THE NIF HOHLRAUM SCIENCE CAMPAIGN

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Indirect drive (ID) implosions on the National Ignition Facility use a hohlraum to convert laser power to a temporally shaped x-ray drive that implodes the fuel capsule and initiates fusion burn. The laser-hohlraum coupling mechanisms and efficiency of converting laser power to a particular x-ray spectrum determine the velocity, adiabat and symmetry of the implosion. The mission of hohlraum science is to develop a greater understanding of these hohlraum-specific effects using focused experiments that can guide improvements in radiation-hydrodynamic modeling predictability. This can lead to the development of better hohlraums and an increased likelihood of ignition.

A major campaign is focused on characterizing the time-dependent coronal plasma electron temperature (T_e) using x-ray spectroscopy from mid-Z tracer elements and Au L-shell emission. In parallel, experiments are exploring the efficiency, coupling, and predictability of hohlraum drive vs hohlraum gas-fill. This effort is aimed at finding a hohlraum design that has the high-coupling, low hot-electron preheat, and predictable capsule implosion energetics of a low gas-fill while incorporating enough gas to limit wall blow-in and mitigate the symmetry challenges of low-gas-fill. Experiments are also exploring hohlraum shape changes (Rugby) and the use of alternate wall materials (copper, foams, depleted uranium, gold-boron mixtures) to control the drive spectra, mitigate backscatter, and control the hohlraum wall blow-in. Experiments are beginning to characterize the laser-spot energy redistribution caused by cross-beam energy transfer (CBET) in the early time part of the laser pulse for gas-filled hohlraums. This can provide insights into methods to control early time sources of dynamic asymmetry. Experiments are also developing techniques to quantify hot-electron preheat at the peak of the laser power, characterize the early-time symmetry dynamics and how it impacts hot-spot shape, and to characterize and control the region where the hohlraum wall blow-in poses the greatest risk to symmetry control.

This talk will discuss details of each of these efforts and how the experiments and interpretation are providing better understanding of hohlraum physics and leading to hohlraum improvement.

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