Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Laser Acceleration of Ultra-thin Multi-Ion Foil: Accelerating Quasi-Monoenergetic Proton Beam by Combination of Radiation Pressure and Heavy-Ion Coulomb Repulsion CHUAN-SHENG LIU, TUNG-CHANG LIU, XI SHAO, BENGT ELIASSON, MIN-QING HE, JAO-JANG SU, GALINA DUDNIKOVA, ROALD SAGDEEV, University of Maryland, College Park, Maryland 20742, USA — Using ultra-thin proton-carbon foils, we found a critical ratio of proton/carbon concentration, below which there is a self-organized triple layer of electrons, protons and carbons. Because of its smaller charge-to-mass ratio, the protons layer is accelerated by the RPA in the front of the carbon layer. When the electron layer becomes transparent due to the Rayleigh-Taylor instability, laser energy leaks out and the radiation pressure can no longer accelerate the electron layer, thus stopping the acceleration of proton layer. However, the Coulomb repulsion by the carbon layer continues to accelerate the proton layer, sustaining a quasi-mono energetic prtoton spectrum. Using a normalized peak laser amplitude of a = 5 and a carbon-proton target with 10% protons, our PIC simulation shows that the combined acceleration of the proton layer by radiation pressure and Coulomb repulsion can last as long as 60 laser periods, and the resulting quasi-monoenergetic (less than 10% energy spread) proton energy is $\sim$ 70 MeV.

Xi Shao
University of Maryland, College Park, Maryland 20742, USA

Date submitted: 15 Jul 2011 Electronic form version 1.4