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Indirect imaging of optical near-fields in dielectric laser accelerators

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Dielectric Laser Accelerators (DLAs) have undergone extensive theoretical and experimental study recently. For all applications of DLAs, the laser-generated near field pattern strongly influences the potential quality of electron beams traversing the DLAs. Although these fields are well understood theoretically and numerically, they have not been observed experimentally. To do so, we use ultrafast electron microscopy to image the spatial dependent energy modulation of electrons propagating through DLA near-fields. This allows for an indirect measurement of the electromagnetic near fields at silicon nano structures. This is achieved in a laser triggered transmission electron microscope (TEM) that provides sub-ps time resolution combined with spectrally resolved imaging typically used for PINEM studies. We report on findings from this experimental study and their comparison to numerical simulations.

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