

Title: Supplementary Movie 1

Description: Spin dynamics showing the cooling down process at zero magnetic field from 80 K down to 0 K for monolayer CrCl₃.

Title: Supplementary Movie 2

Description: Similar as the Movie S1, but at a 50 mT magnetic field.

Title: Supplementary Movie 3

Description: Similar as the Movie S1, but at a 500 mT magnetic field.

Title: Supplementary Movie 4

Description: Spin dynamics at zero field and 0 K showing the collision process between a vortex and an antivortex since the early times when both are relatively isolated till they collapsed. Two antimerons are involved in this process.

Title: Supplementary Movie 5

Description: Similar as Movie S4, but involving a meron and an antimeron.

Title: Supplementary Movie 6

Description: Macro-dynamics of the magnetic domains showing the movement of the vortex and antivortex at the boundary between domain structures. The colors of the vortex and antivortex (blue and red) are kept the same as the one for the S_y component of the magnetization to simplify the analysis. However, the core of the spin textures are primarily composed by out-of-plane spins as highlighted in Figure 2.

Title: Supplementary Movie 7

Description: Spin dynamics showing the cooling down process at zero magnetic field from 80 K down to 0 K for monolayer CrI₃.

Title: Supplementary Movie 8

Description: Spin dynamics showing the cooling down process at zero magnetic field from 60 K down to 0 K for monolayer CrBr₃.

Title: Supplementary Movie 9

Description: Spin dynamics showing the cooling down process at zero magnetic field from 80 K down to 0 K for monolayer CrF₃.