SPIN EXCITATIONS IN DOPED MANGANITES

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9.7 cm

We investigate a novel effective $t-J$ model for doped $La_{1-x}A_xMnO_3$ compounds, where A are divalent alkaline earth ions, and $0 < x < 0.5$. In the presence of strong Coulomb interaction U at the Mn ions, the superexchange (J-term) between spins $S = 2$ in the undoped $LaMnO_3$ compound follows from virtual $d_i^4 d_j^4 \rightleftharpoons d_i^3 d_j^5$ excitations due to the hopping of either e_g or t_{2g} electron [1]. The hopping of doped holes in $La_{1-x}A_xMnO_3$ (t-term) occurs in the correlated e_g band and depends on the magnetic order according to the double exchange mechanism. It promotes a transition from the A-type antiferromagnetic to a ferromagnetic phase, and modifies the e_g-superexchange. Using Schwinger bosons for the $S = 2$ spins and slave bosons for the two e_g orbitals, $d_{x^2-y^2}$ and $d_{3z^2-r^2}$, we derive the magnetic excitations in the ferromagnetic phase. The momentum dependence of the magnon spectrum is determined by the geometry of the perovskite lattice, giving a new interpretation to the earlier result derived for a nondegenerate band [2]. Both the effective ferromagnetic interactions and the stiffness constant increase rapidly with the actual hole doping level. Taking realistic values of the e_g-hopping t and Hund's exchange J_H [1], we estimate the magnon dispersion in ferromagnetic doped manganites.

[1] L. F. Feiner and A. M. Oleś, Phys. Rev. B. **59**, 3295 (1999).

[2] N. Furukawa, J. Phys. Soc. Jap. **65**, 1174 (1996).

13.4 cm

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