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Controlling the dynamical modes of the chiral magnetic structures by spin Hall effect[1] RONGHUA LIU, WENG-LEE LIM, SERGEI URAZHDIN, Department of Physics, Emory University, Atlanta, GA 30322 — Recently, pure spin currents generated due to spin Hall effect have been proved as an efficient approach to reverse the magnetization, modify the dynamical relaxation rates, and excite magnetization oscillations in the heavy metal/ferromagnetic heterostructures. In addition, the Dzyaloshinskii-Moriya interaction (DMI) can also induce chiral magnetization configurations and rich dynamics in these asymmetrical heterostructures. We controllably excited several distinct dynamical modes in spin Hall oscillator based on Pt/ [CoNi] magnetic multilayer with perpendicular anisotropy. At low current, a quasi-linear Slonczewski-like propagating spin wave mode was excited. This mode transforms to a localized soliton mode above a certain threshold current. At large fields, this mode can be identified as the spin wave 'bullet' mode. At small fields, the localized mode is transformed to the topological structure of the 'droplet' mode, which comes from the oscillations of the chiral domain walls forming the boundary of the bubble domain due to DMI. Our measurements demonstrate a straightforward route for emission of spin waves by nano-oscillators controlled either by current or by the applied magnetic field.

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