Centre DE Nanosciences & DE Nanotechnologies

C2N General Seminar

Friday April 19th 2019 - 10h 00

Amphitheater of C2N

Quantum thermal transport in circuits

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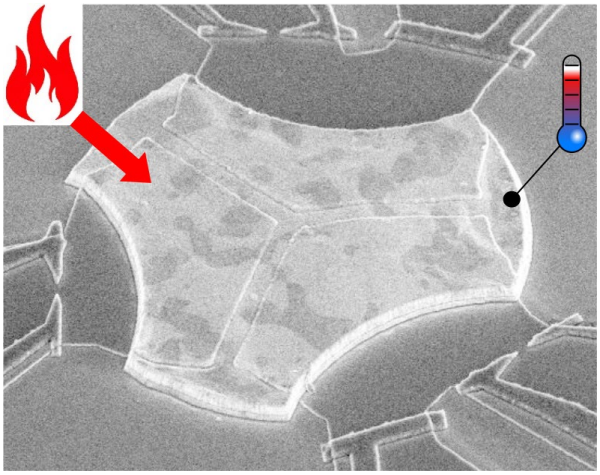
Heating drives a crossover from quantum to classical behaviors. However, heat itself is ruled by the laws of quantum mechanics. In small electrical circuits, the fundamental implications span from a different quantum thermodynamics to the quantum phase influence on heat. In addition, the flow of heat provides a revealing and complementary probe for the investigation of intriguing phases of matter, by unveiling neutral states invisible to electrical transport. In the long term, quantum thermal phenomena will ineluctably constitute an essential parameter for the quantum engineering of nanocircuits. Other envisioned possibilities include novel calorimetry devices and thermal machines.

Whereas the quantum transport of electricity is being actively investigated since more than three decades, the thermal facet is more challenging to access. In particular, there is no equivalent of the ammeter for the flow of heat. Only recently experimental observations are emerging, such as the universal thermal conductance quantum, heat interferometry, or the heat conductance across a superconducting quantum bit. After a general introduction of the field, I will present the experimental determination of the universal limit imposed to heat flow by quantum mechanics, and the observation of heat Coulomb blockade, a many-body quantum effect that can selectively apply to heat but not to electricity in violation of the standard Wiedemann-Franz law.



Circuit for the study of quantum heat transport.

Frédéric PIERRE is a CNRS researcher at the Center for Nanoscience and Nanotechnology, within the Paris-Saclay University. With his team, Quantum Physics in Circuits (https://qpc.c2n.universite-paris-saclay.fr), he experimentally investigates the fundamental physics of electrical quantum circuits.

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