optimization of laser-triggered particle and x-ray production

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The laser-plasma methods of particle acceleration up to the high energy and X-ray generation attracted a lot of attention more than last 10 years due to many practical applications in inertial fusion, nuclear physics, biology and medicine.

In this work we describe the new mechanism of ion acceleration from near-critical targets and optimized electron source based on laser-plasma acceleration for X-ray generation. When the laser pulse interacts with a near-critical plasma, its group velocity inside the target can be very low. The ponderomotive sheath potential of the moving laser pulse front can then capture background protons to accelerate them. As the laser light propagates inside the target, its group velocity increases as a result of relativistic self-focusing. If a rate of pulse velocity increase coincides with a rate of proton acceleration by the ponderomotive field, then the protons can be accelerated very effectively.