

Abstract

The electrostatic potentials (Debye and wake) and energy loss due to a charged projectile propagating through an dusty plasma are derived employing kappa and generalized (r,q) velocity distributions for the Dust Acoustic Wave (DAW). It is found that these quantities in general differ from their Maxwellian counterparts and are sensitive to the values of spectral index, kappa in case of kappa distribution and to r, q in case of generalized (r,q) distribution. The amplitudes of these quantities are less for small values of the spectral index (kappa, r=0, q) but approach to the Maxwellian in the limit $\kappa \rightarrow \infty$ (for kappa distribution) and for r=0, $q \rightarrow \infty$ (for generalized (r, q) distribution). For any non-zero value of r, the potential and the energy loss grow beyond the Maxwellian results. The effect of kappa and generalized (r, q) distributions on potential and energy loss is also studied numerically and the results are compared with those of the Maxwellian distribution.

A generalized dielectric constant for the electron Bernstein waves using non-Maxwellian distribution functions is derived in a collisionless, uniform magnetized plasma. Using Neumann's series expansion for the products of Bessel functions, we can derive dispersion relations for both kappa and the generalized (r,q) distributions in a straight forward manner. The dispersion relations now become dependent upon the spectral indices κ and (r,q) for the kappa and the generalized (r,q) distribution respectively. Our results show how the non-Maxwellian dispersion curves deviate from the Maxwellian depending upon the values of the spectral indices chosen. Pure dust Bernstein waves are also investigated using non-Maxwellian kappa and (r,q) distribution functions. Dispersion relations for both distributions are derived considering waves whose frequency is of the order of dust cyclotron frequency and dispersion curves are plotted. It is observed that the propagation band for dust Bernstein waves is rather narrow as compared with the electron Bernstein waves. However the band width increases for higher harmonics, for both kappa and (r,q) distributions. Effect of dust charge on dispersion curves is also studied and one observes that with increasing dust charge, the dispersion curves shift toward the lower frequencies. Increasing the dust to ion density ratio causes the dispersion curve to shift toward the higher frequencies. Relevance of this work can be found in astrophysical dusty plasmas where non-Maxwellian distribution is present along with the dust particles.