

All-optical Control of THz Spin Dynamics

Keywords: magnetic thin film, spin current, terahertz spintronics



National Institute for Materials Science

Background

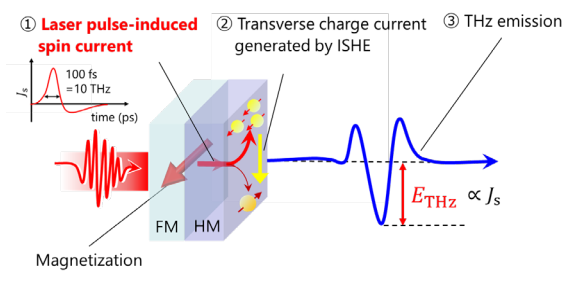
Toward future IoT society model, fast operation and high density recording media is strongly desired. However, its spin dynamics reaches THz frequency range (0.1-10 THz). The control and detection of fast spin dynamics are technically difficult by using a conventional electrical method.

Aim

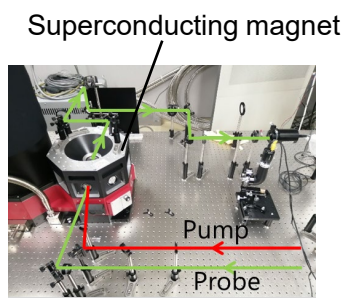
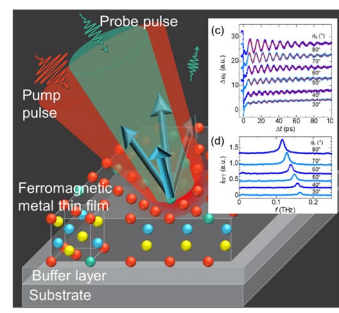
All-optical technique with ultrafast laser pulses can control and detect the fast magnetization dynamics at THz frequencies. Clarifying the fast magnetization dynamics and operating the recording information in $L1_0$ -FePt nanogranular film are desired to realize high density recording media & optical data storage.

Advanced Research Topics

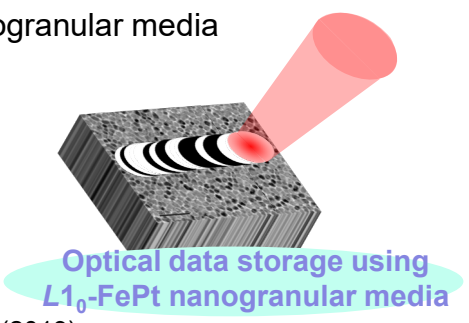
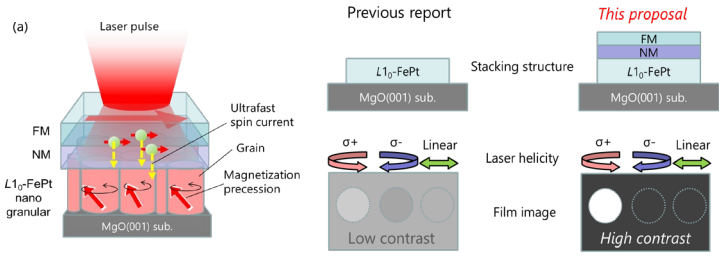
- ✓ Optimizing the thin film structure for optically induced ultrafast spin current



- ✓ Investigating the THz magnetization dynamics in ferromagnetic thin films



- ✓ All-optical magnetization switching in $L1_0$ -FePt nanogranular media



Publications

- Y. Sasaki, *et al.*, Phys. Rev. B **100**, 140406 (2019).
- Y. Sasaki, *et al.*, Appl. Phys. Exp. **13**, 093003 (2020).
- Y. Sasaki, *et al.*, Small **18**, 2200378 (2022).

Summary

- Efficient ultrafast spin current generation is applied for the spintronic THz emitter.
- THz spin dynamics with heating & ultrafast spin current in $L1_0$ -FePt nanogranular media can be investigated by using the all-optical method.

Research outcome

- All-optical control of the THz spin dynamics with thermal heating & ultrafast spin current will be utilized in future high density magnetic recording media & optical data storage technologies.



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