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Laser Proton Acceleration by Radiation Pressure and Its Scaling CHUAN LIU, T.C. LIU, X. SHAO, J.J. SU, BENGT ELIASSON, V.K. TRIPATHI, GALINA DUDNIKOVA, ROALD Z. SAGDEEV, East West Space Science Center, University of Maryland — The search for mono-energetic protons are always of great interests, both for science and for many applications, among the medical therapy of cancer and fast ignition of laser fusion. Radiation Pressure Acceleration (RPA) of quasi-monoenergetic protons by illuminating an ultra thin foil (thickness < wavelength) with a short pulse, intense laser has been actively studied. RPA is the radiation pressure acceleration of the whole foil trapping protons in it or equivalently a "light sail." In this paper, we present analytical modeling and PIC simulation of the scaling of proton energy by RPA of ultra thin foil. By defining the monoenergetic proton as having sufficiently small energy spread in PIC simulation, we studied the proton mono-energy profile as a function of the laser power and peak intensity, thickness of the thin foil and target density. We found that the Rayleigh-Taylor (R-T) instability plays significant role in increasing the energy spread of accelerated protons. The simulation results are able to provide experimentalists with optimal scaling for instability avoidance and optimal ion acceleration.

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