UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

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Topological transport in magnetic systems: from novel SQUIDs to topological batteries

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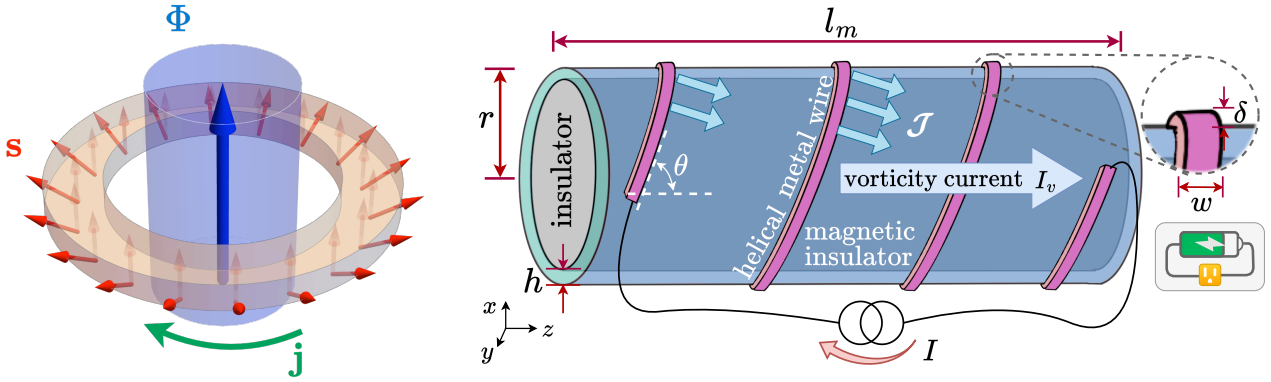

We study the transport of topological objects – such as winding, skyrmions, and vortices – in magnetic systems. To this end, we formulate topological continuity equations. Unlike Noether charges, whose conservation follows from symmetries, these are rooted in the homotopy of the order parameter space. Based on this framework, we explore device concepts including SQUIDs in spin superfluids [1] and spin-triplet superconductors (left figure) [2], as well as a topological vortex battery (right figure) [3].

[1] Y. Zhu, E. Kleinherbers, L. Levitov, and Y. Tserkovnyak, Proposal for spin superfluid quantum interference device, Phys. Rev. B 112, L100405 (2025)

[2] C. Dao, E. Kleinherbers, B. Brekke, and Y. Tserkovnyak, Topological hydrodynamics in spin-triplet superconductors, arXiv:2508.06758

[3] C. Dao, J. Zou, E. Kleinherbers, and Y. Tserkovnyak, Topological transport of vorticity on curved magnetic membranes, Phys. Rev. B 111, L100401 (2025)