Abstract Submitted
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Cascade Acceleration of MeV Electrons During Intense Femtosecond Laser-Nanometer Foil Transparency.[1] PRASHANT SINGH, F. LI, A. JUNGHANS, A. FAVALLI, R. REINOVSKY, C. HUANG, S. PALANIYAPPAN, Los Alamos National Laboratory, A. MOREAU, R. HOLLINGER, C. CHASE, S. WANG, Y. WANG, J. ROCCA, Department of Electrical and Computer Engineering, Colorado State University, Fort Collins — TV/m electric fields present in focus of intense short-pulse laser has the potential of accelerating electrons to ultra-relativistic energy. Despite its merit in boosting electron energy, experimental demonstration of direct electron acceleration to 10's MeV energy by laser field, however, remains elusive. We demonstrate the two-stage acceleration of electron during a 40 fs, second-harmonic, high-contrast ($>10^{-12}$), relativistic intense laser pulse irradiating 5 - 20 nm thin foils. For thin foils undergoing relativistic transparency, electrons at the target front surface are first heated by the radiation pressure of incident laser pulse. This is followed by electrons gaining additional energy while co-moving with the transmitted laser field. The extent of electron heating showed a strong dependence on the fraction of transmitted laser field. The spatial profile of electron beam also shows an annular profile due to the ponderomotive force from the laser pulse. PIC simulation reproduced the experimental results and reveals the detailed mechanism of electron gaining momentum in the transmitted laser field.

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