Special Issue

Quantum Transport in Mesoscopic Systems

Message from the Guest Editors

Mesoscopic physics has now become a well-established, mature field. The techniques developed in the 1980s and 1990s to understand electronic transport in small conductors form a standard toolbox that is available for theoreticians and experimentalists alike. Importantly, the electrical properties of mesoscopic conductors happen to be governed directly by the quantum properties of carriers, hence the term “quantum transport”. However, the advent of new materials with exotic properties poses serious challenges for the understanding of novel phenomena using standard formalisms. Further, today’s possibility of designing different setups and measurement schemes offers the opportunity of investigating transport effects lying at the interface between condensed matter, thermodynamics, and quantum information. This issue attempts to review recent trends in quantum transport and mesoscopics with a rich variety of topics: nanoscale heat and dissipation, coherent single-electronics, semiconductor spintronics, topological quantum matter, quantum Hall effects, graphene structures, strongly interacting systems, noise and fluctuations, etc.

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The concept of entropy is traditionally a quantity in physics that has to do with temperature. However, it is now clear that entropy is deeply related to information theory and the process of inference. As such, entropic techniques have found broad application in the sciences.

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