

Subject card

Subject name and code	Astrophysics, PG_00182265						
Field of study	Physics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2028/2029		
Education level	Bachelor's studies	Subject group			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	full-time studies	Mode of delivery			at the university		
Year of study	3	Language of instruction			Polish		
Semester of study	5	ECTS credits			3.0		
Learning profile	academic	Assessment form			credit		
Conducting unit	Division of Atomic and Molecular Spectroscopy and Astrophysics -> Institute of Theoretical Physics and Astrophysics -> Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Piotr Gnaciński				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	45		0.0		45.0	90
Subject objectives	<ol style="list-style-type: none"> 1. To explain the structure of celestial bodies. 2. Understanding the interrelationships and interactions between astrophysical objects. 3. Explain the physical laws responsible for astrophysical phenomena. 4. To become familiar with the research methods used in astrophysics. 						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZL3_W01] has advanced knowledge of physical concepts, principles and theories, understands their historical development and significance not only for physics, but also for other exact and natural sciences and cognition of the world	The student knows: 1. The laws of physics that determine the course of astrophysical phenomena. 2. Astrophysical objects occurring in the Universe and relations between them. 3. Research methods used in astrophysics. 4. The role of astrophysics in the study of the laws of nature. 5. The structure of the Earth, Solar System bodies, Stars, Galaxies and the Universe. 6. The impact of astronomy and astrophysics on the development of physics, mathematics and technology.	[SW4] test/exam - oral or written [SW3] text preparation/written work
	[FIZL3_W05] understands astrophysical phenomena and the laws governing them, knows advanced physical processes taking place in the Universe	The student knows: 1. The laws of physics that determine the course of astrophysical phenomena. 2. Astrophysical objects occurring in the Universe and relations between them. 3. Research methods used in astrophysics. 4. The role of astrophysics in the study of the laws of nature. 5. The structure of the Earth, Solar System bodies, Stars, Galaxies and the Universe. 6. The impact of astronomy and astrophysics on the development of physics, mathematics and technology.	[SW4] test/exam - oral or written [SW3] text preparation/written work
	[FIZL3_U09] can extrapolate the results obtained in the terrestrial laboratory to describe phenomena in the Universe	The student is able to extrapolate the results obtained in the Earth laboratory to the Universe	[SU3] text preparation/written work [SU4] test/exam - oral or written
	[FIZL3_W10] has advanced knowledge of the elementary components of matter and the types of fundamental interactions between them, of the manifestations of these interactions in phenomena occurring on various scales from subatomic to astronomical, knows the time and energy scales associated with these phenomena	The student knows the methods of observing electromagnetic waves from gamma rays to radio waves, observing gravitational waves, neutrinos and cosmic rays.	[SW4] test/exam - oral or written [SW3] text preparation/written work

Subject contents	<p>1. Elements of spherical trigonometry: spherical triangle, horizontal, equatorial and ecliptic coordinate system.</p> <p>2. Astronomical time: true solar, mean solar and stellar time; calendar.</p> <p>3. Astronomical observations: optical, radio, gamma-ray and satellite observations. Influence of the Earth's atmosphere on observations.</p> <p>4 The structure of the Earth and the Earth's atmosphere; the ozone hole, the ionosphere, auroras, the greenhouse effect.</p> <p>5. Kepler's laws in the context of the Planetary System. Space velocities.</p> <p>6 Rotational, circular and precessional motion of the Earth.</p> <p>7. The Earth-Moon system: orbit of the Moon, stellar, synodic and draconic months, solar and lunar eclipses, tides.</p> <p>8. Review of physical properties of planets, moons and minor bodies of the Planetary System; gravitational resonance; other planetary systems.</p> <p>9. Basic physical parameters of the Sun: mass, radius, effective temperature, chemical composition. Solar activity. The problem of solar neutrinos.</p> <p>10. The Internal structure of the Sun - basic equations; thermonuclear reaction cycles; energy transport mechanisms.</p> <p>11. Luminosities, temperatures, radii and masses of stars. H-R diagram.</p> <p>12. Double stars and variable stars. Clusters and stellar associations.</p> <p>13 Interstellar matter: dust and gas components, emission, reflection and dark nebulae.</p> <p>14. Stellar evolution and its course in the H-R diagram. Late stages in the evolution of massive stars: supernovae, neutron stars, black holes.</p> <p>15. Structure of the Galaxy: spiral structure, rotation, populations and subsystems. Distribution of interstellar matter in the Galaxy.</p> <p>16. Other galaxies: classification and physical characteristics, determination of distances, active galaxy nuclei and quasars, galaxy clusters.</p> <p>17. Elements of cosmology: Hubble's law, basic cosmological models, relic radiation (fluctuations), primordial nucleosynthesis, evolutionary history of the Universe (eras).</p>											
Prerequisites and co-requisites	<ul style="list-style-type: none"> A. Passed subjects: major subjects from the first and second year of study and mathematical analysis and linear algebra. B. Basic knowledge of atomic structure and elementary particles. 											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 1039 794 1070">Subject passing criteria</th> <th data-bbox="801 1039 1139 1070">Passing threshold</th> <th data-bbox="1145 1039 1482 1070">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 1075 794 1106">final test</td> <td data-bbox="801 1075 1139 1106">51.0%</td> <td data-bbox="1145 1075 1482 1106">50.0%</td> </tr> <tr> <td data-bbox="456 1111 794 1137">exam</td> <td data-bbox="801 1111 1139 1137">51.0%</td> <td data-bbox="1145 1111 1482 1137">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	final test	51.0%	50.0%	exam	51.0%	50.0%
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Recommended reading	Basic literature	<p>H. Kartunen, P. Kroger, H. Oja, M. Poutanen, K.J. Donner, "Astronomia ogólna"</p> <p>J. Kreiner, "Astronomia z Astrofizyką"</p>										
	Supplementary literature	<p>E. Rybka, Astronomia ogólna</p> <p>J. Stodólkiewicz, Astrofizyka ogólna z elementami geofizyki</p> <p>M. Kubiak, Gwiazdy i materia międzygwiazdowa</p> <p>M. Jaroszyński, Galaktyki i budowa Wszechświata</p> <p>A. Opolski, H. Cugier, T. Ciurla, Wstęp do astrofizyki</p> <p>J. Mietelski, Astronomia w geografii</p>										
	eResources addresses											
Example issues/ example questions/ tasks being completed	not applicable											
Work placement	Not applicable											

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