The Anomalous Hall effect in MnSi and Fe$_x$TaS$_2$

MINHYEA LEE, Princeton University

In a high-purity ferromagnet with long carrier lifetime $\tau$, e.g. MnSi, the ordinary Hall conductivity $\sigma^N_H$ can dominate the intrinsic Anomalous Hall effect (AHE) conductivity $\sigma^A_H$. We show that the large magnetoresistance provides a way to separate accurately the two Hall currents. Below $T_C$, we find that the AHE conductivity is strictly proportional to the magnetization $M$, viz. $\sigma^A_H = S_H M$ with a parameter $S_H$ that is independent of both temperature $T$ and field $H$. This implies that $\sigma^A_H$ is strictly independent of $\tau$. In the layered, hard ferromagnet Fe$_x$TaS$_2$, the large coercivity leads to abrupt reversals of $M$ when it switches. We show that this provides an accurate way to separate $\sigma^A_H$ from $\sigma^N_H$. Again, $\sigma^A_H$ is independent of $T$ from 5 to 50 K. We compare the observed constancy at low $T$ with theories for the AHE. We also describe a Hall anomaly recently observed in MnSi under pressure. This anomaly appears to arise from strong sensitivity of the Hall current to the spin texture, possibly reflecting its finite chirality. The dependence of the anomaly to $T$ and $H$ will be reported.

**This work is done in collaboration with Y. Onose, J. G. Checkelsky, E. Morosan, R. J. Cava, Y. Tokura and N. P. Ong.

1Research supported by NSF Grant DMR 0213706.