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Quantum Criticality out of Equilibrium: Kondo Destruction and V/T Scaling in a Magnetic Single-Electron Transistor STEFAN KIRCHNER, QIMIAO SI, Rice University — Non-equilibrium quantum phase transitions have so far received only limited attention despite the long-standing strong interest in classical out-of-equilibrium phase transitions. This is in part due to the fact that dynamics and statics are already intermixed at an equilibrium quantum phase transition. Nanostructured devices constitute simplified systems, both theoretically and experimentally, to study well-defined out-of-equilibrium states that give rise to unique steady-state limits. We recently showed that such a system, a magnetic single-electron transistor, can be tuned through a continuous quantum phase transition as the applied gate voltage is tuned [1,2]; the Kondo effect is critically destroyed across the quantum critical point, an effect that is also of interest in some bulk strongly correlated systems such as heavy fermions[3]. To address the non-linear electronic transport near the transition, we generalize the system to a large-N limit, where an exact quantum Boltzmann treatment becomes possible. We determine the universal scaling functions for the I-V characteristics in the linear and non-linear regime, and demonstrate a V/T scaling in the quantum critical state out of equilibrium. [1] S. Kirchner et al., Proc.Natl.Acad.Sci. 102 (2005) 18824 [2] S. Kirchner, Q. Si, Physica B (2007), doi:10.1016/j.physb.2007.10.297 [3] S. Kirchner and Q. Si, Phys. Rev. Lett. in press; arXiv:0706.1783v1.

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