Spin-State Transition in RCoO$_3$ (R = La, Pr, and Nd): Single-Crystal ^{59}Co NMR Measurements

A. Shimokata, S. Yamada, Y. Shimizu, and **M. Itoh**

Department of Physics, Nagoya University, Nagoya, Japan

A thermally-induced transition from a nonmagnetic to a paramagnetic state, so-called spin-state transition, in RCoO$_3$ (R: rare earth) is a long-standing issue of strongly correlated electron system. It has attracted much interests whether the transition from a low-spin ($S = 0$) to a high-spin ($S = 2$) state takes place through an intermediate spin ($S = 1$) state. We address a microscopic study of the orbital state in RCoO$_3$ (R = La, Pr, and Nd) by single-crystal ^{59}Co NMR measurements. The ^{59}Co nuclear spin-lattice relaxation rate and Knight shift measurements revealed the spin-state transition with the critical slowing down of fluctuations at 50 K in LaCoO$_3$. On the other hand, PdCoO$_3$ and NdCoO$_3$ exhibit no clear transition but a small continuous change in the local spin susceptibility at high temperatures above 300 K. Subtracting the contribution from the magnetic rare-earth spins to the ^{59}Co Knight shift, we obtained the magnetic hyperfine coupling constant between a ^{59}Co nuclear spin and 3d spins in the paramagnetic state with the finite 3d spin susceptibility in PrCoO$_3$ and NdCoO$_3$. The hyperfine coupling tensors of PrCoO$_3$ and LaCoO$_3$ are axially symmetric and dominated by a sum of dipole hyperfine fields from the 3d orbitals theoretically expected in the high-spin state.