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Spin-state polarons as a precursor to ferromagnetism and metallicity in hole-doped $LaCoO_3$ A. PODLESNYAK, M. RUSSINA, Hahn-Meitner-Institut, Berlin, Germany, E. POMJAKUSHINA, K. CONDER, Paul Scherrer Institut, Switzerland, D. KHOMSKII, Institute of Physics II, University of Cologne, Germany — Lightly doped cobaltites $La_{1-x}Sr_xCoO_3$ exhibit magnetic properties at low temperatures, in strong contrast to the diamagnetic $LaCoO_3$. We undertook an inelastic neutron scattering study with the goal to identify the energy spectrum and magnetic state of cobalt ions in the doped system with $x = 0.002$. In distinguish to the parent compound, where no excitations have been found for $T < 30$ K, an inelastic peak at $\Delta E \sim 0.75$ meV was observed in $La_{0.998}Sr_{0.002}CoO_3$ at $T = 1.5$ K. The intensity of this excitation is much higher than what is expected from an estimated concentration of doped holes. Furthermore, strong Zeeman splitting of the inelastic peak corresponds to an unusually high effective magnetic moment $\sim 15\mu_B$. Neighboring low-spin (LS) Co^{4+} and intermediate-spin Co^{3+} ions can share an e_g electron by swapping configuration. The t_{2g} electrons, in their turn, couple ferromagnetically. Therefore, we propose that the holes introduced in the LS state of $LaCoO_3$ are extended over the neighboring Co sites forming spin-state polarons and transforming the involved Co^{3+} ions to the higher spin state. Grows of spin-state polarons with hole doping finally results in a metallic ferromagnetic state for $x > 0.3$.

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