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Development of a theoretical model using Kappa distribution and its application to study generation of KAWs

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A generalized theoretical model is developed using kinetic theory for non-thermal plasmas by assuming the drifting Kappa distribution, non-uniform steaming, velocity shear and temperature anisotropy. An extensive algebraic procedure in kinetic approach using Vlasov's equation will be discussed. A generalized dispersion relation is derived for this purely Kappa distribution without making any approximations or assumptions. From this, the expression for Kappa electron is obtained by expanding the dispersion function in the respective limit and solving the integrals present in the expressions. As a special case, a three component plasma model comprising of the cold background ions, hot electrons having kappa distribution and hot ion beams is considered for the generation of kinetic Alfvén waves (KAWs).The background ions and beam ions are considered Maxwellian and the ion beam is only allowed to have velocity shear and non-uniform streaming. A dispersion relation for the excitation of the kinetic Alfven waves (KAWs) from this model will be analyzed. How the Kappa electron is affecting the generation mechanism of the KAWs will be explored in detail. From the analysis, the more favorable condition for the excitation of KAWs in the presence of Kappa electron will be discussed. The effect of other plasma parameters like number density, propagation angle, temperature etc. on the excitation of KAWs will be examined. A comparative study of the results obtained from this model will be carried out with a plasma model having all the three species as drifting-Maxwellian. Further, the application of the model to some of the Earth's magnetospheric regions will be discussed and a comparison of the results with observations will be made.