Optimized operation of dielectric laser accelerators: Multibunch

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We present a self-consistent analysis to determine the optimal charge, gradient, and efficiency for laser driven accelerators operating with a train of microbunches. Specifically, we account for the beam loading reduction on the material occurring at the dielectric-vacuum interface. In the case of a train of microbunches, such beam loading effect could be detrimental due to energy spread, however this may be compensated by a tapered laser pulse. We ultimately propose an optimization procedure with an analytical solution for group velocity which equals to half the speed of light. This optimization results in a maximum efficiency 20% lower than the single bunch case, and a total accelerated charge of 10^6 electrons in the train. The approach holds promise for improving operations of dielectric laser accelerators and may have an impact on emerging laser accelerators driven by high-power optical lasers.

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