NONLINEAR INTERACTION OF EM WAVES WITH PLASMAS

By

Dharm Pal Singh

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Indian Institute of Technology, New Delhi

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TO MY MOTHER AND FATHER

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(DHARM PAL SINGH)

ABSTRACT

When a high power laser beam interacts with a plasma, several linear and nonlinear phenomena like resonant absorption, stimulated scattering, anomalous heating, harmonic generation, self-focusing, modulational and filamentation instabilities, nonlinear Landau damping, profile modification and other parametric instabilities play an important role. The occurence of lower values of nonlinear threshold for self-focusing has motivated the investigators for its detailed study. The transient setting of ponderomotive nonlinearity in a collisionless plasma has been studied and consequently the self-focusing of the pulse and the focusing of the plasma wave occurs; it has been concluded that the self-focusing of the pulse does not only depend on the instantaneous value of the pulse intensity but also on the previous history of the pulse. Thus the plasma wave excitation becomes a transient phenomenon. In contrast to the earlier studies on filamentation which consider the conditions for the growth of the filamentation for Gaussian beams, the dynamics of growth of a nonuniform ripple superimposed on the main beam has been analysed. The important conclusion is that the focusing of the ripple is determined by the parameters of the ripple as well as that of the main beam and also the phase difference between the electric

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