

Ion acceleration in the RPDA regime

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Abstract

The radiation pressure exerted by an ultra intense electromagnetic pulse on a quasi-neutral plasma foil is a very efficient acceleration mechanism capable of providing ultrarelativistic ion beams. In this acceleration (**R**adiation **P**ressure **D**ominant **A**cceleration) regime the ions move forward under the push of the pulse pressure with almost the same velocity as the electrons and thus have a kinetic energy well above that of the electrons.

A fundamental feature of this acceleration process is its high efficiency, as the ion energy per nucleon turns out to be proportional in the ultrarelativistic limit to the electromagnetic pulse energy.

In this presentation we will review two recent investigations:

- 1) the acceleration of sub-wavelength, solid-density plasma foils by the ultraintense radiation pressure of circularly polarized laser pulses accounting for nonlinear self-induced transparency effects¹,
- 2) the possibility of enhancing the energy of the accelerated ions by a transverse expansion of the thin target. The expansion decreases the number of accelerated ions in the irradiated region increasing the energy and the longitudinal velocity of the remaining ions. In the relativistic limit, the ions become phase-locked with respect to the electromagnetic wave, which is the indication of an unlimited acceleration².

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²S.V. Bulanov, E.Yu. Echkina, T.Zh. Esirkepov, I.N. Inovenkov, M. Kando, F. Pegoraro, G. Korn, *Phys. Rev. Lett.*, **104**, (2010);

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