

| | | | | |
|---|-----------------|-----------------------------|-------------------|--------|
| Level: bachelor | | | | |
| Course title: Quantum mechanics | | | | |
| Status: obligatory | | | | |
| ECTS: 7 | | | | |
| Requirements: Theoretical mechanics, Fundamentals of mathematical physics | | | | |
| Learning objectives | | | | |
| Study of Quantum Mechanics using more abstract mathematical formalism introducing the basic quantum field theory and systems of identical particles. | | | | |
| Learning outcomes | | | | |
| After taking the course, the students should have developed: | | | | |
| General abilities: basic knowledge of this field, following the literature, analysis of various solutions and the choice of the most adequate solution, application in practice and other subjects. | | | | |
| Subject-specific abilities: knowledge of abstract mathematical formalism of Quantum Mechanics; knowledge of the basic quantum Filed Theory (second quantization). | | | | |
| Syllabus | | | | |
| <i>Theoretical instruction</i> | | | | |
| Historical development of quantum mechanics. Superposition principle. De Broglie hypothesis. Heisenberg uncertainty relations. Postulates of quantum mechanics. Hilbert space. Operators of physical quantities. Measurement problem in quantum mechanics. Schroedinger equation. One-dimensional problems: potential well, step and barrier. Linear harmonic oscillator. Hydrogen atom. Eigenproblem of orbital (angular) momentum operator. Spherical harmonics. Electron spin. Theory of stationary perturbations: nondegenerated and degenerated spectrum. Identical particles. Pauli's principle. Exchange interaction. Orto- and parahelium. Schrödinger, Heisenberg and interaction picture. Heisenberg's motion equations and quantisation of classical systems. Theory of measurement (in quantum mechanic). Representation theory. Kinetic momentum and momentum addition. Variation principle. Nonstationary perturbations. S-matrix and transition probability. Systems of identical particles. Hartree–Fock approximation. Scattering theory. Elastic and inelastic scattering. Scattering of identical particles. The elements of relativistic quantum mechanics. Dirac electron theory and Pauli equation. Introduction to quantum field theory. Second quantisation of electromagnetic field. Interaction of radiation with matter. | | | | |
| <i>Practical instruction</i> | | | | |
| Problem solving. Homework. | | | | |
| Weekly teaching load | | | | |
| Lectures: 4 | Exercises: 3 | Other forms of teaching: | Student research: | Other: |