Andreev-Coulomb drag in coupled quantum dots

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Electrical power can be generated in a quantum dot system that rectifies the energy absorbed from non-equilibrium fluctuations of its environment. Typically, this depends on tiny energy-dependent asymmetries of the device [1]. We show that larger currents are expected in hybrid systems, where a superconductor hybridizes even-parity states (with 0 and 2 electrons) in the quantum dot. We consider the environment to consist on a quantum dot Coulomb-coupled to the conductor one. The non-equilibrium charge fluctuations in the second dot correlate with the Andreev processes that inject Cooper pairs in the superconductor. This provides the necessary symmetry breaking energy transfer. We analyze this mechanism in two configurations depending on the non-equilibrium source: i.e., when the quantum dot is coupled to (i) two terminals at different chemical potential, and (ii) a single but hot terminal. We show that pair and quasiparticle contributions can be distinguished by a change of sign of the generated current [2].

References:

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