
Quantum Noise Measurement of a Carbon Nanotube Quantum Dot in the Kondo Regime

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Résumé

Probing the fast dynamics of many-body correlated systems has been the subject of a long-standing research activity. In this regard, nanoscale devices offer unique possibilities. Due to recent progress in nanotechnology, it is now feasible to design nanoscale devices in which correlated effects appear under out-of-equilibrium conditions. The Kondo effect in quantum dots constitutes in this respect a paradigmatic model system, where a single electron spin of the quantum dot is dynamically screened by the conduction electrons, leading to a many-body resonance. This effect has been studied extensively in transport and, more recently, by current fluctuation measurements. However, all previous studies focused exclusively on the low frequency limit, while the high frequency regime, i.e. the dynamics remained experimentally unexplored.

In this work, we present the first measurements of the high frequency current fluctuations of a carbon nanotube quantum dot in the Kondo regime by resonantly coupling it to an on-chip detector. Our experiment allows to probe many-body correlations at frequencies of the order of the inverse timescale associated with the creation of the correlated state. The results are in good agreement with theoretical calculations provided that an additional spin decoherence rate is included. This experiment constitutes a new original tool for the investigation of the nonequilibrium dynamics in nanoscale devices.

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