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Inertial Confinement Fusion Implosions with Seeded Magnetic Fields on OMEGA

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Experiments applying laser-driven magnetic-flux compression to inertial confinement fusion (ICF) experiments to enhance the fuel-assembly performance are described. Spherical CH targets filled with 10 atm of deuterium gas were imploded by the OMEGA laser in polar-drive geometry. The targets were embedded with an 80-kG magnetic seed field. Upon laser irradiation, the high-implosion velocities and ionization of the target fill lead to trapping of the magnetic field inside the capsule and its amplification through flux compression to up to tens of megagauss. At such strong magnetic fields, the hot spot inside a spherical target becomes strongly magnetized, reducing the heat losses through electron confinement. The experimentally observed ion temperature was enhanced by 15% and the neutron yield was increased by 30%, compared to nonmagnetized implosions. This represents the first experimental verification of performance enhancement resulting from embedding a strong magnetic field into an ICF capsule. The compressed field was probed via proton deflectometry using the 14.7-MeV protons generated in the D+^{3}He fusion reactions from a laser-imploded glass microballoon. Experimental data for the fuel-assembly performance and magnetic field are compared to numerical results from combining the 1-D hydrodynamics code *LILAC* with a 2-D, azimuthal symmetry MHD postprocessor. This work was supported by the U.S. Department of Energy under Cooperative Agreement No. DE-FC02-04ER54789 and DE-FC52-08NA28302.

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