INSTITUT NEEL Grenoble

Proposition de stage Master 2 - Année universitaire 2022-2023

Chiral textures in magnetic thin films

Cadre général :
The magnetisation of thin films can be manipulated not only by magnetic field but also by an electrical current through the so-called spin transfer torque effects. The dynamics of domain walls - the regions that separate magnetic domains- depends on their internal structure: this is determined by the balance between different energy terms i.e. exchange, anisotropy and magnetostatic. It was recently discovered that in non-centrosymmetric thin films where the magnetic layer is deposited on a heavy metal with large spin-orbit interaction, the presence of interfacial Dzyaloshinskii interaction (DMI) can stabilise magnetic structures *with a fixed chirality*, skyrmions and domain walls with Néel internal spin structure.

The current- and field-driven dynamics of such objects is non trivial and strongly depends on the strength of the DMI. In view of possible applications to spintronic devices, it is important to measure and optimize such interaction.

Two experimental techniques are mostly used to measure the strength of the DMI. The first is based on the study of domain wall dynamics driven by a magnetic field. The second is based on the inelastic scattering of photons by spin waves, whose propagation depends on the chirality of the magnetic texture and can be measured by Brillouin Light scattering (BLS).

Sujet exact, moyens disponibles :

A BLS spectrometer has been recently acquired at Institut Néel. The aim of the internship will be to compare the interfacial DMI of a magnetic multilayer (Pt/Co/Oxide) using domain wall dynamics and BLS. The student will deposit the multilayer with magnetron sputtering. He/she will characterise the magnetic properties (magnetisation, magnetic anisotropy) with classical magnetometry techniques, will carry out domain wall dynamics measurements using magneto-optical Kerr microscopy, will measure the DMI by BLS. The effect of external parameters on the magnetic properties, such as an electric field applied using a gate, will also be tested. If the time allows it, micromagnetic simulations will be carried out to compare experiments with theoretical models.

Available instruments at Institut Néel : magnetron sputtering for magnetic thin film deposition, clean room for optical and electronic lithography, magneto-optical microscopes for magnetic imaging. The Brillouin Light Scattering spectrometer is being constructed and will be operational at the time of the internship.

Interactions et collaborations éventuelles :
Interactions with colleagues of SPINTEC and LPS Orsay are likely

Ce stage pourra se poursuivre par une thèse (ou **ce sujet est limité à un stage M2**...).
Yes

Formation / Compétences :
Some notions of magnetism and nanomagnetism are required; having followed magnetism courses in M1 would be a plus.

Période envisagée pour le début du stage :
March-Avril 2023

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