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A reconfigurable waveguide for energy-efficient transmission and local manipulation of information in a nanomagnetic device[1]

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In the last few years, interest in propagating-spin-wave based devices has grown largely due to advances in nanotechnology which allows shapes of geometrically confined magnonic elements to be fabricated, the development of new advanced experimental techniques for studying high-frequency magnetization dynamics and the potential use of spin waves as information carriers in spintronic applications. The first part of this talk will focus on design and fabrication strategies for synthesizing nanomagnetic networks with deterministic magnetic ground states [1]. Reliable reconfiguration between ferromagnetic (FM), antiferromagnetic (AFM) and ferrimagnetic ground magnetic states will be shown in rhomboid nanomagnets which stabilize to unique ground states upon field initialized along their short axis [2]. In the second part, a new waveguide consisting of dipolar coupled rhombic shaped nanomagnetic chain that eliminate the requirement of a stand-by power during operation will be presented [3]. The sizes of the nanomagnets are small enough to retain their correct magnetic states once initialized. It will be shown that our waveguide could be used to send spin wave signal around a corner without any stand-by power. Another important parameter for device operation is the manipulation of the output signal, which is similar to a gating operation in a transistor. In our design, gating operation is demonstrated by switching the magnetization of single/multiple nanomagnets in the waveguides in order to manipulate the spin wave amplitude at the output. [1] A. Haldar and A. O. Adeyeye, ACS Nano 10, 1690-1698 (2016). [2] A. Haldar and A. O. Adeyeye, Appl. Phys. Lett. 108, 022405 (2016). [3] A. Haldar, D. Kumar and A. O. Adeyeye, Nature Nanotech 11,437-443 (2016).

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