Session 25bB

Competing orders in the cuprate superconductors **25bB1**

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Recent observations support the proposal that ground state correlations in the cuprates can be described by a common theory of competing order parameters in the doped Mott insulator, and of proximity to quantum phase transitions associated with them. The competing orders can be tuned by an applied magnetic field: theoretical predictions[1] for the phase diagram as a function of doping concentration and magnetic field strength, and for the structure of the field-induced vortices in the superconductor will be presented. The microstructure of the charge order observed in STM will also be related to theoretical predictions arising from studies of magnetic transitions in Mott insulators and in superconductors.

[1] See http://onsager.physics.yale.edu/superflow.html for more info.

Antiferromagnetic vortex core studied by spatially-resolved NMR **25bB2**

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Recent experimental studies have established that the spatially-resolved NMR in the vortex state serves as a powerful probe for locally different electronic state. We provide local information on antiferromagnetic (AF) correlations in the different regions of the vortex state by ^{205}Tl-NMR imaging in nearly optimal-doped $Tl_2Ba_2CuO_6$. $^{205}T_l^{-1}$ in the vortex core is enhanced almost by two orders larger than that of the superconducting region, and the T-dependence of T_1^{-1} shows a peak at T=20 K well below T_c=85 K, indicating clearly that in the core region Cu spins show a local AF ordering. These results indicate that the suppression of the d-wave SC order parameter leads to the nucleation of islands with local AF order.

25bB3 Doping and field dependence of vortex core states in $Bi_2Sr_2CaCu_2O_{8+\delta}$

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Using scanning tunneling spectroscopy, we show that for slightly overdoped $Bi_2Sr_2CaCu_2O_{8+\delta}$ samples a high degree of electronic homogeneity can be obtained, depending on the superconducting transition width. Such homogeneous samples are ideally suited for the study of vortex cores. The energy of quasiparticle states in the vortex cores is shown to scale with the superconducting gap, and independent of the magnetic field between 1 and 6 T. These observations allow a discussion on the discrete nature of quasiparticle states in vortex cores in high-T_c superconductors.

25bB4 High Magnetic Field NMR Microscopy of Vortices in High-Tc Superconductors

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We present spatially resolved NMR measurements of the vortex structure of HTS, including a spatially resolved measurement of the spin-lattice relaxation rate, which is sensitive to the local density of electronic states (DOS). With this tool we have investigated the electronic excitations both inside and outside the vortex cores. In the regions outside the vortex core we observe the vortex currents shifting the quasiparticle excitation spectrum through a Doppler effect. In the vortex core region we find the evidence for the existance of antiferromagnetic fluctuations.

25bB5 Possible Antiferromagnetic Vortex Cores in $La_{2-x}Sr_xCuO_4$ Probed by μSR

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The spatial field distribution in the flux line lattice (FLL) state of $La_{2-x}Sr_xCuO_4$ (LSCO) has been studied by muon spin rotation (μSR). In a single crystalline LSCO with nominally optimal doping ($x = 0.15$), we have observed two μSR signals at high fields where one signal exhibits strong broadening unexpected for the field profile of conventional FLL state. The possibility to attribute such a field-induced component to the antiferromagnetic vortex cores suggested by neutron diffraction is discussed.