

Quantum Mechanics I

Lecturers:

- [Prof. Dr. Philippe Blanchard](#)
- [Carsten Petersen](#)

Requirements:

Courses:

- [Quantum Mechanics I](#) (lecture / 4 hours per week)
- [Exercises Quantum Mechanics I](#) (exercises / 2 hours per week)

Credite points: 9 CP (lecture + exercises + exam)

Examination: oral

Table of contents:

- Insufficiency of classical physics
 - photo effect, Compton effect
 - particle-wave dualism
- Wave mechanics
 - wave functions, super positional principle
 - Schrödinger equation, dispersion etc.
 - Expectation value, ... operator
 - commutators, adjoint operators
 - Fourier transformation
 - stationary states, eigenvalues, eigenfunctions, uncertainty principle
- One dimensional examples
 - harmonic oscillator etc.
 - tunnel effect, bounded and scattered states
- Introduction of internal degrees of freedom (explained by light (photons))
- Axiomatic formalism of QM
 - axioms (Hilbert spaces, operators, measurement, time evolution)
 - projector algebra
 - representation of QM (Heisenberg and Schrödinger picture)
 - symmetry transformations and conserved quantities
- 3-dimensional Problems
 - angular momentum
 - Coulomb potential
 - hydrogen atom
 - addition of angular momentums (Clebsch Gordon coefficients)
- Scattering theory
 - cross section, scattering amplitude
 - Born approximation
- Spin and identic particles
 - charged particle in EM-field (Stern-Gerlach exp)
 - spin formalism (especially $S = 1/2$)

- Time independent perturbation theory
 - non degenerated states
 - degenerated states