

Master internship/PhD

Internship/job title	Spin-polarized electron spectroscopy for probing spin-dependent electronic processes in 2D materials
Location :	Laboratoire PMC – Ecole Polytechnique – Route de Saclay – 91128 Palaiseau
Contact :	Fausto Sirotti & Lucio Martinelli
email/ telephone	fausto.sirotti@polytechnique.edu - 33 (0)1 69 33 46 89 lucio.martinelli@polytechnique.edu – 33 (0)1 69 33 46 60
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Observations	Starting date : January – March 2019

TOPIC: Magnetization dynamics is a rapidly expanding scientific domain because of the many possible applications for information and communication technologies[1,2] If femtosecond laser excitations are currently used to manipulate magnetization [3] and to induce phase transitions in magnetic metals [4], few experiments are reported on semiconductors.

Nevertheless, currently used spin-polarized electron sources are based on semiconductor materials. This is one of the main activities of our group at PMC [5,6]. At present we are developing a new source of spin polarized electrons exploiting well-established principles of optical spin orientation in semiconductors for optically generating pulsed spin-polarized free electron beams.

The Master student will participate to the installation and commissioning of the spin-polarized electron source which is under development. Experiments will be performed using continuous and pulsed laser sources to optimize the production of short electron pulses. Characterization of the produced spin-polarized electron beams will be done at Polytechnique and in collaboration with research groups based on large installations at SOLEIL synchrotron in Gif-sur-Yvette and at FERMI free electron laser in Trieste (Italy). This source will be implemented on a spin-resolved electron spectroscopy experiment to probe spin-dependent electronic processes in 2D-materials.

The topic requires skills in mechanics, electronics and programming, as well as interest in instrumentation development.

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)

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