CORRELATION FUNCTIONS IN THE SPIN-FERMION MODEL

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9.7 cm

We investigate a spin-fermion multiband model [1] derived for the valence electrons in CuO_2 planes including both p_σ and p_π in-plane oxygen orbitals in the limit of strong correlations. Treating the excitations of the spins at Cu sites within the linear spin-wave theory and solving the problem in a self-consistent Born approximation we have found the sector of Zhang-Rice (ZR) quasiparticles coexisting with higher energy oxygen states. The quasiparticle dispersion and the dispersion of the oxygen states at higher energy are even in quantitative agreement with the experimental data in insulating $Sr_2CuO_2Cl_2$ [2], reproducing the ZR singlet states with their asymmetry in the intensity around the $(\pi/2,\pi/2)$ point in the Brillouin zone and giving strong $O(2p_\pi)$ band states near the (π,π) point. Next, using the realistic parameters for CuO_2 planes we calculated various spin-correlation functions relative to the position of the moving oxygen hole in the quantum Néel state produced by copper spins. The antiferromagnetic correlations are reduced in the neighborhood of the hole and the correlation functions can exhibit similar dipolar distortions as reported in the context of the t-J model [3]. The spin deviations created by the hole motion are weaker than those obtained in the t-J model.

[1] J. Bała, A.M. Oleś, and J. Zaanen, Phys. Rev. B. **54**, 10 161 (1996).
[2] J. J. M. Pothuizen *et al.*, Phys. Rev. Lett. **78**, 717 (1997).
[3] A. Ramšak and P. Horsch, Phys. Rev. B **48**, 10 559 (1993), *ibid.* **57**, 4308 (1998).

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