Paramagnonlike excitations and spin diffusion in magnetic resonance studies of copper oxide superconductors

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Abstract

The relaxation function theory for a doped two-dimensional Heisenberg antiferromagnetic system in the paramagnetic state for all wave vectors through the Brillouin zone is presented in view of the low frequency response of high- Tc copper oxide superconductors. We deduced the regions of long lifetime [T 400 (1-4x) K] and "overdamped" [T 700 (1-4x) K] paramagnonlike excitations in the temperature (T) -doping index (x) phase diagram from plane oxygen nuclear spin-lattice relaxation rate (1 T1) 17 data right up to optimally doped La2-x Srx Cu O4, thus providing the regimes for the spin-wave concept and the overdamped mode. © 2007 The American Physical Society.