



Course syllabus

Faculty of Technology

Department of Physics and Electrical Engineering

4FY515 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 2015-05-22

Revised 2017-09-04 by Faculty of Technology. Prerequisites are revised.

The course syllabus is valid from spring semester 2018

Prerequisites

Physics 90 credits, mathematics 45 and a 7.5 credit course in Statistical physics 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 A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student’s performance is assessed as fail (i.e. received the grade F).

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.

Course Evaluation

During the course or in close connection to the course, a course evaluation is to be carried out. The result and analysis of the course evaluation are to be communicated to the students who have taken the course and to the students who are to participate in the course the next time it is offered. The course evaluation is carried out anonymously. The compiled report will be filed at the Faculty.

Credit Overlap

The course cannot be included in a degree along with the following courses of which the content fully, or partly, corresponds to the content of this course: 4FY815 Statistical Physics II

Other

Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

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