Centre DE Nanosciences & DE Nanotechnologies

C2N General Seminar

Friday May 24th 2019 - 10h 00

Amphitheater of C2N

Ultrasonic drive of magnetization dynamics

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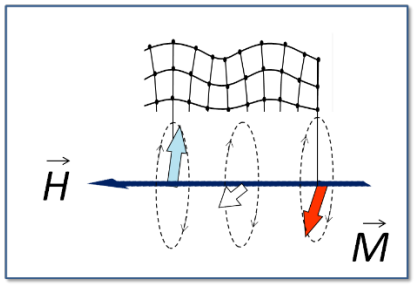
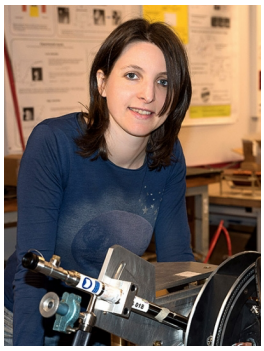
Magnetostriction links the shape of a magnetic material to its magnetization direction. Kittel recognized early on the interest of applying this strain dynamically to induce magnetic resonance [1]. His ideas have seen a recent revival of interest when combined to a wide range of optical or electrical acoustic wave excitation techniques. These waves are widely used in the fields of semiconductors physics, nanophotonics, and quantum optomechanics. In the Gigahertz range, they become relevant to magnetism physics, as these are typically the eigenfrequencies of the magnetization in most ferromagnets. I will describe the work we have been doing on (Ga,Mn)As using sub-GHz surface acoustic waves (SAWs) to manipulate, control, and switch magnetization - even in the absence of any applied magnetic field [2,3,4]. I will detail the experimental technique we have developed that enables us a spatio-temporal detection of these ultrasound driven magnetization dynamics. I will conclude by some perspectives on the use of magneto-acoustics in both magnetic and acoustic devices.



[1] L. Thevenard *et al.*, “Irreversible magnetization switching using surface acoustic waves,” *Phys. Rev. B* **87**, 144402, 2013.
[2] L. Thevenard *et al.*, “Precessional magnetization switching by a surface acoustic wave,” *Phys. Rev. B* **93**, 134430, 2016.
[3] P. Kuszewski *et al.*, “Resonant magneto-acoustic switching: influence of Rayleigh wave frequency and wavevector,” *J. Phys. Condens. Matter* **30**, 244003, 2018.
[4] P. Kuszewski *et al.*, “Optical probing of Rayleigh wave driven magneto-acoustic resonance,” Phys. Rev. Appl. **10**, 034036, 2018.



Laura THEVENARD She did her PhD on the dilute magnetic semiconductor GaMnAs at the Laboratoire de Photonique et Nanostructures with Aristide Lemaître on (Ga,Mn)As. She then went on to do a post-doc on Permalloy nanostructures in the group of Russel Cowburn, who was then located within Imperial College London. A few years after arriving at Institut of Nanosciences of Paris in 2009 (Sorbonne Universités campus) as a CNRS researcher, she developed with C. Gourdon, colleagues from the lab's Acoustics team, and A. Lemaître from the C2N, an original strategy to manipulate, control, and switch magnetization using surface acoustic waves of up to 1 GHz. The main experimental techniques are based on the magneto-optical kerr effect, that we implement either statically to perform magnetic domain imaging, or on a "pump-probe" set-up to access magnetization dynamics. In 2015 she received the Bronze Medal of the CNRS.

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