Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Design of Laser Profile in Boosting the Energy of Monoenergetic Protons Accelerated by Radiation Pressure and Shielded Coulomb Repulsion TUNG-CHANG LIU, XI SHAO, CHUAN-SHENG LIU, MINQING HE, University of Maryland, College Park, BENGT ELIASSON, Ruhr-University Bochum, Germany, VIPIN TRIPATHI, Indian Institute of Technology, India, JAO-JANG SU, University of Maryland, College Park, JYHPYNG WANG, SHIH-HUNG CHEN, National Central University, Taiwan — Laser radiation pressure acceleration is considered as an effective method in obtaining monoenergetic ions with high energy. By irradiating a laser beam on a multi-species target made of carbon and hydrogen, the proton layer can be accelerated by radiation pressure and shielded Coulomb repulsion successively. The shielded Coulomb repulsion provided by the left-behind electron-carbon layer can not only further accelerate the proton layer, but also keep the proton layer stable for a long time. The acceleration time of quasi-monoenergetic protons by the combined mechanisms is extended over ten times longer compared to the case of applying single-species targets and using radiation pressure acceleration alone. 60 MeV of quasi-monoenergetic protons from a multi-species foil with input laser power of 70 TW is obtained, which is at least five times greater than the energy obtainable from pure hydrogen targets. In order to reach 100 MeV with the same laser power, we studies different designs of input laser profiles to further boost the energy outcome, and an improvement of at least 20% energy enhancement is achieved. An analytical approach to interpret and optimize the results is also studied.

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Date submitted: 13 Jul 2012 Electronic form version 1.4