Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Superfluid Stiffness, Nodal Quasiparticles and Quantum Phase Fluctuations in Underdoped Cuprates NANDINI TRIVEDI, RAJDEEP SENSARMA, MOHIT RANDERIA, The Ohio State University — We study the low temperature superfluid stiffness $\rho_s(T;x)$ as a function of hole doping x and temperature T for strongly correlated d-wave superconductors. Using Gutzwiller projected wavefunctions and renormalized mean-field theory (RMFT), we calculate $\rho_s(0;x)$ and show that it scales with the quasiparticle spectral weight Z. These analytical results are in excellent agreement with earlier variational Monte Carlo studies [1]. We next show that self-consistent inclusion of the zero point motion of phase fluctuations leads to further suppression of $\rho_s(0;x)$, which now vanishes below a doping level of approximately 5%. To determine the T-dependence of ρ_s we calculate the current carried by nodal quasiparticles (QP) within RMFT and show that the effective charge of the nodal QP is given by Zm^*/m. Our analytic formula for the effective charge is in excellent agreement with numerical Monte Carlo results of Nave *et al.* [2]. We will conclude by comparing our results with experiments on underdoped cuprates.

[1] A. Paremakanti, M. Randeria and N. Trivedi, Phys. Rev. Lett. **87**, 217002 (2001)
[2] C. P. Nave, D. A. Ivanov and P. A. Lee, Phys. Rev. B. **73**, 104502 (2006)

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Date submitted: 20 Nov 2006 Electronic form version 1.4