RECENT PROGRESS IN PARTICLE ACCELERATION FROM INNOVATIVE TARGETS FOR LASER-PLASMA INTERACTIONS

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This study is motivated by a recent trendin using innovative low-density targets with an electron densityclose to the relativistic critical density [1] andcircularly polarized laser pulses for ion and electron acceleration which demonstrates significant progress inachieving the highest particle energies and numbers. Based on 3D PIC simulations we compared efficiency of proton acceleration from thin foils and innovative low-density targets irradiated by linearly and circularly polarized laser pulses. Utilization of laser pulse with circular polarization results in noticeable increase of maximum proton energy both from thin foils in directed Coulomb explosion regime and from low-density targets in synchronized laser-triggered ionacceleration (SASL) regime [2]. We also addressed the problem of pre-plasma impact on ion acceleration. We demonstrate that optimal pre-plasma size may results in increase of maximum energy of protons accelerated by 300 mJ laser pulses from ultra-thin foils. At the same time, for petawatt class lasers pre-plasma reduce efficiency of SASL regime.

The sources of laser-accelerated electrons based on the interaction of high-intensity femtosecond laser pulses with innovative low-density targets are perfectly suited for producing X-ray pulses either due to the electron radiation when escaping the target or due to their conversion to bremsstrahlung radiation in a converter target. By using 3D PIC simulations,we have performed optimization of laser-target design to get most effective electron source suitable for deep radiography with 4J 30fs laser pulses.

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References

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