# Physikalisches Kolloquium

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Di 7.11.17
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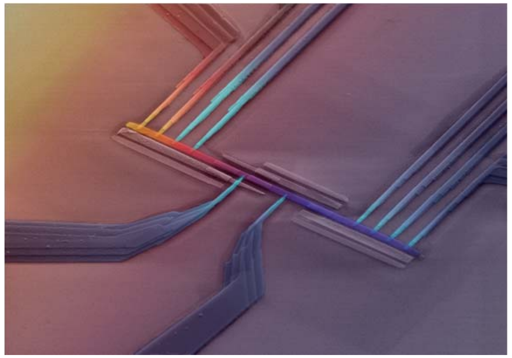
14:45 Uhr, Kaffee/Tee
R 513

## Superconductivity: The coherence in heat transport

The emerging field of phase-coherent caloritronics (from the Latin word calor, heat) [1] is based on the possibility of controlling heat currents by using the phase difference of the superconducting order parameter. The goal is to design and implement thermal devices that can control energy transfer with a degree of accuracy approaching that reached for charge transport by contemporary electronic components. This can be done by making use of the macroscopic quantum coherence intrinsic to superconducting condensates, which manifests itself through the Josephson effect and the proximity effect. Here, I will initially report the first experimental realization of a heat interferometer [2-4]. We investigate heat exchange between two normal metal electrodes kept at different temperatures and tunnel-coupled to each other through a thermal device in the form of a DC-SQUID. Heat transport in the system is found to be phase dependent, in agreement with the original prediction. After this initial demonstration, we have extended the concept of heat interferometry to various other devices, implementing the first quantum `diffractor' for thermal fluxes [5, 6], realizing the first balanced Josephson heat modulator [7], and the first tunable „0-π" thermal Josephson junction [8]. Finally, I will conclude by showing the realization of the first phase-tunable thermal router [9] which is able to control the heat transferred between two terminals residing at different temperatures. Thanks to the Josephson effect, our structure allows to regulate the thermal gradient between the output electrodes until reaching its inversion, and represents an important step towards the realization of caloritronic logic components.



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[6] M. J. Martínez-Pérez and F. Giazotto, Nat. Commun. 5, 3579 (2014).
[7] A. Fornieri, C. Blanc, R. Bosisio, S. D'Ambrosio, and F. Giazotto, Nat. Nanotechnol. 11, 258 (2016).
[8] A. Fornieri, G. Timossi, P. Virtanen, P. Solinas, and F. Giazotto, Nat. Nanotechnol. 12, 425 (2017).
[9] G. Timossi, A. Fornieri, F. Paolucci, C. Puglia, and F. Giazotto, arXiv:1710.04606v1 (submitted 2017).