Study of shock ignition approach in heavy ion fusion of reactor-size DT target

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Abstract
The ignition of pre-compressed fuel by convergent shock wave, as a new approach in inertial confinement fusion that is known as shock ignition is considered with the aim of achieving high gain and providing threshold of ignition in lower energy. In this research, optimization of the energy has been done according to the hydrodynamic efficiency and target energy gain in a five-layer fuel pellet of nuclear fusion reactor size with heavy ion driver by one-dimensional code, DEIRA4. Then, with substitution of the box pulse by three-stage pulse in shock ignition, the power and time of each phase are optimized and the energy consumption, fuel efficiency and Rayleigh–Taylor instability is investigated. Calculations show that in optimal target with DT fuel, by applying three-stage pulse by heavy ion beam $^{207}$Pb, target energy gain is 542, corresponding to 21% increase in energy efficiency, and 19% decrease in deriver energy. Also, the decreasing of implosion velocity and e-fold parameter shows the more fuel stabilities in shock ignition than the hydrodynamic instabilities in central ignition.

Keywords: shock ignition, heavy ion driver, e-fold parameter, Rayleigh-Taylor instability

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