

CONDENSED MATTER SEMINAR

Thursday 5 May at 14.30

“Femto-second to pico-second laser pulse to switch magnetization”

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During the last decade all-optical ultrafast magnetization switching in magnetic material thin film without the assistance of an applied external magnetic field has been explored [1,2]. It has been shown that femto-second light pulses can induce magnetization reversal in a large variety of magnetic materials [3,4]. However, so far, only certain particular ferrimagnetic thin films exhibit magnetization switching via a single femto-second optical pulse. All optical helicity dependent switching of a ferromagnetic layer could be demonstrated for a low number of pulses [5]. Recently the single-pulse switching of various magnetic material (ferrimagnetic, ferromagnetic) within a magnetic spin-valve structure have been demonstrated. Our experimental study reveals that the magnetization states are determined by spin-polarized currents generated by the light pulse interactions with the GdFeCo layer [6]. A detail study showing how spin-polarized currents are generated and how they interact with a Ferromagnetic (FM) layer can lead to magnetization switching will be presented [7,8]. Finally, magnetization dynamics measurement show that the reversal of the FM layer happens in less than one picosecond which can be modelled [9].

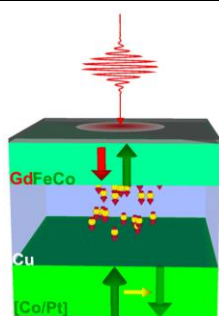


Figure 1

Sketch of a spin-valve structure used to demonstrate femto-second single pulse switching of each magnetic layer independently. The generation of femto-second spin current is shown to play a major role.

- [1] C. D. Stanciu, et al Phys. Rev. Lett. **2007**, 99, 047601
- [2] I. Radu et al, Nature **2011**, 472, 207
- [3] S. Mangin, et al, Nat. Mater. **2014**, 13, 286
- [4] C. -H. Lambert, et al Science **2014**, 345, 1337
- [5] G. Kichin, et al Phys. Rev. App. 12 (2), 024019 **2019**
- [6] S. Iihama et al Adv Matter 1804004 **2018**
- [7] Q. Remy, et al Adv. Sci. 2001996 **2020**
- [8] J. Igarashi, et al Nano. Lett. 20, 12, 8654–8660 **2020**
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