# Non-equilibrium Noise and Symmetry of the Kondo effect

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**Abstract**

Most of the time, electronic excitations in mesoscopic conductors are well described, around equilibrium, by non-interacting Landau quasi-particles. This allows a good understanding of the transport properties in the linear regime. However, the role of interaction in the non-equilibrium properties beyond this regime has still to be established.
A paradigmatic example is the Kondo many body state, which can be realized in a carbon nanotube (CNT) quantum dot. As CNT possess spin and orbital quantum numbers, it is possible to investigate the usual twofold degenerate SU(2) Kondo effect as well as the four fold degenerate SU(4) state by tuning the degeneracies and filling factor.

Combining transport and current noise measurements in such a dot, we have identified the SU(2) and SU(4) Kondo states [1]. Our experiment shows that, a two-particle scattering process due to residual interaction emerges in the non-equilibrium regime. The effective charge e*, which characterizes this peculiar scattering, is determined to be e*/e =1.7 ± 0.1 for SU(2) and e*/e =1.45 ± 0.1 for SU(4), in perfect agreement with theory [2].

This result demonstrates that current noise can detect unambiguously the many-particle scattering induced by the residual interaction and the symmetry of the ground state.

In addition, we managed to induce a continuous transition from SU(4) to SU(2) with the magnetic field, which allowed us to monitor the evolution of the fundamental properties (transmission channels and effective charge) along this quantum crossover [3].

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