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Overcoming the laser wakefield acceleration dephasing limit using multiple driver pulses[1] JAMES SADLER, Los Alamos National Laboratory, CHRISTOPHER ARRAN, University of York, HUI LI, KIRK FLIPPO, Los Alamos National Laboratory — The electric field in laser-driven plasma wakefield acceleration is orders of magnitude higher than conventional radio-frequency cavities, but the energy gain is limited by dephasing between the ultra-relativistic electron bunch and the wakefield, which travels at the laser group velocity. We present a way to overcome this limit within a single plasma stage, by using a train of laser pulses in a modulated density profile. This creates a succession of acceleration sections, where the pulses' wakefields combine constructively, and non-resonant drift sections, where the wakefield disappears and the electrons rephase. In a two-dimensional particle-in-cell simulation, electrons were accelerated to over three times the energy obtained from a uniform plasma. Minimising laser depletion limits the scheme to sub-relativistic laser intensities.

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