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				
	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_K01] knows the limitations of his own knowledge and skills; can formulate questions precisely; understands the need for further education and other	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 [SK4] test/exam - oral or written
[FIZMU2_K02] is aware of the conclusive role of experiment in the verification of physical theories; is aware of the scientific method in the accumulation of knowledge	Thanks to gained knowledge, a student shall be able to compare theoretical predictions of, say, spectral lines of atoms with the gathered experimental data.	[SK1] oral statement/conversation/ discussion [SK2] presentation/project/paper/ report [SK4] test/exam - oral or written
[FIZMU2_W01] has advanced knowledge of general physics and 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, cognition of the world and social development	The student understands. the historical context, that lead to presented results.	[SW1] oral statement/ conversation/discussion
[FIZMU2_W06] has knowledge of the current directions of development of physics and fundamental dilemmas of modern civilization	A student understands the connection of presented problems to contemporary physical research, for a example, a role of the scattering theory in high-energy physics, or open systems in foundations of quantum mechanics.	[SW1] oral statement/ conversation/discussion
[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_U09] can work independently or in a team	A student is able to conduct chosen calculations on her own, confront their results, and divide a calculation cycle to stages.	[SU1] 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
Presentaton of chosen problem	51.0%	50.0%
Open written exam (3 questions)	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

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