
SEMINAR FIZIČKOG ODSJEKA

Vrijeme: utorak, 22. 04. 2008., 14:15 sati (točno)
Mjesto: Fizički odsjek, Bijenička c. 32, predavaonica F08

Transport properties of quasi-one- and quasi-two-dimensional cuprates

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Many of the remarkable physical properties of systems containing low dimensional copper oxide chains and planes still lack an explanation. In this talk I will present two recent electrical transport studies on cuprate single crystals that shed light on their peculiar features and on the scope of applicability of Fermi liquid theory as a successful descriptive framework. In the first part of the talk, an investigation of the metallic ground state of the extremely anisotropic quasi-one-dimensional metal PrBa_2Cu_4O_8 (t_b^2: t_a^2: t_c^2 ~ 4000: 2: 1), as a function of temperature, magnetic field and disorder content will be presented. A specific electronic state, labelled frustrated metallicity, is identified in this compound for a certain well defined range of disorder [1, 2, 3]. In the second part of the talk, experiments and modelling of the temperature dependence of resistivity \rho, Hall coefficient R_H and magnetoresistance MR in the heavily overdoped non-superconducting metal La_{1.7}Sr_{0.3}CuO_{4} will be presented and discussed. The analysis implies a breakdown of the isotropic-\ell approximation at low temperatures in this quasi-two-dimensional system, a result that may have important implications for our understanding of the low-T Hall coefficient across the entire phase diagram of the high-temperature superconducting cuprates [4, 5].

[1] New J. Phys. 8 (2006) 172-183;
[2] Phys. Rev. Lett. vol. 99, 136402 (2007);
[3] Phys. Rev. Lett. vol. 98, 146601 (2007).
[4] N.E.Hussey, Treatise on High Temperature Superconductivity, Ed. J.R. Schrieffer, (Springer Verlag, Amsterdam, 2006);
[5] http://arxiv.org/abs/0707.4601

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