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Indications of a Quantum Critical Point in $Bi_2Sr_2CaCu_2O_{8+\delta}$ Using a Local Kondo Effect EDUARDO CALLEJA, University of Colorado at Boulder, JIXIA DAI, Rutgers University, GERALD ARNOLD, University of Colorado at Boulder, GENDA GU, Brookhaven National Laboratory, KYLE MCELROY, University of Colorado at Boulder — A complete understanding of the complex phase diagrams that are present in high temperature superconductors remains elusive. While there is an overwhelming amount of experimental data on the existence and interplay of the phases present in high T_c superconductors from local probes, much of the existing data only looks at the charge degree of freedom of the material. By substituting Fe atoms for Cu atoms in the CuO plane of $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212), we gain the ability to access the spin degree of freedom since the Fe atoms retain their magnetization below the superconducting transition temperature. This leads to a local Kondo effect which can be observed using Spectroscopic-Imaging Scanning Tunneling Microscopy (SI-STM) and the local Kondo temperature can be extracted from spectra via a theoretical model. We show that the examination of this local Kondo temperature across local and sample average doping leads to the observation of a change in the quasiparticle spin degree of freedom at a quantum critical point (QCP) with a nominal hole doping of roughly 0.22, in agreement with other probes. The observation of the QCP in Bi2212 with this new method to access the spin degree of freedom helps to unravel some of the mystery behind the complex phase diagram of Bi2212.

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