

INTERACTION OF INTENSE ELECTROMAGNETIC  
BEAMS WITH PLASMAS

by

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## ABSTRACT

The present thesis deals with some aspects of the interaction of intense electromagnetic (e.m.) beams with plasmas which has acquired prime importance because of its relevance to controlled thermonuclear fusion. In Chapter I, the possibility of confining a plasma in a rectangular waveguide excited in  $TE_{20}$  mode has been investigated. The principal idea is that because of the ponderomotive force or due to non-uniform heating, the plasma can redistribute itself to concentrate around intensity minima. In Chapter II, the spatial growth of small fluctuations in the intensity profile of a uniform plane e.m. wave that can break the plasma into filaments has been investigated. It is seen that the presence of magnetic field makes the plasma more prone to filamentation instabilities. In the field of laser induced fusion, the basic problem is of the efficient coupling of laser beam energy with the plasma. In a hot plasma, absorption takes place by conversion of e.m. waves into electrostatic waves which can suffer Landau damping and in turn heat the plasma. In the third and fourth Chapters, excitation of an upper hybrid wave and of a plasma wave in a magnetoplasma by a Gaussian e.m. beam has been investigated. The excitation of these electrostatic waves is highly nonuniform because of self focusing of the e.m. beam and is quite sensitive to magnetic field strength. In the last Chapter, the possibility of self focusing of e.m. beams in parabolic and non-parabolic semiconductor plasmas has been investigated when the dielectric function may have arbitrary nonlinearity.

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