

Advanced Theoretical Condensed Matter Physics

Instructor: Hans Kroha

Lecture: Tu 12, Fr 8-10, HS I, PI

Exercises: Every second week (T.Stollenwerk and P. Henseler)

Prerequisites: Quantum mechanics I + II (second Quantisation); Theoretical Physics IV: Statistical Physics (Physik 520); Theoretical Condensed Matter Physics (Physics 617) advantageous

General description: The lecture will give a balanced presentation of essential phenomena of many-body physics and of important, modern methods for their theoretical description. From the broad field of many-body physics several topics to be treated in more depth will be selected at the participants' discretion.

Contents:

- Foundations of quantum field theory at finite temperature
- Foundations of quantum field theory for non-equilibrium system
- Quasiparticles and collective excitations in solids
- Superconductivity BCS theory, collective excitations in superconductors, Josephson effects
- Quantum magnetism: Magnetic impurities in metals, Kondo effect, the renormalization group, magnetic lattice systems
- Disordered quantum systems: Models for electrons in a random potential, disorder-induced metal-insulator transition (weak localization, Anderson localization), scaling theory

Literature:

- W. Nolting: Grundkurs Theoretische Physik VII: Vielteilchenphysik
- A. Altland, B. Simons: Condensed Matter Field Theory
- M. Tinkham: Introduction to Superconductivity
- J. R. Schrieffer Theory of Superconductivity
- P. Fazekas: Lecture Notes on Electron Correlation and Magnetism
- A. Hewson: The Kondo Effect to Heavy Fermions

The lecture may be given in English or German at the participants' discretion.