Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Two-dimensional Quantum Critical Point in Underdoped $Bi_2Sr_2CaCu_2O_{8+\delta}$ THOMAS LEMBERGER, JIE YONG, ANDREW MCCRAY, The Ohio State University, MUNTASER NAAMNEH, AMIT KANIGEL, Technion - Israel Inst. of Technology, MOHIT RANDERIA, The Ohio State University —
Underdoped $Bi_2Sr_2CaCu_2O_{8+\delta}$ films with T_c's from 5 to 70 K are fabricated by sputtering and Pulsed Laser Deposition (PLD). Temperature dependences of superfluid densities are measured to study the superconductor-to-insulator quantum phase transition. Sputtered films, which tend have higher dopings, show superfluid densities that are weakly linear in T at low-T and drop dramatically where Kosterlitz-Thouless-Berezinski theory predicts, assuming that individual CuO_2bilayers are uncoupled. However, our PLD films, which are more underdoped than the sputtered films, have superfluid densities that are roughly linear from low T to T_c. Also, There is no indication of thermal critical behavior near T_c. Underdoped YBCO crystals also lack critical behavior, even though critical behavior is strong in optimally doped and moderately underdoped samples. Near the superconductor-to-insulator phase transition, T_c and $n_s(0)$ have a linear relationship that mimics that of ultrathin, two-dimensional films of Ca-doped $YBa_2Cu_3O_{7-\delta}$, thereby indicating a 2-D quantum critical point at low doping.

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Date submitted: 17 Nov 2010 Electronic form version 1.4