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Hydrodynamic Relations for Direct-Drive, Fast-Ignition Inertial Confinement Fusion Implosions C.D. ZHOU, R. BETTI, Fusion Science Center for Extreme States of Matter and Fast Ignition and Laboratory for Laser Energetics, U. of Rochester — Relations between stagnation and in-flight phases are derived both analytically and numerically for hydrodynamic variables relevant to direct-drive inertial confinement fusion implosions. Scaling laws are derived for the stagnation values of the shell density and areal density and for the hot-spot pressure, temperature, and areal density. A simple formula is also derived for the thermonuclear energy gain and in-flight aspect ratio. Implosions of cryogenic DT capsules driven by UV laser energies ranging from 25 kJ to 2 MJ are simulated with a one-dimensional hydrodynamics code to generate the implosion database used in the scaling-law derivation. These scaling laws provide guidelines for optimized fuel assembly and laser pulse design for direct-drive, fast-ignition, and conventional inertial confinement fusion. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreements DE-FC52-92SF19460 and DE-FC02-04ER54789.

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