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. Partion function, Gibbs entroy and free energy. Phase transitions and critical phenomena. Ising model, transfer-matrix model, mean-field theroy and renormalization. Ideal gases. Fermi-Dirac statistics, Bose-Einstein statistics and Plancks 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.