

All-optical control of magnetization

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Since the demonstration of ultrafast demagnetization by a 60 fs laser pulse and the subsequent magnetization reversal by a single 40 fs laser pulse, the manipulation of spins by ultra-short laser pulses has become a fundamentally challenging topic with a potentially high impact for future spintronics, data storage and quantum computation. Expansion to hybrid magnetic materials, multilayers, FePt and even magnetic garnets are ongoing efforts to develop all-optical switching (AOS) towards an alternative and energy efficient approach to magnetic recording.

Lecture topics:

1. Time scales and stimuli in magnetism
2. Classification of laser induced effects
 - a. Thermal effects
 - b. Nonthermal photo-magnetic effects
 - c. Nonthermal opto-magnetic effects
3. Experiments
 - a. AOS of Ferrimagnets
 - b. AOS of Ferromagnets
 - c. AOS of Dielectrics
4. Towards applications
 - a. All-optical switching at the nanoscale
 - b. AOS of recording media
 - c. Neuromorphic applications
5. Outlook

Recommended reading:

- [1] A. Kirilyuk, A.V. Kimel, and Th. Rasing, Laser-induced dynamics and reversal in ferrimagnetic alloys. *Rep. Prog. Phys.* 76, 026501 (2013)
- [2] Andrei Kirilyuk, Alexey V. Kimel and Theo Rasing: Ultrafast optical manipulation of magnetic order. *Reviews of Modern Physics*, 82 (2010), 2731-2784. *Review of Modern Physics* 88, 039904 (2016)