Heat transport via a local two-state system

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Abstract

The recent progress of micro-fabrication technology has enabled us to study quantum transport phenomena of phonons and photons experimentally. It is remarkable that there are several similarities between heat transport and electron transport. For example, quantization of heat conductance, which is an analogue of quantization of conductance in electron transport, has been observed experimentally. Recently, it has been shown that a phenomenon similar to the Kondo effect occurs in heat transport via a local two-state system[1]. In this study, the heat conductance has been calculated based on the spin-Boson model with the spectral function for the ohmic case. However, the sub-ohmic case and the super-ohmic case have not been studied in detail.
In this study [2], we study heat transport via a local two-state system coupled to non-ohmic heat baths by using a quantum Monte Carlo method. We show that the heat conductance is proportional to $T\hat{}(2s+1)$ at low temperatures whenever the system has a delocalized(singlet) ground state. This result is consistent with the general Shiba's relation. For the sub-ohmic case, if the coupling strength was larger than a critical value, the behavior of heat conductance at low temperatures changes drastically, because of a quantum phase transition.

References

K. Saito and T. Kato, Phys. Rev. Lett. **111**, 214301 (2013)
M. Kato, T. Kato, and K. Saito, in preparation.

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