Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Laser acceleration of monoenergetic protons via a double layer emerging from an ultra-thin foil[1] BENGT ELIASSON, Ruhr-University Bochum, Germany, CHUAN S. LIU, XI SHAO, ROALD SAGDEEV, University of Maryland, College park, MD, PADMA K. SHUKLA, Ruhr-University Bochum, Germany, GALINA DUDNIKOVA, T.C. LIU, University of Maryland, College park, MD — Theoretical and numerical studies are presented of the acceleration of monoenergetic protons in a double layer formed by the laser irradiation of an ultra-thin film. The ponderomotive force of the laser light pushes the electrons forward, and the induced space charge electric field pulls the ions and makes the thin foil accelerate as a whole. A stable double layer is formed, in which the ions are trapped by the combined electric field and inertial force in the accelerated frame, together with the electrons that are trapped in the well of the ponderomotive and ion electric field. The trapped ions reach monoenergetic energies up to 100 MeV and beyond, making them suitable for cancer treatment. We present an analytic theory for the laser-accelerated ion energy as a function of the laser intensity, foil thickness and the plasma number density. The underlying physics of the trapped and untrapped ions and of the stabilization of the Rayleigh-Taylor instability are discussed.

[1]This work was partially supported by the DFG through the Research Unit 1048 and by the Swedish Research Council (VR).

Bengt Eliasson
Ruhr-University Bochum

Date submitted: 13 Jul 2009

Electronic form version 1.4