Stabilization and racetrack application of asymmetric Néel skyrmions in hybrid nanostructures

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Nontrivial magnetization textures, such as skyrmions and vortices, have become a driving force in the field of magnetism due to their enormous potential for processing and transporting information. The ability to encode information in spin textures or spin waves can lead to the development of magnonic devices that are more space-efficient than optical devices and more energy-efficient than current electronics. In this presentation, we will demonstrate that a Néel-type skyrmion confined within a nanodot placed on top of a ferromagnetic in-plane magnetized stripe provides a unique and compelling platform to investigate the dynamics of spin waves and magnetization textures in hybrid structures. In this hybrid structures skyrmion induces an imprint upon the stripe, which, in turn, asymmetrically squeezes the skyrmion in the dot, increasing their size and the range of skyrmion stability at small values of Dzyaloshinskii-Moriya interaction, as well as introducing skyrmion bi-stability. We will discuss the consequences of skyrmion stabilization and furthermore, the spin wave coupling between propagating modes in the stripe, and skyrmion excitations. Moreover, we will present a technique for the unconstrained transport of skyrmions along a hybrid racetrack [1].

References:

[1] M. Zelent, M. Moalic, M. Mruczkiewicz, X. Li, Y. Zhou, M. Krawczyk, arXiv preprint arXiv:2209.14824 (2022).

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