Tunable Quantum Criticality and Super-ballistic Transport in a 'Charge' Kondo Circuit

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Abstract

The exotic 'quantum critical' physics that develops in the vicinity of quantum phase transitions is believed to underpin the fascinating behaviors of many strongly correlated electronic systems, such as heavy fermions and high temperature superconductors. However, the microscopic complexity impedes their quantitative understanding. Tunable circuits could circumvent this obstacle. With a device implementing a quantum simulator for the three-channel 'charge' Kondo model [1], we explored the rich strongly correlated physics in two profoundly dissimilar regimes of quantum criticality [2]. The universal scalings, both toward different low-temperature fixed points and along the multiple crossovers from quantum criticality, were observed. Notably, we demonstrated an unanticipated violation of the maximum conductance for ballistic free electrons, in agreement with novel numerical renormalization group calculations.

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