Odd behaviors of chiral films

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Brief Biographical Sketch

Brato Chakrabarti is an Assistant Professor at the International Center for Theoretical Sciences (ICTS-TIFR) Bengaluru. He is in the Biological Physics group and associated with the Fluid Dynamics group at ICTS. He is broadly interested in problems of soft and active matter and biological fluid mechanics. He obtained his Ph.D. in Applied Mechanics from the University of California, San Diego, working with Prof. David Saintillan, and subsequently was a Research Fellow at the Center for Computational Biology at the Flatiron Institute working with Prof. Mike Shelley.

Abstract

An important class of microscale fluid-structure interactions in biology involves the interactions and deformations of flexible elasticae, both passive and active, with fluid flows. This is evident from fundamental biological transport processes such as the swimming microorganisms using internally actuated cilia or flagella, the transport of material by ciliary carpets, and the involvement of both actuated flexible filaments in the first symmetry-breaking of vertebrate cells. I will introduce a class of such problems that can be categorized as *boundary-driven self-organized flows*, which arise from interactions between emergent flows and active processes near surfaces. I will then discuss how such active processes, when coupled to microscopic chiral processes, exhibit a variety of instabilities, give rise to micro-pumps, and generate odd viscosity. Our results have implications for microfluidic mixing, rheological response of active materials, and bio-inspired material design.