Abstract Submitted
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Slow capillary jets in normal gravity: stability analysis and excitation by ultrasonic and electrostatic stresses[1] DAVID THIESSEN, JOEL LONZAGA, PHILIP L. MARSTON, Washington State University — The convective stability of a liquid jet in normal gravity issuing from a nozzle has been investigated experimentally and theoretically. The modes of the jet are excited downstream from the nozzle by a localized, modulated ultrasonic radiation pressure or modulated electrostatic stress. The spatially amplifying mode is detected using an optical extinction apparatus sensitive to small-amplitude fluctuation. Experimental data show that the commonly used stability analysis for homogeneous jets does not apply to accelerating jets with low nozzle velocities. Consequently, an asymptotic stability analysis is developed that incorporates the gravitational effect. General agreement between the theory and experiment is obtained including on some novel features unique to accelerating jets. The upstream propagating neutral mode is also excited under special conditions. Conversion of this mode (from neutral to amplifying) upon reflection from the nozzle results in interference with the original amplifying mode. The interference effect detected downstream modulates the growth of the instability and thus significantly affects the break up length.

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