Master internship/PhD

Internship/job title	**Magnetization manipulation by optical spin injection at ferromagnetic metal/semiconductor interface**
Location :	Laboratoire PMC – Ecole Polytechnique – Route de Saclay – 91128 Palaiseau
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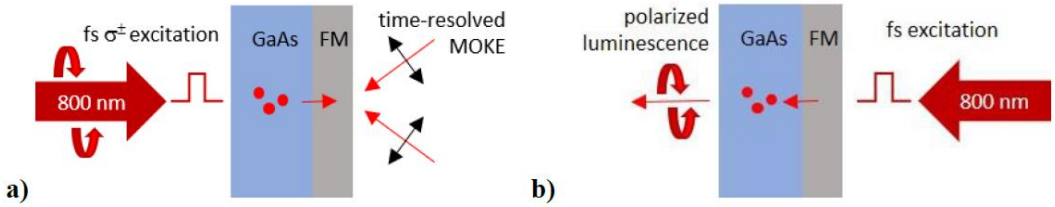
Observations	Starting date : January – March 2019

TOPIC: Ultrafast magnetization manipulation is a challenging issue for future information and communication technologies [1,2]. Optical excitation is a promising tool since the demonstration of sub-picosecond magnetization quenching and reversal following femtosecond laser pulse [3,4]. There are growing indications that light-excited spin-polarized hot carriers play a key role in the observed phenomena. However, the mechanisms governing the ultrafast magnetization changes are not fully elucidated. We propose to investigate the magnetization dynamics under femtosecond optical excitation in a ferromagnetic metal (FM) / semiconductor (SC) heterostructure. This new approach will exploit the well-established principles of optical spin orientation in semiconductors for optically generating or detecting spin-polarized hot-carrier current pulses in the junction [5,6]. This will provide direct and selective access to the effect of photo-excited spin-polarized hot-carriers on the magnetization dynamics.



Schematics of the configurations (a) for injecting spin-polarized photo-electrons excited in the SC into the FM layer: circularly polarized laser radiation creates photoelectrons with longitudinal spin polarization; (b) for detecting the hot-carrier polarization excited by fs excitation in the FM layer.

During the intership we will deposit epitaxial iron layers on GaAs and concentrate on polarized luminescence detection using continuous and pulsed laser pulses. The internship is part of a collaboration with the Institut Jean Lamour in Nancy and the Centre de Nanosciences et de Nanothechnologies (C2N) of Paris Saclay University.

1. J. Vogel et al., Phys.Rev.Lett.**108**, 247202 (2012)
2. V. Uhlír et al. , Phys. Rev. B. **83**, 020406 (2011)
3. E. Beaurepaire et al., Phys. Rev. Lett. **76**, 4250 (1996)
4. F. Pressacco et al., Structural Dynamics **5**, 034501 (2018)
5. X. Li et al., Appl. Phys. Lett. **105**, 052402 (2014)
6. N. Rougemaille et al., Phys. Rev. B **77**, 094409 (2008)

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CANDIDATE & POSITION: Methods to be used include Spin-polarized electron spectroscopy, luminescence spectroscopy. Funding for a subsequent Ph.D. may be via a ministry Ph.D. scholarship, the ANR or an external funding agency.

LABORATOIRE DE PHYSIQUE DE LA MATIERE CONDENSEE
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