Metallic Charge Stripes and Superconductivity in Cuprates

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Studies of the system $La_{1.6-x}N_{0.4}Sr_xCuO_4$ have clearly demonstrated that stripe order competes with superconductivity [1]. The nature of the competition is subtle, however, as recent optical conductivity [2] and angle-resolved photoemission [3] experiments have shown that in cuprates even ordered stripes are essentially metallic (i.e., there is no substantial charge-excitation gap). If charge stripes are to be relevant to the mechanism of superconductivity, a prerequisite is that a stripe-liquid phase should exist. Neutron scattering studies of the model system $La_{2-x}Sr_xNiO_4$ have established that the charge-stripe solid melts into a stripe-liquid phase [4], and similar results have been obtained for the cuprate $La_{1.875}Ba_{0.125}CuO_4$ [5]. Applying a magnetic field along the c-axis of an underdoped superconductor can induce static spin stripe order [6], while it has no effect on a sample with uniform charge stripe order [7]. Comparison of these and related results indicates that the magnetic vortices in the superconductor must pin charge-stripe "halos". Some combination of these results will be presented.

Work at Brookhaven is supported by the Office of Science, U.S. Department of Energy, under Contract No. DE-AC02-98CH10886.

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