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Noise induces motile topological defects in passive nematics

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Topological defects are increasingly being identified in various biological systems, where their characteristic flow fields and stress patterns are associated with continuous active stress generation by biological entities. Here, using numerical simulations of continuum fluctuating nematohydrodynamics we show that even in the absence of any activity, both noise in orientational alignment and hydrodynamic fluctuations can independently result in flow patterns around topological defects that resemble the ones observed in active systems. Remarkably, hydrodynamic or orientational fluctuations alone can
reproduce the experimentally measured stress patterns around topological defects in epithelia. We further highlight subtle differences between noise in orientation and hydrodynamic fluctuations based on defect trajectories and persistence time. Our simulations show the possibility of both extensile-
and contractile-like defect motion due to fluctuations and reveal the defining role of passive elastic stresses in establishing fluctuation-induced defect flows and stresses.

Field of study

Biophysics

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