



Laser accelerated energetic protons from a non-uniform density plasmisphere

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The intense main laser pulse is usually preceded by a pre-pulse of lower intensity in all the available high-power laser facilities. This pre-pulse ionizes the target and renders its density inhomogeneous for the upcoming main-pulse [1]. Here, we demonstrate the tunability of the inherent primary ion acceleration mechanisms to attain a handle on the ion beam qualities. We use three-dimensional particle-in-cell simulations to analyze the interaction of an intense circularly polarized laser main-pulse on a pre-deformed hydrogen-plasma microsphere. A density non-uniformity is considered with a central peak plasma density which drops isotropically towards the plasma boundary. The steepness of the density profile is found to play a crucial role in the acceleration processes involved, as well as on the maximum energy attained by the protons. It is seen that a smaller density gradient leads to a near-isotropic expansion of the target, whereas, a steeper gradient in the density favours the formation of shocks in the decreasing density profile which eventually reflects protons to high velocities.

References

1. A. Andreev, *et al*, Plasma Phys. Cont. Fusion, 48 (11), 1605, 2006.