Non-equilibrium current and relaxation dynamics of a charge-fluctuating quantum dot

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Fri Jul 01 15:00 2011
(Seminar Room THP)

Abstract

We study the steady-state current in a minimal model for a quantum dot dominated by charge fluctuations and analytically describe the time evolution into this state. The current is driven by a finite bias voltage V across the dot, and two different renormalization group methods are used to treat small to intermediate local Coulomb interactions. The corresponding flow equations can be solved analytically which allows to identify all microscopic cutoff scales. Exploring the entire parameter space we find rich non-equilibrium physics which cannot be understood by simply considering the bias voltage as an infrared cutoff. For the experimentally relevant case of left-right asymmetric couplings, the current generically shows a power-law suppression for large V. The relaxation dynamics towards the steady state features characteristic oscillations as well as an interplay of exponential and power-law decay.

[1] C. Karrasch, S. Andergassen, M. Pletyukhov, D. Schuricht, L. Borda, V. Meden, H. Schoeller, Eur. Phys. Lett. **90**, 30003 (2010).

[2] S. Andergassen, M. Pletyukhov, D. Schuricht, H. Schoeller, L. Borda, Phys. Rev. B **83**, 205103 (2011).