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Laser acceleration of electrons at a dielectric structure – from novel accelerator technology to ultrafast measurement devices

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In free space, efficient momentum transfer over an extended distance between an oscillating field and a massive charged particle is impossible. With a proper boundary, this notion does not hold any longer. We have recently shown that electrons can be continuously accelerated with laser light at a dielectric grating structure. With low-power femtosecond laser pulses at 800 nm we could accelerate non-relativistic 30-keV electrons with a gradient of 25 MeV/m. With relativistic electrons and similar parameters, the acceleration gradients will exceed 1 GeV/m. We will present the underlying physics, will show the details and results of this proof-of-concept experiment, and will sketch potential applications and devices resulting from dielectric laser-based acceleration and control schemes.

Summary

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