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The Anomalous Hall effect in MnSi and Fe_xTaS_2[1]

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In a high-purity ferromagnet with long carrier lifetime τ, e.g. MnSi, the ordinary Hall conductivity σ_H^N can dominate the intrinsic Anomalous Hall effect (AHE) conductivity σ_H^A. 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. $\sigma_H^A = S_H M$ with a parameter S_H that is independent of both temperature T and field H. This implies that σ_H^A is strictly independent of τ. In the layered, hard ferromagnet Fe_xTaS_2, the large coercivity leads to abrupt reversals of M when it switches. We show that this provides an accurate way to separate σ_H^A from σ_H^N. Again, σ_H^A 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.

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