Fast electrical switching of multilevel antiferromagnetic memory

Kamil Olejník
Institute of Physics, Academy of Sciences of the Czech Republic

Traditionally, antiferromagnets (AFMs) were out of the main focus of spintronics. Their role in spintronic devices was limited and mostly auxiliary - such as for stabilization of reference ferromagnetic (FM) layers in tunneling magnetoresistance devices via exchange bias. The reason was in the difficulty to control the magnetic state of AFMs. This has changed recently, when it was theoretically predicted [1] and experimentally demonstrated [2] that the orientation of moments of an AFM can be effectively manipulated by electrical means utilizing current induced staggered spin orbit fields present in AFM materials with particular symmetry properties. This opened a way to exploit the potential advantages of AFMs in spintronic. First is the fast dynamics of AFM moments, second is the robustness of information stored in AFM state against magnetic fields.
In this talk, we will present the details of electrical switching and readout of state of antiferromagnetic devices made of CuMnAs (an example AFM exhibiting staggered SO fields). In particular, we will focus on experiments with varying length of writing pulses in broad range between tens of milliseconds to hundreds of picoseconds.

[1] J. Zelezny et al., Phys. Rev. Lett. 113, 157201 (2014)
[2] P. Wadley et al., Science 351, 587–590 (2016)