Sonderforschungsbereich 689
Spinphänomene in reduzierten Dimensionen

Seminarankündigung

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Ort: PHY 9.2.01
Zeit: Dienstag, 3. Mai 2016, 14.15 Uhr

Thema: Chiral Interactions in Thin Film Magnets

Abstract
The Dzyaloshinskii-Moriya interaction (DMI) arises in situations where structural inversion symmetry is broken in a magnetic material. It favours chiral magnetic states. Whilst considered a curiosity for many decades, it has recently become a topic of intense interest due to its ability to stabilise spin textures with non-trivial topology, most notably skyrmion monolayers. In order to realise skyrmion-based spintronics, thin films showing strong DMI are needed. Structural inversion symmetry is broken in bulk in the B20 lattice, which is possessed by the helimagnetic metal FeGe. We have grown epitaxial layers of this material showing interesting transport properties, can have their chiral states controlled by ferromagnetic capping layers, and show in inversion of the sign of the DMI on doping with Co.
On the other hand, structural inversion asymmetry is also naturally present at an interface, and ultrathin (sub-nm) magnetic layers, which are often perpendicularly magnetized, will also show DMI. This leads to homochiral domain walls that are topologically protected against mutual annihilation unless the applied field is large. We have shown that the DMI of sputtered Pt/Co/Pt layers can be inverted by the insertion of an Ir overlayer, that the sign and magnitude of the DMI in Pt/Co/Pt can be controlled by varying differences in interfacial roughness above and below the Pt, and that the DMI can be made to oscillate by varying the electron count of the top layer in Pt/Co/Pt. Small skyrmion bubbles have been observed in perpendicularly magnetised (Pt/Co/Ir)xW multilayers by both scanning X-ray transmission microscopy using XMCD contrast (in patterned dots) and Lorentz transmission electron microscopy (in sheet films).


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