Doctoral positions
2016-2017

Thesis supervisor

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Thesis topic : Spin wave control by spin-orbit interaction in two dimensionnal magnetic systems : law of refraction

Spin waves are the most important collective excitations in magnetic systems. Occurring both in metals, semiconductors and in insulators, they can be thought of as propagating oscillations of the electronic spins around their average equilibrium orientation. Interest in spin waves has risen in recent years in the context of spin-based electronic (magnon spintronics). In particular, it has been suggested that spin waves could offer a low-dissipation alternative to traditional methods for transporting information and performing logical operations. However, such a vision creates the need of controlling the propagation of spin waves by electrical, magnetic and optical means - a challenge that has not yet been met.

Spin-orbit interaction is relativistic effect occuring when an electron is moving in electric field : the motion is converted into an effective magnetic field acting on its spin and proportional to the electron velocity. This interaction embedds lots of promising tools for magnon spintronics as it converts a charge current into magnetic torque acting on spin-waves.

By studying the interplay between spin-orbit fields and spin-waves in a magnetic two-dimensional electron gas, we plan to make conclusive experimental and theoretical evidences that the velocity of spin waves can indeed be controlled both in amplitude and orientation by varying the strength of the spin-orbit coupling.

We will mainly use inelastic light scattering to measure the dispersion and the damping rate of spin waves in a magnetic two-dimensional electron gas in a CdMnTe quantum well with, eventually, patterned profile of the spin-orbit fields. This could lead to novel applications in spin-wave based transistors, spin-wave routing devices or the realization of lenses for spin waves.

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Potential sources of funding available: The candidate will have to apply to the EDPIF grants, see here : https://www.edpif.org/en/recrutement/index.php

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