, Addison Weslley, San Francisco
2. J. Binney, M. Merrifield, 1998, Galactic Astronomy, Princeton University Press

Calculation of ECTS points

Activities	Activity hours*
Lecture	30
Classes	30
Preparation for classes	60
Reading the indicated literature	20
Preparation for the assessment	20
Student workload	**Hours** 160

Number of ECTS points	ECTS 6

* academic hour = 45 minutes

Efekty uczenia się dla kierunku

Kod	Treść
AST_K2_K01	The graduate is ready to critical evaluation of gained knowledge and received content
AST_K2_U05	The graduate can plan and carry out learning independently, understands the need of lifelong learning and is able to inspire and organise the process of learning of other people
AST_K2_U06	The graduate can independently search for professional information and astronomical data, knows the most important astronomical journals and databases, which allows proper selection of sources and information from these sources used to solve complex and unusual research problems
AST_K2_W01	The graduate knows and understands the physical foundations of astronomical phenomena sufficiently enough to describe, study and understand them
AST_K2_W02	The graduate knows and understands in depth selected problems in the scope of advanced astrophysics
AST_K2_W04	The graduate knows and understands in depth modern tools, techniques and methods of observational astronomy
AST_K2_W05	The graduate knows and understands the main development directions and the most recent discoveries in astronomy