DPP07-2007-001841

Abstract for an Invited Paper
for the DPP07 Meeting of
the American Physical Society

Suppression of Stimulated Brillouin Scattering in multiple-ion species inertial confinement fusion Hohlraum Plasmas.[1]

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Understanding and control of laser coupling into high-electron temperature hohlraums is important for the success of the indirect-drive approach to inertial confinement fusion (ICF). Parametric instabilities such as stimulated Brillouin scattering (SBS) and stimulated Raman scattering (SRS) can backscatter the incident laser light reducing the total drive energy and affecting radiation symmetry. Consequently, recent hohlraum designs for indirect-drive ignition on the National Ignition Facility investigate wall liner material options so that the linear gain for parametric instabilities will be below threshold for the onset SBS. Increasing the Landau damping of acoustic waves by employing multiple-ion species plasmas offers the perspective of controlling SBS. Although the effect of two-ion species plasmas on Landau damping has been directly observed with Thomson scattering, early experiments on SBS in these plasmas have suffered from competing non-linear effects or laser beam filamentation. In this study, a reduction of SBS in multiple-ion species hohlraum plasmas to below the percent level has been demonstrated. By adding a low-mass ion species (Hydrogen) to a CO2 hohlraum gas fill, the SBS reflectivity was reduced by 3 orders of magnitude. The reduction in the total backscattered energy resulted in an increase of the hohlraum radiation temperature indicating improved coupling of the heater beams. These observations may be scaled to the plasma conditions within ignition scale hohlraums and support employing multiple-ion species plasmas in target designs for the first attempt at ignition on the National Ignition Facility.

[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.