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Suppression of Superfluid Density in Underdoped Cuprates WEI-CHENG LEE, Department of Physics, the University of Texas at Austin, Austin TX 78712, JAIRO SINOVA, Department of Physics, Texas A&M University, College Station, TX 77843-4242, USA, ANTON A. BURKOV, Department of Physics and Astronomy, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1, YOGESH JOGLEKAR, Department of Physics, Indiana University-Purdue University Indianapolis, Indianapolis, Indiana 46202, USA, ALLAN H. MACDONALD, Department of Physics, the University of Texas at Austin, Austin TX 78712 — A key challenge for theories of high-T_c cuprates is to explain why the superfluid density vanishes as the antiferromagnetic insulator state is approached. Viewing a cuprate as a doped Mott insulator gives a natural explanation of this property, but one that is not obviously compatible with the fact that superconductivity always vanishes at finite doping. We propose another possible explanation, starting from weak-coupling conventional d-wave BCS theory and calculating the correlation contribution to the superfluid density. We show that triplet fluctuations of the d-wave superconducting order parameter are canonically conjugate to antiferromagnetic fluctuations, and that this causes the correlation energy to increase in magnitude when superconductivity is weakened by a phase gradient. In our theory the inelastic neutron scattering resonance has the character of a magnetic plasmon rather than the character of an exciton.

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