Ferrimagnetic Spintronics

J. M. D. Coey[1]

[1] *School of Physics, Trinity College Dublin, Ireland*

Spin electronics is largely concerned with spin polarized electron transport in thin films of ferromagnets and paramagnets with strong spin-orbit coupling. Antiferromagnets have attracted attention in recent times on account of their high frequency spin dynamics, the absence of any stray field and the possibility of switching the antiferromagnetic axis through 90° in crystal structures of appropriate symmetry. Metallic ferrimagnets offer the best of both worlds, and some unique properties of their own. When half-metallic, they combine high spin polarization with little or no net magnetization or stray field near compensation. Domains can be imaged directly. The magnetization can be switched by spin-orbit torque, resonance frequencies are high, coercivity and anisotropy field can be huge, there are prospects of switching a single layer by spin-orbit torque and ultra-fast all-optical toggle switching can be observed, with re-switching on a 10 ps timescale. These features will be illustrated with reference to the original zero moment half metal, Mn_2Ru_xGa with the XA Heusler structure, and also with reference to amorphous rare-earth transition metal ferrimagnets. Future prospects and challenges will be outlined.