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Network patterns and strength of orbital currents in layered cuprates

Eremin M., Eremin I., Terzi A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

In the frame of the t-J-G model we derive a microscopical expression for circulating orbital currents in layered cuprates using the anomalous correlation functions. In agreement with muon spin relaxation, nuclear quadrupolar resonance and neutron scattering (NS) experiments in YBa2Cu3O6+x we successfully explain the order of magnitude and the monotonous increase of the internal magnetic fields resulting from these currents upon cooling. However, the marked enhancement of NS intensity at Tc, reported recently, seems to indicate a non-mean-field feature of coexistence between the current and superconducting states. A relation of this enhancement to the appearance of a small admixture of s-wave symmetry component of the conventional charge-density wave state and also the dependence of the sliding charge-current condensation energy on the phase of the order parameter are discussed.