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Resonant-spin-ordering of vortex cores in interacting mesomagnets[1]

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The magnetic system of interacting vortex-state elements have a dynamically reconfigurable ground state characterized by different relative polarities and chiralities of the individual disks; and have a corresponding dynamically controlled spectrum of collective excitation modes that determine the microwave absorption of the crystal. The development of effective methods for dynamic control of the ground state in this vortex-type magnonic crystal is of interest both from fundamental and technological viewpoints. Control of vortex chirality has been demonstrated previously using various techniques; however, control and manipulation of vortex polarities remain challenging. In this work, we present a robust and efficient way of selecting the ground state configuration of interacting magnetic elements using resonant-spin-ordering approach. This is achieved by driving the system from the linear regime of constant vortex gyrations to the non-linear regime of vortex-core reversals at a fixed excitation frequency of one of the coupled modes. Subsequently reducing the excitation field to the linear regime stabilizes the system to a polarity combination whose resonant frequency is decoupled from the initialization frequency. We have utilized the resonant approach to transition between the two polarity combinations (parallel or antiparallel) in a model system of connected dot-pairs which may form the building blocks of vortex-based magnonic crystals. Taking a step further, we have extended the technique by studying many-particle system for its potential as spin-torque oscillators or logic devices.

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