

Laser-Driven Implosion of Target Plasma Using Externally Applied Magnetic Field

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The concept of fast ignition is one of the most promising approaches to nuclear fusion. It is based on the principle of separation of the ICF target compression ("slow" adiabatic compression) and the process of thermonuclear ignition of a deuterium-tritium mixture ("rapid" heating of the target and thermonuclear combustion wave initiation - the compression shock waves initiate fusion in the target). Such method allows to minimize the D-T plasma energy at 20 - 50 kJ for the ignition threshold and 0.3 - 1 MJ for the fusion initiation with high gain.

We propose the scheme of magneto-inertial fusion (MIF) [1-4] for the first stage of "fast ignition". MIF has the advantages of both fusion concepts - high energy density as inertial confinement fusion (ICF) and the thermal insulation of a plasma as magnetic confinement fusion (MCF). The scheme of laser-driven MIF is based on the general idea of adiabatic compression/acceleration of the target material by pulsed laser (laser driver). The target consists of a pre-formed low-temperature plasma target and the magnetic field is "frozen" into the plasma.

Two-dimensional radiation-hydrodynamics model of compression of the plasma target placed in an external magnetic field is created. Code PLUM (Plasma jets and Laser driven Universal Model) is used for the numerical simulation. Physical model and results of numerical simulation of the laser-driven implosion of target plasma in the presence of an external magnetic field are discussed.

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References

- [1]. S.V. Ryzhkov, "The behavior of a magnetized plasma under the action of laser with high pulse energy," *Probl. Atom. Sci. Tech. Series "Plasma Electronics and New Methods of Acceleration" №4 (7)*, 105-110 (2010)
- [2]. V.V. Kuzenov, S.V. Ryzhkov, "Developing the numerical model for studying laser-compression of magnetized plasmas," *Acta Technica* 56, T454-467 (2011)
- [3]. V.V. Kuzenov, S.V. Ryzhkov, *Probl. Atom. Sci. Tech. Series "Plasma Physics" № 1 (83)*, 12-14 (2013)
- [4]. V.V. Kuzenov, S.V. Ryzhkov, *Probl. Atom. Sci. Tech. Series "PENMA" № 4 (86)*, 103-107 (2013)