University of Gdańsk

Subject card

Subject name and code	Quantum Physics, PG_00182317						
Field of study	Physics						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
Education level	Master'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	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		5.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Rada Uczelni						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Marcin Wieśniak, prof. UG				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	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	60		0.0		65.0	125
Subject objectives	The aim is to present advanced problems in quantum mechanics, such as the description of an ensemble of identical particles, scattering theory, relativistic equations of motion in. quantum mechanics, and the open system formalism.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[FIZMU2_W02] has in-depth knowledge in mathematics and mathematical and computational methods, necessary to solve and model physics problems with an elevated level of complexity and deepened in the selected area of physics	A student understands the formalism allowing to describe systems of indistinguishable particles, quantum description of relativistic systems an generalizations of equations of motion to open systems. They also understands the formalism of quantum scattering.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[FIZMU2_K01] is ready to critically evaluate the knowledge and content received, to formulate questions precisely and to further educate themselves and others	A Student acknowledges interpretational difficulties in quantum mechanics, in particular in case of open systems, indistinguishable particles, or Dirac binspinors.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report
[FIZMU2_U01] is able to apply the scientific method in solving physical problems, conducting experiments and reasoning	A student understands implications of more subtle effects (e.g., relativistic) to more general problems. She can conduct calculations of chosen physical problems.	[SU1] oral statement/conversation/ discussion
[FIZMU2_W01] has in-depth knowledge of various areas of physics; knows the history of the development of physics and its importance for the progress of exact and natural sciences, knowledge of the world and social development; has in-depth knowledge of the current directions of physics development and the fundamental dilemmas of modern civilization	The student understands. the historical context, that lead to presented results.	[SW1] oral statement/ conversation/discussion

Subject contents

Formalism of indistinguishable particles

Scattering theory: S-matrix, partial waves method, the optical theorem

Klein-Gordon equation: pain wave,non-relativistic limit, charge density, pi-meson atom

Dirac equation: pain wave,non-relativistic limit, pi-meson atom

Open system formalism: density matrix, Krauss operators, master equation

Prerequisites and co-requisites

Finished course of quantum mechanics I, or equivalent

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Open written exam (3 questions)	51.0%	50.0%
Presentaton of chosen problem	51.0%	50.0%

Recommended reading

Basic literature	Leonard I. Schiff, "Mechanika kwantowa", PWN 1977
Supplementary literature	E. Słoimińska, R. Kostecki, "Mechanika Kwantowa Notatki z wykładów dr hab. Ernesta Aleksego Bartnika"
eResources addresses	

Example issues/ example questions/ tasks being completed

Scattering theory, partial wave method

Pi-meson atom: a sketch of a solution

Properties of Dirac matrices

Nonrelativisic limit of quantum mechanics

Master equation: justification for a form

Work placement

Not applicable

Document generated electronically. Does not require a seal or signature.