SSM
Scuola Superiore Meridionale

Course title:

Introduction to Quantum Mechanics

Duration [number of hours]**: 24**

PhD Program [MERC/MPS/SPACE]**: SPACE**

Name and Contact details of unit organizer(s):

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Course Description [max 150 words]**:**

At the end of 19-th century, scientists found phenomena that could not be explained in terms of Mechanics ed Electromagnetism laws. These were phenomena mainly restricted to the microscopic world or strictly related to it. It was the beginning of a big revolution in Physics that led to the born of Quantum Mechanics (QM) and Theory of Relativity. The course is a brief and general introduction to Quantum Mechanics. It aims to provides the main concepts of this very counterintuitive theory as well as the mathematical tools necessary to tackle quantitatively the subject. In particular, the Schrödinger equation will be introduced and studied for some quantum systems. The path integral formalism will be described and used in the perturbation theory with the representation of Feynman diagrams. Moreover, it will be employed to describe some peculiar examples: instantons and interactions with an external electromagnetic field.

Syllabus:

1. Experimental foundations of quantum theory
2. Schrödinger picture and probabilistic
3. Integrating the equations of motion
4. The Axiomatic of Quantum Mechanics
5. Introduction to spin
6. Path integral formalism
7. Perturbation theory and Feynman diagrams
8. Instantons
9. Interaction with an external electromagnetic field

Assessment:

Oral exam

Suggested reading and online resources:

1. Advanced Concepts in Quantum Mechanics, by G. Esposito, G. Marmo, G. Miele, G. Sudarshan, Cambridge University Press.
2. Quantum Theory, by D. Bohm, Dover Publications, Inc., New York.
3. Modern Quantum Mechanics, by J.J. Sakurai and Jim Napolitano, Cambridge University Press.
4. Quantum Mechanics and Path Integrals, by R.P. Feynman, A.R. Hubbs, Dover Publications, Inc., New York.