Skyrmion Hall effects in antiferromagnetic skyrmions

Amal Aldarawsheh 1,2, Moritz Sallermann 1, Muayyad Abusaa 3, Samir Lounis 1,4

1 IAS-1, FZJ, Germany
2 University of Duisburg Essen - Physics, Germany
3 Arab American University - Physics, Palestine, State of
4 University of Duisburg Essen - Physics, Germany

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Antiferomagnetic (AFM) skyrmions, characterized by the antiferomagnetic coupling of two ferromagnetic (FM) solitons, have emerged as a highly promising avenue in the realm of spintronics, particularly for the development of advanced racetrack memory devices. A distinguishing feature of AFM skyrmions is their zero topological charge and hence anticipated zero skyrmion Hall effect (SkHE). Here, we unveil that the latter is surprisingly finite under the influence of spin-transfer torque, depending on the direction of the injected current impinging on intrinsic AFM skyrmions emerging in CrPdFe trilayer on Ir(111) surface[1,2]. Hinging on first-principles combined with atomistic spin dynamics simulations, we identify intrinsic and extrinsic SkHEs and uncover that FM skyrmions in the underlying Fe layer act as effective traps for AFM skyrmions, confining them and reducing their velocity. These findings hold significant promise for spintronic applications, advancing our understanding of AFM and FM skyrmion interactions in heterostructures.

References