

**MA 1: Micro- and Nanostructured Magnetic Materials I/ Spin Structures - Invited Talk**

Time: Monday 10:15–10:45

Location: HSZ 04

**Invited Talk**

MA 1.1 Mon 10:15 HSZ 04

**Emergent magnetic monopoles and associated Dirac strings in artificial kagome spin ice** — •LAURA HEYDERMAN — Paul Scherrer Institute, 5232 Villigen PSI, Switzerland

Artificial spin ice systems, consisting of two-dimensional arrangements of single-domain nanomagnets, have recently been in the focus of scientific interest since they provide an opportunity to directly study the effects of frustration [1, 2]. Our work has focused on artificial kagome spin ice, with elongated nanomagnets arranged on the kagome lattice forming an array of hexagonal rings. Synchrotron x-ray photoemission microscopy allows direct imaging of the magnetic state of each nanomagnet, having moments pointing in one of two orientations parallel to their long axis. Our recent observations demonstrate the

existence of emergent magnetic monopoles and their associated Dirac strings at room temperature in a quasi-infinite nanomagnet array [3]. In an applied magnetic field, monopole-antimonopole pairs nucleate and then separate in an avalanche-type manner along one-dimensional Dirac strings, consisting of overturned dipoles. This behaviour is distinct from conventional domain growth in two-dimensional systems and results in the formation of a stripe phase towards the end of magnetization reversal. The observed hysteresis, monopole densities and 1D Dirac-string avalanches are quantitatively explained by Monte Carlo simulations and the results open the way to a controlled manipulation of magnetic charges that may lead to new spintronic devices. [1] R.F. Wang et al., *Nature* 439, 303 (2006) [2] E. Mengotti et al., *Phys. Rev. B* 78, 144402 (2008) [3] E. Mengotti et al., *Nature Physics* (2010)