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Study of the effects of the electric field on the skyrmion lattice with SANS

Skyrmions constitute a new magnetic topology that occurs only under specific conditions of temperature, applied magnetic fields, and only in certain chiral magnets lacking inversion symmetry. Thanks to their topological stability and the low current density required for the manipulation of their position, skyrmions constitute a valid alternative to domain walls as information carriers in spintronic devices [1].
In order to develop skyrmoinic devices, it is important to understand the characteristics and behaviour of the skyrmion lattice in relation both to external stimuli such as electric fields, and to the underlying crystal structure. In this context, we have studied the response of the skyrmion lattice to the electric field in a single crystal of Zn substituted Cu2OSeO3 with small angle neutron scattering.
On one hand the Zn substitution is observed to shift the position of the skyrmion pocket towards lower temperatures [2], while the application of an electric field changes the size of the pocket according to its polarity, in agreement with the know behaviour of pristine material [3].
Moreover, thanks to the effect of the Zn substitution, we have been able to measure the formation time of the skyrmion lattice, which is longer than its decaying time, suggesting two different mechanism involved in the two different processes. The formation time increases with decreasing temperature, allowing us to extract the energy barrier for the formation of the skyrmion lattice.
This small angle neutron scattering work constitute a step forward towards the understanding of both chemical substitution, as a way of engineering materials with suitable characteristics for the development of skyrmionc devices, and of the response of the skyrmion lattice nucleating under the application of an electric field.
[1] A.Fert, V.Cros, and J.Sampaio. Nat. Nano, 8, 152 (2013), [2] A. Štefančič et al. Phys. Rev. Mat. 2, 111402(R) (2018) [3] J.S. White et al. Phys. Rev. Applied 10, 014021 (2018)

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