Interference-induced extrinsic thermoelectrics

Rafael Sánchez[1,3], Cosimo Gorini[2], and Geneviève Fleury[2]

[1]*Departamento de Física Teórica de la Materia Condensada, Universidad Autónoma de Madrid, 28059 Madrid, Spain*
[2]*Université Paris-Saclay, CEA, CNRS, SPEC, 91191, Gif-sur-Yvette, France*
[3]*Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, 28059 Madrid, Spain*

Mesoscopic conductors become efficient thermoelectric converters by using the spectral properties of a nanostructure (e.g., a quantum dot or a quantum point contact) to separate the electron-hole excitations generated by a heat source to which it is coupled. This is the case in all proposals and experiments so far, be them based on two- or three-terminal configurations. We call them intrinsic because (i) the heat source might be switched off, but not be uncoupled from the conductor, and (ii) because the mechanism for broken electron-hole symmetry is a property of the conductor. In contrast to these, we present an extrinsic thermoelectric effect in conductors to which we do not impose any asymmetry, allowing for a dual operation of the system once the heat source is not coupled. We present this with the example of a ballistic one-dimensional conductor which is approached by a scanning tip [1]. The tip serves as a quantum coherent local heat injector that generates interference patterns. These enable two remarkable effects: a nonlocal thermoelectric response of an electron-hole symmetric system which is modulated by the position of the hot probe tip, and a nonreciprocal longitudinal response leading to a thermoelectric diode effect. We introduce a model of pure dephasing which confirms the quantum interference origin of the effect [2].

[1] G. Fleury, C. Gorini and R. Sánchez, "Scanning probe-induced thermoelectrics in a quantum point contact". arxiv.:2106.03908.

[2] R. Sánchez, C. Gorini and G. Fleury, "Extrinsic thermoelectric response of coherent conductors", in preparation.