



Course syllabus

Faculty Board of Science and Engineering
School of Computer Science, Physics and Mathematics

4FY815 Statistisk fysik II, 7,5 högskolepoäng
Statistical Physics II, 7.5 credits

Main field of study

Physics

Subject Group

Physics

Level of classification

Second Level

Progression

A1N

Date of Ratification

Approved by the Board of the School of Computer Science, Physics and Mathematics
2012-12-10

The course syllabus is valid from spring semester 2013

Prerequisites

Physics 90 credits, mathematics 45 credits or equivalent.

Objectives

After taking this course the student is expected to have acquired:

- a deeper understanding of the theory of statistical mechanics
- knowledge of the main theoretical methods used in studying phase transitions (e.g. mean-field, transfer matrices, criticality and scaling, numerical algorithms, renormalization group)
- the skill of using theoretical and mathematical methods to solve advanced problems and to build models in statistical mechanics.

Content

This course is an advanced presentation of the Theory of Phase Transition, and requires the knowledge of the basics of Statistical Mechanics.

1. Ising model

Generalities. One-dimensional Ising model: transfer matrix. Para-ferromagnetic transition in $D=2$: Peierls argument.

Onsager's explicit solution, Kramers-Wannier duality.

2. Continuous phase transitions

Fluctuation-dissipation theorems. Widom scaling and scaling relations. Extension of Mean-field theories and correlation functions. Evaluation of critical exponents within mean-field theory. Real Space Renormalization Group.

3. Monte Carlo methods: stochastic processes with Markov property: detailed balance, ergodicity. Spin flipping: the Metropolis algorithm, Cluster flipping: the Swendsen-Wang algorithm.

Type of Instruction

The teaching consists of lectures and tutorials.

Students can also register for the “distance” version of the course and follow the course via the internet. IT support and technical information: Email and web connection. Real-time and recorded lectures on course homepage.

Examination

The course is assessed with the grades Fail (U), Pass (G) or Pass with Distinction (VG).

Assessment of student performance is made through written test and/or oral examinations and/or presentation of mandatory assignments.

Reexamination will be offered within six weeks under the regular semester periods. The numbers of examinations are limited to five times.

On request, students may have their credits translated to ECTS-marks. Such a request must be sent to the examiner before the grading process starts.

Course Evaluation

A course evaluation will be carried out at the end of the course in accordance with the guidelines of the University. The result of the course evaluation will be filed at the department.

Required Reading and Additional Study Material

Reference Literature

1. Huang, K., Statistical Mechanics, Second edition (1987) John Wiley
2. Supplementary material electronically provided by the Teacher