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Orientational fluctuations of amorphous nematogenic solids

FANGFU YE, Georgia Institute of Technology, BING LU, University of Illinois at Urbana-Champaign, PAUL GOLDBART, Georgia Institute of Technology — Amorphous nematogenic solids (ANS) are media comprising rod-like nematogens that have been randomly linked to form elastically deformable macroscopic networks. Classes of ANS include chemical nematogen gels (i.e., networks of small molecules) and liquid crystalline elastomers (built from crosslinked nematogen-containing macromolecules), as well as biophysical networks such as those composed of actin filaments. We use a method inspired by the cavity approach to construct a replica free energy for these random systems, and investigate the correlations of the thermal fluctuations of the orientational alignment of the nematogens at spatially separated points. We identify two qualitatively distinct regimes: (a) a weakly localized regime, in which the correlations decay exponentially with separation; and (b) a strongly localized regime, characterized by correlations that also decay but oscillate as they do.

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