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In-situ Generation of Focal Conic Defects in Flow of Smectic-A Liquid Crystals in Microchannels¹ SHAHAB SHOJAEI-ZADEH, SHELLEY ANNA², Carnegie Mellon University — The response of ordered phases of layered liquids such as smectic-A liquid crystals to flow is often dominated not by the direct coupling of flow to molecular degrees of freedom, but by the driven motion of defects in these systems. This is because flow generates instabilities in these systems that lead to the formation of defects. Most attention to date focuses on the global viscoelastic behavior and shear alignment of layered liquids, while little work has been done to understand defect motion and defect/flow interaction in these systems. Here we introduce a new approach, which enables simultaneous generation and observation of focal conic defects in pressure-driven flow of smectic-A liquid crystals. We observe that introducing a sudden change in the cross-sectional area of a microchannel via a small obstacle leads to the formation of a steady stream of defects. Generated defects move along the microchannel and interact with each other and with the flow itself. We measure the pressure drop and defect velocity and relate these to observed defect size and microchannel geometry. These results provide a novel way of probing nonlinear behavior of layered fluids under flow.

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