University of Gdańsk

Subject card

Subject name and code	Paradoxes of Quantum Mechanics, PG_00165960		
Field of study	Quantum Information Technology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
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	dr inż. Paweł Mazurek	

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	15.0	30

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_W04] knows advanced methods of theoretical and mathematical physics necessary in creating models of quantum mechanics		
[QITL3_U01] is able to apply the scientific method in solving physical problems and reasoning in the field of quantum information theory	Using quantum formalism, student can show basic results concerning paradoxes of quantum mechanics.	[SU2] presentation/project/paper/ report
[QITL3_W01] has extended knowledge in the field of general physics and advanced knowledge in the area of quantum information theory; knows the history of the development of quantum information theory and its importance for the progress of science, knowledge of the world and social development	Student knows basic quantum mechanical paradoxes. Student understand main features of quantum fenomena and knows the diffreneces to classical mechanics.	[SW2] presentation/project/paper/ report

<table>
<tr><td>Subject contents</td><td>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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>presentation</td><td>51.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>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</td></tr><tr><td>Supplementary literature</td><td>None.</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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