Graduate Program in Spintronics Seminar

"All optical switching in Ferromagnetic layer: From multiple to single laser pulse"

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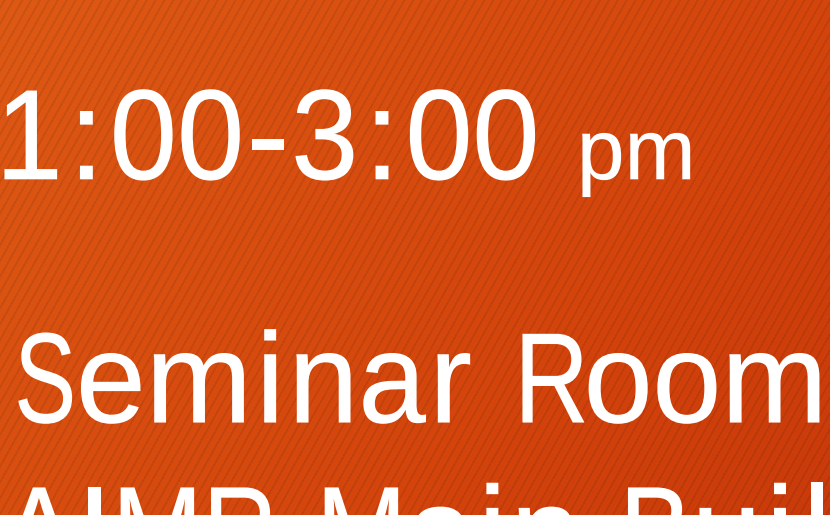
Date: Thursday, November 1, 2018

Time: 1:00-3:00 pm

Place: Seminar Room, 2nd Floor,
AIMR Main Building
Katahira Campus, Tohoku University



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All optical switching in Ferromagnetic layer: From multiple to single laser pulse

All-optical ultrafast magnetization switching in magnetic material thin film without the assistance of an applied external magnetic field is being explored for future ultrafast and energy-efficient magnetic storage and memories. Indeed the low-power manipulation of the magnetization, at ultrashort timescales,has become a fundamental challenge for future application but also for its understanding (1,2). In this presentation we will focus on the possibility of manipulating magnetization of a broad variety of magnetic material using all-optical helicity-dependent switching (AO-HDS (3-5)). This stype of switching has only been demonstrated after several hundreds of femtosecond pulses and the mechanism behind this switching is still unclear. Here we explore the optimization of (AO-HDS) for ferromagnetic material namely Co/Pt. We have investigated the role of different parameters such as the laser pulse duration and the laser fluence on the magnetisation. From this study we have built the state diagram shown on Figure 1. We also demonstrate that full AO-HDS can be observed for a limited number of pulses and that AO-HDS effect is shown for a single pulse only. These results provide a pathway to engineering materials for future applications based on all-optical control of magnetic order. Moreover it challenge present theories based on Magnetic Circular Dichroisme (6) and give credit to angular moment transfer from light to magnetism.

[1] I. Radu *et al*. Nature 472, 207 (2011)
[2] T. A. Ostler *et al*. Nat. Commun. 3, 666 (2012)
[3] S. Mangin *et al*. Nat. Mater. 13, 286 (2014)
[4] C. -H. Lambert *et al*. Science 345, 1337 (2014)
[5] M. S. El Hadri *et al*. Phys. Rev. B 94, 064412 (2016)
[6] J. Gorchon *et al.*Appl. Phys. Lett. 111, 042401 (2017)