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Melting of the orbital order in LaMnO3 probed by NMR

Trokiner A., Verkhovskii S., Gerashenko A., Volkova Z., Anikeenok O., Mikhalev K., Eremin M., Pinsard-Gaudart L.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The Mn spin correlations were studied near the O′-O phase transition at TJT=750 K up to 950 K with 17O and 139La NMR in a stoichiometric LaMnO3 crystalline sample. The measured local hyperfine fields originate from the electron density transferred from the eg and t2g orbitals to the 2s(O) and 6s(La) orbits, respectively. By probing the oxygen nuclei, we show that the correlations of the Mn spins are ferromagnetic in the ab plane and robust up to TJT, whereas along the c axis they are antiferromagnetic and start to melt below TJT, at about 550 K. Above TJT, the ferromagnetic Mn-Mn exchange interaction is found isotropic. The room-temperature orbital mixing angle, φNMR= 109±1.5ã, of the eg ground state is close to the reported value which was deduced from structural data on Jahn-Teller distorted MnO6 octahedra. For T>TJT, LaMnO3 can be described in terms of nonpolarized eg orbitals since both eg orbitals are equally occupied. © 2013 American Physical Society.

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