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Proton acceleration by interaction of high intensity laser with microstructured snow targets

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Traditional approach to laser based acceleration of protons relies on target normal sheath acceleration (TNSA) or radiation pressure acceleration (RPA) schemes. However, achieving the 150MeV proton energy levels applicable for cancer treatment requires multi-PW laser systems. We have demonstrated possibility to obtain 25MeV proton bunches accelerated by the interaction of a 5TW ultra short laser pulse with a microstructured snow target. This significantly increased proton energy is the result of localized enhancement of the laser field intensity near the microstructured tip which in turn amplify the charge separation in the plasma, leading to improved acceleration of the protons for the same laser power. Our microstructured snow scheme also relaxes the requirements of high contrast ratio of the laser system. I will present our results related to the target structure, influence of prepulse on the target structure and density gradients. The 2D PIC simulations conducted by us provide a significant understanding of the approach.

Primary author: Prof. ZIGLER, Arie (Hebrew University)

Co-authors: Mr SCHLIEFER, Elad (Hebrew University); Dr BUTTON, Mordehai (Hebrew University of Jerusalem); Dr HENIS, Zohar (Hebrew University of Jerusalem)

Presenter: Prof. ZIGLER, Arie (Hebrew University)

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