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A Phase-Field Method for Computing Elasto-Capillary Flows of Liquid Crystals MINGFENG QIU, JAMES FENG, University of British Columbia, JEAN-CHRISTOPHE LOUDET, University of Bordeaux — We propose a phase-field model to compute elasto-capillary flows of nematic liquid crystals. The formulation provides a consistent description of nematic microstructure, in particular topological defects, and recovers macroscopic surface tension and liquid crystal anchoring stress. This is made possible by incorporating the Beris-Edwards theory for nematic hydrodynamics based on a tensor order parameter in a phase-field formalism approximating the sharp-interface limit. We apply the method to the problem of drop retraction in the presence of a nematic-isotropic interface. We characterize a variety of different cases and examine their dynamics. In this regime, our calculation uncovers a proportional relationship between steady-state drop deformation and the elasto-capillary length, signifying competition between bulk distortional elasticity and surface tension, mediated by the anchoring energy. The new computational framework opens doors to a large class of fundamental problems concerning colloidal interaction in coupled elasto-capillary fields.

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