The Interacting Mesoscopic Capacitor Out of Equilibrium

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Abstract

We consider the full non-equilibrium response of a mesoscopic capacitor in the large transparency limit, exactly solving a model with electron-electron interactions appropriate for a cavity in the quantum Hall regime. For a cavity coupled to the electron reservoir via an ideal point contact, we show that the response to any time-dependent gate voltage V_g(t) is strictly linear in V_g. We analyze the charge and current response to a sudden gate voltage shift, and find that this response is not captured by a simple circuit analogy. In particular, in the limit of strong interactions a sudden change in the gate voltage leads to the emission of a sequence of multiple charge pulses, the width and separation of which are controlled by the charge-relaxation time
tau_c=hC_g/eˆ2 and the time of flight
tau_f. We also consider the effect of a finite reflection amplitude in the point contact, which leads to non-linear-in-gate-voltage corrections to the charge and current response.

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