



SI2380 Advanced Quantum Mechanics 7.5 credits

Kvantmekanik, fortsättningskurs

Course syllabus for SI2380 valid from Autumn 11

This is a translation of the Swedish, legally binding, course syllabus.

Grading scale: A, B, C, D, E, FX, F

Education cycle: Second cycle

Main field of study: Physics

Intended learning outcomes

After completion of the course you should be able to:

- apply Dirac's bracket notation.
- use Hermitian and non-Hermitian operators.
- know the path integral formalism of quantum theory.
- have knowledge about the matrix formulation of quantum mechanics and use density matrices.
- compute angular momentum and spin as well as have a good command of addition of angular momenta.
- use the variational principle and the WKB approximation.
- know the Aharonov-Bohm effect.
- have general knowledge about scattering theory as well as compute basic quantities in scattering theory.

Course main content

Dirac's bracket notation. Hermitian and non-Hermitian operators. Wave packets. Path integral formulation of quantum theory. Matrix formulation. Density matrices. Many-body systems. Symmetries, rotational invariance, and angular momentum. The hydrogen atom. Spin. Addition of angular momenta. The variational principle and the WKB approximation. Time independent and time dependent perturbation theory. The Aharonov-Bohm effect. Introduction to scattering theory. Møller's wave operators. The Lippmann-Schwinger equation. Scattering matrices. The Born series and the Born approximation. Scattering amplitude, differential cross-section, and total cross-section. The optical theorem. Partial wave analysis. Long range potentials. The Rutherford formula. Resonances in scattering. Decay width and the Breit-Wigner formula.

Language of instruction

Language of instruction is specified in the course offering information in the course and programme directory.

Eligibility

Recommended prerequisites:
Mathematical Methods in Physics.
Quantum Physics.

Literature

- See current course homepage.

Recommended literature

- J.J. Sakurai, Modern Quantum Mechanics, 2nd edition, Addison-Wesley (Pearson) (2007)
- L.E. Ballentine, Quantum Mechanics: A Modern Development, World Scientific 2nd edition (May 1998).
- R.L. Liboff, Introductory Quantum Mechanics, Addison-Wesley (2003)
- R. Shankar, Principles of Quantum Mechanics, Kluwer (1994)

Examination

- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, F

Requirements for final grade

A written exam (TEN1; 7,5 university credits).