OBSERVATION OF INDIRECT-DRIVE INERTIAL CONFINEMENT FUSION IMPLOSION ASYMMETRY ON THE SHENGUANG III PROTOTYPE LASER FACILITY

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To achieve the high density compression in indirect-drive inertial confinement fusion, implosion symmetry and hohlraum radiation uniformity are strictly required. Three kinds of hohlraum lengths were used to study the symmetry scaling on the Shenguang III prototype laser facility. Hot spot radiography was taken by an x-ray framing camera and the hot spot ellipticity a/b which showd a "P2 like" implosion distortion was measured.

The indirect-drive implosion asymmetry is determined by the hohlraum radiation uniformity. Most factors affecting hohlraum radiation uniformity can be taken into account by a view-factor code IRAD 3D, so time-resolved difference between polar and equatorial radiation flux can by calculated by IRAD 3D. Then, the time-resolved a/b evolution can be calculated by a simplified analytic model integrating the total difference between polar and equatorial radiation flux before each moment, because during the acceleration phase the capsule distortion at some time is the accumulation effect of total radiation drive before that time. The calculated results of the time-resolved implosion asymmetry are basically in agreement with experimental results. Meanwhile, the physical mechanism for how hohlraum radiation nonuniformity evolution induces the variations of implosion asymmetry with hohlraum length and time is analyzed.