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Crossed-Beam Energy Transfer in Direct-Drive Implosions

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Direct-drive-implosion experiments on OMEGA have revealed the importance of crossed-beam energy transfer[1] (CBET), which is caused by stimulated Brillouin scattering. The CBET reduces the laser absorption in a target corona by $\sim$10% to 20% and, therefore, decreases the implosion performance. The signature of CBET is observed in time-resolved, reflected-light spectra as a suppression of red-shifted light during the main laser pulse. Simulations without CBET typically predict an earlier bang time and overestimate the laser absorption in high-compression, low-adiabat implosions. Simulations using a CBET model and a nonlocal heat-transport model[2] explain well the scattered-light and bang-timing measurements. This talk will summarize the possible mitigation strategies for CBET required for robust ignition designs. CBET most effectively scatters incoming light that interacts with outgoing light originated from laser beam edges. This makes it possible to mitigate CBET by reducing the beam diameter with respect to the target diameter. Implosion experiments using large 1400-μm-diam plastic shells and in-focus and defocus laser beams have demonstrated the reduction of CBET in implosions with a smaller ratio of the beam-to-target diameters. Simulations predict the optimum range of this ratio to be 0.7 to 0.8. Another mitigation strategy involves splitting the incident light into two or more colors. This reduces CBET by shifting and suppressing the coupling resonances. The reduction in scattered light caused by CBET is predicted to be up to a factor of 2 when incident light colors are separated by $\delta\lambda > 6$ Å. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.

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[2]V. N. Goncharov *et al.*, Phys. Plasmas **15**, 056310 (2008).