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Laser-driven ion acceleration using truly mass-limited targets

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Results on experiments on laser driven ion acceleration will be presented, which have been carried out at the IOQ in Jena, either with the 40-TW Ti:Sapphire system JETI or with the fully diode pumped, 100-TW POLARIS system. First, experiments on truly mass-limited targets will be presented, which have used water droplets of few- μm diameter showing a clear modulation of the protons' energy spectrum. Furthermore, experimental results on the first application of mass-limited, cryogenically cooled, solid-hydrogen targets will be presented, which show for the first time a significant enhancement of conversion efficiency and the clear formation of non-thermal features in the spectrum, which can be explained by means of 2D PIC simulations. Finally, experimental results using nm-thin foils and frequency doubled, ultra-high contrast pulses from POLARIS will be presented. Here, clear signatures of acceleration both by the radiation pressure (RPA) and via target normal sheath acceleration TNSA can be distinguished in the protons' beam profile and spectrum. Details of the physics underlying the interaction process will be discussed using numerical simulations and an outlook for the future program on ion acceleration in Jena will be given.

Primary author: Prof. KALUZA, Malte (University of Jena, Helmholtz-Institute Jena)

Presenter: Prof. KALUZA, Malte (University of Jena, Helmholtz-Institute Jena)

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