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Investigating the hohlraum radiation properties through the angular distribution of the radiation temperature on Shenguang-III prototype

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The symmetric radiation drive is essential to the capsule implosion in the indirect drive fusion, but is difficult to achieve due to the non-uniform radiation inside the hohlraum. The angular distribution of the radiation flux escaping from the hohlraum laser entrance hole (LEH) is sensitive to non-uniform radiation properties such as laser spot and plasma motion, therefore providing an effective way to study it. To reduce the gap between the two-dimensional rad-hydro simulation and three-dimensional effects caused by limited beams on Shenguang-III prototype laser facility, first we evaluate the influence of power balance and pointing accuracy of laser beams on the measured results. Then the non-uniform radiation properties of both vacuum and gas-filled hohlraums are studied by investigating the angular distribution of the x-ray flux. The simulations show that both the angular distribution and the intensity of the x-ray flux can be affected by the electron heat flux. Comparisons between the experiments and simulations further indicate that the x-ray emission of the blow-off plasma is overestimated in the simulations when it stagnates around the hohlraum axis. The axial position of the laser spot can also be estimated by the angular distribution of the radiation temperature due to their sensitive dependence. The inferred laser spot moves closer to the laser entrance hole in the gas-filled hohlraum than that in the vacuum hohlraum, consisting with the x-ray images taken from the framing camera.

References

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