UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

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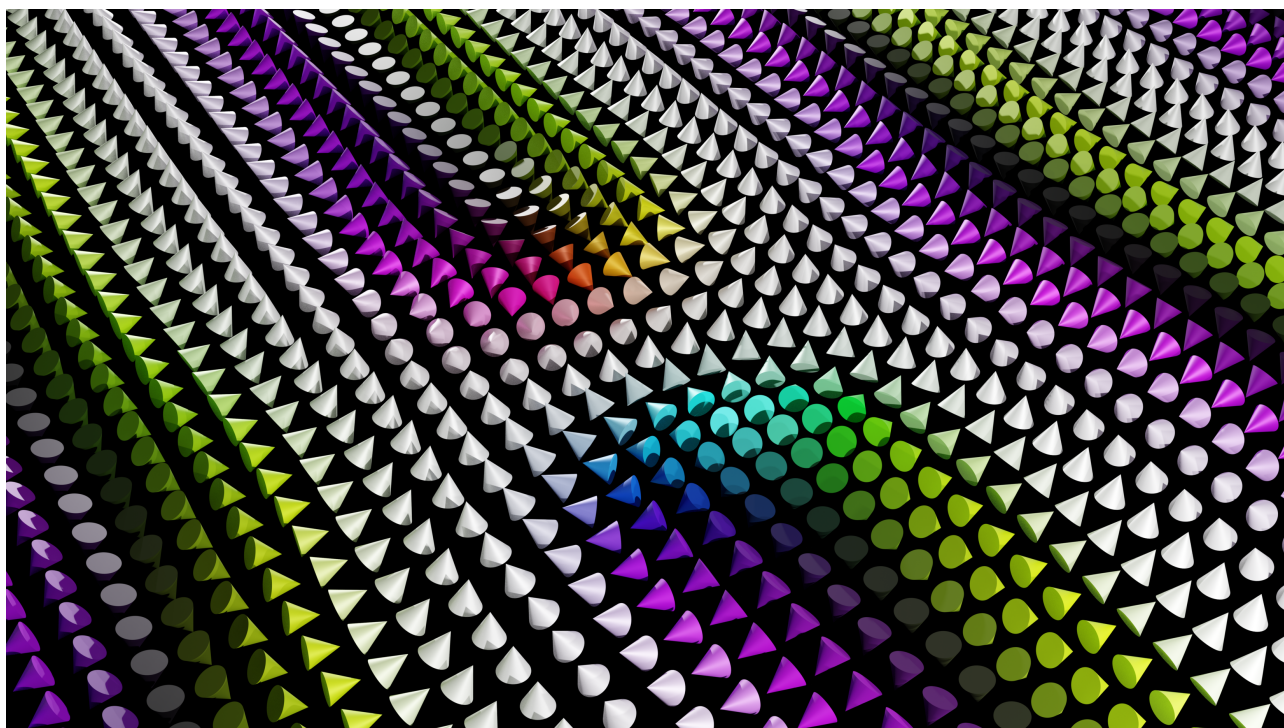
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Construction of Topological Magnetic Structures

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Topological solitons show up across a range of physical systems and scales, from theories of subatomic particles to models of the Sun's plasma. They are localized structures that cannot be created or destroyed through a continuous deformation. In this talk, I will discuss topological solitons in magnetism.

In the first part, I will talk about two-dimensional whirl-like topological magnetic textures: so-called skyrmions. Specifically, I will present the creation of skyrmions confined to quasi-1D "railway tracks", allowing their high-speed motion through the application of currents.[1]

In the second part, I will unveil a novel type of topological excitation: spacetime hopfions, a counterpart to spatial hopfions - three dimensional smoke ring-like structures. I will show two methods to construct spacetime hopfions by manipulating magnetic skyrmions. The first method involves the excitation of the skyrmion's internal modes using an electric field, while the second involves the braiding of skyrmions.[2]

[1] R. Knapman, D. R. Rodrigues, J. Masell, K. Everschor-Sitte, J. Phys. D: App. Phys. 54, 404003 (2021)
[2] R. Knapman, T. Tausendpfund, S. A. Díaz, K. Everschor-Sitte, arXiv:2305.07589