APPLIED MATHEMATICS COLLOQUIUM

Spontaneous Symmetry Breaking in Soft Matter and Active Fluids

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Abstract: Geometric constraints affect symmetry breaking and pattern selection in a wide range of non-equilibrium processes, from crystal growth and virus capsid assembly to intracellular signaling and morphogenesis. In the first part of this talk, I will summarize our recent theoretical work that aims to understand how curvature controls symmetry breaking and topological defect formation on the wrinkled surfaces of elastic bilayer materials. Specifically, we will derive a generalized Swift-Hohenberg equation that can explain essential aspects of the experiments performed by our collaborators. In the second part, we will generalize the underlying ideas to obtain a generic analytically tractable description of bacterial and other active suspensions. The resulting generalized Navier-Stokes equations reveal an unexpected chiral symmetry-breaking mechanism, and offer new insight into the triad dynamics of classical turbulence by uncovering a previously unknown cubic invariant. The talk will conclude with a brief overview of ongoing work in my group that focuses on the mathematical description of developmental processes in a variety of biological systems.

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Applied Math Colloquium: https://math.mit.edu/amc/fall18/
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