Abstract Submitted
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Electron Acceleration by High Intensity Lasers at Sharp Matter Interfaces[1] J. MAY, J. TONGE, W.B. MORI, UCLA, F. FIUZA, R. FONSECA, L. SILVA, GoLP/IPFN, IST, C. REN, University of Rochester — A key question in the fast ignition approach to nuclear fusion is how electrons are accelerated at a light-plasma interface by very intense lasers. To investigate this, we use the PIC code OSIRIS to model the interaction of high intensity lasers ($I>=5x10^{19}$ W/cm^2) with a sharp boundary of an over-critical plasma ($n>>n_c$). We find that, for these experimental parameters, none of the commonly proposed absorption mechanisms – i.e., inverse Bremsstrahlung, JxB, Brunel heating – can account for the spectrum of forward accelerated electrons. Instead, we propose a mechanism in which these electrons thermally exit the plasma, resonantly interact with the incoming and reflected laser light within a quarter wavelength of the surface, and then turn back into the plasma - gaining in the process up to twice the quiver velocity. Electrons must leave the plasma at high energies, specific angles, and in phase with the laser wave in order to be accelerated. This mechanism is confirmed by 2D OSIRIS simulations with particle tracking, as well as from the results of a 1D numerical imposed field model.

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