

Breaking inversion symmetry and searching for chiral magnetism

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Chiral and magnetic materials attracted attention some time ago due to their potential for spintronics applications and as skyrmion hosts. However, these complex magnetic orders often arise from several, often competing, interactions.¹

This talk discusses some strategies for designing functional materials that are non-centrosymmetric, with a focus on non-collinear and chiral magnetic structures. I will discuss some of my group's work looking at non-collinear magnetism on achiral² and on chiral crystal structures including the stuffed tridymite BaFeGaO_4 and a comparison with multiferroic BaFe_2O_4 ³ and ferrotoroidal BaCoSiO_4 .⁴

(1) Cheong, S.-W.; Xu, X. Magnetic chirality. *npj Quantum Materials* **2022**, *7*, 40.

(2) Li, M.-R.; McCabe, E. E.; Stephens, P. W.; Croft, M.; Collins, L.; Kalinin, S. V.; Deng, Z.; Retuerto, M.; Sen Gupta, A.; Padmanabhan, H.; *et al.* Magnetostriction-polarization coupling in multiferroic Mn_2MnWO_6 . *Nature Communications* **2017**, *8*, 2037. Frank, C. E.; McCabe, E. E.; Orlandi, F.; Manuel, P.; Tan, X.; Deng, Z.; Croft, M.; Cascos, V.; Emge, T.; Feng, H. L.; *et al.* $\text{Mn}_2\text{CoReO}_6$: a robust multisublattice antiferromagnetic perovskite with small A-site cations. *Chemical Communications* **2019**, *55*, 3331-3334.

(3) Orlandi, F.; Delmonte, D.; Calestani, G.; Cavalli, E.; Gilioli, E.; Shvartsman, V. V.; Graziosi, P.; Rampino, S.; Spaggiari, G.; Liu, C.; *et al.* $\gamma\text{-BaFe}_2\text{O}_4$: a fresh playground for room temperature multiferroicity. *Nature Communications* **2022**, *13*, 7968.

(4) Ding, L.; Xu, X.; Jeschke, H. O.; Bai, X.; Feng, E.; Alemayehu, A. S.; Kim, J.; Huang, F.-T.; Zhang, Q.; Ding, X.; *et al.* Field-tunable toroidal moment in a chiral-lattice magnet. *Nature Communications* **2021**, *12*, 5339. Xu, X.; Huang, F.-T.; Admasu, A. S.; Kratochvílová, M.; Chu, M.-W.; Park, J.-G.; Cheong, S.-W. Multiple ferroic orders and toroidal magnetoelectricity in the chiral magnet BaCoSiO_4 . *Physical Review B* **2022**, *105*, 184407.