Tunable Kondo-Luttinger systems far from equilibrium

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We theoretically investigate the non-equilibrium transport of a quantum dot coupled to two interacting one-dimensional electron leads with a bias voltage V across the dot. In equilibrium (V=0), the system exhibits either a conducting one-channel Kondo (1CK) or an insulating two-channel Kondo (2CK) ground state, as the Luttinger parameter $0 < K < 1$ (the interaction strength in 1d leads) is decreased. A quantum phase transition between 1CK and 2CK ground states is reached when $K = 1/2$. We apply a controlled frequency-dependent renormalization group approach to compute the non-equilibrium current in the presence of a finite bias voltage V for various K. For $V \to 0$, the conductance has its well-known equilibrium form, while with decreasing K it displays a distinct non-equilibrium profile at finite voltage. To clarify this distinct non-equilibrium behavior, we address the interplay between non-equilibrium decoherence, Kondo entanglement and Luttinger physics. The combined effects of large bias voltage and strong electron interactions in the leads stabilize the two-channel Kondo physics, resulting in non-trivial modifications of the conductance. This disdinct feature persists at a finite channel asymmetry. C-H Chung, K.V.P. Latha, K. Le Hur, M. Vojta, P. Wölfle, Phys. Rev. B 82, 115325 (2010).