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High field gradient for electron acceleration and ultra-short electron pulse formation ALEXANDER POKROVSKY, ALEXANDER KAPLAN, Johns Hopkins University — We explore a possibility of strongly inelastic scattering and large energy exchange between the tightly focused laser and electron beams in the "transverse" geometry, whereby the beams propagate normally to each other. In the most basic configuration of the laser standing wave we demonstrate that multi-MeV electron acceleration per pass is attainable, if the field has large spatial gradient along the direction of electron motion. The electron motion in this case is relativistic, and the energy gain or loss can be retained by an electron with very high efficiency. The proposed scheme may provide enormous ~ 0.1 TeV/cm acceleration gradient. We also show that the transverse electron and laser beam configuration can cause strong temporal electron focusing resulting in formation of ultra-short electron bunches. Such a system has a potential to operate as a full-switch laser gate for electrons, a new base element of a free-electron laser and laser electron accelerators.

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