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The shape of bubbles and Drops rising in a Nematic Liquid Crystal CHUNFENG ZHOU, Dept. of Chemical and Biological Engr., University of British Columbia, PENGTAO YUE, JAMES J. FENG, Dept. of Chemical and Biological Engr., and Dept. of Mathematics, University of British Columbia, CHUN LIU, Dept. of Mathematics, The Pennsylvania State University, JIE SHEN, Dept. of Mathematics, Purdue University — This work is motivated by recent experimental observation of unusual "inverted-heart" shapes that a bubble assumes when rising in an anisotropic fluid. A possible explanation is in terms of the molecular orientation of the matrix fluid with respect to the bubble surface. In this work, we use numerical simulations to test such a hypothesis. The moving interface problem is formulated in a diffuse-interface framework. The anisotropic fluid is represented by a simplified Leslie-Ericksen theory for nematic liquid crystals, with director anchoring on the surface of an isotropic drop. The simulations are carried out using axisymmetric finite elements. Results show an array of drop shapes, depending on the interplay among inertial, capillary, anchoring and elastic effects. Drops with sufficiently strong planar anchoring and moderate elasticity rising in a medium with vertical far-field orientation assume the inverted-heart observed in experiments. This is shown to be mainly due to the competition between interfacial tension, anchoring energy and bulk elastic energy. Furthermore, two boojum defects appear on the upper and lower poles. The size of the defects plays an significant role in shaping the rising bubble.

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