



Course syllabus

Statistisk mekanik Statistical Mechanics

FMFN25, 7,5 credits, A (Second Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED F/Pi

Date of Decision: 2023-04-18

General Information

Main field: Nanoscience.

Elective for: F4, F4-tf, MNAV2, N4

Language of instruction: The course will be given in English

Aim

The course shall provide the foundations of statistical physics that is needed both in applications and for studies in theoretical physics. A focus is set on advanced concepts and methods to describe interacting many-particle systems and critical phenomena.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- know the fundamentals of statistical physics regarding both the mathematical model and applications
- be able to study theoretical concepts and to choose mathematical tools
- to perform calculations for specific problems in different areas of physics.

Competences and skills

For a passing grade the student must

- be able to use the methods of statistical physics for analysis och computation of relevant physical problems
- independently acquire information on an application of the theory and presenting it.

Judgement and approach

For a passing grade the student must

decide when a quantum mechanical analysis is necessary.

Contents

Statistical methods for macroscopic systems based on a quantum mechanical description. Relation to thermodynamics. Partition function, Gibbs entropy and free energy. Phase transitions and critical phenomena. Ising model, transfer-matrix model, mean-field theory and renormalization. Ideal gases. Fermi-Dirac statistics, Bose-Einstein statistics and Planck's law of radiation with applications for, e.g., electron and photon gases.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Written exam, written presentation of a project and mandatory laboratory work.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Assumed prior knowledge: Quantum mechanics corresponding to FMFF40 Quantum Mechanics, General Course or FMFF15 Quantum Mechanics and Mathematical Methods.

The number of participants is limited to: No

The course overlaps following course/s: FMF150, FMFN20

Reading list

- David Chandler: Introduction to Modern Statistical Mechanics. Oxford University Press, 1987, ISBN: 0195042778.

Contact and other information

Course coordinator: Tobias Ambjörnsson, tobias.ambjornsson@thep.lu.se

Course homepage: <http://www.atp.lu.se/english/education/courses/statistical-mechanics/>

Further information: The course is given by the Faculty of Science and does not follow the study period structure.