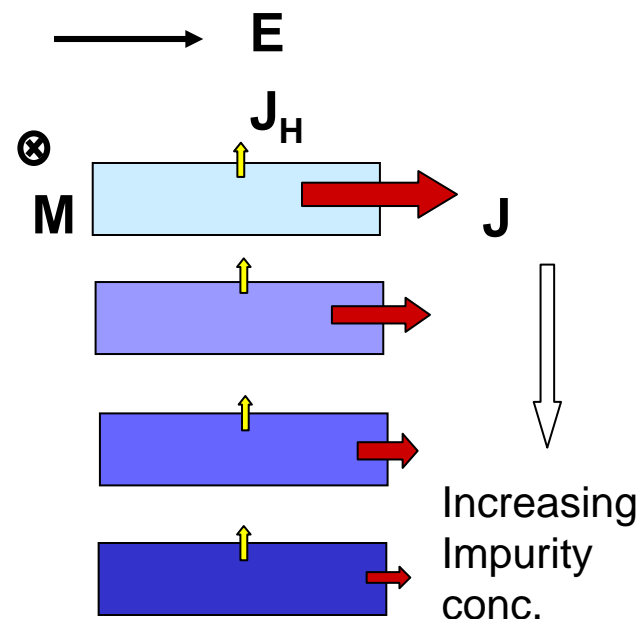


Dissipationless Hall current in ferromagnets

R. J. Cava and N. P. Ong, Princeton University, DMR-0213706

In all metals, the electrical current \mathbf{J} is strongly dissipated by scattering of electrons from impurities. If we increase the impurity concentration c , \mathbf{J} measured in a fixed electric field \mathbf{E} at low temperatures (5 K, say) decreases in proportion to c (figure). A recent experiment shows that the Hall current in a ferromagnet is a striking exception. The experiment confirms a 50-year old prediction that the anomalous Hall current in ferromagnets is independent of c (hence it is 'dissipationless'). In a ferromagnet, the anomalous Hall current \mathbf{J}_H flows 'sideways' perpendicular to both \mathbf{E} and the magnetization \mathbf{M} . Lee *et al.* investigated many samples of the spinel CuCr_2Se_4 with varying Br content. With increasing Br content, the resistivity at 5 K increases by several decades as expected from the decrease in \mathbf{J} (large solid arrows). However, \mathbf{J}_H remains at the same value in all samples (small arrows). Lee *et al.* point out that \mathbf{J}_H constitutes a current in which the spins are fully polarized, and may be exploited for investigating spin currents in spintronics.



Wei-Li Lee *et al.* *Science* 203, 1647 (2004)