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On the role of electrostatic potential well on electron acceleration in pre-plasma[1] BOOSHAN PARADKAR, SERGEI KRASHENINNIKOV, FARHAT BEG, UCSD — Recent experiments have shown that the presence of a pre-formed plasma in front of a solid target, produced due to the laser pre-pulse, results in a strong increase of both averaged and maximum energies of electron beam generated due to the interactions of main laser pulse with the target (e.g. see Ref.1). Moreover, these energies can greatly exceed corresponding ponderomotive scaling. This can be very beneficial from the point of view of the generation of energetic ($\sim$100 MeV) proton beams. However, until very recently the underlying physical mechanism of electron heating enhancement caused by pre-plasma was not clear. Numerical simulations reveal the formation of deep asymmetric electrostatic potential well in the pre-plasma region [2]. This potential well is formed due to strong electron heating caused by the synergistic effect of electron interactions with laser and potential well [3], which resembles the Fermi acceleration mechanism. In this work we describe the electron heating mechanism, physics of the formation of electrostatic potential well, and present the scaling for maximum electron energy, which can be gained due to synergistic effect of electron interactions with laser field and potential well in pre-plasma.

[1] T. Yabuuchi, et al., PoP **17**, 060704 (2010); [2] B. S. Paradkar, et al., PRE **83**, 046401 (2011); [3] B. S. Paradkar, S. I. Krasheninnikov, and F. N. Beg, PoP **19**, 060703 (2012).

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