Fritz-Haber-Institut der Max-Planck-Gesellschaft

Physikalische Chemie — Direktor: Prof. Dr. Martin Wolf

MAX-PLANCK-GESELLSCHAFT

Department Seminar:

Wednesday, October 10, 2018, at **2:00** p.m.

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Coauthors: T. Seifert (PC/FHI), Z. Kašpar (Prague), V. Novák (Prague), P. Wadley (Nottingham), R.P. Campion (Nottingham), M. Baumgartner (Zürich), P. Gambardella (Zürich), P. Němec (Prague), J. Wunderlich (Prague & Cambridge), J. Sinova (Mainz), M. Müller (PC/FHI), T. Kampfrath (PC/FHI), T. Jungwirth (Prague & Nottingham).

Ultrafast writing of an antiferromagnetic memory

PC Seminar Room G2.06, Building G, Faradayweg 4 T. Kampfrath

Abstract:

The electrical control of magnetic moments of antiferromagnets (AFMs) using staggered current induced spin-orbit (SO) fields opened possibility to use AFMs for memory applications [1]. The AFM memories promise several advantages. Part of them stems from their zero magnetic moment providing stability against external magnetic field and higher integration density thanks to lack of stray fields. Another is the relative abundance of AFMs and richness of their properties. For our present work, the key property AFMs is their fast magnetization dynamics. While for ferromagnetic moments typical switching rates are in GHz range (corresponding to tens to hundreds of mT anisotropy fields) for AFMs the damping is enhanced by exchange interaction (of the order of hundreds of T) promising feasible THz range operation.

Here, we experimentally investigate the writing speed of AFM memory cells fabricated from epitaxial CuMnAs films. We start with results showing electrical writing with pulse lengths from milliseconds to hundreds of picoseconds [2]. Since shorter pulses cannot be applied using electrical circuitry, we use picosecond radiation pulses to investigate the writing in THz range. We observe the analogous memory functionality with picosecond pulses as in the range between milliseconds and nanoseconds showing that the same current induced SO field switching mechanism is feasible also in the THz range for AFMs.

[1] P. Wadley et al., Science 351, 587–590 (2016)..
[2] K. Olejník et al., Nat. Commun. 8, 15434 (2017).