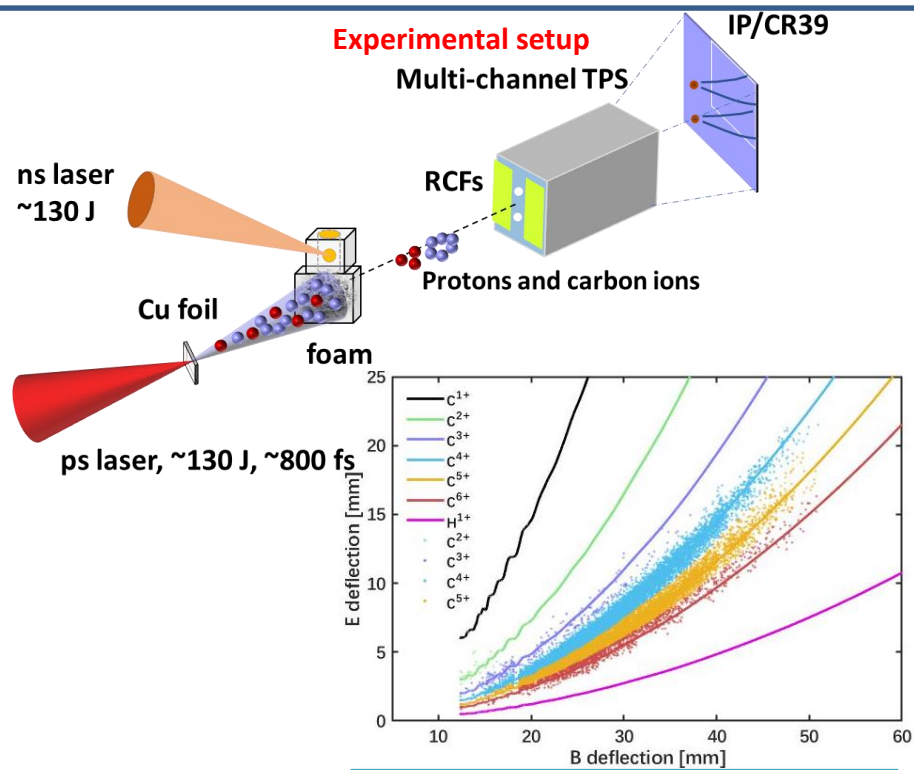


Charge state evolution of laser-accelerated carbon ions in dense ionized matter: target density effect

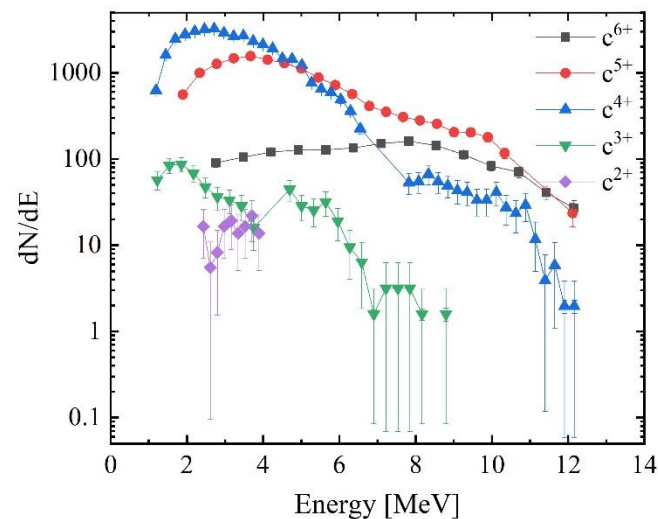
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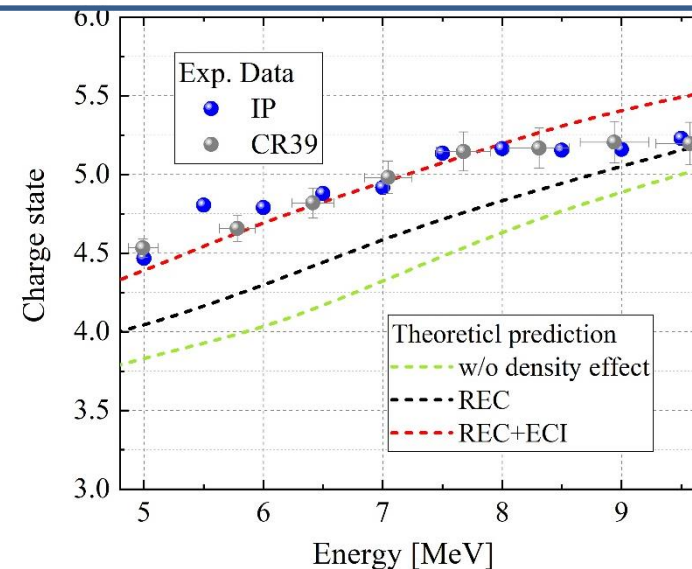
Introduction: The charge state evolution of heavy ion in plasma is of fundamental importance for alpha particle self-heating, ion driven HEDP, astro-observation explanation, plasma stripper and laser acceleration technology. We experimentally measured the charge state distribution of laser-accelerated carbon ions passing through the dense ionized matter with XGIII laser facility. The well-defined and quasi-static dense ionized target with $T \sim 17$ eV and $n_e \sim 4 \times 10^{20} \text{ cm}^{-3}$ is produced by irradiating a Tri-Cellulose Acetate (TCA) foam sample with soft X-rays from a ns-laser-heated hohlraum.



Thomson parabola spectra of carbon ions passing through the plasma



The energy spectra of carbon ions passing through the plasmas



Comparison between the measured Z_{average} with predictions solving the rate equations.

The effective charge state of ion in dense plasma is supposed to be higher than that in low-density-plasma cases, because the electron capture rate could be reduced (REC), and the coulomb ionization rate could be enhanced (ECI). Our result experimentally demonstrated that the target density effect play an important role in plasmas with electron density of about $4 \times 10^{20} \text{ cm}^{-3}$.