NUMERICAL SIMULATION OF LASER RADIATION ABSORPTION TAKING INTO ACCOUNT THE RESONANT MECHANISM AND THE GENERATION OF FAST ELECTRONS IN A PLASMA WITH A SIZE THAT OCCURS WHEN A THERMONUCLEAR TARGET IS IGNITED [[1]](#footnote-1)\*)

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A model of resonance absorption of laser radiation in a plasma involving the deformation of the density profile by the ponderomotive force has been proposed. A mechanism of the linear transformation of laser radiation into plasma waves at resonance absorption has been discussed. The quasilinear diffusion equation for the electron distribution function in the plasma field has been used to describe the generation of fast electrons by plasma waves. Formulas have been obtained to estimate the energy fraction absorbed through the resonance mechanism and the energy of fast electrons. These formulas have been used in the two-dimensional hydrodynamic code ATLANT-HE [1]. The hydrodynamics of the plasma and the absorption of laser radiation have been calculated for conditions of the NIF facility experiment at a radiation power of 30 TW and a base pulse duration of 7.5 ns [2]. In the experiment, a flat CH-target was irradiated by part of the beams of the NIF installation. The plasma has the spatial dimensions appearing upon the irradiation of a spherical target for the initiation of the fusion reaction. The calculations have shown that the resonance absorption mechanism leads to the generation of fast electrons with an energy of about 40–80 keV. Fast electrons carry an energy of about 1–3% of the laser energy [3]. These results are close to the experimental data.

Under the assumption that resonance absorption is the main mechanism of the generation of fast electrons, the results of the experiment with the planar target cannot be applied to a spherical target. The resonance mechanism strongly depends on angles of incidence of radiation on the plasma, and the interaction conditions close to the case of the planar target will be satisfied only for a small fraction of laser radiation in the case of the spherical target. This conclusion is important for the choice of irradiation regimes and the composition of the laser nuclear fusion target because of stringent restrictions on the preliminary heating of the target by fast electrons.

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References

1. I.G. Lebo, N.N. Demchenko, A.B. Iskakov, et al., Laser Part. Beams, **22**, 267 (2004).
2. M.J. Rosenberg, A.A. Solodov, J.E. Myatt et al., Phys. Rev. Lett., **120**, 055001 (2018).
3. N.N. Demchenko, JETP, Vol. 130, p. 945 (2020).

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/It/ru/DA-Demchenko.docx) [↑](#footnote-ref-1)