Direct observation of magnetic surface states in a chiral magnet — •Nikolai S. Kiselev[1], Andras Kovács[2], Filipp N. Rybakov[3], Zi-An Li[2,4], Stefan Blügel[1], and Rafal E. Dunin-Borkowski[2] — [1]Peter Grünberg Institute and Institute for Advanced Simulation, Forschungszentrum Jülich and JARA, 52425 Jülich, Germany — [2]Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons and Peter Grünberg Institute, Forschungszentrum Jülich, 52425 Jülich, Germany — [3]M.N. Miheev Institute of Metal Physics of Ural Branch of Russian Academy of Sciences, Ekaterinburg 620990, Russia — [4]Institute of Physics, Chinese Academy of Sciences, 100190 Beijing, China

We report on the first direct observation of magnetic surface states, which had previously been predicted theoretically, in a chiral magnet [1]. We study the in-field behavior of a thin film of FeGe using Lorentz transmission electron microscopy and off-axis electron holography and infer the projected in-plane component of magnetization in the film from our experimental results using a model-based reconstruction technique. We observe the formation and evolution of surface spin spirals that exhibit hysteretic behavior. In good agreement with theoretical predictions, the observed surface spin spirals show much lower contrast and a much larger modulation period than ordinary helical spin spirals, which appear in lower fields. A comparison of our experimental data with micromagnetic simulations reveals that dipole-dipole interactions play a significant role in the quantitative description of such systems.

[1] F. N. Rybakov et al., New J. Phys. 18, 045002 (2016).