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Generation of magnetic skyrmion bubbles by inhomogeneous spin-Hall currents[1] OLLE HEINONEN, WANJUN JIANG, HAMOUD SOMAILY, SUZANNE G.E. TE VELTHUIS, AXEL HOFFMANN, Argonne Natl Lab
— Recent experiments have shown that magnetic skyrmion bubbles can be generated and injected at room temperature in thin films[1]. Here, we demonstrate, using micromagnetic modeling, that such skyrmions can be generated by an inhomogeneous spin Hall torque in the presence of Dzyaloshinskii- Moriya interactions (DMIs). In the experimental Ta-$Co_{20}Fe_{60}B_{20}$ thin films, the DMI is rather small; nevertheless, the skyrmion bubbles are stable, or at least metastable on observational time scales. We identify two different mechanisms, one in a low-current regime and the other in a high current regime, that destabilize a domain wall injected from a narrow region into an expanding region with inhomogeneous spin-Hall torque. In the first, asymmetric torques on the domain wall lead to a cascade of bubble formation and subsequent fragmentation. In the second, an approximately steady-state texture is injected into the wide region. When the current is turned off, the inhomogeneous spin texture relaxes and regions can coalesce into bubbles that attain a definite chirality because of the DMI. [1] W. Jiang *et al.*, Science **349**, 283 (2015).

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