Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Instability of low viscosity elliptic jets with varying aspect ratio
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— In this work an analytical description of capillary instability of liquid elliptic jets with varying aspect ratio is presented. Linear stability analysis in the long wave approximation with negligible gravitational effects is employed. Elliptic cylindrical coordinate system is used and perturbation velocity potential substituted in the Laplace equation to yield Mathieu and Modified Mathieu differential equations. The dispersion relation for elliptical orifices of any aspect ratio is derived and validated for axisymmetric disturbances with m =0, in the limit of aspect ratio, $\mu = 1$, i.e. the case of a circular jet. As Mathieu functions and Modified Mathieu function solutions converge to Bessel's functions in this limit the Rayleigh-Plateau instability criterion is met. Also, stability of solutions corresponding to asymmetric disturbances for the kink mode, $m = 1$ and flute modes corresponding to $m \geq 2$ is discussed. Experimental data from earlier works is used to compare observations made for elliptical orifices with $\mu \neq 1$. This novel approach aims at generalizing the results pertaining to cylindrical jets with circular cross section leading to better understanding of breakup in liquid jets of various geometries.

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Date submitted: 03 Aug 2011 Electronic form version 1.4