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The mathematics of defects in liquid crystals

Abstract

Defects in liquid crystals are of great practical importance and theoretical interest. Despite tremendous efforts, predicting the location and transition of defects under various topological constraint and external field remains to be a challenge. We investigate defect patterns of nematic liquid crystals confined in different geometries under different boundary conditions, within the Landau-de Gennes model. A spectral method that numerically solves the Landau-de Gennes model with high accuracy is implemented, which allows us to study the detailed static structure of defects. Four conjectures are made to summarize the common characteristics of defects in the Landau-de Gennes theory, in the hope of providing a deeper understanding of the defect pattern in nematic liquid crystals. We have also made some progress on the stability of line defects.