Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Stabilizing effect of elasticity on the inertial instability of submerged viscoelastic liquid jets. BAVAND KESHAVARZ, GARETH MCKINLEY, Massachusetts Institute of Technology — The stability of submerged Newtonian and viscoelastic liquid jets is studied experimentally using flow visualization. Precise control of the amplitude and frequency of the imposed linear perturbations is achieved through a piezoelectric actuator attached to the nozzle. By illuminating the jet with a strobe light driven at a frequency slightly less than the frequency of the perturbation we slow down the apparent motion by large factors ($\sim 100,000$) and capture the phenomena with high temporal and spatial resolution. Newtonian liquid jets become unstable at moderate Reynolds numbers ($Re_j \sim 150$) and sinuous or varicose patterns emerge and grow in amplitude. As the jet moves downstream, the varicose waves gradually pile up in the sinuous ones due to the difference in their corresponding wave speeds, leading to a unique chevron-like morphology. Experiments with model viscoelastic polymer solutions show that this inertial instability is fully stabilized sufficiently large levels of elasticity. We compare our experimental results with the theoretical predictions of an elastic Rayleigh equation for an axisymmetric jet and show that the presence of streamline tension is indeed the stabilizing effect for inertioelastic jets.

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Date submitted: 01 Aug 2017

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