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Bulk ion Acceleration in the Light-Sail regime, studied by ion and neutron spectroscopy

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The rapid progress in laser technologies has led to an increasing interest in ion acceleration due to the reduced costs and compactness in comparison with conventional accelerators. Among other mechanisms, Radiation Pressure Acceleration, particularly LightSail regime, has drawn significant attention due to its ion energy and efficiency scaling. RPA relies on the target remaining reflective for the pulse duration for the exchange of momentum to happen, whereas ultrathin targets are prone to premature transparency for several reasons. We report on the extension of the LS regime to ultrathin, lowdensity targets by using multilayer targets, preventing relativistic transparency. Significantly narrow_band spectral features at high deuteron energies (central energy ~15MeV) were produced by lowering the target thickness to hundreds of nm, in agreement with LS mechanism. Where further reduction in thickness led to a significant spectral broadening of those peaks, using a thin layer of highZ material enabled reasserting the bunched acceleration of bulk ions. Such acceleration was not only studied using traditional Thompson parabola spectrometers, but also characterized using neutron spectroscopy. Since neutrons'flux, angular distribution and spectrum solely depend on the parent ion_beam characteristics, neutron spectroscopy feedbacks information extremely difficult otherwise to measure.

Primary authors: Mr ALEJO, Aaron (Queen's University of Belfast); Dr KAR, Satyabrata (Queen's University Belfast)

Presenter: Mr ALEJO, Aaron (Queen's University of Belfast)

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