Increasing the efficiency of laser acceleration of charged particles and generation of radiation from targets with preplasma

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One of the possible ways to improve the efficiency of laser sources of charged particles and secondary radiation is associated with the use of targets with controlled preplasma on the irradiated side, created by a prepulse or an additional pulse of nanosecond duration. This report presents the results of end-to-end hydrodynamic modeling of target expansion under the action of a nanosecond laser pulse and kinetic calculations (particle-in-cell method) of electron and proton acceleration by a powerful short laser pulse incident on an expanding target. The dependence of the number and energy of accelerated particles on the characteristic gradient of the target profile, determined by the energy of the nanosecond prepulse, is shown. The optimal conditions for accelerating electrons and protons are discussed. Using the characteristics of accelerated electrons as initial data in the GEANT-4 code, the spectra of their bremsstrahlung radiation in the converter target are presented.

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