

Electronic transport and superconductivity

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ECTS credits: 6

Language of instruction: English

Examination: written exam

Description:

The main goal of this course is to present the different regimes of electronic transport in conductors and how quantum mechanical effects affect their resistance or conductance. The first part of the course will present the quasi-classical regime and its corrections related to electronic interferences in diffusive conductors as well as the quantization of the conductance of low dimensional ballistic conductors. Topological materials, where the quantization of the conductance can become insensitive to the local properties of the conductor will also be discussed. The second part of the course is devoted to superconductivity. After a brief introduction on superconductors, the microscopic BCS theory will be presented, and the electrodynamic properties of superconductors studied. Special attention will be devoted to quantum phase coherence aspects, such as the Josephson effect. In particular, transport properties through Andreev states in normal conductors coupled to superconductors will be explained in the spirit of the first part of the lecture. Topological superconductors and their specificities will be also discussed.