SUPPLEMENTARY MATERIAL

for

Commensurate States and Pattern Switching via Liquid Crystal Skyrmions Trapped in a Square Lattice

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(Dated: January 31, 2020)

Simulation parameters:

The thermal coefficients of the free energy are a = -40, b = -60, c = 100 and yield scalar order parameter $S \approx 0.6$. $p = \frac{2\pi}{q_0} = 2$ and L = 0.01 corresponding to a reduced chirality $\kappa = \sqrt{108cLq_0^2/b^2} = 0.54$. Damping coefficient $\Gamma = 1$, and update time step $\Delta t = 0.001$.

The lattice spacing was set to u = 0.05-the natural pitch corresponds 40 lattice units. The interaction distance of skyrmions are of the order of p thus barriers as L = 60 were chosen. The external field controls the size of the skyrmions. Field strengths were varied until the skyrmions fill the space between barriers (which were deliberately chosen to be of the order of p).

Other content:

(A) Final snapshots from simulations of system size 8×8 pillars with various packing ratios.

- Fig. 1 : Packing ratio 1:1
- Fig. 2 : Packing ratio 2:1
- Fig. 3 : Packing ratio 3:1
- Fig. 4 : Packing ratio 4:1
- (B) Video S1-Sq-Hex.avi: switching between Square and Hexagonal lattices.
- (C) Video S2-Sq-Ice.avi: switching between Square Lattice and dimer configuration.
- (D) Video S3-PointField.avi: strength of radially decaying field is varied: switching between Square Lattice and dimer configuration. Radial dependence of the field alignment strength is $\alpha = 5 \exp(-5(r/r_0)^2)$



FIG. 1: Packing ratio = 1:1



FIG. 2: Packing ratio = 2:1



FIG. 3: Packing ratio = 3:1



FIG. 4: Packing ratio = 4:1