

<b>Module:</b>	<b>Elective Advanced Lectures: Theoretical Physics</b>
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<b>Module No.:</b> physics70c
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<b>Course:</b>	 universität <b>bonn</b>	<b>Transport in mesoscopic systems (T)</b>
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<b>Course No.:</b> physics762
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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