distinctive FEATURES OF STRONG SHOCk WAVE GENERATION BY A BEAM OF LASER-ACCELERATED FAST ELECTRONS

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Heating a substance by a flux of laser-accelerated fast electrons opens up the possibility of generating a strong shock wave with a pressure exceeding a gigabar scale [1]. This is due, firstly, to the high density of energy flux of laser-accelerated fast electrons, which is close to the intensity of the laser pulse that forms them, and, secondly, to auspicious character of the heating of the matter with a solid density, compared to laser radiation. The relevance of the study is conditioned by the development of one of the most promising methods for igniting a precompressed laser thermonuclear target – "shock ignition" [2], as well as the development of research into the equation of state, in particular, with the transition of these laboratory studies to a gigabar pressure scale [3].

The formation of high-temperature plasma and the generation of a shock wave in the non-evaporated part of a plain target under the heating by fast electrons flux are studied in this work in a wide range of problem parameters – the energy of fast electrons and the electron beam energy density. The work is based on the results of numerical simulation of the impact of a monoenergetic beam of fast electrons on a plain target using a one-dimensional hydrodynamic code and a new kinetic module associated with it to calculate the energy transfer from fast electrons to plasma. The dependencies of the time of formation of a shock wave and the pressure amplitude behind its front on the energy of fast electrons and the density of the electron beam energy flux are obtained for both the flow of non-relativistic and relativistic fast electrons. The effect of electron heat conduction on the shock wave formation dynamics is investigated. The requirements for the parameters of a beam of laser-accelerated fast electrons capable of ensuring the formation of a plain, quasi-stationary shock wave to study the equation of state at the level of a gigabar pressure under laboratory conditions are determined.

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References

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