CORE-CM SEMINAR
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Detection and Manipulation of Magnetic Skyrmions in Metal Silicide Nanowires

Skyrmions, novel topologically stable spin vortices, hold promise for next-generation magnetic storage due to their nanoscale domains to enable high information storage density and their low threshold for current-driven motion to enable ultralow energy consumption. One-dimensional (1D) nanowires are ideal hosts for skyrmions since they not only serve as a natural platform for magnetic racetrack memory devices but also can potentially stabilize skyrmions. We have developed methods to synthesize free standing nanowires of many silicides, including the B20 monosilicides (MnSi, FeSi, CoSi) and their alloys ($Fe_xCo_{1-x}Si$), many of which display exotic helimagnetic and skyrmion magnetic orderings. Using Lorentz TEM and magnetotransport measurements, we have found that magnetic Skyrmions are stable over a larger magnetic field-temperature range in MnSi nanowires compared to bulk crystal and thin films. We have developed a method based on Andreev reflection spectroscopy to electrically determine the spin polarization ratios and a general method to measure Hall effect in nanowires. Using the topological Hall effect (THE) of MnSi nanowires, we further confirmed the extended phase stability and demonstrated the current-driven motion of skyrmions in this extended skyrmion phase region. These results open up the exploration of nanowires as an attractive platform for investigating skyrmion physics in 1D systems and exploiting skyrmions in magnetic storage concepts.

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