UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

PHYSICS OF QUANTUM COMPUTATION

Enrollment year	2019/2020
Academic year	2019/2020
Regulations	DM270
Academic discipline	FIS/03 (MATERIAL PHYSICS)
Department	DEPARTMENT OF PHYSICS
Course	
Curriculum	Fisica della materia
Year of study	1°
Period	2nd semester (02/03/2020 - 12/06/2020)
ECTS	6
Lesson hours	48 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	MACCHIAVELLO CHIARA (titolare) - 6 ECTS
Prerequisites	Basic notions of quantum physics, that will be recalled at the beginning of the course (supplementary material will be suggested to students who never attended a course on quantum physics).
Learning outcomes	Learning of fundamental theoretical concepts related to the physics of quantum computation, with an introduction to quantum communication protocols and entanglement theory. At the end of the course the student will have the tools to update quickly on further developments in quantum computing, a scientific field in rapid and continuous progress.
Course contents	The course deals with the main developments in the theory of quantum computation and communications. The main topics are: Basic notions of the theory of computational complexity. Logic gates and networks. Quantum computation: single qubit gates and two-qubit gates. Universal quantum gates. Quantum algorithms: Deutsch and Deutsch-Jozsa's algorithms, Simon's algorithm, quantum phase estimation algorithm,

	quantum search, Shor'salgorithm. Introduction to the theory of quantum error correction. Superdense coding and quantum teleportation. Basic notions of classical cryptography, RSA protocol, and introduction to quantum cryptography. Introduction to entanglement theory. Separability criteria and techiques for distillation and detection of entanglement. Entanglement in quantum algorithms. One-way quantum computation.
Teaching methods	The course is organized with lectures on the blackboard, where all the details and tools necessary to the understanding of the topics will be properly addressed, with the aim of stimulating a highly interactive atmosphere with the students.
Reccomended or required readings	I.L. Chuang and M.A. Nielsen, Quantum Information and Quantum Computation, Cambridge University Press (Cambridge UK 2000).
Assessment methods	Oral examination.
Further information	Oral examination.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile