RAYLEIGH TAYLOR GROWTH AT AN EMBEDDED INTERFACE DRIVEN BY A RADIATIVE SHOCK

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Radiative shocks are those where the radiation generated by the shock influences the hydrodynamics of the matter in the system.[1] Radiative shocks are common in astrophysics, including during type II supernovae[2,3], and have also been observed in the rebound phase of a compressed inertial confinement fusion (ICF) capsule[4]. During supernovae and the early phases of supernova remnant development, and at interfaces susceptible to Rayleigh-Taylor (RT) mixing, radiative fluxes from shocks may potentially reduce the instability growth by RT, relative to what would be present in a purely hydrodynamic system.

Laboratory studies of radiative shocks have been conducted using laser-driven ablators to launch strong shocks into mid- and high-Z gases[5,6]. While the shocks are demonstrably affected by the radiative flux from the shock front, these experiments have not had sufficient energy to drive a radiative shock in a system with an RT-unstable interface. Using a ~325 eV hohlraum on the National Ignition Facility (NIF), we are able to, for the first time, generate a radiative shock that traverses an RT-unstable interface. Because the generation of radiation at the shock front is a strong function of shock velocity ($\propto v^8$), the RT growth rates in the presence of fast and slow shocks were directly compared. We observe reduced RT spike development when the driving shock is expected to be radiative. Both low drive (~225 eV) hydrodynamic RT growth and high drive (~325 eV), radiatively-stabilized growth rates are in good agreement with 2D models. This NIF Discovery Science result has important implications for our understanding of astrophysical radiative shocks, as well as the dynamics of ICF capsules.

This work was performed under the auspices of the Lawrence Livermore National Security, LLC, (LLNS) under Contract No. DE-AC52-07NA27344. Document number LLNL-ABS-670025.

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