

Parallel propagating electromagnetic waves in multicomponent plasmas with observed non-Maxwellian distribution function

Muhammad Nouman Sarwar Qureshi (1) and Warda Nasir (2)

(1) Department of Physics, GC University, Lahore, Pakistan (nouman_sarwar@yahoo.com), (2) Department of Physics, Forman Christian College (A Chartered University), Lahore, Pakistan

Electron velocity distributions (EVDs) in the solar wind are frequently observed with dense core population superimposed by a hot superthermal 'halo' population. Such nonthermal distributions are generally fitted by considering core as Maxwellian and superthermal part by kappa distribution. However, at the bow shock and in the magnetosphere EVDs often exhibit flat tops at the low energies. In this paper, we present the Cluster observations of two component, a hot and cold EVDs from magnetosphere and fit them with generalized (r,q) distribution function which is the generalized form of the kappa and Maxwellian distribution functions and reduces to kappa and Maxwellian in limiting cases. The fitting shows a clear deviation of the observed distributions from the ideal Maxwellian or kappa distribution. We then employ (r,q) distribution function to derive the dispersion relation of right hand circularly polarized waves and studied the real frequency and growth rate of Whistler waves using the fitted values of the spectral indices r and q and the observed plasma parameters. Comparison of the numerical results is also given with Maxwellian results.