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Universal sheet resistance of the cuprate superconductors N. BARIŠIĆ, University of Minnesota, USA, and CEA-DSM-IRAMIS, France, M.K. CHAN, G. YU, University of Minnesota, Y. LI, Peking University, China, X. ZHAO, Jilin University, China, M. DRESSEL, Universität Stuttgart, Germany, A. SMONTARA, Institute of Physics, Croatia, M. GREVEN, University of Minnesota —
Upon introducing charge carriers into the underlying copper-oxygen sheets of the cuprates, the parent insulator evolves into a superconductor and eventually into a seemingly conventional Fermi liquid. Much has remained elusive about the nature of this evolution, and about the peculiar metallic state at intermediate hole-carrier concentrations (p), where the planar resistivity exhibits a linear temperature dependence ($\rho \propto T$) that is disrupted upon cooling toward the superconducting state by the opening of a 'pseudogap' along the Fermi surface. Here we demonstrate for the quintessential compound $HgBa_2CuO_{4+\delta}$ a purely Fermi-liquid-like resistivity ($\rho \propto T^2$) deep in the pseudogap regime. Our result when combined with select prior work for other compounds reveals the fundamental resistance per copper-oxygen sheet in both the linear ($\rho_S = A_{1S}T$) and quadratic ($\rho_S = A_{2S}T^2$) regimes, with $A_{1S} \propto \quad A_{2S} \propto 1/p$. Theoretical models for the cuprates can now be benchmarked against this remarkably simple universal behavior. *Preprint: arXiv:1207.1504.*
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