

## Laser-driven ion acceleration for High-Energy-Density-Physics

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### Abstract

Research on Laser ion acceleration for High-Energy-Density-Physics requires to investigate the laser - generation of bright ion sources, the dynamics of these sources in plasma focusing devices and the measurement of plasma heating induced by these proton beam sources in solid materials as well as in shock-compressed plasmas.

Applications range from the determination of the equations of state for high-energy density plasmas to understand the extreme conditions in the interior of giant planets, to the determination of stellar opacities and to Ion-driven Fast Ignition Inertial Confinement Fusion research.

In this work we will present the study of proton beam generation with multi-kJ, multi-beamlet, Peta-Watt laser irradiation, demonstrating that multiple, coherent beamlets interfering in the laser focus dramatically increase the laser energy absorption into hot electrons and ions.

We will subsequently present the dynamics of these ion sources in focusing plasma devices, and demonstrate that the dynamics is dominated by return current generated magnetic fields.

Finally, we will present results from a preliminary experiment of ion-induced heating in mid-Z material, the first of the kind conducted in Japan.

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