The study of collective acceleration of laser plasma by rapidly increasing magnetic field

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This paper presents the new experimental results concerning acceleration of deuterium ions extracted from laser plasma in the rapid-growing nonuniform magnetic field in order to initiate the nuclear reactions D (d, n)3He and Т (d, n)4He.

In order to obtain plasma a laser on yttrium-aluminum garnet activated with neodymium that generates in Q-switched mode the pulses of infrared radiation (λ = 1.06 μm) with the energy W ≤ 0.85 J and duration of ≈ 10 ns.

An increase in the rate of expansion of a laser plasma from 107 to 108 cm/s, created by the emission of portable lasers, is achieved within the framework of [1-2] at a magnetic field increase rate of 2•107 T / s, which allows the initiation of a nuclear reaction D + D, D + T.

In the present study, the velocity of a bunch of a laser plasma at a magnetic field induction rate of 3•108 T / s was experimentally measured, and angular distributions of accelerated particle fluxes were measured in the range from 00 to 300. The maximum and mean ion velocities were determined by the time-of-flight technique.

The proposed system allows the generation of neutrons, including possibly thermonuclear ones, on counterflows using two similar magnetic accelerators located coaxially, facing each other. In this case the problem related to degradation of solid neutron-generating targets is resolved. There also occurs a possibility of fast accumulated running time of packed solid targets at using of deuteron-tritium laser targets.

References

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