Kinetic model to interpret Whistler waves in multicomponent non-Maxwellian space plasmas

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Whistler waves are right handed circularly polarized waves and are frequently observed in space plasmas. The Low frequency branch of the Whistler waves having frequencies nearly around 100Hz, known as Lion roars, are frequently observed in magnetosheath. Whistler waves are generally observed in the frequency range, i.e. observations of at top electron distributions with single as well as two electron populations. In the past, lion roars were studied by employing kinetic model using classical bi-Maxwellian distribution function, however, could not be justi ed both on quantitatively as well as qualitatively grounds. We studied Whistler waves by employing kinetic model using non-Maxwellian distribution function such as the generalized (r, q) distribution function which is the generalized form of kappa and Maxwellian distribution functions by employing kinetic theory with single or two electron populations. We compare our results with the Cluster observations and found good quantitative and qualitative agreement between them. At times when lion roars are observed (not observed) in the data and bi-Maxwellian could not provide the su cient growth (damping) rates, we showed that when generalized (r, q) distribution function is employed, the resulted growth (damping) rates exactly match the observations. We compare our results with the Cluster observations and found good quantitative and qualitative agreement between them. In this paper, by deriving the general dispersion relation for R and L waves, we studied the Whistler waves with two electron temperature (r,q) distribution function. The numerical values of plasma parameters are taken from Cluster data and plot the whistler wave's real frequency and damping/growth.

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