

Melting of the orbital order in LaMnO₃ probed by NMR

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Abstract

The Mn spin correlations were studied near the O'-O phase transition at $T_{JT}=750$ 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 e_g and t_{2g} 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 T_{JT} , whereas along the c axis they are antiferromagnetic and start to melt below T_{JT} , at about 550 K. Above T_{JT} , the ferromagnetic Mn-Mn exchange interaction is found isotropic. The room-temperature orbital mixing angle, $\phi_{NMR}=109\pm 1.5^\circ$, of the e_g ground state is close to the reported value which was deduced from structural data on Jahn-Teller distorted MnO₆ octahedra. For $T>T_{JT}$, LaMnO₃ can be described in terms of nonpolarized e_g orbitals since both e_g orbitals are equally occupied. © 2013 American Physical Society.

<http://dx.doi.org/10.1103/PhysRevB.87.125142>
