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Ferromagnetism and unconventional impurity effects in Rh- and Ga- doped $LaCoO_3$ SHINICHIRO ASAI, RYUJI OKAZAKI, ICHIRO TERASAKI, Department of Physics, Nagoya University, YUKIO YASUI, Department of Physics, Meiji University — The perovskite oxide $LaCoO_3$ has been long investigated because of a dramatic change of its spin state for Co^{3+} ions with temperature variation. The Co^{3+} ions ($3d^6$) in $LaCoO_3$ takes the non-magnetic low-spin state of t_{2g}^6 at low temperature. The spin state of the Co^{3+} ions in this system is sensitive to the chemical substitutions; we have found a weak ferromagnetism in a solid solution of $LaCoO_3$ and $LaRhO_3$ [S. Asai *et al.*, JPSJ 80, 104705 (2011).]. Since the two oxides are non-magnetic at low temperature, our finding is an example of "order by disorder," where a non-magnetic impurity makes a non-magnetic oxide ferromagnetic. We have further investigated the magnetization and x-ray diffraction of $LaCo_{0.8-y}Rh_{0.2}M_yO_3$ (M = Rh, Ga) [S. Asai *et al.*, PRB 86, 014421 (2012).]. The magnetization decreases by the Ga^{3+} substitution much more drastically than by the Rh^{3+} substitution. It indicates that at least two kinds of Co^{3+} ions exist in $LaCo_{0.8}Rh_{0.2}O_3$; one is nonmagnetic, and the other is magnetic. In this talk, we will also discuss the change of the lattice volume with the Rh^{3+} and Ga^{3+} substitution [S. Asai *et al.*, JPSJ 82, 114606 (2013).].

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