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Press Release

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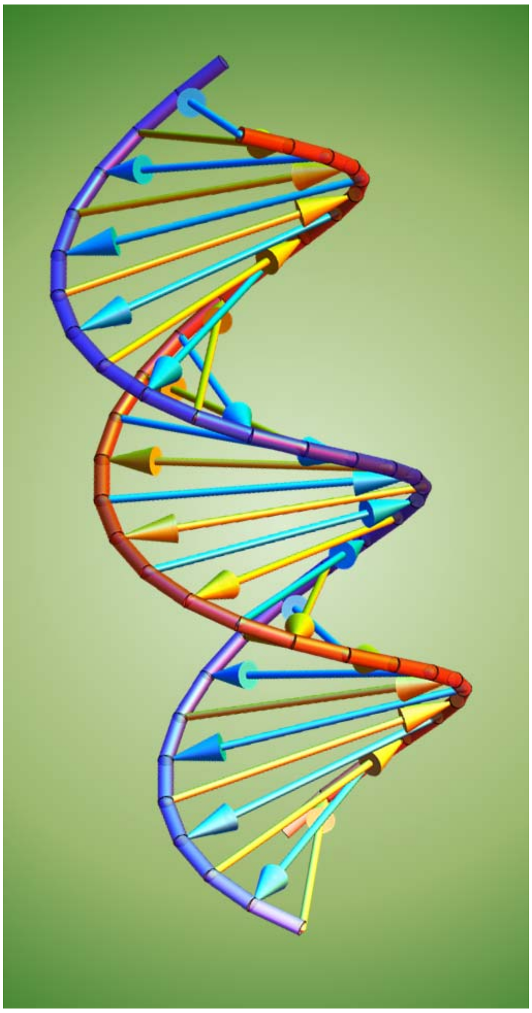
Topologically stable magnetic Helix: theoretical Concept of a novel Technique for Information Transfer and Energy Storage

As reported in PRL 112, 017206 (2014) and arXiv:1312.4342, analyzing analytically the size dependent properties of magnetic chains that are coupled via either exchange or long-range dipolar or Ruderman-Kittel-Kasuya-Yosida interactions, a particularly simple law has been discovered: magnetic configurations corresponding to helices with integer number of twists, that are commensurate with the chain's length, are stabilized topologically. On that basis, an energy-storing element that uses spin at every stage of its operation has been proposed.



The novel generation of computers is supposed to be based on logical elements made of chains of magnetic atoms or nanomagnets. Any logical element requires energy supply, but uses the energy not all the time. A key issue for technology's competitiveness is to figure out how to store energy when it isn't used. Here, we discover that it can be stored in magnetic helices with integer number of revolutions. Based on simulations and a benchmarked prototype, this finding permitted E. Y. Vedmedenko and D. Altwein to propose an energy storing element that uses spins only.

To store energy one has to rotate one of the end-nanomagnets in a chain until the helix will click into place. At the later time the magnet may be released to deliver the energy on demand. The longer is a chain, the larger amount of rotations can be stored. The stable magnetic helices can be also used to transfer the information. To do so, one has to read out when a knot, created at one end of the chain will arrive at the other chain's end. The main advantage of the proposed concept is its scalability from the macro- to the atomic scale and applicability to the great diversity of systems like e.g. magnetic multilayers, magnetic or molecular nanoarrays, colloids, Bose-Einstein condensates, and atomic ensembles.

Original publication:
Topologically Protected Magnetic Helix for All-Spin-Based Applications
E. Y. Vedmedenko and D. Altwein,
Phys. Rev. Lett. **112**, 017206 (2014)
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Related web page:
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