

Frustrated bimeron shows rich and exotic dynamics

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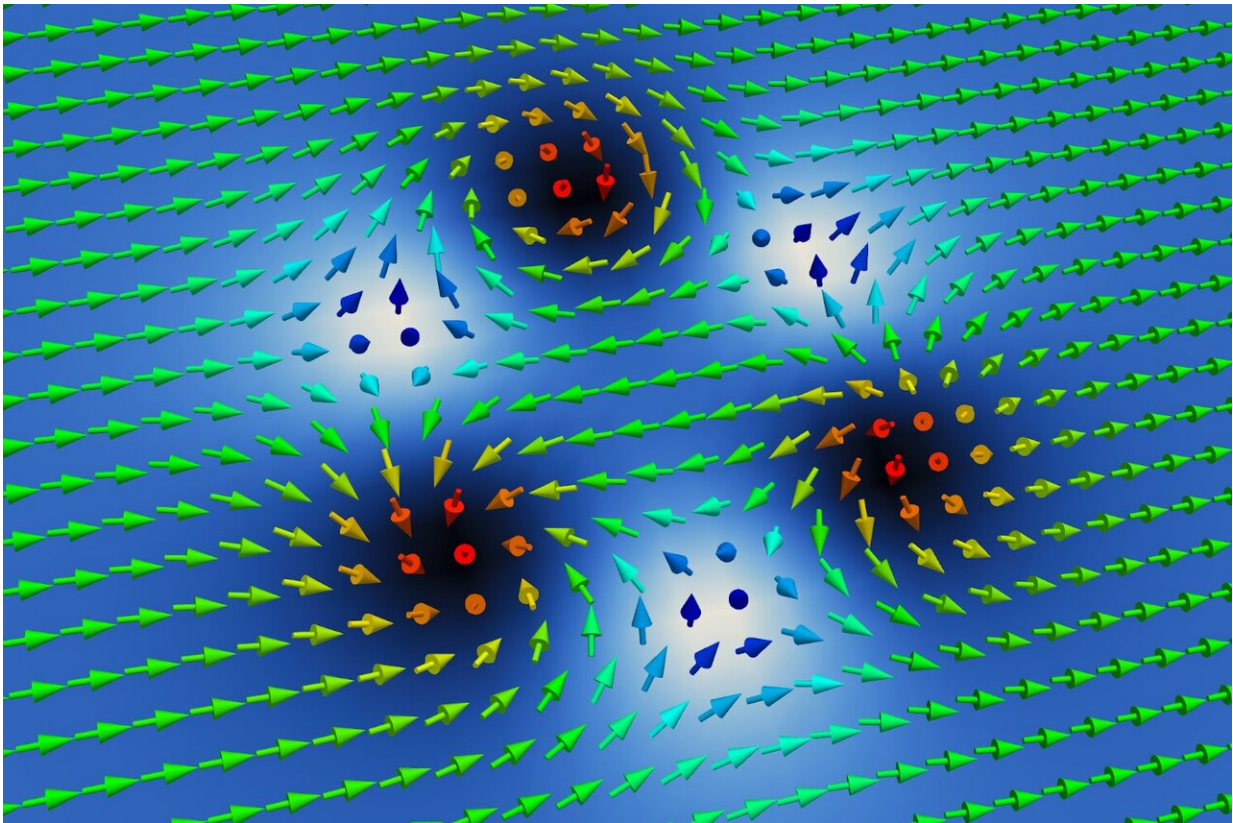


Illustration of a cluster-like bimeron state carrying a topological charge of three.
Credit: Xichao Zhang (2020).

Topological spin textures in magnetic systems with exchange frustration, such as skyrmions and bimerons, may show non-trivial topology and

exotic dynamics.

In a recent work carried out by an international research team from China, Japan, and Australia, the authors theoretically study the static and dynamic properties of topologically non-trivial bimerons in a ferromagnetic monolayer with exchange frustration and in-plane magnetic anisotropy.

They find that the bimeron shows rich dynamics induced by spin-orbit torques, which depend on the setup of driving current as well as the topology of bimeron. They computationally demonstrate that frustrated bimerons can be merged in a way that respects the topology conservation. In analogy with [nuclear physics](#), frustrated bimerons with higher topological charges are more energetically favorable. This investigation suggests that the spin dynamics in frustrated magnets can be more complex and diverse than that in conventional chiral magnets.

The results were published online on 27 April in the journal *Physical Review B*, in a paper by Prof. Yan Zhou's Group from The Chinese University of Hong Kong, Shenzhen (CUHKSZ), and four collaborators from The University of Tokyo, Japan, Shinshu University, Japan, the University of New South Wales, Australia, and Sichuan Normal University, China.

"Previously we studied the dynamics of skyrmions in frustrated spin systems with competing interactions," says Dr. Xichao Zhang, a postdoctoral researcher at CUHKSZ, and the first author of the study. "Now, we are thinking about other topological spin textures. Bimeron is a topological counterpart of skyrmion, and it also carries an integer topological charge. Indeed, in this work we numerically found that frustrated bimerons do have some new features of dynamics. For example, it can be driven into either linear motion or rotation."

"Bimerons can serve as topologically protected bits of information in in-plane magnetized systems. The advantage of frustrated in-plane ferromagnetic films is that they can host stable bimerons of different topological charges, thus allowing for more advanced logic operations in these systems," explains Dr. Oleg A. Tretiakov, senior lecturer at the University of New South Wales, and the co-author of this study.

"Both skyrmions and bimerons can be used as non-volatile information carriers, so it is worth studying the static and dynamic properties of these topological spin textures in different [magnetic systems](#), which will be helpful for the design of future spintronic devices based on them," explains Dr. Yan Zhou, associate professor of CUHKSZ, and the corresponding author of the study.

More information: Xichao Zhang et al. Static and dynamic properties of bimerons in a frustrated ferromagnetic monolayer, *Physical Review B* (2020). [DOI: 10.1103/PhysRevB.101.144435](https://doi.org/10.1103/PhysRevB.101.144435)

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