493rd ASRC Seminar

Date: 13:30 - 14:30, 26th November

Location: Meeting room 103, ASRC Building

Speaker: Prof. Mathias Klaui

(Johannes Gutenberg University Mainz, Germany)

Title: Ultra-fast domain wall dynamics

Since conventional approaches of manipulating magnetization using magnetic fields exhibit unfavourable scaling and results in limited switching speed, alternative approaches based on spin-currents have emerged. The transfer of angular momentum ("spin transfer torque effect") leads for instance to current-induced domain wall motion (CIDM), which has become the focus of intense research in the last few years. We have comprehensively investigated CIDM and determined the acting adiabatic and non-adiabatic torque terms [1]. We find that the previously neglected diffusive torque term [2] can play an important role for vortex core displacement. For out-of-plane magnetized Co/Pt a large non-adiabatic torque is found, while in Co/Ni the adiabatic torque dominates [3]. Using pure diffusive spin currents we find large efficiencies for domain wall displacement due to strong spin accumulation absorption [4]. To increase the spin diffusion length, we use robust turbostratic graphene and find spin injection across transparent contacts. We have also used the Spin Seebeck Effect to generate spin currents that then affect domain wall propagation [5] and using Free Electron Laser sources we measure the ultra-fast magnetization dynamics due to superdiffusive spin currents [6]. Finally we also investigate field-driven domain wall motion in ring structures with a view of measuring the spin motive force effect.

[1] L. Heyne et al., Phys. Rev. Lett. 105, 187203 (2010); M. Eltschka et al., Phys. Rev. Lett. 105, 056601 (2010). [2] A. Manchon, W.-S. Kim, and K.-J. Lee, arXiv:1110.3487. [3] J. Heinen et al., J. Phys. Cond. Mat. 24, 24220 (2012); T. Koyama et al., Nature Mat. 10, 194 (2011). [4] D. Ilgaz et al., Phys. Rev. Lett. 105, 076601 (2010). [5] P. Möhrke et al., Sol. Stat. Com. 150, 489 (2010); J. Franken et al., Appl. Phys. Lett. 95, 212502 (2009). [6] B. Pfau et al., Nature Comm. 3, 1100 (2012).

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