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OV/5-3: Theory of Ignition, Burn and Hydro-equivalency for Inertial Confinement Fusion Implosions

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Recent advances in the theory of ignition and burn for inertial confinement fusion are presented and related to the experimental observables of the current indirect-drive ignition campaign on the National Ignition Facility (NIF) and the direct-drive implosion campaign on the OMEGA laser. The performance parameter currently used for the ignition campaign (the Experimental Ignition Threshold Factor or ITFX) is related to the well-known Lawson criterion. Hydro-equivalent curves are derived and used to extrapolate current results from OMEGA to future direct-drive ignition experiments on the NIF. The impact of laser-plasma instabilities, hot electron and radiation preheat on the hydrodynamic scaling is discussed. Remedies to mitigate the detrimental effects of laser-plasma and hydrodynamic instabilities are presented. It is also shown that ignition through a late shock launched at the end of the laser pulse (shock ignition) may be possible on the NIF at sub-megajoule energies.

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