STRAIN-DRIVEN TOPOLOGICAL TEXTURES IN FERROIC MATERIALS

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Our objective is to explore new ways of creating and stabilizing topological textures — such as domain walls, vortices, merons, skyrmions, and Hopfions — in ferroic materials [1-3] through the utilization of strain- and geometry-induced effects. The pronounced coupling between the order parameter and crystal lattice, particularly evident in certain types of ferroics like ferroelectrics or antiferromagnets, plays a pivotal role in establishing the equilibrium electric or magnetic state. This coupling not only facilitates the control but also enables the optimization of technological parameters within the sample, thereby paving the way for diverse industrial applications.

One of the key applications of ferroics lies in memory devices, where their properties can significantly enhance information processing, storage, and communication efficiency. Additionally, ferroic materials are being explored for use in terahertz nanoelectronics, neuromorphic computing systems, and low-dissipation computing circuits, offering opportunities for advanced device design and improved functionalities [4-6].

Engineering and manipulating various ferroic textures through by-design approaches opens the way to novel material functionalities and advance the development of innovative devices. This pursuit not only expands our fundamental understanding of ferroic materials but also holds promise for practical applications across multiple disciplines.

References

[1] I. Luk'yanchuk, et al., Nat. Commun. 11, 2433 (2020).
[2] Y. Tikhonov, et al., Sci. Rep. 10, 8657 (2020).
[3] S. Kondovych, et al., SciPost Phys. 14, 056 (2023).
[4] Oh, S., et al., APL Mater. 7. (2019) 091109.
[5] Baudry, L., et al., Sci. Rep. 7. (2017) 42196.
[6] Razumnaya, A. et al., Neuromorph. Comput. Eng. 3. (2023) 024003.

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