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NIF Science Use: plan and designs for highly nonlinear ablative Rayleigh-Taylor Instability experiments A. CASNER, L. MASSE, CEA, V. SMALYUK, LLNL, I. IGUMENSHCHEV, LLE, S. LIBERATORE, L. JACQUET, CEA, B. REMINGTON, H.-S. PARK, D. BRADLEY, LLNL, F. GIRARD, O. POUJADE, L. VIDEAU, D. GALMICHE, J.-P. JADAUD, P. LOISEAU, CEA, S. SARKAR, UCSD — In the context of NIF Science User program we propose to study on the NIF ablative Rayleigh-Taylor Instability (RTI) in transition from weakly nonlinear to highly nonlinear regimes. NIF provides a unique platform to study the rich physics of nonlinear and turbulent mixing flows in High Energy Density plasmas because it can accelerate targets over much larger distances and longer time periods than previously achieved on the NOVA [1] and OMEGA [2,3] lasers. In one shot, growth of RT modulations can be measured from the weakly nonlinear stage near nonlinear saturation levels to the highly nonlinear bubble-competition, bubble-merger regimes and perhaps into a turbulent-like regime. The role of ablation on highly-nonlinear RTI evolution will be comprehensively studied by varying ablation velocity using indirect and direct-drive platforms. We will present detailed hydrocodes designs of these platforms and discuss the path forward for these experiments which use NIF diagnostics already qualified. [1] B. Remington *et al.*, Phys. Plasmas **2**, 1, (1995). [2] L. Masse, *et al.*, Phys. Rev. E **83**, 055401 (2011). [3] V. Smalyuk *et al.*, Phys. Plasmas **13**, 056312 (2006).

Alexis Casner
CEA

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