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**Laser-Direct-Drive ICF—A Pathway to Ignition**[1]

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The National Ignition Facility (NIF) and Omega collaboration has made significant progress in laser-direct-drive (LDD) experiments using a variety of inertial confinement fusion (ICF) targets. In LDD, laser beams efficiently and directly irradiate a fuel-filled shell and ablatively drive an implosion. The ultimate goals of ICF are ignition and energy gain, where the required ablation pressure is determined primarily by the direct laser energy deposition into the target's expanding coronal plasma. LDD implosions contend with a wide array of laser–plasma instability effects that impede laser energy conversion into shell kinetic energy. Ignition requires high-compression targets that increase sensitivity to sources of drive and target nonuniformity. Recent LDD research has leveraged high-adiabat designs robust to nonuniformity with some providing a high neutron-flux platform. This tutorial provides an overview of the history of LDD ICF, highlighting the benefits amidst the challenges of direct illumination on the pathway to LDD ignition. Efforts to control hydrodynamic instability and the extensive list of diagnostic measurements employed will be discussed. Advances in multidimensional radiation-hydrodynamic simulations will be discussed, as well as implications both for better models and tighter engineering controls. Current experiments and future LDD-ICF designs will be explored. This talk will illustrate how LDD-ICF research represents a multi-lab effort that spans many disciplines, all combined into this rich area of physics research, full of discovery opportunity.

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