Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Orientation and temperature dependence of the anomalous Hall effect in hcp cobalt IVO SOUZA, University of California, Berkeley, ERIC ROMAN, YURIY MOKROUSOV, University of California, Berkeley and University of Hamburg — We calculate from first-principles the evolution of the intrinsic anomalous Hall conductivity vector $\vec{\sigma}^a$ of hcp Co as the spin magnetization direction $\hat{\mathbf{M}}$ is tilted away from the c-axis. We find that $\vec{\sigma}^a$ varies smoothly with the tilt angle θ, and that its magnitude is strongly reduced, by a factor of about four, between $\theta = 0$ and $\theta = \pi/2$, in good agreement with the measured anisotropy ratio of about three.[1] In addition to the anisotropic linear magnetization dependence ($\sigma_z^a/M_z \neq \sigma_x^a/M_x$) expected for any uniaxial crystal, there is a considerable nonlinearity in the dependence of σ_x^a on $M_x = M\sin\theta$, while the relation between σ_z^a and $M_z = M\cos\theta$ is essentially linear, as in Mn_5Ge_3.[2] The overall angular dependence of $\vec{\sigma}^a$ is well-described by an expansion in terms of $l = 1$ and $l = 3$ spherical harmonics. From Zener's model for the influence of thermal fluctuations of $\hat{\mathbf{M}}(\mathbf{r})$ on the temperature dependence of magnetic anisotropies,[3] we predict that the $l = 3$ terms give rise to an appreciable increase with temperature of the anisotropy ratio.

[1]N. V. Volkenshtein *et al.*, Fiz. Metal. Metalloved. **11**, 152 (1961).
[2]C. Zeng *et al.*, Phys. Rev. Lett. **96**, 037204 (2006).
[3]C. Zener, Phys. Rev. **96**, 1335 (1954).

Ivo Souza
University of California, Berkeley

Date submitted: 21 Nov 2008 Electronic form version 1.4