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Neutron scattering evidence for spin and charge inhomogeneity in cuprate superconductors[1]

JOHN TRANQUADA, Brookhaven National Lab

Neutron diffraction studies have provided clear evidence for charge and spin stripe order in $La_{2-x}Ba_xCuO_4$ and $La_{1.6-x}Nd_{0.4}Sr_xCuO_4$ for a range of x, with a maximum ordering temperature at $x = 1/8$. The ordering of stripes competes with superconducting order. Recent measurements of the magnetic excitation spectrum in $La_{1.875}Ba_{0.125}CuO_4$ show that: 1) the energy scale corresponds to antiferromagnetic superexchange, 2) the qualitative features do not change when static stripe order disappears [1], and 3) the spectrum is very similar to that found in other cuprate superconductors. New measurements on optimally-doped $Bi_2Sr_2CaCu_2O_{8+\delta}$ [2] are consistent with the concept of a universal spectrum. Results on over-doped $La_{2-x}Sr_xCuO_4$ show that the magnetic spectral weight disappears as the superconductivity goes away [3]. These results suggest that slowly-fluctuating charge inhomogeneity is common to the cuprates and underlies the high-temperature superconductivity.

1. Guangyong Xu, J.M. Tranquada, T.G. Perring, G.D. Gu, M. Fujita, and K. Yamada, (unpublished).

2. Guangyong Xu, J.M. Tranquada, B. Fauqué, G.D. Gu, M. Hücker, T.G. Perring, L.-P. Regnault, and J.S. Wen, (unpublished).

3. S. Wakimoto, K. Yamada, J.M. Tranquada, C.D. Frost, R.J. Birgeneau, and H. Zhang, cond-mat/0609155.

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