

Condensed Matter Physics

Module No.: MN-P-SP-CondMat, MN-P-PN-CondMat, MN-P-WaMa

Course: Mesoscopic Physics

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Category	Type	Language	Teaching Hours	CP	Semester
Specialized Course	Lecture	English	2	3	SoSe

Requirements for participation:

Basic knowledge of condensed matter physics

Type of module examinations:

Oral examination

Duration of the course:

1 semester

Aims of the course:

Understanding of theoretical and experimental concepts of mesoscopic physics
Knowledge of important examples

Contents of the course:

Mesoscopic physics encompasses the study of micro- or nano-scale devices in which electronic transport is strongly affected by quantum physics. The lecture will introduce to its fundamental concepts, at the core of modern nanoscience, and present some important examples such as spectacular examples of conductance quantization, and some recent developments in the field, in relation with modern quantum information techniques.

Topics covered are:

- Boltzmann equation of transport
- From diffusive to ballistic transport
- Conductance fluctuations and localization corrections
- Landauer-Büttiker scattering approach to transport
- Noise and current correlations in mesoscopic systems
- Time-dependent scattering and photo-assisted processes
- Quantum Hall effect(s)
- Quantum dots
- Introduction to circuit quantum electro-dynamics

Recommended literature:

- Skriptum (available during the course)
- Datta, Electronic transport in mesoscopic systems
- Ihn, Semiconductor Nanostructures: Quantum States and Electronic Transport
- Girvin & Yang, Modern Condensed Matter Physics