THz radiation generation by three-wave parametric coupling.

Himani Dewan*[1], M. Singh[2], R.Uma[3] and R.P Sharma[4].

[1-4]Centre for Energy Studies, Indian Institute of Technology Delhi, New Delhi 110016, India.

Email: (1) him20010@gmail.com , (2) monikaiitd09@gmail.com , (3) ruma@ces.iitd.ernet.in

(4)rpsharma@ces.iitd.ac.in .

Abstract

This paper discusses the generation of terahertz radiations via the parametric coupling of high power extraordinary (X-mode) laser beam with Trivelpiece-Gould (TG) mode and Kinetic Alfven Wave (KAW) in a magnetized plasma system. In this process, the nonlinear coupling between X-mode laser (ω_0) and TG mode (ω_1) produces KAW with frequency in terahertz range (THz). The X-mode laser beam exerts a ponderomotive force on the electrons, and imparts a nonlinear oscillatory velocity at beat frequency, $\omega_2 = \omega_0 - \omega_1$. A strong transient current is generated by the nonlinear coupling of laser velocity and TG density perturbation. The requisite phase matching condition is shown by modeling the parallelogram, which obeys the conservation of energy and momentum simultaneously. The coupling coefficients for the three wave interaction are derived and the growth rate of this decay instability is deduced. In this study, the extraordinary laser pump propagates in a direction which is perpendicular to the magnetic field.High dependency upon the applied transverse magnetic field is exhibited by the efficiency, power, beam quality, and the tunability of the present scheme. In summary, our dynamical model follows the progression of THz generation in an intense laser generated plasma by parametric three wave coupling .This scheme to generate THz radiation has momentous aftermath both theoretically and experimentally. We analytically developed model equations for the three interacting waves, along with growth rate for parametric decay instability.