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Noise and fluctuation statistics in mesoscopic heat transport

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Fluctuations play important role in thermodynamics of small systems. In the talk, I will discuss two recent results on fluctuations in mesosopic heat transport. One is the demonstration [1] that the fluctuation-dissipation theorem for thermal conductance of a mesocopic junction is not valid at non-zero frequencies ω. Finite relaxation energy creates fluctuations of the energy flux in the junction even at vanishing temperature, T=0, when the conductance vanishes. This suggest that in contract to electrical conductance, there is no "Kubo-Green formula" for equilibrium thermal conductance at $\omega \neq 0$. Non-equilibrium heat transfer satisfies general "fluctuation relations" of non-equilibrium thermodynamics. Recently, we have established the conditions of applicability of these relations to single-electron tunneling (SET), and calculated explicitly the statistics of dissipated energy in driven SET transitions [2], which gives an example of general statistics of energy dissipation in reversible information processing. An interesting consequence of this statistics is the possibility of implementing the electronic version of Maxwell's demon in the SET structures [3].

[1] D.V. Averin and J.P. Pekola, Phys. Rev. Lett. **104**, 220601 (2010).
[2] D.V. Averin and J.P. Pekola, arXiv:1105.041.
[3] D.V. Averin, M. Mottonen, and J.P. Pekola, arXiv:1108.5435.