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Current-induced skyrmion dynamics in constricted geometries JUNICHI IWASAKI, Univ. of Tokyo, MASAHITO MOCHIZUKI, Aoyama Gakuin Univ., NAOTO NAGAOSA, Univ. of Tokyo and RIKEN CEMS — Skyrmion is a vortex-like swirling spin structure with quantized topological number realized in chiral magnets, which can be driven by ultralow current density. For the skyrmion-based spintronic devices, we studied skyrmion motions in confined geometries by micromagnetic simulations. We found that the current-driven motion of skyrmions under the influence of geometrical boundaries is completely different from that in an infinite plane. In a channel of finite width, the confinement transverse to the direction of the current gives the steady-state characteristics of the skyrmion velocity as a function of current that are similar to those of domain walls in ferromagnets, whereas the transient behaviour depends on the initial distance of the skyrmion from the boundary and is distinct to skyrmion. Furthermore, we show that the creation of a single skyrmion can be controlled by an electric current in a simple constricted geometry comprising a plate-shaped specimen of suitable size and geometry.

[1] J. Iwasaki, M. Mochizuki and N. Nagaosa, Nature Nanotech. 8, 742 (2013).

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