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Prediction of laser-induced breakdown in sub-micron-thick dielectric targets for laser-ion acceleration

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In laser-ion acceleration experiments, the rising flank of a high power laser pulse can cause target pre-ionization and subsequent pre-expansion long before the arrival of the main laser peak. Exact knowledge of this target pre-expansion is required in order to understand laser-plasma acceleration mechanisms with the help of numerical simulations. For dielectric targets, the start of target pre-expansion is characterized by the point in time at which the target undergoes laser-induced breakdown (LIB).
In this contribution, we present a recently published method to determine the time of LIB in sub-micron-thick Formvar targets during interaction with a specific high-power laser pulse [1]. The required pulse-duration-dependent LIB threshold of Formvar is measured in a dedicated experiment. A comparison of LIB threshold to previously published data facilitates an empirical LIB scaling for other wide-band-gap dielectric materials used as targets in laser-ion acceleration experiments.

[1] S. Assenbaum et al 2025 Plasma Phys. Control. Fusion 67 015032

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