Abstract for an Invited Paper
for the DPP06 Meeting of
The American Physical Society

3ω Laser Beam Propagation in Inertial Confinement Plasmas*[1]

DUSTIN FROULA, Lawrence Livermore National Laboratory

A study of the relevant laser-plasma interaction processes in a long-scale length high-temperature transparent plasma has been performed using a new target platform to emulate the plasma conditions in an indirect drive fusion target. Recent experiments in this plasma emulator have demonstrated that for ignition relevant conditions (T_e >3 keV, I < $2x10^{15}$ W-cm^{-2}) the 3ω laser light propagates through a high-density ($5x10^{20}$ cm^{-3}) plasma with a peak transmission of 90%. Experiments have demonstrated an understanding of filamentation in these conditions that is consistent with theory increasing our confidence in our ability to execute the beam conditioning and focal spot designs for future ignition experiments. This target has been well characterized using Thomson-scattering where the peak electron temperature is shown to be 3.5 keV. The electron temperature measurements agree with HYDRA flux-limited radiation hydrodynamics calculations. Using a recently implemented 3ω transmitted beam diagnostic, the filamentation threshold has been experimentally measured for a beam that employs a continuous phase plate (CPP). For intensities above the threshold for filamentation, the beam was shown to spray. Defocusing the high-power laser beam reduced the backscatter while filamentation was not changed as predicted. Recent experiments investigating the importance of polarization and temporal smoothing of laser beams for propagation in this target platform will be presented. Detailed hydrodynamic and laser-plasma interaction simulations capture the stimulated Brillouin, stimulated Raman, and filamentation thresholds providing significant confidence that our models used for ignition designs can correctly predict the conditions where energy loss and beam propagation through the under dense NIF hohlraum plasmas will be small.

** Collaborators: L. Divol, S. H. Glenzer, J. S. Ross, N. Meezan, S. Prisbrey, S. Dixit.

[1]This work was performed under the auspices of the U.S. Department of Energy by University of California Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.