

Abstract Submitted
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Chaotic mixing of an active nematic in viscous environments¹

AMANDA TAN, KEVIN MITCHELL, LINDA HIRST, University of California, Merced — The unifying theme of active matter is that collections of subunits consume energy locally, translate that energy into movement, and ultimately produce large-scale flows. Such materials are out of equilibrium systems. A fascinating example of a tunable non-equilibrium system is the microtubule/kinesin-based active nematic that forms at an oil/water interface. This material, based on biological polymers and molecular machines, produces a steady-state in which we observe moving topological defects that braid around one another. Defects are continuously created and annihilate, generating fluid flows. A direction of interest in non-equilibrium systems is to study how the active material responds to changes in its environment. To generate external environmental changes, we change the viscosity of the oil that the network is in contact with and probe subsequent changes in the morphology and speed of the network. Lower viscosity oils give lower defect densities and produce higher network speeds, and vice versa for higher viscosity oils. Using analysis from chaotic advection theory, we explore how environmental changes affect various quantitative parameters such as the local fluid stretching rates within the network and the topological entropy as calculated from defect braiding.

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