# THE EFFECT OF HYDRODYNAMIC INSTABILITIES ON THE PERFORMANCE OF AN INDIRECT DRIVE CAPSULE IMPLOSION.

K. McGlinchey, N.P.L. Niasse, J.P. Chittenden
Centre for Inertial Fusion Studies, Imperial College, U.K.
k.mcglinchey13@imperial.ac.uk

The ability to accurately simulate the effects of the Rayleigh-Taylor Instability on capsule implosions is critical in understanding their performance. The recent work of Smalyuk et al [1] radiographing the growth of pre-imposed perturbations provides a platform to benchmark the capability of radiation-hydrodynamic codes. Before this work can be carried out, one-dimensional simulations must be able to accurately reproduce ignition-type conditions. This involves ensuring a properly triggered shock sequence occurs to minimise the adiabat of the fuel, requiring accurate treatment of the radiation transport and atomic physics.

We report on simulations of Inertial Confinement Fusion (ICF) experiments occurring at the National Ignition Facility (NIF) using the 3D radiation hydrodynamics code CHIMERA developed at Imperial College. High-foot radiation drive shots recently performed by the NIF are modelled in 1D-spherical symmetry. The simulations are driven using multi-group radiation transport and opacity based on a non-LTE atomic model. The effect of shock timing on hot spot stagnation conditions is presented, with particular emphasis on their impact on the adiabat and neutron yield of the implosion. Results show that for a properly timed shock sequence, the resulting hot spot conditions are in agreement with simulations performed at Livermore.

With confidence in the 1D result, capsule stability during the implosion phase of ICF targets can then be investigated. Simulations have been benchmarked against recent 2D growth rates obtained from backlighting experiments at the NIF for different harmonic modes [1]. We present 2D vs 3D harmonic perturbation comparisons, which have been simulated in order to give insight into the different dynamics at play on the capsule surface. Asymmetric 3D perturbations have also been imposed to provide a situation closer to the native surface roughness present on the capsule.

[1] V. Smalyuk et al. "First Measurements of Hydrodynamic Instability Growth in Indirectly Driven Implosions at Ignition-Relevant Conditions on the National Ignition Facility." Physical Review Letters, May 2014.