Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

**Fractional-exponent behavior of magnetization near $T_c$ in** $Bi_2Sr_2CaCu_2O_8$ LU LI, YAYU WANG, Physics Dept., Princeton Univ., M.J. NAUGHTON, Physics Dept., Boston College, S. ONO, Y. ANDO, Central Research Inst. Electric Power Industry, Tokyo, N.P. ONG, Physics Dept., Princeton Univ. —
Using high-resolution torque magnetometry, we have investigated in detail how long-range phase coherence develops as the critical temperature $T_c$ (88.7 K) is approached in optimally-doped $Bi_2Sr_2CaCuO_{8+\delta}$ with field $\mathbf{H}||\mathbf{c}$. Three distinct regimes are observed. Above ~92 K, $|M|$ increases rapidly as $T \to T_c$ in step with the vortex Nernst signal. $M$ is strictly linear in $H$ in weak $H$, but shows strong curvature at large $H$ (5-14 T). The curvature provides a determination of the correlation length $\xi_{sc}$ which grows as a power law, viz. $\xi_{sc} \sim 1/t^{\nu}$. In the second regime, $86 < T < 92$ K, $M$ becomes nonlinear in $H$, viz. $M \sim H^{\alpha(T)}$, where the exponent $\alpha(T)$ decreases from 1 to 0. This interesting fractional-exponent behavior is highly unusual and fits poorly with conventional pictures of 'fluctuating diamagnetism.' As previously known, $M$ is virtually $H$ independent below 2 Tesla at the "crossing temperature" $T_{cr} = 86$ K. Below $T_{cr}$, $M$ is a function of $\log H$. We compare this behavior with predictions of the 3DXY and Kosterlitz-Thouless theory. Supported by funds from the U.S. National Science Foundation under grant DMR 0213706.

Lu Li
Physics Dept., Princeton Univ.

Date submitted: 20 Mar 2013 Electronic form version 1.4