Magnetotransport in Disordered Antiferromagnets from First Principles

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The emerging field of antiferromagnetic spintronics offers a new exciting playground for predicting and modeling non-equilibrium spin-dependent phenomena.

For instance recent theoretical studies have predicted current induced torques on the spin-sublattice magnetizations in Mn2Au [1] and a large anomalous Hall effect (AHE) in the noncollinear IrMn3 [2].

However, the presence of more spin sublattices in combination with disorder, and strong relativistic effects brings inevitable challenges for the first principles calculations of e.g. conductivity or spin-orbit torques. In our presentation we will show several advances in the understanding of the transport phenomena in antiferromagnets (AFM). We will focus particularly on the anisotropic magnetoresistance (AMR) and AHE. Several materials will be discussed, for example we predict a small AMR in Mn2Au and a relatively large AMR in IrMn3.

The effect of disorder is studied within the fully relativistic TB-LMTO+CPA [3]. From the numerical results we infer key material parameters that govern the galvanomagnetic effects in AFM and discuss qualitative trends in the dependence of the AMR and AHE on these parameters.