Novel Magnetism and the Phase Diagram of the Cuprates

M. Greven

University of Minnesota, USA

Magnetic correlations might cause the superconductivity in the cuprates and are generally believed to be antiferromagnetic. Following our success in growing sizable crystals of the single-layer model compound $HgBa_2CuO_{4+\delta}$,[1] we used polarized neutron diffraction to demonstrate the universal existence of a novel type of magnetic order in superconducting samples.[2] Unlike antiferromagnetism, this order does not break the lattice translational symmetry. Our subsequent inelastic neutron scattering measurements confirmed the existence of the well-known magnetic resonance at the antiferromagnetic point[3] and led to the discovery of several excitations branches that appear to be fundamental collective modes associated with the novel magnetic order.[4] The observed magnetism is consistent with a particular type of order involving circulating charge currents and with the notion that the phase diagram of the cuprates is controlled by an underlying quantum critical point.[5]

[1]X. Zhao *et al.*, Adv. Mat. **18**, 3243 (2006); N. Barišić *et al.*, Phys. Rev. B **78**, 054518 (2008).
[2]Y. Li *et al.*, Nature **455**, 372 (2008).
[3]G. Yu *et al.*, Phys. Rev. B **81**, 064518 (2010).
[4]Y. Li *et al.*, Nature **468**, 283 (2010); and unpublished results.
[5]C. Varma, Nature **468**, 184 (2010).