

Quantum Mechanics

Lecturer: Przemysław Małkiewicz

Teaching assistant: Daniele Rizzo

Starts: 29/02/2024

Place: Room 207

This course will comprise 13 lectures, and will be largely based on Paul Dirac's book "The Principles of Quantum Mechanics" (4th edition). It will start with an overview of classical mechanics and then gradually develop the formalism of quantum mechanics, finally applying it to some basic dynamical systems. The covered topics include:

- The basics of Lagrangian and Hamiltonian formalisms, Hamilton-Jacobi equation;
- The principle of superposition, ket and bra vectors, linear operators and their adjoints, the spectral theorem;
- Dirac's delta function, basic kets and bras, resolution of unity, wave functions and matrix operators;
- Quantum Poisson Brackets, Schrödinger's and momentum representations, the uncertainty principle, unitary transformations;
- Schrödinger's and Heisenberg's forms of equations of motion, stationary states, motion of wave packets, density operators;
- Harmonic oscillator, angular momentum and systems with multiple angular momenta, hydrogen atom;
- Perturbation theory: stationary and time-dependent methods;
- Atoms and radiation: transition probabilities and selection rules;
- Collision problems;
- Interactions between atoms and photons.

An optional written testout exam will be given three weeks after the course begins. The final exam will comprise a problem-solving part and an oral part (final evaluation = exam: 80% + homeworks: 20%).