PARAMETRIC INSTABILITIES IN PLASMAS

by

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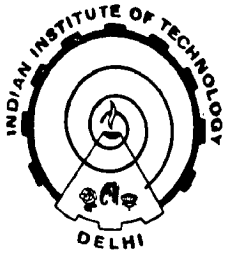

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SUMMARY

In the present thesis the author has studied the stimulated Raman and Brillouin scattering in magnetoplasmas when the pump is a Gaussian electromagnetic beam (Propagating in different modes for example ordinary mode, circularly polarized mode) and has shown that the spatial amplification factors and temporal growth rates are significantly differing from that of a uniform pump (within the W.K.B. and paraxial ray approximations).

The author has also studied the effect of a radially symmetric ripple superimposed on a Gaussian electromagnetic beam on wave excitation in magnetoplasma and also on Raman and Brillouin scattering in magnetized as well as unmagnetized plasmas. It is seen that these phenomena depend on the position of the ripple on electromagnetic beam and the phase angle between the ripple and the main beam. Some numerical calculations have been performed to show the effect of ripple on these phenomena explicitly.

In laser-plasma interaction experiments, short duration (pulse width of the order of nano seconds) laser pulsesare commonly used. When the pulse width (t_o) is comparable to the characteristic time of diffusion of the carriers across the pulse (τ_d), the steady state theories are no longer valid. Because when t_o and τ_d are comparable, the ponderomotive nonlinearity does not only

depend on the instantaneous intensity of the pulse but also on its back history. In this thesis the author has studied stimulated Raman and Brillouin scattering in an unmagnetized plasma when the pump is a high power Gaussian (in space and time) electromagnetic pulse.

The last part of the thesis consists of a study of the parametric decay instability of an ordinary plane electromagnetic wave in a magnetoplasma having ion temperature much greater than the electron temperature. It is shown that in such type of plasmas the wave can decay into an electrostatic upper hybrid wave and an electron acoustic wave. It is seen that the growth rate of the decay instability dominates over the decay into ion quasi mode decay at relatively lower pump powers. For the typical set of parameters of 2XIIB mirror machine the growth rate of this decay process comes out to be 3.87×10^4 sec^{-1}.

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