Nagaoka ferromagnetism in spin-polarized transport through quadruple quantum dot system

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Motivated by the experimental evidence of Nagaoka ferromagnetism in quantum dot systems [1], we search for possible confirmation of such kind of ferromagnetism by analyzing the electric and thermal transport properties. In particular, we consider four quantum dots arranged in a two-by-two square lattice, coupled to external ferromagnetic source and drain electrodes. Turning on and off the specific conditions for Nagaoka's ferromagnetism to occur by changing the value of intra-dot Coulomb interactions, we determine the transport coefficients, including electric and heat conductance, thermopower, tunnel magnetoresistance and current polarization. The calculations have been performed both for equilibrium and out-of-equilibrium regimes. We have found that some results can indirectly confirm the ferromagnetic alignment of electron spins.

References:

[1] J. P. Dehollain, U. Mukhopadhyay, V. P. Michal, Y. Wang, B. Wunsch, C. Reichl, W. Wegscheider, M. S. Rudner, E. Demler, and L. M. K. Vandersypen, Nature **579**, 528 (2020).

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