



Introduction to Quantum Methods in the Physical Sciences

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The aim of these lectures is to provide an introduction to the structural formalism of quantum mechanics. Quantum methods in the physical sciences form a system of principles that explain the nature of nature. This course develops introductory methods to describe interactions on the scale of atoms and discusses how these phenomena are related to everyday life. The main mathematical tools built on are probability, vector spaces, and partial differential equations. The course is suitable for students interested in following theoretical investigations of microscopic processes in atoms, molecules, and materials.

No deep prior knowledge of quantum theory is required. Access to a computer is an advantage.

Main topics:

- Background.
- 1. Evidence of quantum mechanics.
- 2. Wave mechanics.
- 3. Probability.
- 4. Vector spaces & linear operators.
- 5. State functions.
- 6. Eigenspectrum problems.

- Foundation quantum mechanics.
- 1. General formalism.
- 2. Partial differential equations.
- 3. Properties and observables.
- 4. Interacting particles.
- 5. Hartree's problem.
- 6. Applications.

The total number of lecture hours: 20, laboratory exercises: 0, self-teaching: 60, direct tutoring and consultations: 20.

ECTS Points: 4