Session 27aC

QED_3 Theory of Pairing Pseudogap in Cuprates **27aC1**

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I review recent progress in understanding the underdoped cuprates by using a fluctuating d-wave superconductor as the point of departure. As the phase order is destroyed by underdoping, the effective theory takes the form of a quantum electrodynamics in $(2+1)$ dimensions (QED_3). The role of Dirac fermions is played by nodal quasiparticles while the gauge field encodes topological frustration felt by quasiparticles in presence of unbound vortex-antivortex fluctuations. In its chirally symmetric phase, the QED_3 effective theory is a non-Fermi liquid, exhibiting anomalous power laws in its fermionic propagators. As one approaches half-filling, this algebraic Fermi liquid (AFL) suffers a spontaneous transition to the chiral symmetry-broken state of QED_3. The chiral symmetry breaking gives rise to an incommensurate antiferromagnetism (SDW), QED_3 stripe phases and other forms of competing insulating states.

Interplay between static magnetism and superconductivity in HTSC cuprates **27aC2**

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We present our recent results of Muon Spin Relaxation (μSR) studies which reveraled: (1) formation of nano-scale ($\sim$ 15-30 Å radius) islands with static magnetism in superconducting stage-4 $La_2CuO_{4.11}$ [A.T. Savici *et al.*, PRB66 in press]; (2) trade-off between the volume fraction of static magnetsim and the superfluid density in $(La,Eu,Sr)_2CuO_4$, which demonstrates that static magnetism and supercnductivity occur in mutually exclusive regions; (3) correlations between T_c and n_s/m^* (superconducting carrier density / effective mass) in these systems with co-existing superconductivity and static magnetism; and (4) field-induced static magnetism existing exclusively in the under-optimally doped region of $(La,Sr)_2CuO_4$.

27aC3 Magnetism and superconductivity of $La_{2-x}Sr_xCuO_4$: The NMR point of view

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Recent NMR results showing the coexistence of magnetic order and superconductivity in $La_{2-x}Sr_xCuO_4$ will be reviewed. The data will be compared to those obtained by other techniques. The glassy nature of magnetic freezing, the existence of inhomogeneities, the influence of a magnetic field, the spin and charge textures are among important questions to be discussed. See Phys. Rev. B **63**, 144508 (2001) for an introduction and references.[1]

[1] *This talk will be mainly based on results obtained in collaboration with V. Mitrović, M. Horvatić, C. Berthier, P. Ségransan (Grenoble), A. Campana, F. Borsa, A. Rigamonti, P. Carretta (Pavia), P. Kuhns, A.P. Reyes, W.G. Moulton (Tallahasse), A. Vietkin, A. Revcolevschi (Orsay) and K. Yamada (Kyoto).*