

Discrete breathers in nonlinear magnetic metamaterials

N. Lazarides^{1*}, M. Eleftheriou², G. P. Tsironis³

¹ Department of Physics, University of Crete, and IESL FORTH, P. O. Box 2208, 71003 Heraklion, Greece, and Department of Electrical Engineering, T.E.I. of Crete, P. O. Box 140, Stavromenos, 71500, Heraklion, Greece

² Department of Physics, University of Crete, and IESL FORTH, P. O. Box 2208, 71003 Heraklion, Greece, and Department of Music Technology and Acoustics, T.E.I. of Crete, E. Daskalaki, Perivolia, 74100 Rethymno, Greece

³ Department of Physics, University of Crete, and IESL FORTH, P. O. Box 2208, 71003 Heraklion, Greece

* Electronic Address: nl@physics.uoc.gr

Magnetic metamaterials composed of split-ring resonators or U -type elements may exhibit discreteness effects in THz and optical frequencies due to weak coupling. We consider a model one-dimensional metamaterial formed by a discrete array of nonlinear split-ring resonators with each ring interacting with its nearest neighbours. On-site nonlinearity and weak coupling among the individual array elements result in the appearance of discrete breather excitations or intrinsic localized modes, both in the energy-conserved and the dissipative system. We analyze discrete single and multibreather excitations, as well as a special breather configuration forming a magnetization domain wall and investigate their mobility and the magnetic properties their presence induces in the system.

[1] N. Lazarides, and G. P. Tsironis, *Phys. Rev. E* **71**, 036614 (2005).

[2] N. Lazarides, M. Eleftheriou, and G. P. Tsironis, cond-mat/0605674 (2006), accepted in *Phys. Rev. Lett.*