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Spin-Wave Generation by DW Collision SEONGHOON WOO, TRISTAN DELANEY, GEOFFREY BEACH, Massachusetts Institute of Technology (MIT) — Spin waves (SWs) in nanoscale metallic ferromagnets have generated much recent interest. Micromagnetic simulations have shown that SWs can couple to and propel DWs by exciting internal resonances, and this effect could be used as a means of low-power DW manipulation. However, generating and detecting large-amplitude exchange-mode SWs is challenging due to their very short wavelengths, which cannot be directly excited by. Here we show, through micromagnetic (OOMMF) simulations, that DWs can be used both to efficiently generate and detect exchange-mode SWs. We first examine SW emission resulting from field-driven DW collisions in Permalloy nanowires. DW annhilation generates intense SW bursts that almost uniformly populate the available SW spectrum across a broad frequency range. The SW power spectrum was characterized as a function of nanowire width, DW topology, and driving field used to induce DW collision. SW bursts were detected through their influence on a third DW pinned at a notch a fixed distance from the DW collision point. SWs induced DW depinning in the presence of background field significantly below the DW depinning field in the absence of SW excitations. The reduction in depinning field dropped with distance between the collision point and the pinned DW, consistent with the decay length due to Gilbert damping. These results show DWs can act as efficient sources of large-amplitude SWs, which can be detected by their influence on a nearby DW. The design of experiments to test these predictions will be discussed.

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