

Module:	Elective Advanced Lectures: Theoretical Physics
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Module No.: physics70c

Course:	 universität bonn	Transport in mesoscopic systems (T)
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Course No.: physics762

Category	Type	Language	Teaching hours	CP	Semester
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