Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Dynamics of laser driven proton beams exhibited by experimentally determined laser absorption and reflection JIANHUI BIN, KLAUS ALLINGER, Ludwig-Maximilians-University Munich, KONSTANTIN KHRENNIKOV, Max-Planck-Institute of Quantum Optics, PAUL BOLTON, JOERG SCHREIBER, Ludwig-Maximilians-University Munich — Plasma expansion driven by irradiation of targets by intense laser pulses has attracted scientific interest for decades; especially with laser intensities beyond the threshold for heating electrons to relativistic energies ($>1.37*10^{18}$W/cm^2). Expansion velocities of at least ten percent of the speed, yield tens of MeV ion kinetic energies. Improving our understanding of the physics of ion acceleration is crucial for its various potential applications. Here we show the experimental investigation of proton acceleration from nanometer thin foils with intense laser pulses. We analyzed the laser absorption by parallel monitoring laser transmissivity and reflectivity with different laser intensities when moving the targets along the laser axis. A direct correlation between laser absorption and maximum proton energy is observed. Experimental results are interpreted via analytical estimation, exhibiting a coexistence of plasma expansion and radiation pressure acceleration (RPA) mechanisms in the whole proton acceleration based on the measured laser absorption and reflectivity. The result enhances understanding of the underlying physics underlying laser-driven ion acceleration and can guide for further optimization.

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Date submitted: 07 Jul 2016 Electronic form version 1.4