DPP15-2015-001318

Abstract for an Invited Paper
for the DPP15 Meeting of
the American Physical Society

Experimental Observation of Nonlinear Mode Coupling In the Ablative Rayleigh-Taylor Instability on the NIF

DAVID MARTINEZ, Lawrence Livermore Natl Lab

We investigate on the National Ignition Facility (NIF) the ablative Rayleigh-Taylor (RT) instability in the transition from linear to highly nonlinear regimes. This work is part of the Discovery Science Program on NIF and of particular importance to indirect-drive inertial confinement fusion (ICF) where careful attention to the form of the rise to final peak drive is calculated to prevent the RT instability from shredding the ablator in-flight and leading to ablator mixing into the cold fuel [1,2]. The growth of the ablative RT instability was investigated using a planar plastic foil with pre-imposed two-dimensional broadband modulations and diagnosed using x-ray radiography [3]. The foil was accelerated for 12ns by the x-ray drive created in a gas-filled Au radiation cavity with a radiative temperature plateau at 175 eV [4]. The dependence on initial conditions was investigated by systematically changing the modulation amplitude [5], ablator material and the modulation pattern. For each of these cases bubble mergers were observed and the nonlinear evolution of the RT instability showed insensitivity to the initial conditions. This experiment provides critical data needed to validate current theories on the ablative RT instability for indirect drive that relies on the ablative stabilization of short-scale modulations for ICF ignition. This paper will compare the experimental data to the current nonlinear theories.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC.

[1] J.D. Lindl *et al.*, Phys Rev. Lett 1975
[2] T. Ma *et al.,* Phys. Rev. Lett. 2015
[3] A. Casner et al., Physics of Plasmas 22, 056302 (2015).
[4] A. Casner *et al.,* HEDP 2014;
[5] D. A. Martinez *et al.,* Phys. Rev. Lett. 2015.