Abstract Submitted
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The Physics of Aerobreakup: Viscous Liquids[1] CHEE-LOON NG, VLADIMIR MITKIN, THEO THEOFANOUS, UCSB — We present results for high viscosity silicon oil drops in supersonic gas flows, extending the available data, in Ohnesorge number (Oh) space, by one order of magnitude (up to ∼100). Using Laser Induced Fluorescence (LIF) at exposure times down to 3 nanoseconds, including oblique angles that allow clear visualization of the frontal area of the drop, we find that the asymptotic regime at extremely high Weber numbers is not piercing by Rayleigh Taylor waves as previously thought (also known as the "catastrophic" regime), but rather Shear-Induced Entrainment (SIE). This previous misunderstanding was a mirage of the shadowgraph method utilized in past work. Present results are in agreement with recent results for low viscosity liquids (Oh<0.1) found with the same experimental facility and instrumentation (Theofanous and Li, Physics of Fluids, Vol 20, No 5, May 2008). Moreover in the present work we quantify the critical We as function of the Oh, for the onset of breakup, as well as for the breakup regime "transition region", which is from Rayleigh-Taylor Piercing to SIE (as in the case of low viscosity fluids). Both critical We numbers increase with increasing Oh.

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