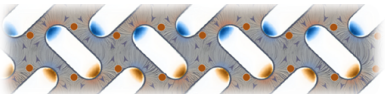
Workshop on 

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Field driven Domain and Domain Wall Formation in the 'Pinwheel' Artificial Spin Ice

Artificial Spin Ices are arrays of strongly correlated nano-scale magnetic islands. While initially envisaged as a twodimensional analogue of bulk frustrated pyrochlores [1], they are now seen as a possible avenue for designing functional materials. Recently, a new tiling pattern of artificial spin ice has gained attention for its unusual ordering processes [2]. This patterning, called the pinwheel, is a variation on the classic square ice, and is formed by rotating each island through 45 degrees about its centre. Unlike square ASI which possesses an antiferromagnetic ground state, pinwheel spin ice appears to behave as a ferromagnet [3,4]. The base unit for this macro-ferromagnetism is the net moment of each pinwheel vertex. Structures reminiscent of domains and domain walls in continuous media are seen [5]. This apparent ferromagnetism is confirmed by our field-driven results from Lorentz transmission electron microscopy (LTEM). We observe several domain-wall configurations, most of which are direct analogues to those seen in continuous ferromagnetic films. However, novel charged walls also appear due to the geometric constraints of the system. Moreover, we find that by changing the orientation of the externally applied magnetic field it is possible to control the nature of the spin reversal with the emergence of either 1-D or 2-D avalanches.

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