

## Transport in mesoscopic systems (T) - physics762

Degree - M.Sc. in Physics (PO von 2014)

<i>Module</i>	<b>Elective Advanced Lectures: Theoretical Physics</b>
<i>Module No.</i>	physics70c

<i>Course</i>	<b>Transport in mesoscopic systems (T)</b>
<i>Course No.</i>	physics762

<b>Category</b>	<b>Type</b>	<b>Language</b>	<b>Teaching hours</b>	<b>CP</b>	<b>Semester</b>
Elective	Lecture with exercises	English	2+1	5	WT/ST

### Requirements for Participation:

#### Preparation:

Classical mechanics

Elementary thermodynamics and statistical physics (physik521)

Advanced quantum theory (physics606)

Introductory theoretical condensed matter physics (physics617)

**Form of Testing and Examination:** Requirements for the examination (written or oral); successful work with the exercises

**Length of Course:** 1 semester

#### Aims of the Course:

Understanding essential transport phenomena in solids and mesoscopic systems

Acquisition of important methods for treating transport problems

#### Contents of the Course:

Linear response theory

Disordered and ballistic systems

Semiclassical approximation

Introduction to quantum chaos theory, chaos and integrability in classical and quantum mechanics

Elements of random matrix theory

Specific problems of mesoscopic transport (weak localization, universal conductance fluctuations, shot noise, spin-dependent transport, etc.)

Quantum field theory away from thermodynamic equilibrium

**Recommended Literature:**

K. Richter, Semiclassical Theory of Mesoscopic Quantum Systems, Springer, 2000 (<http://www.physik.uni-regensburg.de/forschung/richter/richter/pages/research/springer-tracts-161.pdf>)

M. Brack, R. K. Bhaduri, Semiclassical Physics, Westview Press, 2003

S. Datta, Electronic Transport in Mesoscopic Systems, Cambridge University Press, 1995

M. C. Gutzwiller, Chaos in Classical and Quantum Mechanics, Springer, New York, 1990

F. Haake, Quantum signatures of chaos, Springer, 2001

M. L. Mehta, Random matrices, Elsevier, 2004

J. Imry, Introduction to mesoscopic physics, Oxford University Press

Th. Giamarchi, The physics of one-dimensional systems, Oxford University Press