Coulomb Blockade in a Nonthermalized Quantum Dot

Igor Lerner[1], Igor Yurkevich[2], George McArdle[1,3], Rose Davies[1,2]

[1]University of Birmingham, Birmingham, United Kingdom, [2]Aston University, Birmingham, United Kingdom, [3]University of Nottingham, Nottingham, United Kingdom

We consider how the absence of thermalization affects the classical Coulomb blockade regime in quantum dots under the condition of negligible inelastic scattering during the dwelling time of the electrons in the dot. By solving the quantum kinetic equation in the experimentally accessible regime when the dot has two relevant occupation states, we calculate the current-voltage characteristics for arbitrary coupling to the leads. If the couplings are strongly asymmetric, the Coulomb staircase is practically reduced to the first step, which is independent of the charging energy, when the Fermi energy is comparatively small, while the standard thermalized results are recovered in the opposite case. When the couplings are of the same order, nonlinear transport through the dot drastically changes resulting in an additional (compared to the thermalized case) jump in the conductance at voltages close to the charging energy, which could serve as an experimental manifestation of the absence of thermalization.

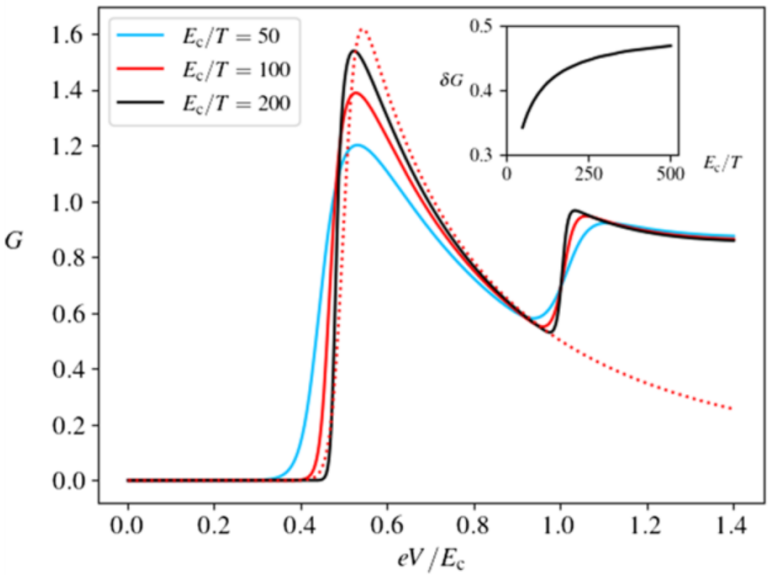

Fig. 1 shows a jump in differential conductance absent in a thermalised case (shown with dotted line) while the inset shows the dependence of the peak height on the charging energy.

References:

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