DOMAIN WALL DYNAMICS IN FERROMAGNETIC NANOSTRUCTURES

Topological defects of domain walls (DWs) in ferromagnetic materials are of paramount importance as regard to both fundamental physics as well as potential applications in non-volatile memory and spin logic devices. This thesis investigates topological manipulation and dynamics in both in-plane and out-of-plane magnetized nanostructures. For in-plane nanostructures, a technique to control, detect and rectify the topological nature of a transverse DW was proposed and experimentally verified. The topological defects play a crucial role in DWs interaction, leading to mutual annihilation or formation of bound states. This causes stochasticity in the DW generation. A method whereby single DW can be generated deterministically was demonstrated and experimentally verified. Lastly, dynamics of chiral Néel DWs driven by spin orbit torques (SOTs) in perpendicularly magnetized heterostructures were studied. A cross over from the field dominated DW depinning to current dominated DW depinning was established as the magnitude of the current was increased. The SOT in concert with Dzyaloshinskii-Moriya interaction (DMI) was correlated to this anomaly.