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Quantifying the dependence on initial conditions and ablation for the ablative Rayleigh-Taylor Instability in the highly nonlinear regime

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The asymptotic evolution of the Rayleigh-Taylor (RT) instability has been widely studied, but a consensus is still lacking on the influence on initial conditions (ICs) on the final self-similar regime. A planar direct-drive platform has been deployed at the NIF to investigate the highly nonlinear stage of the ablative RT [1]. This platform allows to benchmark the nonlinear theory of the ablative RTI in a unchartered experimental regime. The initial seeds of the RT were formed using a well-characterized imprinting laser beam, and the growth of the optical depth modulations and the acceleration of the foil are observed using time-resolved x-ray radiography. We show that the mixing parameter of the nonlinear ablative RT has a strong dependence on ICs, as previously observed in classical hydrodynamics experiments. The variance can be attributed to the dominance of either bubble competition or bubble merger. We will adapt this platform to examine the effects of different materials on RT development. By varying the ratio of ablation velocity to acceleration, we will gain a new understanding of the role of ablation in the RT. This has deep implications across a range of HED physics research, including supernovae investigations, mix studies, and ICF capsule design. [1] A. Casner et al, Plasma Phys. Control. Fusion **60**, 014012 (2018).

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