

MAR15-2014-000441

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Tailoring the topology of an artificial magnetic skyrmion

JIA LI, University of California, Berkeley

A skyrmion is a topological twist of a continuous field that was first proposed by Skyrme to describe discrete nucleons. In condensed-matter physics, skyrmions emerge as topological invariant spin textures in a two dimensional Heisenberg spin lattice. Evidence of skyrmions in condensed matter physics appeared after the discovery of the Quantum Hall Effect in which the lowest energy charged excitations can be mapped onto two-dimensional magnetic skyrmion states. Despite theoretical predictions, it remains an experimental challenge to realize an artificial magnetic skyrmion whose topology can be well controlled and tailored so that its topological effect can be revealed explicitly in a deformation of the spin textures. Here we report epitaxial magnetic thin films in which an artificial skyrmion is created by embedding a magnetic vortex into an out-of-plane aligned spin environment. By changing the relative orientation between the central vortex core polarity and the surrounding out-of-plane spins, we are able to control and tailor the system between two skyrmion topological states. An in-plane magnetic field is used to annihilate the skyrmion core by converting the central vortex state into a single domain state. Our result shows distinct annihilation behaviour of the skyrmion core for the two different skyrmion states, suggesting a topological effect of the magnetic skyrmions in the core annihilation process.