SESSION 19

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Stripes transport and related phenomena

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Stripe-induced dimensional crossovers and transport properties

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The key problem in physics of high-Tc cuprates is whether doping is inhomogeneous and holes are expelled into the 1D stripes. We demonstrate that the scattering mechanism, defining the transport properties, is the same in spin-ladders and underdoped cuprates. This implies that transport through conducting charge stripes in cuprates is fully controlled by the inelastic length coinciding with the magnetic correlation length in spin-ladders, i.e. holes in stripes behave very similarly to holes in spin-ladders. The 1D stripe transport model developed by one of the authors (VVM) [1-2] describes remarkably well the temperature dependences of the resistivity and the scaling behaviour of magnetic and transport properties of underdoped cuprates (including transport in fields up to 50 T) using essentially one fitting parameter - spin-gap [3], decreasing with the hole doping. In the framework of this model the hole-rich stripes are just ladders with the even number of chains and therefore the pseudo-gap is simply the spin-gap in the ladders. Effective dimensionality is 2D at high temperatures and 1D in the pseudo-gap stripe regime. Disorder can lead to the pinning of stripes and their fragmentation thus enforcing the interstripe hopping which effectively recovers the 2D regime. Using a simple solvable model with angular dependent coupling [4], combining attraction along the stripes with the Coulomb repulsion perpendicular to stripes, we have found a strong enhancement of superconducting critical temperature Tc due to the interstripe Coulomb repulsion.

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Keywords: *high-temperature superconductivity, spin gap, pulsed magnetic fields, stripes.*

References

[1] V.V. Moshchalkov, *cond-mat*/9802281.
[2] V.V. Moshchalkov, *Physica C* 317-318, 361 (1999).
[3] V.V. Moshchalkov, L. Trappeniers, J. Vanacken, *Europhys. Lett.* 46, 75 (1999).
[4] V.V. Moshchalkov, V.A.Ivanov, *cond-mat*/9912091

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Temperature dependence of Andreev reflection in Au/$La_{2-x}Sr_xCuO_4$ point-contact junctions at different doping

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We performed point-contact experiments on high-quality $La_{2-x}Sr_xCuO_4$ polycrystalline samples with $0.116 \leq x \leq 0.186$. We used very sharp Au tips (~ 2 m of diameter) which, due to the rather large dimensions of the grains (5 ~ 10 m) allowed us to obtain a single-grain touch. We seldom observed quasiparticle tunneling, and more frequently Andreev reflection. The stability of the contact allowed us to study the temperature dependence of the Andreev curves up to T_c. The well reproducible results indicate the presence of a large Andreev gap, but give no evidence of a pseudogap even in the underdoped samples. We fitted the curves at low temperature by using the model by Tanaka and Kashiwaya allowing for different symmetries of the order parameter, among which the *s*+*d*-wave gives the best fit. All the symmetries give consistent values of the isotropic component of the gap Δ_{is}, always much greater than the anisotropic one Δ_{an}. Moreover, Δ_{is} and Δ_{an} have a different behaviour in temperature.
In the overdoped region, Δ_{is} obtained from Andreev reflection coincides with the gap determined by quasiparticle tunneling or ARPES. In the underdoped regime the Andreev gap decreases with x in contrast to recent ARPES measurements where the gap rapidly increases at the lowering of x. These results seem to confirm in LSCO the hypothesis, recently appeared in literature, of the existence of two distinct energy scales, one associated to the pair formation and the other related to the achievement of the phase coherence in the condensate.

Keywords: *Andreev reflection, La-based cuprates, point-contact spectroscopy.*

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Topological scenario for stripe formation in doped manganites

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The spin-charge-orbital complex structures of manganese oxides are studied using topological concepts. The key quantity is the “winding number” w associated with the Berry-phase connection of an e_g-electron parallel-transported through Jahn-Teller centers, along zigzag one-dimensional paths in an antiferromagnetic environment of t_{2g}-spins. From these concepts, it is shown that the “bi-stripe” and “Wigner-crystal” states observed experimentally have different w's. Namely, those states are classified by the difference in topology of zigzag one-dimensional paths. Predictions for the spin structure and the charge-stacking pattern of the charge-orbital ordered states for heavily doped manganites are discussed.

Keywords: *Bi-stripe, Jahn-Teller distortion, Berry-phase connection.*

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