

Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910



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“Mesoscopic thermo-electronics”

Electrons in a conductor react not only to voltage but also to temperature gradients. In their motion, they carry electric charge as well as energy. This makes it possible to think of devices that either are powered only from excess heat or they manage the control of heat flows.

Mesoscopic (nanoscale) systems are good candidates for this, because their spectrum can be easily designed, e.g. by using resonances in quantum dots as energy filters, or controlling the opening of single channels in quantum point contacts. Multiterminal conductors can be built where charge and heat flows are separated. Two terminals support the charge current with the third one serving as the heat source heat. This is interesting because the properties of the mesoscopic junction determine how the injected heat current affects transport in the conductor. This way, the system can be designed to work as a heat engine (if heat is converted into useful electric power [1]) or to manipulate the heat flows in all-thermal operations such as a thermal transistor or a thermal diode [2].

I will discuss how these effects can be controlled in different mesoscopic systems where electron-electron interactions [3] and scattering properties can be easily tuned by gate voltages or external fields. Additionally, novel effects appear due to the interplay of quantum coherence and non-equilibrium situations.

[1] B. Sothmann, R. Sánchez, and A. N. Jordan, *Nanotechnology* **26**, 032001(2015).

[2] R. Sánchez, H. Thierschmann, and L. W. Molenkamp, *Phys. Rev. B* **95**, 241401 (2017); *New J. Phys.* **19**, 113040 (2017).

[3] R. Sánchez and M. Büttiker, *Phys. Rev. B* **87**, 075312 (2011); H. Thierschmann *et al.*, *Nature Nanotech.* **10**, 854 (2015).

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