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Title

Tunable laser plasma accelerator based on longitudinal density tailoring

Source

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Abstract

Laser plasma accelerators(1) have produced high-quality electron beams with GeV energies from cm-scale devices(2) and are being investigated as hyperspectral fs light sources producing THz to gamma-ray radiation(3-5), and as drivers for future high-energy colliders(6,7). These applications require a high degree of stability, beam quality and tunability. Here we report on a technique to inject electrons into the accelerating field of a laser-driven plasma wave and coupling of this injector to a lower-density, separately tunable plasma for further acceleration. The technique relies on a single laser pulse powering a plasma structure with a tailored longitudinal density profile, to produce beams that can be tuned in the range of 100-400 MeV with per-cent-level stability, using laser pulses of less than 40 TW. The resulting device is a simple stand-alone accelerator or the front end for a multistage higher-energy accelerator.