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Numerical Analysis of Direct-drive Golden Double-shell Implosion

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The volumetric ignition which can substantially reduces the radiation loss requires low threshold temperature and low implosion velocity. Golden double-shell design is one of the volumetric ignition designs. The design consists of two concentric golden shells with the inner shell enclosing a volume filled with DT fuel. The thick inner golden shell can re-radiate the escaped radiation back to DT fuel to reduce the radiation loss. The outer shell consists of two layers: an Au layer covered with a CH layer. The CH layer which can efficiently absorb the energy of the incident laser beams acts as the ablated material to drive the vicinal Au layer as payload mass to fly inward like a rocket to collide with the inner shell to get velocity and pressure multiplication. In this report we numerically re-examined the physical processes of double-shell implosion. Numerous 1D multi-groups hydrodynamic simulations show that the velocity multiplications due to shells collision locate in range about 1˜1.3 for mass ratio of two Au shells in 2˜10 . Although increment of mass ratio of two Au shells does not increase the velocity multiplication, it increases the areal density of DT fuel in the highest compressed moment, thence increases the burning efficiency of DT fuel. Usage of high mass ratio of two Au shells is a way to increase the areal density of DT. The lower amount of DT fuel filled the higher implosion velocity required to get ignited. To get DT fuel efficiently burned the state ρRT>2g/cmˆ2 keV must be reached. 2D simulations are used to illustrate the development of non-uniformity of lasers illumination in the processes of implosion.

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