High Performance Capsule Implosions on the Omega Laser Facility with Rugby Hohlraums

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Rugby-shaped hohlraums have been proposed as a method for x-ray drive enhancement for indirectly-driven capsule implosions [1]. This concept has recently been tested in a series of shots on the OMEGA laser facility at the Laboratory for Laser Energetics at the University of Rochester. In this talk, experimental results are presented comparing the performance of D2-filled capsules between standard cylindrical Au hohlraums and rugby-shaped hohlraums. Not only did the rugby hohlraums demonstrate 18% more x-ray drive energy as compared with the cylinders, but the high-performance design of these implosions (both cylinder and rugby) also provided ≈ 20X more DD neutrons than any previous indirectly-driven campaign on Omega (and ≈ 3X more than ever achieved on Nova implosions driven with nearly twice the laser energy). This increase in performance enables, for the first time, a measurement of the neutron burn history of an indirectly-driven implosion. Previous DD neutron yields had been too low to register this key measurement of capsule performance and the effects of dynamic mix. A wealth of additional data on the fuel areal density from the suite of charged particle diagnostics was obtained on a subset of the shots that used D3He rather than D2 fuel. Comparisons of the experimental results with numerical simulations are shown to be in excellent agreement. The design techniques employed in this campaign, e.g., smaller NIF-like laser entrance holes and hohlraum case-to-capsule ratios, provide added confidence in the pursuit of ignition on the National Ignition Facility.


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