# Acceleration of ions from ultra-thin foils and neutron generation

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Laser-driven ion acceleration has attracted significant attention over the past decade due to its reduced size and cost with respect to conventional accelerators [1]. In particular, the acceleration of deuterium ions is of importance for fusion studies, as well as the generation of neutron sources, with applications in science, industry, healthcare, and security. In this context, Radiation Pressure Acceleration (RPA) is emerging as an appealing mechanism, with the potential to be extremely efficient with laser intensities beyond $10^{21}$ W cm$^{-2}$. Particularly interesting is the Light Sail (LS) regime of RPA [2], in which the laser propels forward the irradiated portion of an ultra-thin target, leading to efficient acceleration of ions in a narrow spectral bandwidth and divergence cone.

A key requirement for efficient LS acceleration is to maintain the integrity of the ultra-thin target over the duration of the laser pulse. Here we present a possible route to avoid premature termination of LS acceleration from ultra-thin foils, achieved by adding a high-Z surface layer[3]. The stabilisation is investigated experimentally by simultaneous ion and neutron spectroscopy, and is demonstrated not only by the narrow-band ion spectra, but also by an abrupt (order of magnitude) increase in fast neutrons from the deuterium plasma layer. Highly beamed fast neutrons at fluxes exceeding $10^9$ n/sr above 2.5 MeV were produced from the ultra-thin (100*s* of nm) CD foils at optimum conditions. The neutron flux recorded exceeds by more than an order of magnitude the isotropic flux measured from thicker CD targets under similar interaction conditions, explained as a signature of plasma layer integrity during the acceleration.

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