ABSTRACT

In this dissertation, the spatial damping of electromagnetic waves is studied by employing the kinetic theory. In particular, spatial damping of right handed and left handed (R-L) circularly polarized waves, ordinary wave and extraordinary wave is discussed in collisionless plasmas by using the Maxwellian velocity distribution of electrons. In this analysis, we have taken the wave vector to be complex but the wave frequency as real, which contrasts to the customary approach in which the wave frequency is taken complex while the wave vector is real. A comparison is made between numerical and analytical results. For R-L waves, it is investigated that in the hot plasma spatial damping properties can be significantly different from the cold plasma. The possible reason is wave-particle interaction (cyclotron resonance) and higher order thermal effects. It is also shown that the response of plasma to the interacting electromagnetic wave shows the variety of changes in different frequency domains. For perpendicular propagating ordinary and extraordinary modes, the spatial attenuation is investigated by employing the numerical and analytical methods to unveil the complicated structure. The banded attenuation between the harmonics is theoretically investigated, which may have applications both for laboratory and space plasmas. Specifically we have examined how the imaginary wave vector is incorporated with the Poynting flux theorem for circularly polarized wave (CPW) in bi- kappa distributed plasma. We also noticed how the energy flux is affected when the parallel and perpendicular temperatures are different with respect to the direction of ambient magnetic field. It is found that the CPW transports its energy rapidly when the perpendicular temperature is larger than the parallel temperature to the background magnetic field. We also investigated how the wave delivers its energy rapidly over long distance for low values of kappa spectral index (κ). Thus the two parameters, temperature anisotropy and kappa index, control the transport of wave energy.