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Effect of the plasma ion channel on self-focusing of a Gaussian laser pulse in underdense plasma

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Abstract

We have considered the self-focusing of a Gaussian laser pulse in unmagnetized plasma. High-intensity electromagnetic fields cause the variation of electron density in plasma. These changes in the special conditions cause the acceleration of electrons to the higher energy and velocities. Thus the equation of plasma density evolution was obtained considering the electrons ponderomotive force. Then, an equation for the width of laser pulse with a relativistic mass correction term and the effect of ion channel were derived and the propagation of high-intensity laser pulse in an underdense plasma with weak relativistic approximation was investigated. It is shown that the ratio of ion channel radius to spot size could result in different forms of self focusing for the laser pulse in plasma.

Keywords: relativistic plasma, self-focusing, gaussian laser pulse, width of laser beam, ion channel, ponderomotive force

For full article, refer to the Persian section