Modules:

physics700 **Elective Advanced Lectures**
physics730 **Theoretical Physics**

Course: Transport in mesoscopic systems (T)

Course No.: physics762

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

Requirements:

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, Cambrige 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