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Experimental observation of exchange-mode spin-wave via domain wall annihilation SEONGHOON WOO, TRISTAN DELANEY, GEOFFREY BEACH[1], Massachusetts Institute of Technology — Spin waves (SWs) in magnetic nanostructures have generated great interest recently, motivated by the possibility of high-speed, low-power magnonic devices applications. A number of micromagnetic researches, therefore, have been conducted, revealing the particular behaviors of SWs in nanostructured ferromagnets. However, SWs' short attenuation length prevents them from being observed and used experimentally. Generating large-amplitude exchange-mode SWs, which is thus indispensable for real device applications, are still challenging because their very short wavelengths cannot be directly excited. Here, we present the first experimental evidence of the exchange-mode SWs. Using micromagnetics, we firstly show that the annihilation of two DWs releases their exchange energy by a mean of localized SW burst, which has broad range band and intense amplitude. Another micromagnetic result also shows that the collision-induced SWs inside a nanowire can cause the depinning of a DW with an assisting magnetic field. By taking advantage of an anisotropic magneto-resistance (AMR) effect and relative electrical measurements, we observe the generation/annihilation of DWs and the contribution of generated SWs to the DW depinning process experimentally. The additional depinning field of ~ 8 Oe caused by SWs can be readily achieved, enough to propagate a standstill DW in a well-defined pinning-free nanostructure. This work shows the first experimental observation of exchange-mode SWs and highlights a new route towards SW-integrated spintronic devices.

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