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Geometric optimization of Dielectric Laser Accelerator (DLA) through PIC simulations

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The quest to realize a particle accelerator on a chip has led to the emergence of dielectric laser accelerators (DLAs). DLAs have the capability of sustaining accelerating gradient in ~ GV/m using the grating-shaped dielectric microstructures. The geometry of these microstructures is one of the decisive features to affect the acceleration gradient and energy gain. Here we present an optimization study to compare the performance of different geometrical configurations of dielectric microstructures through particle in cell (PIC) simulations. Assuming an electron beam with energy of 1 MeV traversing dielectric microstructures, excited by a laser with wave length of 1.93 μm, pulse length of 100 fs and electric field of 1 GV/m, we show that even with the same grating parameters, the designed shape/structure plays a crucial role in enhancement of energy gain.

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