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Spin-state transitions and magnetic polaron in lightly doped $La_{1-x}Sr_xCoO_3$. A. PODLESNYAK, Hahn-Meitner-Institut, Berlin, Germany, M.W. HAVERKORT, II Physikalisches Institut, Universitaet zu Koeln, Germany, K. CONDER, Paul Scherrer Institut, Villingen, Switzerland, E. POMYAKUSHINA, ETH Zurich & Paul Scherrer Institut, Villingen, Switzerland, DANIEL KHOMSKII, II Physikalisches Institut, Universitaet zu Koeln, Germany — Using the inelastic neutron scattering (INS) technique, we identified the energy levels of the thermally excited states of Co^{3+} ions in both $LaCoO_3$ and $La_{0.998}Sr_{0.002}CoO_3$. In $LaCoO_3$ an excitation at $\sim$0.6 meV appears at T>30K, whose intensity follows the bulk magnetization. Within a model including crystal field interaction and spin-orbit coupling we interpret this excitation as originating from a transition between thermally excited states located about 120 K above the ground state. Since the g-factor obtained from the field dependence of the INS is $g\sim$ 3, we interpret this state as a high-spin state of Co^{3+}. The lightly doped material $x\sim$0:002 exhibits paramagnetic properties at low temperatures. An INS peak at energy transfer $\sim$0.75 meV was observed in it already at T= 1:5 K. We propose that the holes introduced in the LS state of $LaCoO_3$ by doping are extended over the neighboring Co sites, forming thus magnetic polaron and transforming all the involved Co ions (e.g. 6 of them) to the high-spin state. Similarly to $LaCoO_3$, we interpret the INS transition at 0.75 meV as that on these high-spin Co^{3+} ions.

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