Kinetic theory of dust ion acoustic waves in a kappa plasma

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Using kinetic theory, we have carried out an investigation of linear dust ion acoustic waves in an unmagnetized collisionless plasma with kappa-distributed [1] electrons and ions, and Maxwellian dust grains of constant charge. We make use of the plasma dispersion function for arbitrary kappa [2, 3]. Both analytical and numerical results, the latter following from the full solution of the dispersion relation, are presented, and a detailed comparison is made over a range of plasma parameter values. Comparison is also made with the approximate results given for the damping by Lee [4]. In addition, numerical solution of the full dispersion relation is used to explore the effects of the spectral indices of the ions and electrons, and the species’ temperature and density ratios, on the damping of the waves.

References