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Particles acceleration processes in the laser plasma

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To date, as a result of a large series of experimental and theoretical studies scientists managed to identify the role and nature of the absorption of laser radiation in a plasma, the mechanisms of energy transfer between different components, the main properties of kinetics of the ionization state and dynamics of expansion of the laser-plasma torch. A significant contribution to the experimental research has been made, in particular, due to the development and application of laser mass spectrometry, allowing one to determine the charge composition of the plasma, the properties of the processes of ionization, acceleration, and recombination in laser plasma. Numerous studies have established that the laser plasma is an intense emitter of charged and neutral particles: the electrons, ions, and atoms. The mechanisms of the energy spectra of ions and neutral particles have been studied in detail, and laser sources of particles, which have found application in accelerators, cyclotrons, and mass spectrometers, have been developed and technically implemented. A laser-plasma generator of multiply charged ions produces a large number of heavy ions in the regime of short periodic pulses, which is of interest for ion accelerators operating in the pulse periodic regime. The source of this type is also promising for research in the field of heavy-ion fusion. The laser-plasma generator is based on the physical phenomenon of generation of highly excited states of atoms by a high-power laser pulse focused on the surface of a solid target. With expanding a high-temperature laser plasma into vacuum a high-power flux of charged particles is produced.

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