The effect of inhomogeneous pairing amplitude on superfluid stiffness in a $d$-wave superconductor

MING CHENG, WU-PEI SU, Texas Center for Superconductivity and Department of Physics, University of Houston, Houston, TX 77204 — To explain the disparity between $T_c$ and $T^*$ in optimally doped and underdoped cuprates, we propose that $T_c$ is related to superconducting gap amplitude standard deviation ($\sigma$); while $T^*$ is related to average gap amplitude. We calculate the superfluid stiffness ($D_s$) using BdG formalism for a $d$-wave superconductor. The calculations show that $D_s$ decreases as ($\sigma$) increases, suggesting lower $T_c$ for more inhomogeneous gap distribution. The theoretic result is consistent with recent STM experiments which study the electronic inhomogeneities due to out-of-plane disorder.

Ming Cheng
Texas Center for Superconductivity and Department of Physics, University of Houston, Houston, TX 77204

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