Ultra bright gamma radiation source and high-density electron-positron jets using the 15PW laser pulse

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An end-to-end PIC and GEANT4 numerical simulation of the acceleration of an electron bunch by a powerful 15 PW laser pulse and generation of gamma radiation and a positron beam in a converter target is carried out. The high efficiency of conversion of laser radiation into gamma radiation and positrons is due to the use of the regime of relativistic self-trapping of a laser pulse for the wake acceleration of electrons, which leads to the achievement of the maximum charge of multi-MeV electrons and the maximum conversion coefficient of laser energy in them in targets of near-critical density. The simulation demonstrates the high efficiency of using a laser induced source of gamma radiation for deep radiography of hidden dense objects.The acceleration of electrons to high energies (more than 2 GeV) and the efficient conversion of their energy into the energy of gamma quanta using the 15 PW laser makes it possible to obtain even exotic particles as a result of photonuclear reactions, for example, kaons and even lambda baryons and to register them behind a converter target as single events.