

Spin Mechanics 4



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Zero-field current switching of a single ferromagnetic layer

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Spin Hall effect (SHE) switching allows current switching of a single ferromagnetic (FM) layer in contact with a heavy metal (HM), where the pure spin current from the HM switches the adjacent FM layer via the spin orbit torque (SOT). However, this highly attractive scheme cannot occur unless a magnetic field is also applied along the current direction, or with some built-in asymmetry in the structure, thus greatly diminishing its utility. In this work, we describe the essential role of the magnetic field, which not only breaks geometrical symmetry and but also causes asymmetrical domain wall motion that accomplishes switching. More importantly, we demonstrate a new method of exploiting competing SOT by exploiting HMs with opposite spin Hall angles, different Dzyaloshinskii-Moriya interaction constants, and competing pure spin current. We describe the intricate physics that accomplishes current switching of a single ferromagnetic layer in zero magnetic field.

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