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Nucleation of 360 deg DWs in a wire using a local circular field¹

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Mount Holyoke College — Understanding domain wall (DW) motion in ferromagnetic nanostructures is important to realize proposed magnetic data storage and logic devices. Interest in 360° DWs has increased recently with the recognition that their minimal stray field creates only short range interactions, leading to a potentially higher packing density compared to 180° DWs. Our simulations demonstrate the feasibility of nucleating a 360° DW at a specific location along a wire by applying a local circular field that is centered in close proximity to the wire. We simulate the field strength as if from a current carrying wire, which can be experimentally realized by passing current through the tip of an AFM [1,2]. The successful nucleation of a 360° DW depends on the dimensions of the Py wire, on the strength of the circular field, and on the distance of the center of the field from the wire. Once a 360° DW is nucleated, its position shifts with time. We use a notch to stabilize the location of the 360° DW. We investigate the optimal size and spacing of the notches to allow the greatest packing density with control over the nucleation and annihilation of individual domain walls. [1] T Yang et al., Appl. Phys. Lett., 98, 242505 (2011). [2] <http://math.nist.gov/oommf>

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