Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Evidence of two-dimensional quantum critical behavior in the superfluid density of deeply underdoped $Bi_2Sr_2CaCu_2O_{8+x}$ JIE YONG, MICHAEL HINTON, ANDY MCCRAY, Dept. of Physics, The Ohio State University, M. NAAMNEH, AMIT KANIGEL, Dept. of Physics, Technion, Israel, MOHIT RANDERIA, THOMAS LEMBERGER, Dept. of Physics, The Ohio State University — Evidence of two-dimensional (2-D) quantum critical fluctuations is observed in the superfluid density $n_s(T) \propto \lambda^{-2}(T)$ of deeply underdoped $Bi_2Sr_2CaCu_2O_{8+x}$(Bi-2212). Quantum critical behavior is indicated by the evolution of the T-dependence of $n_s(T)/n_s(0)$, which loses any evidence for thermal critical behavior and becomes quasi-linear when underdoping drops the transition temperature T_c below roughly 48K. Two-dimensionality is indicated by the linear scaling of transition temperature T_c with $n_s(0)$. The 2-D behavior contrasts with that of the less anisotropic $YBa_2Cu_3O_{7-\delta}$, which sustains 3D quantum critical fluctuations.

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Date submitted: 12 Dec 2011 Electronic form version 1.4