

A Two-Dimensional Variational Approach to the Modelling of Ferronematic Thin Films

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Abstract

Colloidal suspensions of magnetic particles in liquid crystals are complex fluids that show a coupling between the magnetic particles and the surrounding liquid crystal, which we assume to be in the nematic phase. The material is then referred to as ferronematics. The coupling results in special effective material properties and potential applications in display technologies or multifluidics devices.

In the joint work with Shilpa Dutta, James Dalby and Apala Majumdar [1], we are particularly interested in thin films and consider a variational approach that combines the Landau-de Gennes approach for nematic liquid crystals with the theory of micromagnetics. The talk summarizes our analytical findings and shows our numerical results obtained as stable ferronematic equilibria by solving the related gradient flow equations. We observe the influence of the stray field on interior nematic defects and magnetic vortices.

References

- [1] S. Dutta, J. Dalby, A. Majumdar, A. Schlömerkemper. *A study of ferronematic thin films including a stray field energy*, arXiv:2509.10442