Enhancement of thermoelectric efficiency in a quantum dot coupled to ferromagnetic electrodes due to Rashba spin-orbit coupling

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Thermoelectric effects in spin-polarized transport through a quantum dot weakly coupled to two ferromagnetic leads via spin-conserving and Rashba-induced spin-nonconserving tunneling terms have been investigated theoretically by means of the non-equilibrium Green's function method. The Rashba term [1] leads to various interference phenomena, such as the Fano effect [2], which modify basic transport and electronic properties of the system.

We have analyzed spin-dependent transport through the system, especially such basic transport coefficients like conductance, heat conductance and thermopower. To evaluate the thermoelectric efficiency of the system, we have also calculated the dimensionless coefficient known as the figure of merit.

When the spin accumulation in the external leads becomes relevant, thermoelectric current leads to a spin voltage. Recently, this novel phenomenon has been observed experimentally in metallic magnets [3] and is referred to as the spin Seebeck effect. We have analyzed this effect by calculating spin counterparts of the transport coefficients mentioned above. Interplay between the Rashba-induced effective field and external magnetic field leads to enhancement of both charge and spin figures of merit, opening new possibilities for thermally-induced spin current generation.

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