Doping Dependence of the Giant Spontaneous Hall Effect in La$_{1-x}$Ca$_x$CoO$_3$ ($0.1 \leq x \leq 0.5$) A. V. SAMOILOV, G. BEACH, C. C. FU, N.-C. YEH, Department of Physics, # 114-36, California Institute of Technology, Pasadena, CA 91125, R. P. VASQUEZ, Center for Space Microelectronics Technology, JPL, California Institute of Technology, Pasadena, CA 91109

We report a very large spontaneous Hall effect in ferromagnetic La$_{1-x}$Ca$_x$CoO$_3$ epitaxial films and ceramics. The spontaneous Hall effect is strongest for $x=0.2$, which is a doping level close to the magnetic percolation threshold in La$_{1-x}$Ca$_x$CoO$_3$. Except near the magnetic percolation threshold, the longitudinal resistivity of La$_{1-x}$Ca$_x$CoO$_3$ decreases with increasing field. Peculiar temperature-dependent magnetoresistance occurs in the sample with $x=0.2$. The normal Hall coefficient $R_0$ is much smaller than the spontaneous Hall coefficient. We estimate a lower limit for the carrier density $n = 1/(Roe) > 3 \times 10^{28} \text{m}^{-3}$. The low-field slope of the Hall resistivity reaches a maximum value $\rho_{xy}/(\mu_0 H) \approx 2 \times 10^6 \text{m}^2/\text{C}=200 \mu\Omega\text{cm}/\text{T}$ for $x=0.2$ below the Curie temperature. The large magnitude of $\rho_{xy}/(\mu_0 H)$ may be used for sensitive low-field magnetometers. We suggest that the coexistence of high- and low-spin configurations in the perovskite cobaltites, which gives rise to the magnetic percolation behavior, may be responsible for the giant Hall effect.

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