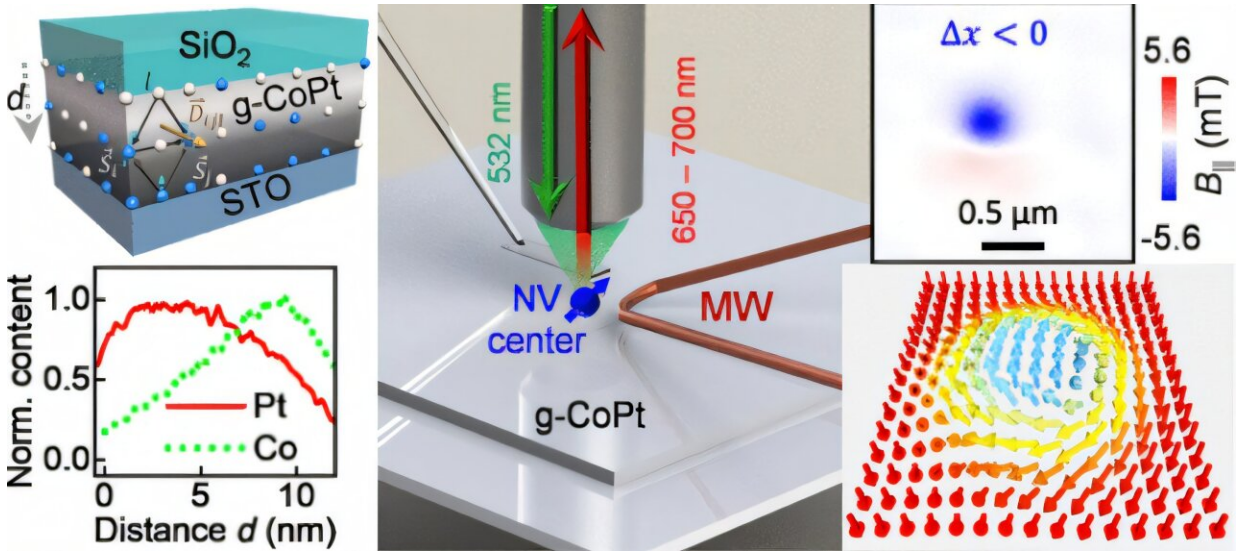
Researchers image magnetic skyrmions at room temperature for the first time

January 8 2025, by Karl Vogel



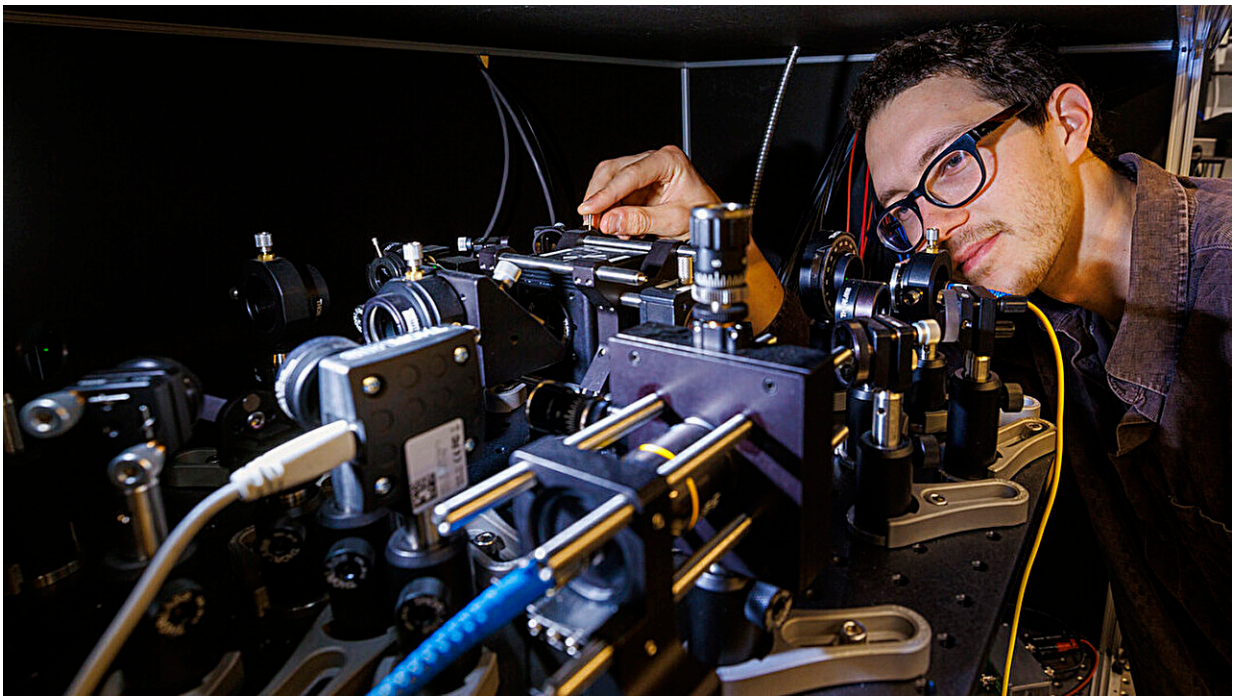
Credit: *ACS Nano* (2024). DOI: 10.1021/acsnano.4c10145

An international research team, working with cutting-edge technology at the University of Nebraska–Lincoln, has made a discovery that may dramatically expand the materials used in next-generation, energy-efficient memory and logic devices.

The team, which includes Nebraska's Abdelghani Laraoui, assistant professor of mechanical and materials engineering, successfully demonstrated for the first time the imaging of magnetic skyrmions at

room temperature in composition engineered magnetic materials. The team observed the tiny, vortex-like particles in these magnetic materials using a nitrogen-vacancy scanning probe in Laraoui's lab. The findings are published in *ACS Nano*.

"This discovery is a huge step forward because, until now, scientists could only observe these skyrmions in bulk chiral magnetic materials at very low temperatures," Laraoui said. "Being able to study them at room temperature opens up a whole new world of applications and possibilities."



Adam Erickson, a doctoral student in materials engineering, adjusts the nitrogen-vacancy scanning probe in Abdelghani Laraoui's lab. Credit: Craig Chandler | University Communication and Marketing

Traditional hard disk drives use the direction of the magnetization of magnetic materials to store binary data. The magnetization can be controlled with magnetic field, light or electrical current, enabling high-density data storage. However, when the magnetic bits get smaller, they are more susceptible to thermal noise and defects in the material that can compromise data integrity.

Manipulating skyrmions with an electrical current can make next-generation computing and memory devices work more efficiently. Demonstrating this at room temperature and with less-expensive materials will change the future for next-generation computing, memory and logic devices, Laraoui said.

More information: Adam Erickson et al, Room Temperature Magnetic Skyrmions in Gradient-Composition Engineered CoPt Single Layers, *ACS Nano* (2024). DOI: 10.1021/acsnano.4c10145

Provided by University of Nebraska-Lincoln