

Anomalous Hall Effect in Co₃PdN Films

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Nitride antiperovskites offer a distinct and underexplored playground for uncovering spintronic and magnetic functionalities. Recently, we have synthesized polycrystalline and epitaxial films of phase pure (001) Co₃PdN for the first time. The magnetization behavior of epitaxial films exhibits a ‘two-step’ magnetization curve that is extremely sensitive to the direction of the applied magnetic field relative to high symmetry directions^{1,2}. In Figure 1, we show the magnetic field dependence of the Hall resistivity for fields applied in-plane. In this planar Hall configuration, a clear step-like feature emerges which is dependent on sweep direction, field magnitude, and applied field angle relative to the *a*-axis. Relatively small, planar magnetic fields generate an anomalous Hall response in Co₃PdN.

By combining MOKE magnetometry and magnetotransport, we identify a rotation of the net magnetization towards the (001) axis (film growth direction) for fields applied in-plane, up to 300 K. We hypothesize that distinct domain dynamics and the magnetic free energy drives the behavior^{1,2}. The unique tunability of the magnetization combined with a spin-polarized DOS positions Co₃PdN as a potentially powerful spintronics platform.

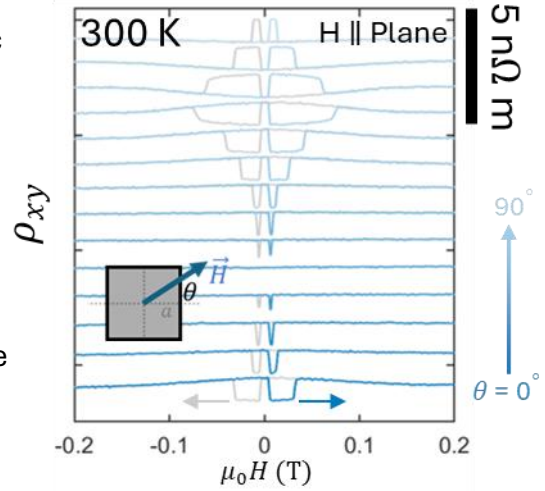


Figure 1: Magnetic field dependence of the Hall resistivity in the planar Hall configuration at 300 K at varying in-plane angles. A step-like feature emerges, dependent on the applied field magnitude and angle relative to the *a*-axis in-plane.

References:

- 1 H. X. Tang, R. K. Kawakami, D. D. Awschalom, and M. L. Roukes, *Giant Planar Hall Effect in Epitaxial (Ga,Mn)As Devices*, [Physical Review Letters](#), **90**, 107201 (2003).
- 2 R. P. Cowburn, S. J. Gray, J. Ferré, J. A. C. Bland, and J. Miltat, *Magnetic switching and in-plane uniaxial anisotropy in ultrathin Ag/Fe/Ag(100) epitaxial films*, [Journal of Applied Physics](#), **78**, 7210 (1995)