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Routes to spatiotemporal chaos in the rheology of nematogenic fluids MOUMITA DAS, Division of Engineering and Applied Sciences, Harvard University, BUDDHAPRIYA CHAKRABARTI, Department of Physics, University of Massachusetts, Amherst, SRIRAM RAMASWAMY, CHANDAN DASGUPTA, AJAY SOOD, Department of Physics, Indian Institute of Science, Bangalore, India
— With a view to understanding the "rheochaos" observed in recent experiments in a variety of orientable fluids, we study numerically the equations of motion of the spatiotemporal evolution of the traceless symmetric order parameter of a sheared nematogenic fluid. In particular we establish, by decisive numerical tests, that the the irregular oscillatory behavior seen in a region of parameter space where the nematic is not stably flow-aligning is in fact spatiotemporal chaos. We outline the dynamical phase diagram of the model and study the route to the chaotic state. We find that spatiotemporal chaos in this system sets in via a regime of *spatiotemporal intermittency*, with a power-law distribution of the widths of laminar regions, consistent with the ideas of H. Chaté and P. Manneville, Phys. Rev. Lett. **58**, 112 (1987). Further, the evolution of the histogram of band sizes shows a growing length-scale as one moves from the chaotic towards the flow aligned phase. Finally we suggest possible experiments which can observe the intriguing behaviors discussed here.

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