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Non-Fermi liquid d-wave metal phase of strongly interacting electrons on the two-leg ladder RYAN V. MISHMASH, UCSB, HONG-CHEN JIANG, KITP, MATTHEW S. BLOCK, UK, Lexington, JAMES R. GARRISON, UCSB, D. N. SHENG, CSU, Northridge, OLEXEI I. MOTRUNICH, Caltech, MATTHEW P. A. FISHER, UCSB — Developing a theoretical framework for conducting electronic fluids qualitatively distinct from those described by Landau's Fermi liquid theory is of central importance to many outstanding problems in condensed matter physics. Perhaps the most important such pursuit is a microscopic characterization of the cuprates, where the so-called "strange metal" behavior above T_c near optimal doping is inconsistent with being a traditional Landau Fermi liquid. Indeed, a microscopic theory of such a strange metal quantum phase could possibly shed new light on the interesting low-temperature behavior in the pseudogap and on the d-wave superconductor itself. Here, we present a theory for a specific example of a strange metal, which we term the "d-wave metal." Using variational wave functions, gauge theoretic arguments, and ultimately large-scale DMRG calculations, we establish compelling evidence that this remarkable quantum phase is the ground state of a reasonable microscopic Hamiltonian: the venerable t-J model supplemented with a frustrated electron ring-exchange term, which we study extensively here on the two-leg ladder. These findings constitute one of the first explicit examples of a non-Fermi liquid metal existing as the ground state of a realistic model.

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