Spin chirality in systems with broken inversion symmetry

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Nowadays, spin chirality is being widely investigated in magnetic materials because it suggest new approaches for material engineering, which can be suitable for application in high-density information storage and logic circuits. The most extensive studies are carried out for magnetic thin films with broken inversion symmetry, where the spin chirality is adjusted via the interfacial Dzyaloshinskii-Moriya interaction (iDMI) [1]. This interaction in systems with perpendicular magnetic anisotropy (PMA) may stabilize chiral Néel-type domain walls or skyrmions (nanometer sized topological protected chiral spin configurations). Therefore, a lot of attention is paid to tune the strength and sign of iDMI. In light of recent result [2], it is known that skyrmions can be stabilized at room temperature by perpendicular exchange bias in HM/F/antiferromagnetic(AF) systems without any external magnetic field, which is an important step forward for skyrmion-based applications.

Here we focused our studies in Au(HM)/Co(F)/NiO(AF) layered systems, where we found that the NiO layer orients the magnetization of the Co layer perpendicularly to the sample plane due the exchange bias coupling between Co and NiO spins [3]. Due to symmetry breaking of the Co interfaces, this system shows iDMI and the use of antiferromagnetic layers allows to obtain significant perpendicular exchange bias field [4].

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[2] G. Yu, et al., Nano Lett. 18, 980 (2018)
[3] P. Kuświk et al., J. Appl. Phys. 119, 215307 (2016)
[4] P. Kuświk et al., Phys. Rev. B 97, 024404 (2018)