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Swift-Hohenberg-type model ANAND OZA, Courant Institute of Mathematical Sciences, JOERN DUNKEL, Massachusetts Institute of Technology — Recent experiments from the Zvonimir Dogic Lab (Brandeis University) demonstrated that ATP-driven microtubule-kinesin bundles can self-assemble into two-dimensional active liquid crystals that exhibit a rich creation and annihilation dynamics of topological defects, reminiscent of particle-pair production processes in quantum systems. This remarkable discovery has sparked considerable theoretical and experimental interest. Here, we present and validate a minimal continuum theory for this new class of active matter systems by modifying the classical Landau-de Gennes theory for liquid crystals, obtaining a tensorial Swift-Hohenberg-type PDE. We simulate the resulting model numerically and develop an algorithm for tracking topological defects. We find that the resulting model agrees quantitatively with recently published data and predicts a regime of antipolar defect ordering. Ordered states go unstable as the activity parameter is increased, yet the chaotic defect dynamics still exhibit local antipolar ordering. Generally, our results suggest that complex nonequilibrium pattern-formation phenomena might be predictable from a few fundamental symmetry-breaking and scale-selection principles.

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