SK2908 Macroscopic quantum phenomena – superconductivity and magnetism 7.5 credits

Makroskopiska kvantfenomen - supraledning och magnetism

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

Establishment

The course plan applies from HT 2025 according to faculty board decision: S-2024-0066. Decision date: 2024-10-07.

Grading scale

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

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

Completed course SI1146 Vector Analysis.

Completed course SI1155 Theoretical physics.

Current or completed course SK2758 Solid state physics.

Language of instruction

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

Intended learning outcomes

After passing the course, the student must be able to:

- Apply fundamental concepts in superconductivity and magnetism.
- Orally present one of the course's concepts with high demands on rigor and clarity

Course contents

Superconductivity: Physical properties of superconductors, theoretical models of superconductors (London, BCS and Ginzburg-Landau theories), type-I and type-II superconductors, high-temperature superconductors, the vortex state and vortex dynamics, Bean's model, the Josephson effect, quantum interference, SQUID, measurements and applications of superconductor

Magnetism: Diamagnetism, paramagnetism, interaction between spin spin-orbit coupling, the Ising model, the Heisenberg model, ferromagnetism antiferromagnetism, ferrimagnetism, spin waves, susceptibility, magnetic domains, fundamental quantum magnetism, measurements and applications of magnetism.

Examination

- DIG1 - Digital examination, 2.5 credits, grading scale: A, B, C, D, E, FX, F
- INL1 - Hand-in problems, 2.5 credits, grading scale: A, B, C, D, E, FX, F
- SEM1 - Seminar, 2.5 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.

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.