Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Colliding laser pulses for enhancing proton acceleration in thin foils[1] JULIEN FERRI, Chalmers University of Technology, EVANGELOS SIMINOS, University of Gothenburg, LAURENT GREMILLET, CEA, DAM, DIF, TNDE FLP, Chalmers University of Technology — Despite having been the most commonly used accelerating method for protons in laser-matter interaction for the past decades, target normal sheath acceleration (TNSA) still produces proton beams whose energy is not high-enough for many interesting applications, in particular due to the poor scaling of their maximum energy with the laser energy. In this contribution, we describe a modified TNSA scheme, in which two laser pulses are simultaneously incident on a solid target with opposite angles. Based on 2 and 3-dimensional simulations with the EPOCH Particle-In-Cell code, we show that this setup leads to a doubling of the proton energy and a strong enhancement of the proton number compared with using a single pulse with the same total energy. This is explained by a much more efficient hot-electron generation, due to a combined effect of the increased electric field in the standing wave in front of the target and the modification of the relative phases of the electric and magnetic fields. This physical process remains valid for a large range of incident angles, which should lead to straightforward implementation in experiments. Finally, we show that this concept remains valid when applied to ultra-thin targets in the relativistic self-induced transparency regime.

[1]Supported by the ERC (ERC-2014-CoG grant 64712), the KAW Foundation, and the Swedish Research Council, Grant No. 2016-05012.

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Date submitted: 27 Jun 2019 Electronic form version 1.4