# Controlling antiferromagnetic domains

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For many years, antiferromagnets were given little attention in research and played only a passive role in spintronics applications due to the difficulties in manipulating and measuring the magnetic order. However, substituting ferromagnets by antiferromagnets as active parts in spintronic devices offers the potential for ultrahigh speed dynamics (THz), stability against strong magnetic field perturbations, and higher component packing density owing to the lack of stray fringing fields, as well as a wider material base and qualitatively new physical phenomena. During the last few years, these advantages have motivated intensive research and gradually “antiferromagnetic spintronics” has been established as an important, independent field and spintronics applications based on antiferromagnets seems to become within feasible reach [1,2].

Tetragonal CuMnAs is a testbed system in which the antiferromagnetic order parameter can be switched reversibly using electrical currents [3]. Originally, orthogonal in-plane current pulses were used to induce 90° rotations of antiferromagnetic domains in a multi-terminal geometry. This type of switching has also been successfully demonstrated in $Mn_2Au$ [4,5], an antiferromagnet that shares the symmetry properties.

Here [6], we demonstrate that antiferromagnetic domain walls in CuMnAs can be manipulated to realize stable and reproducible domain changes using only two electrical contacts. In this geometry, current polarity is reversed changing the sign of the current-induced fields. The resulting Néel spin–orbit torque acts primarily on the domain wall. The reconfigurations are imaged using x-ray magnetic linear dichroism microscopy, and detected electrically. The switching by domain wall motion can occur at much lower current densities than coherent domain switching.

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[2] Jungwirth et al., Nat. Nano. 11, 231–241 (2016).
[3] Wadley et al., Science 351, 587-590 (2016).
[4] Bodnar et al., Nat. Commun. 9, 348 (2018)
[5] Meinert et al., arXiv:1706.06983
[6] Wadley, Reimers et al., Nat. Nano.13, 362–365 (2018)