Bipolar thermoelectricity by spontaneous particle-hole symmetry breaking

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Thermoelectrical effects in superconductors are usually thought absent. In this poster, we show a relevant exception where the opposite is true. Indeed, superconductors can be very strongly thermoactive materials due to the gap opening at the Fermi surface but it requires some tricks to clearly unveil their thermoelectrical potential.

Here, we will discuss how strong thermoelectricity can be generated by spontaneous breaking of the particle-hole symmetry in an asymmetric SIS' junction where the Josephson coupling is sufficiently suppressed [1]. Intriguingly the thermoelectricity is very strong and can be of the order of 300 μV/K for Aluminium based tunnel junctions at sub-Kelvin temperatures. Further, the thermoelectricity is spontaneously bipolar, i.e. opposite sign of the thermo-voltage for the same thermal gradient, as the spontaneous breaking mechanism would imply [2]. We will discuss the generality of the effects for different operating conditions [2], different setup configurations [3], phase-coherent control [4] and noise effects [5]. Finally, we show possible experimental observations of the effect discussing also applications such as superconducting memory [6].

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