

Controlling Magnetism with Light

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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 inverse effects are less known but certainly as fascinating: with light one can manipulate magnetic matter, for example orient their spins. Using femtosecond laser pulses we have recently demonstrated that one can generate ultra short and very strong (~Tesla's) magnetic field pulses via the so called Inverse Faraday Effect. Such optically induced magnetic field pulses provide unprecedented means for the generation, manipulation and coherent control of magnetic order on very short time scales, including the complete reversal of a magnet with a single 40fs laser pulse and the demonstration of inertia-driven spin switching in anti-ferromagnets. Recent results demonstrate that both linearly and circularly polarized light can be used to manipulate magnetic order at fs timescales, increasing the possibilities of all-optical control of magnetism even more.

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