INCOHERENT VS. COHERENT BEHAVIOR IN THE NORMAL STATE OF COPPER OXIDE SUPERCONDUCTORS +

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The self-consistent quantum fluctuations around the mean-field Hartree-Fock state of the Hubbard model provide a very good description of the ground state and low-temperature properties of a two-dimensional itinerant antiferrogmagnet.[1,2,3] Very good agreement with numerical calculations and experimental data is obtained by including the one-and two-loop spin wave corrections to various physical quantities. In particular, the destruction of the long-range order above the Neel temperature can be understood as a spontanteous generation of a length-scale ϵ (T), which should be identified as the spin correlation length.[4] For finite doping, the question of the Hartree-Fock starting point becomes a more complex one since an extra hole tends to self-trap in antiferromagnetic background. Such quantum defects in an underlying antiferromagnetic state can be spin-bags[5] or virtex-like sturctures[6] and tend to suppress the long-range order. If motion of the holes occurs on a time-scale shorter than the one associated with the motion of these quantum defects of a spin background, one obtains several important empirical features of the normal state of CuO superconductors like linear T-dependence of resistivity, the cusp in the tunneling density of states, etc.[4] As opposed to a familiar Fermi-liquid behavior the phenomenology of the above system is dominated by a large incoherent piece of a single hole propagator, resulting in many unusual normal state properties.

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+ Invited Talk

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