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Topological barrier for skyrmion lattice formation in MnSi

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We report the observation of a topological skyrmion energy barrier through a hysteresis of the skyrmion lattice in the prototypical helimagnet MnSi. Measurements of the energy barrier were made using small-angle neutron scattering and a bespoke DC field coil to allow for high-precision hysteresis loops. Data has been analyzed using an adapted Preisach model to quantify the energy barrier for skyrmion formation and the magnetic behavior of the sample as a whole. This analysis was then compared with minimum-energy path analysis based on atomistic spin simulations to verify the topological nature of the barrier. This reveals that the skyrmion lattice in MnSi forms with an activation barrier of several eV and in domains that are several hundred skyrmions in size.

Speakers Gender

Male

Level of Expertise

Student

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No

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