Thermoelectric properties of a hybrid quantum dot containing topological superconductor

P. Trocha,[1] T. Jonckheere,[2] J. Rech,[2] and T. Martin[2]

[1]*Institute of Spintronics and Quantum Information, Faculty of Physics, Adam Mickiewicz University, 61-614 Poznań, Poland*

[2]*Aix Marseille University, Université de Toulon, CNRS, CPT, Marseille, France*

Thermoelectric properties of hybrid systems based on a single-level quantum dot coupled to normal-metal/half-metallic lead and attached to topological superconductor wire are investigated. Topological superconductor wire is modelled by spinless p-wave superconductor which hosts both Majorana bound state and over-barrier quasiparticle excitations. As topological superconductor couples only electrons of one spin orientation the transport through the system is fully spin-polarized. The main interest of the paper is studying the interplay of sub-gap and quasi-particle tunneling and its contribution to thermoelectric response of the considered system. The over-barrier tunneling driven by temperature gradient is responsible for relatively large thermopower, whereas sub-gap processes, due to zero energy Majorana state, only indirectly can influence thermoelectric response. The thermoelectric coefficients, including electric conductance, Seebeck coefficient, heat conductance, and the corresponding figure of merit, are calculated by means of nonequilibrium Green's function technique. The temperature dependence of superconducting gap is considered within the BCS theory. We also study the system out of equilibrium working as heat engine. The output power and the corresponding efficiency are presented.

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