SI2410 Quantum Field Theory 7.5 credits

Kvantfältteori

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

Establishment

Course syllabus for SI2410 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:
Advanced Quantum Mechanics.
Relativistic Quantum Physics.

Language of instruction

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

Intended learning outcomes

After completion of the course you should be able to:

- use functional integrals and perturbation theory in quantum field theory.
- apply renormalization and regularization with quantum field theory.
- have knowledge about gauge theories as well as quantum electrodynamics and quantum chromodynamics.
- know spontaneously broken gauge theories as BCS theory and the Higgs model.

Course contents

Symmetries and the Noether's theorem. Path integral formulation of quantum mechanics. Functional integral formulation of quantum field theory. Introduction to perturbation theory for functional integrals. Introduction to renormalization and regularization. Abelian and non-Abelian gauge theories. Quantization of gauge theories. Quantum electrodynamics. Quantum chromodynamics. Anomalies in perturbation theory. Gauge theories with spontaneous symmetry breaking. Quantization of spontaneously broken gauge theories. Symmetry breaking and Goldstone's theorem. The BCS model. The Higgs mechanism. Mean-field theory and the Hartree-Fock method.

Course literature

- L.S. Brown, Quantum Field Theory, Cambridge (1999)

- M.E. Peskin and D.V. Schroeder, Introduction to Quantum Field Theory, Harper-Collins (1995)

- Lecture notes

Additional reading

- P. Ramond, Field Theory - A Modern Primer, Addison-Wesley (2001)

- See also hep-th/9912205.

Examination

- INL1 - Assignments, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Examination, 3.0 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

Hand in assignments (INL1; 4.5 hp) and an oral exam (TEN1; 3 hp).

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.