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Polar-Drive–Implosion Physics on OMEGA and the NIF

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Polar drive (PD) permits the execution of direct-drive–ignition experiments on facilities that are configured for x-ray drive such as the National Ignition Facility (NIF) and Laser Mégajoule. Experiments on the OMEGA laser are used to develop and validate models of PD implosions. Results from OMEGA PD shock-timing and warm implosions are presented. Experiments are simulated with the 2-D hydrodynamic code *DRACO* including full 3-D ray trace to model oblique beams. Excellent agreement is obtained in shock velocity and catch-up in PD geometry in warm, plastic shells. Predicted areal densities are measured in PD implosion experiments. Good agreement between simulation and experiments is obtained in the overall shape of the compressing shell when observed through x-ray backlighting. Simulated images of the hot core, including the effect of magnetic fields, are compared with experiments. Comparisons of simulated and observed scattered light and bang time in PD geometry are presented. Several techniques to increase implosion velocity are presented including beam profile variations and different ablator materials. Results from shimmed-target PD experiments will also be presented. Designs for future PD OMEGA experiments at ignition-relevant intensities will be presented. The implication of these results for NIF-scale plasmas is discussed. Experiments for the NIF in its current configuration, with indirect-drive phase plates, are proposed to study implosion energetics and shell asymmetries. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.