

›Allgemeines Physikalisches Kolloquium

> **Donnerstag, 02.05.2019 um 16 Uhr c.t.**

Prof. Dr. Pietro Gambardella

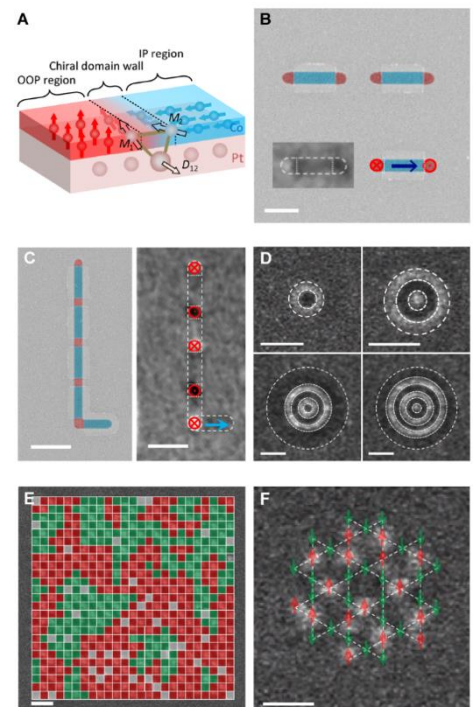
Department of Materials, ETH Zürich



New ways to switch, sense, and couple nanomagnets enabled by spin-orbit coupling

The spintronics landscape has changed dramatically over the last ten years. Much of this change is due to a deeper understanding of the couplings and charge-spin conversion processes mediated by the spin-orbit interaction in different classes of materials. In this talk, I will discuss new opportunities to sense and manipulate the static and dynamic magnetization states of magnetic metals and insulators. Illustrative examples will focus on nonreciprocal magnetoresistance effects [1-3], ultrafast switching of magnetic dots and tunnel junctions [4-7], as well as chirally coupled arrays of nanomagnets, synthetic skyrmions, and antiferromagnets [8].

Figure 1. (A) Schematics of the lateral coupling mediated by the interfacial Dzyaloshinskii-Moriya interaction between adjacent out-of-plane and in-plane regions of a Pt/Co/AlO_x trilayer. (B-F) Scanning electron micrographs and magnetic contrast images of coupled elements. (B,C) Lateral synthetic antiferromagnets. (D) Synthetic skyrmions. (E,F) Artificial spin systems consisting of Ising-like moments coupled via in-plane spacers in (E) a square lattice and (F) a kagome lattice recorded at zero field after saturation by an out-of-plane field. The scale bars are 500 nm (from Ref. 8).



- [1] C.O. Avci, J. Mendil, G.S.D. Beach, and P. Gambardella, Phys. Rev. Lett. **121**, 087207 (2018).
- [2] C.O. Avci et al., Appl. Phys. Lett. **110**, 203506 (2017).
- [3] C.O. Avci et al., Nat. Phys. **11**, 570 (2015).
- [4] A. Manchon et al., arXiv:1801.09636.
- [5] M. Cubukcu et al., IEEE Trans. Magn. **54**, 9300204 (2018).
- [6] M. Baumgartner et al., Nat. Nanotech **12**, 980 (2017).
- [7] M. Miron et al., Nature **476**, 189 (2011).
- [8] Z. Luo et al., Science **363**, 1435 (2019).

