Institute for
Nanoscale Physics and Chemistry

INPAC Lectures on Modern Trends in Nanoscience:

Probing and Controlling Magnetism by Light on femtosecond time-scales

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1st Lecture: October 22 at 16h00

Colloquium Natuurkunde en Sterrenkunde

2nd Lecture: October 24 at 11h00

Celestijnenlaan 200 D, room 05:11

Abstract

The interaction of light with magnetic matter is well known: magneto optical Faraday or Kerr effects are frequently used to probe the magnetic state of materials or manipulate the polarisation of light. The strong developments in femtosecond lasers allows to currently do this on unprecedented timescales.

The inverse effects are less known but certainly as fascinating: with light one can manipulate matter, for example orient their spins. Using femtosecond laser pulses we have recently demonstrated that one can thus generate ultrashort and very strong (~Tesla's) magnetic field pulses that provide unprecedented means for the generation, manipulation and coherent control of magnetic order on very short time scales.

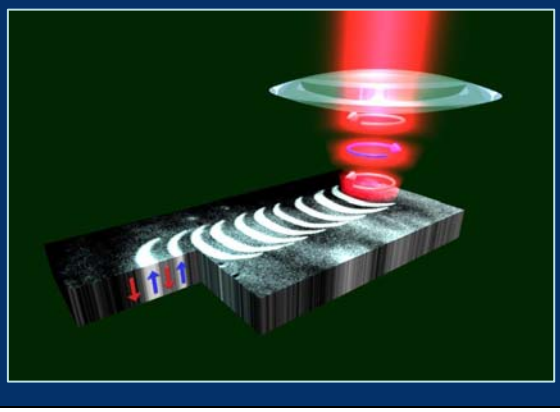
In these two lectures the basic ideas and prospects of both femtosecond magneto-optics as well as opto-magnetism will be discussed and illustrated with recent results.

References

[1] A.V.Kimel, A.Kirilyuk, A.Tsvetkov, R.V.Pisarev and Th.Rasing: Laser induced ultrafast spin reorientation in the antiferromagnet TmFeO. Nature 429 (2004) 850-853

[2] A.V.Kimel, A.Kirilyuk, P.A.Usachev, R.V.Pisarev, A.M.Balbashov and Th.Rasing,Ultrafast nonthermal control of magnetization by instantaneous photomagnetic pulses, Nature 435 (2005), 655-657

[3] C.D.Stanciu, F.Hansteen, A.V.Kimel, A.Kirilyuk, A.Tsukamoto, A.Itoh and Th.Rasing, All-optical Magnetic Recording with Circularly polarized Light, Phys.Rev.Lett.99, 047601 (2007)



Demonstration of compact all-optical recording of magnetic bits by femtosecond laser pulses. This was achieved by scanning a circularly polarized laser beam across the sample and simultaneously modulating the polarization of the beam between left and right circular. White and black areas correspond to 'up' and 'down' magnetic domains, respectively.