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NUMERICAL STUDY OF A PLASMA DYNAMICS AND THERMALIZATION IN THE LASER TARGET WITH A LOW-DENSITY ABSORBER *)

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In the last few decades, the effect of powerful laser pulses on targets with a low-density absorber, from several units to several tens of mg/cm3, including those with a regular or stochastic volumetric structure, has been actively studied. Such targets are promising for creating powerful X-ray sources, generating electron and ion flows of high energy levels, as well as for equalizing temperature fields in targets when heated by several laser beams [1, 2, 3].

The report presents a set of examples concerning modeling the laser radiation effect on targets that imitate the properties of a low-density absorber. The computational experiments were performed using calculation methods on dynamically adaptive [4] and unstructured [4, 5] difference grids.

Calculations of the heating a target in the form of a homogeneous substance layer made of light chemical elements with a density of several tens of mg/cm3 by two laser beams in accordance with the experimental conditions [2] show that the use of locally adaptive grids allows one to significantly (by one to two orders of magnitude) expand the range of scales of the reproduced structure of the plasma flow and obtain refined quantitative data on the propagation of hydrodynamic and thermal waves of transfer of absorbed laser energy.

The effect of a laser beam on a target simulating the properties of a volumetrically structured low-density substance [1,3,6] made as a set of equidistantly located flat layers with different densities (solid materials - CH plastic, gold) separated by gas gaps was simulated. In all calculation variants it was assumed that the targets are heated by a one-sided radiation flux at the 2nd harmonic of Nd-laser, with a duration of 2 ns at a constant (terawatt level) power. The heated surface of the target is taken as a circle with a radius of about 500 μm. Data on the plasma homogenization rate were obtained. A comparative analysis of the numerical results for the multilayer target and a homogeneous target with an average density in the range of (10-20) mg/cm3 equivalent in mass and chemical composition content is performed.

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