Superfluid Stiffness, Nodal Quasiparticles and Quantum Phase Fluctuations in Underdoped Cuprates NANDINI TRIVEDI, RAJDEEP SENGUPTA, 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 $\rho_s$ 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.