



CEA – Saclay, 91191 Gif-sur-Yvette Cedex
Service de Physique de l'Etat Condensé - UMR 3680

Soutenance HDR

Jeudi 14 décembre 2017 à 13h45

Orme des Merisiers SPEC, Amphi C. Bloch, Bât.774

Grégoire de Loubens

SPEC-LNO

“Magnetization dynamics in magnetic nanostructures: spectroscopy, spin transfer effects and nonlinearities”

My research interests lie in the fields of microwave nanomagnetism and spintronics. In particular, I study the interplay between the magnetization dynamics and the transport of angular momentum in heterostructures. This allows to control the relaxation of small magnetic objects, and even to destabilize their magnetization, which then becomes free to auto-oscillate. The obtained magnetization oscillations, typically in the GHz range and of large amplitude, are tunable and can be converted into voltage oscillations through magnetoresistive effects. These spin transfer nano-oscillators are thus quite promising for microwave applications. I aim at characterizing and improving their high frequency properties, which requires a detailed knowledge of their excitation spectra and nonlinear properties. In particular, I am investigating the opportunities offered by the vortex state, a topological configuration that magnetization can adopt in nanostructures, and by the mutual synchronization of several oscillators.

I am also interested in the transmission of pure spin currents at the interface between a ferromagnetic insulator and a normal metal. This possibility recently opened the field of spintronics to insulating magnetic oxides such as Yttrium iron garnet (YIG), a ferrimagnetic material with unsurpassed dynamical quality. Taking advantage of the spin Hall effect to produce a pure spin current transverse to the charge current flowing into a heavy metal layer, it is possible to generate an interfacial spin-orbit torque on an adjacent ultra-thin YIG layer, thereby controlling electrically its magnetic relaxation. This is very promising for magnonics, an emerging research field whose aim is to exploit spin-waves and their quanta magnons to carry and process information, since this offers a natural connection to spintronics.

In this presentation, I will give an overview of my research activities on magnetic vortex dynamics, spin torque nano-oscillators, and magnetization dynamics in magnetic insulators / normal metal hybrids. I will emphasize the links which exist between these three main topics and briefly present my current research projects and future perspectives.



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