INTERACTION OF INTENSE LASER BEAMS WITH PLASMAS

by

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SUMMARY

This thesis presents an investigation of the effect of the self-focusing of Gaussian laser beams on nonlinear third harmonic generation, Raman and Brillouin scattering, excitation of ion-acoustic wave at the beat frequency of two beams and the excitation of upper hybrid waves. The laser beams exert a ponderomotive force on the electrons, leading to ambipolar diffusion of the plasma particles. This modification in the plasma density significantly modifies the propagation characteristics of the various types of waves supported by the plasma. It has been shown that, besides the self-focusing of the laser beams, the plasma wave as well as the ion-acoustic wave can get focused. Consequently, the third harmonic power, the scattered power and the power of the excited electrostatic waves shows a periodic variation with the distance of propagation. The third harmonic power and the backscattered power are enhanced due to self-focusing but the ion-acoustic wave power decreases due to plasma depletion from the axial region. It is thus clear that self-focusing has a deleterious effect on laser driven fusion, in that, at moderate powers, scattering losses are increased and plasma heating due to the beating of two laser beams is decreased.

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