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Polar-Driven Self-Assembly of Magnetic Nanoplatelets in a Multiferroic Nematic

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Magnetic nanoparticles dispersed in liquid crystals interact through the elastic forces of the surrounding medium and often organise into rich, responsive structures. In nematic hosts, these director-mediated interactions can promote collective magnetic order and dramatically enhance magneto-optical effects, even at low particle concentrations. In the case of magnetic nanoplatelets, spontaneous magnetic order can emerge, resulting in a liquid magnet state [1,2].

In this study, we explore how the breaking of polar symmetry in a ferroelectric nematic phase transforms the self-assembly and defect topology of such magnetic suspensions. Using a combination of X-ray scattering, magneto-optical imaging, and rheological measurements, we compare conventional and ferroelectric nematic hybrids.

We find that polarisation–director coupling strongly modifies the particle anchoring conditions, stabilises magnetically responsive defect networks, and drives a qualitatively different self-assembly compared to non-polar nematics. This coupling enables control of the hybrid structure and response via external magnetic fields, opening a route toward functional multiferroic soft matter.

References

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