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Accelerated dynamics of blast wave driven Rayleigh-Taylor instabilities in high energy density plasmas[1] N. SWISHER, Carnegie Mellon University, USA, C. KURANZ, R.P. DRAKE, University of Michigan at Ann Arbor, USA, S.I. ABARZHI, Carnegie Mellon University, USA — We report the systematic analysis of experimental data describing the late time evolution of the high Mach number and high Reynolds number Rayleigh-Taylor instability which is driven by a blast wave. The parameter regime is relevant to high energy density plasmas and astrophysics. The experiments have been conducted at the Omega laser facility. By processing the experimental x-ray images, we quantified the delicate features of RT dynamics, including the measurements of the curvature of the transmitted shock and the interface envelopes, the positions of RT bubbles and spikes, and the quantification of statistics of RT mixing. The measurements were performed at four time steps and for three different initial perturbations of the target (single mode and two two-mode). We found that within the noise level the curvatures of the shock and interface envelope evolve steadily and are an imprint of laser imperfections. At late times, the bubble merge does not occur, and the flow keeps significant degree of order. Yet, the blast-wave-driven RT spikes do accelerate with the power-law exponent smaller than that in case of sustained acceleration. We compared the experimental results with the momentum model of RT mixing and stochastic model achieving good agreement.

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