Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Ion acceleration during isothermal expansion of plasma slab into vacuum EVGENY GOVRAS, VALERY BYCHENKOV, Lebedev Physics Institute, Moscow, Russia — The interaction of short intense laser pulses with solid targets allows record-breaking ion energies to be attained at the laboratory scale. Quasineutral plasma outflow and the regime of plasma expansion with charge separation effects in collisionless isothermal expansion of a semi-bounded plasma have been theoretically studied in great detail. However, at high electron energy (temperature) the model of semi-bounded plasma becomes inapplicable as far as the electron Debye length, λ_{D_e} approaches the foil thickness, L. Also, analytically well studied regime of ion acceleration from plasma foil is the Coulomb explosion. Going beyond previous studies we have developed a theory of plasma slab expansion into a vacuum where the electrons follow Boltzmann distribution with an arbitrary temperature. The electron temperature, T_e, is a controlling parameter of our theory and matches laser intensity. By increasing T_e $(0 < T_e < \infty)$ our theory smoothly switches from the quasineutral expansion approach to the Coulomb explosion limit. We derived both space-time and spectral characteristics of the accelerated ions for arbitrary T_e. In the limits $\lambda_{D_e} < L$ or $\lambda_{D_e} \gg L$ our theory agrees with known results.

Wojciech Rozmus
University of Alberta

Date submitted: 12 Jul 2013 Electronic form version 1.4