

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 phenomena and knows the diffreneces to classical mechanics.		[SW2] presentation/project/paper/report		

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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