Spin-state transitions and magnetic polaron in lightly doped La$_{1-x}$Sr$_x$CoO$_3$. A. PODLESNYAK, Hahn-Meitner-Institut, Berlin, Germany, M.W. HAVERKORT, II Physikalisches Institut, Universität zu Köln, Germany, K. CONDER, Paul Scherrer Institut, Villigen, Switzerland, E. POMYAKUSHINA, ETH Zurich & Paul Scherrer Institut, Villingen, Switzerland, DANIEL KHOMSKII, II Physikalisches Institut, Universität zu Köln, 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 $x = 0.002$ 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.