Internship offered in M2
2017-2018

Responsible for internship

Name:
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Internship topic: **Time and space-resolved magneto-acoustics**

This project aims to study the intimate coupling of strain and magnetization in magnetostrictive materials. When the external strain excitation is dynamic, at frequencies of several hundreds of MHz, one talks about acoustic waves, and we have shown that they can couple very efficiently to the magnetization, provided their frequency is made to resonate with the precession frequency of the magnetization [1]. This coupling can be so efficient that it can fully reverse the magnetization, when exploiting non-linear magnetization dynamics effects [2]. It could be particularly interesting to switch magnetic data bits in memory or logic devices, using the wave-mechanics tool-box offered by acoustic waves

Most works deal with monitoring how the *acoustic wave* amplitude is modified by the magneto-elastic coupling. Here we wish to monitor the real-time *magnetization* dynamics triggered by a travelling surface acoustic wave (precession periods of a few ns) by time-resolved Kerr effect, using visible femtosecond laser pulses that are synchronized to the acoustic wave. The internship will focus on studying the influence of the magnetic field, the wave frequency, or the temperature, and comparing to what is expected from the theory of a coupled magnon-phonon system. A recently acquired scanning stage will be implemented, interfaced and tested during the internship, and we expect to see the first observation of both time- and space-resolved magneto-acoustics.

A good background in solid state physics, optics, and/or magnetism is necessary, a clear enthusiasm for experimental work compulsory.

[1] L. Thevenard, C. Gourdon, et al., Phys. Rev. B **90**, 094401 (2014)

[2] L. Thevenard, C. Gourdon,et al., Phys. Rev. B **93**, 134430 (2016)

Techniques involved: ultra-fast lasers and cryogenics, magneto-optics, radio-frequency devices, basic numerical simulation tools

Type of internship: experimental
Paid internship: Yes
Can this internship be continued for a PhD? Yes
If yes, type of PhD funding envisaged is: Ecole Doctorale ED397

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