DPP10-2010-001731

Abstract for an Invited Paper
for the DPP10 Meeting of
the American Physical Society

Multiple Beam Effects on Backscatter and its Saturation in Experiments with Conditions Relevant to Ignition[1]

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The amplification of light when obliquely intersected by laser beams in a plasma has been analyzed for its relevance to the amplification of backscatter in ignition targets. In the targets for the National Ignition Campaign (NIC) where the amplification of forward going beams is now well known and controlled [1], a linear model of the 23 quads of beams that intersect the light scattered from a single quad in the interior of the hohlraum has shown that backscatter re-amplification with additional gain exponents as high as 8 can be produced in some targets designs. This could lead to un-acceptable energy coupling if not mitigated by wave saturation or careful target design. A series of experiments [2], and 2D VPIC and fluid simulations [3] have been carried out to demonstrate the following key aspects of the model. Re-amplification of light with wavelengths corresponding to SRS from individual beams, by a single pump beam has been demonstrated in normalized plasma conditions similar to some ignition target designs. Saturation of this re-amplification has been observed to be in good agreement with 2D PIC models of non-linear kinetic effects such as trapping and subsequent wave front bowing, which limits the scattered energy to $\sim$1% of the pump energy in the cases studied. Re-amplification of light with wavelengths corresponding to SBS by two pumps is shown experimentally to lead to scattered energy that is well above that of a single pump as expected. SRS scatter in ignition scale hohlraums is shown to increase with increased density in the beam crossing region. The relevance of the work to ignition targets will also be discussed.

[1] P. Michel et al., Physics of Plasmas **17**, 056305 (2010)
[2] R. K. Kirkwood et al., submitted to Phys. Rev. Lett. and in preparation.
[3] Y. Lin L. Yin, B. J. Albright, K. J. Bowers, W. Daughton, and H. A. Rose, Phys. Plasmas, 15, 013109 (2008). and in preparation.

[1]This work was performed under the auspices of the Lawrence Livermore National Security, LLC, (LLNS) under Contract No. DE-AC52- A27344 LLNL-ABS-442791.