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Relativistic Rayleigh Taylor Instability of Radiation Pressure Driven Foil T.C. LIU, CHUAN LIU, VIPIN K. TRIPATHI, X. SHAO, BENGT ELIASSON, J.J. SU, ROALD Z. SAGDEEV, East West Space Science Center, University of Maryland — Laser acceleration of protons has drawn vigorous attention due to their application in cancer treatment and other areas. The scheme that has emerged very promising for the generation of mono-energy ions is the Radiation Pressure Acceleration (RPA) of laser illuminated thin foils. A circularly polarized laser impinged on a submicron thick foil of overdense plasma exerts a ponderomotive force on electrons, pushing them forward and producing a space charge separation. The electric field created by this charge distribution accelerates the ions while the electrons are driven by the difference of radiation pressure force and space charge force. The entire foil is then accelerated stably in a double layer mechanism. The foil can only be accelerated until that Rayleigh-Taylor Instability (RTI) becomes a dominant factor and decomposes the foil into separate cusps. We present RTI mechanism as a single fluid model, by calculating the ponderomotive force of the input pulse in a relativistic circumstance and demonstrating that RTI will force the foil to form cusps after a few waveperiods, preventing the energy gain of monoenergetic ions to increase endlessly. By defining a proper saturation time while the cusps form, we show the scaling of the maximum energy gain to the input pulse amplitude. Comparison with 2D PIC simulation are also presented.

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