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High-Intensity Laser Experiments on Nanoplasmonic Ion Acceleration and Fusion

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High-intensity femtosecond laser irradiation of plasmonic nanostructured polymer targets, including boron-containing thin foils, has been investigated to explore resonant plasmonic field enhancement for improving the efficiency of laser-driven ion acceleration and aneutronic fusion. Experiments conducted at the Wigner Research Centre for Physics and ELI-ALPS aimed to demonstrate enhanced proton/ion energies and increased p-B fusion yield via plasmonic effects. Comprehensive diagnostics utilizing Thomson parabola spectrometry, CR-39 track detectors, and alpha particle detectors were employed to simultaneously characterize the accelerated ion spectra and fusion-generated alpha particles, confirming plasmon-assisted fusion reactions. These results contribute to the development of compact laser-driven fusion sources for potential applications in fusion energy and medical research, while also establishing a versatile platform for investigating plasmonics in strong-field physics.

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