University of Gdańsk

Subject card

Subject name and code	Paradoxes of Quantum Mechanics, PG_00193431						
Field of study	Quantum Information Technology						
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			
Mode of study	full-time studies		Mode of delivery	at the university			
Year of study	1		Language of instruction	English			
Semester of study	1		ECTS credits	2.0			
Learning profile	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Paweł Mazurek				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		0.0		35.0	50
Subject objectives	The aim of the course is to offer basic knowledge about striking quantum mechanical effects that contradict classical common sense.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[QITL3_U02] is able to use their knowledge of quantum information technology – formulate and solve complex and unusual problems and innovatively perform tasks in unpredictable conditions by appropriately selecting sources and information derived from them, evaluating, critically analyzing, synthesizing, creatively interpreting, and presenting this information, as well as by selecting and applying appropriate methods and tools, including advanced information and communication techniques and adapting existing methods and tools or developing new ones		
[QITL3_W01] knows and understands in depth selected facts, objects and phenomena, as well as the methods and theories related to them, explaining the complex relationships between them, constituting advanced general knowledge in the field of quantum information technology, as well as the scientific research methodology specific to this discipline and its importance in the context of contemporary directions of development of science and technology		

Subject contents

Quantum interference and superposition.

No-cloning, its relation with uncertainty.

Quantum teleportation and dense coding.

Theoretical scheme and experimental realizations.

Elitzur-Vaidman bomb tester.

Entanglement, and Schrodinger paradox.

Local realism, GHZ paradox, Bell inequalities, nosignaling boxes and monogamy of quantum (and - supraquantum) correlations.

Contextuality and Peres-Mermin paradoxapplied philosophy: communication complexity from Bell inequalities.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
presentation	51.0%	100.0%

Recommended reading

Basic literature	Literature: Nielsen and Chuang, Quantum Computation and Quantum information;John Preskill, Lecture notes;John Watrous, Lecture notes;Buhrman et al, Non-locality and communication complexity, https://arxiv.org/abs/0907.3584v1
Supplementary literature	None.

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

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