Realization Of Artificial Magnetic Skyrmions At Room Temperature

Tech ID: 25316 / UC Case 2015-874-0

ABSTRACT

Researchers at University of California – Davis have developed a novel method to achieve artificial magnetic skyrmions at room temperature. The invention is suitable for exploration of magnetic skyrmions towards highly energy efficient magnetic information storage, such as high density magnetic recording, magnetic sensors, non-volatile magnetic memory and logic devices

FULL DESCRIPTION

The recently discovered magnetic skyrmions have sparked intense interest in condensed matter physics and materials science. The unique spin texture in magnetic skyrmions leads to a host of fascinating phenomena due to the topologically protected quantum state and emergent electromagnetic field, offering great potential for novel concepts in low dissipation magnetic information storage, or skyrmionics. To date, vast majority of the magnetic skyrmion phases have been limited to low temperatures and finite magnetic fields. However, for systematic studies of the unique properties and the technological exploitation of magnetic skyrmions it is critical to achieve them in the ground state at ambient conditions.

Researchers at the University of California have overcome these challenges and invented novel methods to achieve artificial skyrmion lattices with a stable ground state at room temperature. The approach involves proper choices of materials, structures, and surface modification via ion irradiation, as well as a suitable magnetic field sequence to achieve stable artificial magnetic skyrmion lattices at room temperature and in the absence of any magnetic field. These skyrmions offer a convenient and powerful platform to explore their physical properties. The invention also includes device concepts to utilize such artificial skyrmions towards low dissipation information storage and magnetic sensing

FEATURES/BENEFITS

This invention has several key features which make it an excellent candidate for research and industrial uses:

- The quantum states associated with magnetic skyrmions are topologically protected, offering new mechanisms for information storage and sensing
- Manipulation of such magnetic skyrmions is expected to require extremely low energy, orders of magnitude smaller than counterparts in current technology
- The artificial magnetic skyrmions are realized at room temperature
- The skyrmion state is stable in the absence of any magnetic field
- The invention uses commonly available materials
- Nanofabrication and processing of the materials are easily adaptable to other material systems
- The use of a magnetic field sequence to define the skyrmions is easily adaptable to other systems

APPLICATIONS

The invention has a myriad of potential uses, including:

- Extremely energy efficient information storage using artificial magnetic skyrmions
- Low dissipation skyrmion-based non-volatile magnetic memory
- Low dissipation skyrmion-based magnetic logic devices
- Skyrmion-based magnetic sensors

RELATED MATERIALS

- Realization of ground-state artificial skyrmion lattices at room temperature - 10/08/2015

PATENT STATUS

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OTHER INFORMATION

KEYWORDS

magnetic memory, information storage, magnetic sensor, computer logic, skyrmion

CATEGORIZED AS

- **Communications**
  - Other
- **Computer**
  - Other
- **Nanotechnology**
  - Electronics
- **Semiconductors**
  - Other
- **Sensors & Instrumentation**
  - Other
- **Engineering**
  - Other

RELATED CASES

2015-874-0

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,312,436	06/04/2019	2015-874

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Synthesis Technique to Achieve High-Anisotropy FeNi

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