Spontaneous Symmetry Breaking by Meniscus Streaming

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The Faraday instability is a hydrodynamic instability in which a vertically vibrating fluid bath excites surface waves. Confining these Faraday waves to an annular geometry generates an additional horizontal drifting instability. Existing work suggests that the drifting mechanism may be coupled to streaming (mean) flows due to nonlinear behavior near the surface and annulus boundaries. We leverage experiments and simulations to extend previous mathematical descriptions of the coupling. We also suggest further variations of the experiment and potential applications. We discover fast rotational regimes by varying the vibrational forcing, contact line conditions, geometry, and liquids. Using simulations, we reproduce the Faraday instability and analyze streaming flows with tracer particle's Lagrangian mean. We study reduced 2D problems to understand the isolated effect of meniscus waves in the 3D system. Here, we compare these experimental and computational results and discuss the future directions of our work.