Heat transport in quantum conductors

A. Anthore[1,2], S. Jezouin[1], F.D. Parmentier[1], U. Gennser[1], A. Cavanna[1], Y. Jin[1], F. Pierre [1]

[1]*CNRS, Laboratoire de Photonique et de Nanostructures, UPR20, route de Nozay, 91460 Marcoussis, France.*

[2]*Univ Paris Diderot, Sorbonne Paris Cité, UFR de Physique, 4 rue Elsa Morante, 75013 Paris, France*

Quantum physics rules electrical and heat transport across low dimensional conductors. Despite thirty years of research in mesoscopic physics, the field of quantum heat transport remains mostly unexplored experimentally, essentially because heat currents are much harder to probe than electrical currents.

In this talk, I will present how heat transport measurements allow us to investigate not only fundamental quantities, such as the quantum of thermal conductance[1,2], but also provides a new way to explore the rich physics of the integer and fractional quantum Hall effect. We have developed a very straightforward approach to measure the heat current in quantum conductors realized in two dimensional electron gases at the interface between GaAs and AlGaAs layers. It relies on the measurement of current fluctuations using an extremely sensitive voltage amplifier operating at cryogenic temperatures, based on homegrown high-electron-mobility transistors.

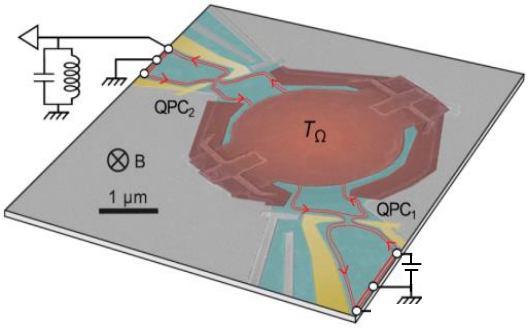

Figure 1 : Colorized SEM image of a sample where quantum conductors are realized in a two dimensional electron gas (cyan zone). The quantum of thermal conductance was inferred from the measurements of current fluctuations using the voltage amplifier (top left) when Joule power was injected by a bias voltage (bottom right).

These experiments pave the way to many studies in the emergent field of quantum heat transport, such as the quantum phase manipulation of heat currents.

[1] Jezouin *et al.,* Science **342**, 601 (2013)

[2] Anthore *et al.,* Reflets de la physique **42**, 16 (2014)