Mitigation of cross-beam energy transfer in flowing plasmas with enhanced laser bandwidth

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Cross-beam energy transfer (CBET) is a laser plasma instability (LPI) in which two overlapping laser beams exchange energy by means of a resonantly-excited ion-acoustic wave in an expanding supersonic plasma [1]. CBET can cause a significant amount of the incident laser energy to be misdirected in direct-drive inertial-confinement-fusion (ICF) implosions, thereby reducing both the maximum ablation pressure achieved and the overall symmetry of the implosion [2,3]. Last year, a working group at the Laboratory for Laser Energetics (LLE) and the U.S. Naval Research Laboratory was formed to study strategies for mitigating CBET using LLE's newly-developed wave-based code LPSE-CBET. One such strategy for mitigating CBET may be to increase the bandwidth of the laser light, thereby disrupting the coherent wave-wave interactions that resonantly excite this parametric process. In this presentation, we report on results of recent two-dimensional LPSE-CBET simulations in planar geometry that demonstrate a significant reduction in CBET gain for laser bandwidths between 2 and 5 THz under realistic plasma conditions. We also discuss some preliminary results in the modeling of stimulated rotational Raman scattering (SRRS). The use of SRRS techniques may provide a straightforward means of enhancing the bandwidth of existing ICF lasers, which would likely have a variety of beneficial LPI effects in both direct and indirect drive schemes.

References

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