University of Gdańsk

Subject card

Subject name and code	Nuclear and Elementary Particles Physics, PG_00199419						
Field of study	Nuclear safety and radiological protection						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2027/2028			
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	2		Language of instruction	Polish			
Semester of study	4		ECTS credits	6.0			
Learning profile	academic		Assessment form	exam			
Conducting unit	Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Angelina Łobejko				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	45.0	0.0	0.0	105
	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	105		0.0	75.0	180	
Subject objectives	To familiarize students with the laws of nuclear physics and elementary particles, methods of their detection, properties, and interactions.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BJORL3_U09] Can independently plan and implement his own learning.	The student is able to independently plan and implement their own learning process in the field of nuclear physics and elementary particle physics. The student is able to identify their own educational needs, select appropriate sources of knowledge, and organize their work in such a way as to systematically deepen their understanding of issues related to radioactivity, fundamental interactions, and the structure of matter.	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU4] test/exam - oral or written
[BJORL3_U04] Can use mathematical and computer apparatus to analyze and solve problems in radiological protection and nuclear safety.	The student is able to use appropriate mathematical apparatus and IT tools to analyze and solve problems related to radiation protection and nuclear safety. The student is able to perform calculations related to radioactive processes, radiation shielding, and radiation source parameters, and is able to analyze measurement data using simple numerical methods and appropriate software.	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU4] test/exam - oral or written
[BJORL3_U01] Can formulate the laws of physics and chemistry using mathematical formalism.	The student is able to formulate the basic laws and relationships of nuclear physics and elementary particle physics using mathematical formalism appropriate to the phenomena described. The student is able to express physical quantities and their relationships in the form of equations, transform them, and interpret the results obtained in the context of issues related to the structure of the atomic nucleus, radioactive transformations, and elementary interactions.	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU4] test/exam - oral or written
[BJORL3_W07] Has advanced knowledge of the construction and principles of operation of scientific apparatus used in radiological protection and nuclear safety.	The student knows the structure and basic principles of operation of equipment used in radiation protection and nuclear safety systems. The student is able to characterize the main types of radiation detectors, measuring devices, and technical infrastructure components used to monitor and control radiation sources, and understands their applications and limitations resulting from technical parameters and operating conditions.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report [SW3] text preparation/written work
[BJORL3_W06] Knows advanced computational methods used to solve typical problems in radiological protection and nuclear safety.	The student knows the basic calculation methods used to solve typical problems related to radiation protection and nuclear safety. The student is able to explain the principles of applying these methods, understands their scope of applicability and limitations, and is able to indicate how these methods support the analysis of processes occurring in radioactive materials, radiation shields, and radiation sources.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report [SW3] text preparation/written work

Course outcome	Subject outcome	Method of verification
[BJORL3_W03] Knows how to plan and perform a simple physical or chemical experiment and analyze the results obtained; knows the elements of the theory of measurement uncertainty as applied to experiments; knows the basic units of the SI system and its most important derived units; knows other systems of measurement units.	The student knows the basic principles of planning and conducting simple experiments in nuclear physics and elementary particle physics and is able to identify the steps necessary to perform measurements correctly. The student understands the importance of analyzing the obtained data and is able to relate the results of experiments to the predictions of theoretical models. In addition, the student has knowledge of measurement uncertainty theory and is able to explain how uncertainties affect the interpretation of experimental results. They know the basic units of the SI system and the most commonly used derived units used in nuclear and particle physics, and are familiar with alternative systems of units, which enables them to correctly use physical quantities in various research contexts.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report [SW3] text preparation/written work
[BJORL3_W02] Understands the role of physical and chemical experimentation, mathematical theoretical models approximating reality, and computer simulations in scientific research methodology; is aware of technological, apparatus, and methodological limitations in scientific research.	The student understands and is able to explain the significance of nuclear experiments and research in the field of elementary particle physics in the process of understanding the structure of matter. The student describes how mathematical theoretical models approximate physical reality and how computer simulations support the analysis and interpretation of experimental data. They demonstrate an awareness of the interrelationships between experiment, theory, and simulation, and are familiar with the main technological, instrumental, and methodological limitations that affect the design and implementation of research in the field of nuclear and elementary particle physics.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report [SW3] text preparation/written work
[BJORL3_W05] Has advanced knowledge of the elementary components of matter and the types of fundamental interactions between them, the manifestations of these interactions in phenomena occurring at scales ranging from subatomic to subatomic, knows the time and energy scales associated with these phenomena.	The student has structured knowledge of the elementary components of matter and the basic types of fundamental interactions between them, and understands how these interactions manifest themselves in phenomena occurring on various scales—from subatomic to nuclear and macroscopic. The student is familiar with the typical time and energy scales characteristic of nuclear and particle processes and is able to relate them to specific physical phenomena. In addition, the student has a basic knowledge of biology necessary to understand the biological effects of ionizing radiation, which enables him or her to identify and interpret processes relevant to nuclear safety and radiation protection.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report [SW3] text preparation/written work

Course outcome	Subject outcome	Method of verification
[BJORL3_W01] Has a detailed knowledge of the basic concepts and principles of nuclear physics and chemistry, understands their historical development and their importance not only for nuclear safety and radiation protection, but also for understanding the modern world.	The student has structured knowledge of the basic concepts of nuclear physics and elementary particle physics and understands their significance for the development of modern science. The student is able to discuss the historical development of these fields, pointing out key discoveries and their impact on nuclear technologies, nuclear safety, and radiation protection. In addition, students understand the basic processes occurring in living matter and the natural environment that are relevant to assessing the impact of ionizing radiation on organisms and ecosystems, which allows them to link physical issues with biological and ecological aspects.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report [SW3] text preparation/written work
[BJORL3_U03] Is able to use the formalism of physics and chemistry to describe phenomena in the microworld.	The student is able to apply the formalism of nuclear physics and elementary particle physics to describe phenomena occurring in the microcosm, in particular those concerning the structure of atomic nuclei, fundamental interactions, and radioactive processes. The student is able to use the basic principles of biology to describe the interaction of ionizing radiation with living matter and is able, at a basic level, to use selected ecological concepts to interpret the effects of radiation in the natural environment.	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU4] test/exam - oral or written

Subject contents	not applicable
Prerequisites and co-requisites	not applicable

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
not applicable	51.0%	45.0%
not applicable	51.0%	20.0%
not applicable	51.0%	35.0%

Recommended reading

Basic literature	not applicable
Supplementary literature	not applicable
eResources addresses	

Example issues/ example questions/ tasks being completed	not applicable
Work placement	Not applicable

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