Structure and Dynamics of Plasma Interfaces in Laser-Driven Hohlraums

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Understanding the structure and dynamics of plasma interfaces in laser-driven hohlraums is important in inertial confinement fusion. To that end, a series of experiments at Omega laser was performed to explore critical aspects of the hohlraum environment, with particular emphasis on the role of self-generated spontaneous electric and magnetic fields at plasma interfaces, including the interface between fill-gas and Au-blowoff. It is shown that such interfaces are either kinetically unstable, leading to forming a diffusion layer and developing an ambipolar electric field, or hydrodynamically unstable, leading to generating Rayleigh-Taylor instabilities. The backlighting protons (3-MeV DD protons and 14.7-MeV D^3He protons generated in shock-driven, D^3He filled capsule implosions) pass through the subject hohlraum and form images on CR-39 nuclear track detectors, providing critical information. Several important physics issues, including ion diffusive mix and Rayleigh-Taylor instabilities, will be studied to shed light on ion kinetic dynamics and plasma hydrodynamic instability at these interfaces. The work described herein was performed in part at the LLE National Laser User's Facility (NLUF), and was supported in part by US DOE (Grant No. DE-FG03- 03SF22691), LLNL (subcontract Grant No. B504974) and LLE (subcontract Grant No. 412160-001G).