A MICROSCOPIC THEORY OF THE MAGNETIC RESONANCE MODE

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A microscopic theory of the dynamic spin susceptibility (DSS) in the superconducting state within the t–J model is presented [1]. The spectrum of spin excitations is studied using an exact representation for the DSS within the Mori-type projection technique for the relaxation function in terms of the Hubbard operators. The self-energy is calculated in the mode-coupling approximation. The DSS reveals a resonance mode (RM) at the antiferromagnetic wave vector $\mathbf{Q} = \pi(1, 1)$ at low temperatures due to a strong suppression of the damping of spin excitations. This is explained by an involvement of spin excitations in the decay process besides the particle-hole continuum usually considered in random-phase-type approximations. The spin gap in the spin-excitation spectrum at $\mathbf{Q}$ plays a dominant role in limiting the decay in comparison with the superconducting gap which results in the observation of the RM even above T_c in the underdoped region. A good agreement with inelastic neutron-scattering experiments on the RM in YBCO compounds is found.

9.7 cm

[1] A.A. Vladimirov, et al., Phys. Rev. B **83** (2011), arXiv:cond-mat/1006.1525.

13.4 cm

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