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Exploring nematic behaviour in systems with polar symmetry.

Active matter encompasses a wide range of systems, from bird-flocks to bacterial colonies. Two main formalisms describe these systems based on individual particle symmetries: polar and nematic. Each formalism leads to unique behaviours, the most significant being the appearance of half and full integer topological defects for nematic and polar respectively. However, recent advances in the experimental manipulation of active matter have revealed that particles with purely polar symmetry can create half-integer topological defects, a phenomenon that is not anticipated by the polar equations. To address this discrepancy, we will revisit the nematic formulation and introduce particle self-propulsion. Introducing this symmetry breaking term that changes the particle movement from immobile shakers to self-propelled particles along the fluid flow. Some preliminary results on this effect are: change in the instability onset (Linear Stability Analysis), self-propulsion can regulate the systems order, creates various active turbulence regimes and creates anisotropy in the flow field.

Field of study

Biophysics

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