Abstract Submitted
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Non-stochastic electron acceleration in relativistic multipicosecond laser-solid interaction[1] KATHLEEN WEICHMAN, University of California, San Diego, ALEXANDER ROBINSON, STFC Rutherford Appleton Laboratory, UK, FARHAT BEG, ALEXEY AREFIEV, University of California, San Diego — Understanding the mechanisms by which relativistic multipicosecond laser pulses incident on solid density targets produce high energy electrons is of fundamental importance for applications of picosecond laser-plasma interactions. We elucidate a potential route to non-stochastic electron acceleration in the underdense ion shelf and opaque plasma wall preplasma profile formed by such pulses. In 1D particle-in-cell simulations, electrons gain energy on a single-bounce trajectory consisting of backward acceleration along the shelf, bounce past the shelf edge, and forward acceleration into the wall. We find that the direct laser acceleration of electrons during forward propagation corresponds to a high energy, non-stochastic regime of electron acceleration in counter-propagating laser pulses made accessible by the pre-acceleration of electrons during backward propagation. Backward energy gain is dominated not by the evolving electrostatic potential, as previously proposed, but by direct laser acceleration in the reflected laser pulse. Furthermore, the observed pre-acceleration is in principle sufficient to enable the final electron energy to exceed the maximum energy attainable from stochastic heating. [arXiv:1906.11975]

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