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Resonant dynamics of Dirac monopoles and strings in an artificial spin-ice lattice OLLE HEINONEN, Argonne National Laboratory, SEBASTIAN GLIGA, Max Planck Institute - Halle, ATTILA KAKAY, Peter Gruenberg Institute - Forschungszentrum Juelich, RICCARDO HERTEL, IPCMS, CNRS and UdS, France — Spin ices can occur in atomic structures, in which the magnetic interaction with neighboring vertices cannot be simultaneously minimized at each atomic vertex, leading to frustration. Artificial spin-ice lattices are arrays of patterned elements geometrically arranged to mimic the frustration in such atomic lattices, and have the advantage that their properties are directly observable using microscopy techniques. Artificial spin-ices can support topological defects, such as Dirac monopoles and Dirac strings connecting the monopoles. We present micromagnetic simulations of the resonant dynamics of a square spin-ice lattice. The simulations predict that topological defects give rise to specific signatures in the excitation spectrum of the lattice and that, moreover, the amplitude of a defect-specific resonant peak increases linearly with the number of defects or length of the Dirac line. A measured spectrum therefore allows to both identify the defects in an array as well as to determine their number. In addition, we observe that the main bulk-like FMR spectral peak is split in the presence of defects in the lattice, compared to a defect-free reference state. This splitting is caused by Dirac strings, in which the FMR frequency is increased due to the different magnetostatic coupling of the elements within a string as compared to the rest of the lattice.

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