UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Statistical Mechanics

2627-1-F1703Q062

Aims

Knowledge and understanding:
The student will acquire a rigorous and advanced understanding of classical and quantum statistical mechanics, statistical ensembles, ideal and interacting gases, phase transitions, and the renormalization group.

Applying knowledge and understanding:
The student will be able to apply statistical mechanics methods to the quantitative analysis of complex systems and to develop theoretical models consistent with physical behavior.

Making judgements:
The student will develop the ability to critically assess models and methods, selecting the most appropriate tools for the system under study.

Communication skills:
The student will be able to present concepts and techniques of statistical mechanics clearly, rigorously, and with formal precision.

Learning skills:
The student will acquire the theoretical tools necessary to independently deepen advanced topics in statistical mechanics and condensed matter physics.

Contents

Statistical ensembles, derivation of the equation of state for classical and quantum gases, theory phases transitions, critical phenomena and renormalization group.

Detailed program

Equilibrium and Statistical Mechanics. Statistical ensembles. Liouville theorem.
Microcanonical, Canonical and Grancanonical ensembles. Ideal and Interacting classic gases, the cumulant-expansion. Quantum gases Fermi-Dirac and Bose-Einstein distributions. Phonon and Photon gases.

Phases transitions and critical phenomena. Van-der-waals equation.
Ising model. Landau and Landau-Ginsburg theories. Renormalization Group.

Prerequisites

Teaching form

Frontal teaching (42 hours)

Textbook and teaching resource

Mehran Kardar, Statistical Physics of Particles, Cambridge University Press.
Landau-Lifshitz, Statistical Physics (part I), Elsevier.
Kerson Huang, "Statistical mechanics" John Wiley & Sons.

Semester

Semester I

Assessment method

Oral exam concerning the topics discussed during the course. Students can be asked to reproduce in detail the demonstrations seen in class.

Office hours

Email me to fix an appointment at: sara.pasquetti@unimib.it

Sustainable Development Goals