Current induced nucleation and motion of skyrmion in symmetric multilayers

S. Rohart*, A. Hrabec, J. Sampaio and A. Thiaville
Laboatoire de Physique des Solides, University Paris-Sud, CNRS, 91405 Orsay Cedex, France
*stanislas.rohart@u-psud.fr

Skyrmions, a magnetic texture characterized by its unique topological charge, have attracted recently a concerted effort to study how they could be controlled and moved in ferromagnetic films or tracks, and open a new route for spintronics and information storage technologies [1]. Stabilization, nucleation and motion are the three challenges toward such an achievement. In this study, we show how a multilayer with a global symmetric stacking allows 300 nm diameter skyrmion stabilization combining Dzyaloshinskii-Moriya (DMI) and dipolar interactions, without strong constrains on materials (in particular without strong DMI). The sample structure is compatible with spin-orbit torques, particularly induced by the spin Hall effect and enables current induced skyrmion motion. In a track, using two asymmetric electrodes (point contact on one side, large contact on the other side), we demonstrate independent nucleation at the point contact and shift of the skyrmion. Velocities up to 60 m/s at current densities lower than $5x10^{11}$ A/m^2 are achieved. The observation of a deflection toward the edges is the ultimate proof of the skyrmion topological charge.

Reference

[1] A. Fert, V. Cros and J. Sampaio, Nature Nanotechnology 8, 152 (2013)