ABSTRACT

Spin-wave transmission through a hybrid magnonic crystal based on vortices in disks

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Reconfigurable magnonic devices play a crucial role in spin-wave computing [1]. In this study, we demonstrate the control over spin-wave transport through the magnetic state of CoFeB nanodisk arrays on a YIG film. The system comprises a YIG film (thickness: 63 nm or 70 nm), a CoFeB nanodisk array (thickness: 30–50 nm, diameter: 120–240 nm, period: 390–630 nm), and a 4 nm Ta spacer. Using broadband spin-wave spectroscopy, super-Nyquist sampling magneto-optical Kerr effect microscopy (SNS-MOKE), and micromagnetic simulations, we investigate how spin-wave propagation in YIG is influenced by the transition of CoFeB nanodisks between vortex and single-domain states. We identify distinct transmission gaps in both states, attributed not to conventional Bragg scattering but to mode quantization perpendicular to the propagation direction. Variations in spin-wave transport between the two magnetization states result from changes in the effective magnetic field within YIG. Moreover, the frequency, width, and depth of these transmission gaps can be tuned by modifying the nanodisk array period and disk diameter. This hybrid structure offers a flexible platform for engineered, reconfigurable spin-wave control, contributing to the advancement of magnonic circuits.

[1] A. V. Chumak et al., *IEEE Transactions on Magnetics* **58**, 1-72 (2022).

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