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Effects of pulse shape and plasma density on laser propagation in laser-driven wakefield accelerators

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The driving laser pulse in a plasma wakefield accelerator experiences changes in the longitudinal energy distribution due to refraction, depletion, photon (de)acceleration and group delay dispersion. These processes are highly dependent on the plasma wave structure, which in turn depends on the laser energy distribution. Here, we present models to describe the evolution of the temporal laser profile and experimental measurements of depletion and pulse compression. This process is shown to be highly dependent on the initial pulse shape, which therefore has a dramatic effect on the electron beams produced by the accelerator.

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