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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 antiferromagnet.<sup>1,2,3</sup> 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 spontaneous generation of a length-scale  $\xi$  (T), which should be identified as the spin correlation length.<sup>4</sup> 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<sup>5</sup> or vortex-like structures<sup>6</sup> 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.<sup>4</sup> 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

References:

- <sup>1</sup>A. Singh and Zlatko Tesanovic, Phys. Rev. **B41**, 614 (1990).
- <sup>2</sup>A. Singh and Zlatko Tesanovic, Phys. Rev. **B** to appear.
- <sup>3</sup>A. Singh, Zlatko Tesanovic, H. Tang, G. Xiao, C. L. Chien, and J. C. Walker, Phys. Rev. Lett. **64**, 2571 (1990).
- <sup>4</sup>A. Singh and Zlatko Tesanovic, submitted to Phys. Rev. **B**.
- <sup>5</sup>J. R. Schrieffer, X-G. Wen, and S.-C. Zhang, Phys. Rev. Lett. **60** 944 (1988).
- <sup>6</sup>A. R. Bishop, F. Guinea, P. S. Lomdahl, E. Louis, and J. A. Verges, submitted to Phys. Rev. Lett.