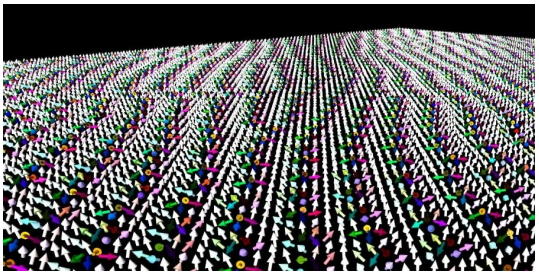

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Theory of magnetic merons revisited: no need for fractional topological charges

Wednesday, 15 October 2025 14:30 (45 minutes)

Magnetic vortices and skyrmions are typically characterized by distinct topological invariants corresponding to elements of homotopy groups of different spaces. At the same time, intermediate forms of these states - merons - exist and are well studied. This term was introduced in the 1970s, and today an elementary magnetic meron is typically understood to be a planar vortex where the core is non-singular due to out-of-plane spins. In this talk, we show how to resolve the puzzling fractional topological charge postulate for merons, which has become standard practice in recent decades. Namely, we present a unified topological classification bringing together vortices, skyrmions, and merons [1]. In this classification, merons, as well as any combinations of them, correspond to elements of the homotopy group isomorphic to the free abelian group $\mathbb{Z}\times\mathbb{Z}$. Additionally, we briefly discuss generalizations to cases where the homotopy group is no longer abelian and has exponential growth [1,2].

[1] F.N. Rybakov, O. Eriksson and N.S. Kiselev, Phys. Rev. B 111, 134417 (2025).
[2] F.N. Rybakov and O. Eriksson, arXiv:2205.15264 (2022).

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