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Theory of dynamic spin susceptibility in terms of the t---V model: Comparison with neutron scattering data for Pr0.88LaCe 0.12CuO4 - X and La2 - X Sr x CuO4

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Abstract

A formula for the dynamic spin susceptibility is derived in terms of the t-J-V model. This formula makes it possible to explain the main features of recent experiments on neutron scattering in the electron-doped superconductor Pr0.88LaCe0.12CuO4 - x . In particular, the proposed theory reproduces well a V-shaped relief in the frequency behavior of the imaginary part χ″(Q, ω) of the susceptibility of the Pr 0.88LaCe0.12CuO4 - x compound in the vicinity of the wave vector Q = (π,π) and the scaling behavior of the position of the maxima in the dependence of the function χ″(Q, ω) T on the quantity ω/T. The magnetism of the high-temperature superconductors is dual. These materials contain charge carriers, on the one hand, and localized spins in the copper ion sublattice, on the other hand. Both these systems are strongly coupled to each other. The mode of collective oscillations is common. The magnetism of localized spins "freezes" with the appearance of the superconducting gap. The recently revealed double-peak structure of the imaginary part χ″(Q, ω) of the susceptibility in superconductors of the La1.84Sr0.16CuO4 type is explained. The low-frequency absorption peak is located within the superconducting gap and interpreted as a manifestation of the branch of spin excitons, and the high-frequency absorption peak predominantly corresponds to renormalized collective oscillations of localized spins.

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