Acoustic kappa-density fluctuation waves in suprathermal kappa function fluids

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Distributions in space plasmas are generally described by a Maxwellian. This type of distribution supports wave modes in which the various physical parameters: density, thermal speed and convection speed can all oscillate. However, space plasma distribution functions are not Maxwellian, but suprathermal, generally well-described by the kappa function. In this study, we adopt the point of view that the kappa function, rather than the Maxwellian, is the equilibrium distribution. Like the Maxwellian, the kappa function contains parameters representing density, thermal speed and convection speed. However, the kappa function also contains a parameter representing the prominence of the suprathermal tail. There appears to be no physical reason why wave-like behavior should be limited solely to density, thermal speed and convection speed. It seems reasonable, and indeed expected, that for suprathermal distributions there should be wave modes in which the suprathermal tail participates. We describe one such wave mode similar to the acoustic wave. This wave mode always propagates faster than the acoustic wave with an equivalent effective temperature and becomes the acoustic wave in the Maxwellian limit.