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Physikalisches Kolloquium

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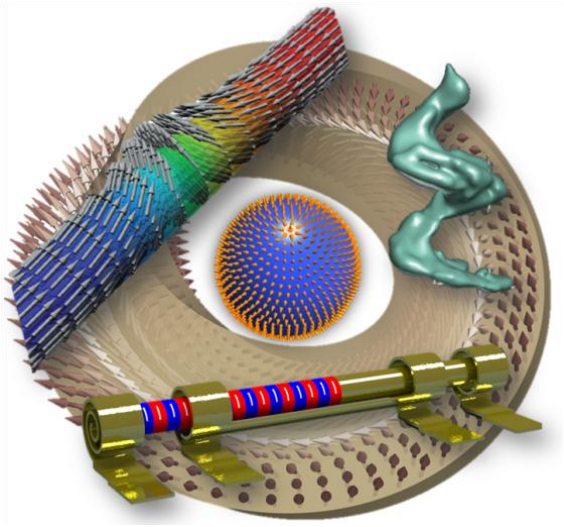
Curvilinear electronics and magnetism: from metageometric materials design to efficient THz converters

Geometry effects have emerged as a novel tool across various areas of physics[1], enabling the tailoring of electromagnetic properties and responses by adjusting the curvature and topology of thin films, 2D materials, and nanowires. Here, we address the fundamentals of geometry-induced effects with a specific focus on magnetism. By synergistically exploring the interplay among curvilinear object geometry, strain, and magnetic textures, we demonstrate the feasibility of metageometric materials design[2] based on hierarchical, large-area curvilinear nanotemplates[3,4]. As an example, this concept paves the way toward realizing curvilinear magnetoelectric materials[5], where the magnetic texture breaks space inversion symmetry and enables magnetoelectric responses. Beyond magnetism, curvature serves as a powerful tool to tailor nonlinear electron transport. Using the specific example of 2D and 3D curvilinear Bi thin films, we show that the strength of the nonlinear Hall effect can be precisely controlled by curvature[6]. This capability enables efficient energy harvesters and upconverters operating in the THz range, which is highly relevant for prospective communication networks.



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[1] P. Gentile et al., *Nature Electronics* (Review) 5, 551 (2022)
[2] D. Makarov et al., *Nature Nanotechnology* (Review), in press
[3] O. Bezsmertna et al., *Nano Letters* 24, 15774 (2024)
[4] G. Gubbiotti et al., *Nano Letters* 26, 1561 (2026)
[5] O. V. Pylypovskyi et al., *Curvilinear magnetoelectrics with magnetic wires*, pp. 269-337 in Magnetic Nano- and Microwires (Elsevier, 2026)
[6] P. Makushko et al., *Nature Electronics* 7, 207 (2024)