SI2170 Quantum Physics 9.0 credits

Kvantfysik

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

Establishment

Course syllabus for SI2170 valid from Autumn 2008

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Physics

Specific prerequisites

Recommended prerequisites: Physics corresponding to modern physics (SH1009), mathematical methods of physics (SI1140).

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After finished course the student should be able to:

- Describe the scientific basis for quantum physics.
- Apply quantum mechanical formalism to physics problems with analytical as well as numerical methods.
- Have a good insight into important application of quantum physics.

Course contents

Part I Quantum mechanics, 7,55 credits:

The basis of quantum mechanics and its postulates. The solution of the Schrödinger equation with simple potentials using analytical and numerical methods. The harmonic oscillator (analytic and numerical solutions). The bracket notation of Dirac. Operator formalism and commutators. Angular momentum and spin. Matrix representation of quantum mechanics. The Pauli principle. Addition of angular momentum. None-degenerate and degenererad time independent perturbation treatment with applications. Coupling of spinn and angular momentum. The Zeeman effect. Hyperfine structure. Introduction to time dependent perturbation calculations and the Fermis goalden rule. Charged particles in elektromagnetic fields. Introduction to scattering theory and the Born approximation. The hydrogen and helium atoms. Simple molecules.

Part II Seminars in quantum physics, 1,5 credit:

Ten two hour lectures with 80% attendance. Write a report based on one of the ten lectures. The lectures will be given by active researchers from the different groups of the physics departments. Applications to for instance chemical binding, sp3-hybridization, quantum computers, quantum dots, quantum circuits, quantum optics, quantum communication, quantum fluids, super conduction, optical lattices, the quantum Hall effect, nuclear spin resonance with medical applications, neutrino oscillations and cosmic background radiation.

Course literature

S. Gasiorowicz, Quantum Physics, 3rd ed., Wiley (2003) or D.J. Griffiths, Introduction to Quantum Mechanics, 2nd ed., Pearson (2005).

Examination

- PRO2 - Project Applied Physics, 1.5 credits, grading scale: P, F
- PRO1 - Project Experimental Physics, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

One written examination (TEN1, 6 university credits), seminars part 1 (PRO1, 1,5 university credits),seminars part 2(PRO2, 1,5 university credits)

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.