Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **153** Type: **Poster not-in-competition (Graduate Student) / Affiche non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

POS-G59 – Investigation of the dynamics of twisted bilayer artificial spin ice structure

Wednesday 9 June 2021 13:49 (2 minutes)

Geometrical frustration arises in systems whose structures support multiple degenerate ground states. Artificial spin ice (ASI), has been built in diverse configurations which allows us to control frustration by experimentally tuning suitable parameters[1]. We present computational results on ASI systems consisting of planar arrays of nanosized elongated ferromagnetic islands where geometrical frustration takes place at the vertices due to dipolar interactions between elements. To date, most studies have employed two-dimensional geometries in order to study magnetic charge dynamics, phase transitions, vertex-based frustration, and other interesting effects[2]. Recently, there has been a surge of interest in realizing three-dimensional artificial spin ice[3]. The use of a third dimension allows increased configurability and optimization of the magnetostatic interaction between different elements of the system. The work mentioned here concerns non-equilibrium dynamics of a bilayer artificial spin ice structure consisting of two identical arrays separated by some distance and rotated at an angle between the two array axes. Introducing an angle between the layers enables the observation of novel, emergent phenomena as it changes the nature of the interactions between the spins. We consider pinwheel variants of a square ice geometry for each array[4]. Using different Monte Carlo techniques, we examine ground state ordering as a function of the interaction strength between layers for different relative orientations. Avalanche processes are also investigated and contrasted with those found in single-layer arrays.

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Session Classification: W-POS-G #57-74 Poster session (Mag.North) / Session d'affiches (Nord mag.)

Track Classification: Magnetic North/Magnétisme Nord