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MeV-scale Dielectric Laser Acceleration

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Dielectric Laser Accelerators (DLAs) have been shown to produce GeV/m acceleration gradients and therefore the potential to shrink commercial accelerators to the cm scale. However, increasing energy gain requires multi-mm interaction lengths, which has previously been limited by dephasing. Progress in optical techniques has made controlling the phase in optical pulses common and available in scientific laboratories. Here we show that applying a liquid-crystal-mask in combination with a pulse front tilt enables the implementation of coherent control on a simple dual grating laser accelerator. Such nearly limitless live-tuning capability for the accelerator enable software-based correction of structure and optical system imperfections, implementation of transverse focusing schemes, control of the output electron beam energy and number of particles accelerated, ultimately maximizing the interaction length for up to 0.5 MeV energy gain.

Working group

invited speaker

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