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Quantum Fluctuations and High-Field Phase Diagram of the Infinite Layer Superconductor $Sr_{0.9}M_{0.1}CuO_2$ (M = La, Gd) C.R. HUGHES, A.D. BEYER, N-C. YEH, Physics Dept., Caltech, Pasadena, CA, V.S. ZAPF, NHMFL, Los Alamos, NM, M-S. PARK, K-H. KIM, S-I. LEE, Physics Dept., Pohang University, Korea — Competing orders in cuprate superconductors can affect the cuprate's low energy excitations, and thus result in unconventional quantum fluctuations that also alter vortex dynamics. We have examined this behavior in the simplest form of cuprates, the electron doped infinite layer $Sr_{0.9}M_{0.1}CuO_2$ ($T_c \approx$ 43 K). Using high magnetic field ($H \leq 60$ T) penetration depth and magnetization vs. H measurements, and lower field ($H \leq 8$ T) 3^{rd} harmonic susceptibility and DC transport measurements, the low-temperature high-field behavior of $Sr_{0.9}La_{0.1}CuO_2$ is studied from 1.9 to 45 K. The upper critical (H_{c2}) and irreversibility (H_{irr}) fields associated with the ab plane and c-axis are determined, and the small ratio H_{irr}^{ab}/H_{c2}^{ab} = 0.27 (extrapolated to 0 K) indicates large quantum fluctuations and thus proximity to a quantum critical point. The insensitivity of the superconductivity to off planar Gd and the ab plane vs. c-axis magnetic anisotropy are also examined with respect to competing orders and quantum criticality.

Cameron Hughes

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