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Beyond a compact magnetic domain wall PHILIPP EIB, CARL ZINONI, ANTOINE VANHAVERBEKE, GIAN SALIS, RETO SCHLITTLER, ANDREAS BISCHOF, ROLF ALLENSPACH, IBM Research - Zurich, Saeumerstr. 4, CH-8803 Rueschlikon, Switzerland
— The generally accepted concept that limits magnetic domain wall velocity is the Walker breakdown. This is the magnetic field at which wall motion becomes oscillatory capping the performance of domain wall-based spintronic devices. To understand the limiting mechanisms, we study vortex walls in $Ni_{80}Fe_{20}$ wires with widths between 300 and 900 nm. We detect the walls by time-resolved magneto-optical Kerr effect in a pump-probe technique setup. The wires are fabricated by electron-beam lithography and by a nanostencil tool [1]. We find the dynamics of vortex walls to depart significantly from the current description of a compact entity evolving along the wire. Instead, the wall is composed of several substructures propagating in different dynamic regimes with very different velocities. Wire edges crucially affect this dynamics and can be influenced by variation of growth parameters. Extensive, parallelized micromagnetic simulations reveal the unusual wall structure and complement the experimental findings [2]. Possibilities how to overcome the limits imposed by the Walker breakdown will be discussed.
[1] L. Gross *et al., Nanotechnology* **21**, 325301 (2010)
[2] C. Zinoni *et al., Phys. Rev. Lett.* **107**, 207204 (2011)

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