UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Quantum Mechanics

2627-3-E3001Q072

Aims

Knowledge and understanding of the principles of Quantum Mechanics.
The student will learn the basic concepts of quantum physics, essential for the understanding of the microscopic world.

More in details:

Knowledge and understanding: The student will learn the fundamental concepts of Quantum Mechanics.

Applying knowledge and understanding: The student will learn to apply Quantum Mechanics to the study of the microscopic world.

Making judgments: The student will develop critical thinking and judgment skills in selecting the most appropriate tool, among those provided during the course, to solve a specific problem.

Communication skills: The student will be expected to acquire a correct and appropriate scientific language suited to the topics covered in the course.

Learning skills: The student will be able to deepen their understanding of specific concepts not covered during the course and to independently pursue advanced study using specialized scientific texts.

Contents

Fundaments of Quantum Mechanics: the Schrödinger equation and its probabilistic interpretation, fundamental quantum systems (quantum harmonic oscillator, hydrogen atom,....), spin and identical particles, perturbation theory.

Detailed program

The crisis of Classical Physics.

The Schrödinger equation and its probabilistic interpretation.

Heisenberg uncertainty principle.

General properties of the Schrödinger equation.

The general principles of quantum mechanics.

Unidimensional problems, the harmonic oscillator.

Angular momentum and spin.

Tri-dimensional problems.

Motion in a central potential, the hydrogen atom.

Interaction with a classic electromagnetic field.

Identical particles.

Perturbation theory.

Prerequisites

Knowledge of Classical Physics and Mathematical Methods for Physics at the level of the first two years of the bachelor degree.

Teaching form

Lessons and exercise sessions, delivery mode, in person, 12 credits

Textbook and teaching resource

C. Cohen-Tannoudji, B. Diu, F. Laloe, “Quantum Mechanics” vol I e II

D.J. Griffiths, “Introduction to Quantum Mechanics”

S. Gasiorowicz, "Quantum Physics", III ed

J.J. Sakurai, J. Napolitano, “Modern Quantum Mechanics”

L.D. Landau, E.M. Lifshitz, “Quantum Mechanics”

R.P. Feynman, R.B. Leighton, M. Sands, "The Feynman Lectures on Physics", Vol III. Free access website http://www.feynmanlectures.caltech.edu

S. Forte, L. Rottoli "Fisica Quantistica"

Semester

First semester

Assessment method

The exam consists of a **written part** with **exercises and problems on the whole course** and an **oral part**. The **oral** part focuses on **the whole program** of the course, including **exercises** and **insights** carried out during the lessons, which are an integral part of the course.

The final result is not a weighted average of the results of the written and oral tests, but is determined by a global assessment, based on: precision and correctness in solving the exercises,
knowledge of the topics, clarity of exposition.

During the course, two **optional** intermediate written exams will be proposed, with **exercises and problems on the part of the program carried out up to the time of the test**. If both of them are passed, the final written exam is waived.

The oral part has to be taken in the **same session** of the written part. Several dates will be made available, according to the number of students that have to take it.

Students that passed the two optional intermediate written exams must take the oral part in the **first session** in January.

Upon request, the exam can be taken in english for Erasmus students.

Office hours

On student request, at agreed time

Sustainable Development Goals

QUALITY EDUCATION