Contribution of higher order correction to nonlinear dust acoustic soliton in dusty plasma with suprathermal ions

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From its beginnings with the initial observations of micron-sized particles in astrophysical1 and processing plasmas, the study of dusty plasmas has rapidly matured as highlighted in recent books. In fact, the ubiquitous presence of dust in the interstellar medium was recognized in the 1930s. Besides affecting the equilibrium quasineutrality condition and modifying the existing plasma wave spectra of an electron-ion plasma, charged dust grains also introduce new types of waves in a dusty plasma and are presumed to play an important role in many astrophysical plasmas. The dust particles are many orders of magnitude heavier than ions, are a source of ionization and recombination for electrons, and their charge is not fixed, but depends on local plasma parameters. Wave propagation in such complex systems is therefore expected to be substantially different from the ordinary two component plasmas and the presence of charged dust can have a strong influence on the characteristics of the usual plasma wave modes, even at frequencies where the dust grains do not participate in the wave motion. The most well studied of such modes are the so called dust-acoustic wave (DAW) and dust ion-acoustic wave (DIAW). Numerous observations clearly indicate the presence of suprathermal electron and ion structures as ubiquitous in a variety of astrophysical plasma environment [1], [2] and measurements of their distribution functions revealed them to be highly nonisothermal. [3] Such suprathermal populations may arise due to the effect of external forces acting on the natural space environment plasmas or to the wave-particle interaction, which ultimately leads to -like distributions. As a consequence, a high-energy tail appears in the distribution function of the particles. In this communication, our motive is to study the effects of both the higher order corrections and the suprathermality ions on the amplitude, width and velocity of dust acoustic soliton in an unmagnetized, collisionless dusty plasma containing dust grains, Maxwellian electrons and suprathermal ions.

[l] W.C. Feldman, J.R. Asbridge, J. Geophys. Res **78**, 2017 (1973).
[2] J.D. Scudder, E.C. Sittler, J. Geophys. Res **86**, 8157 (1981).
[3] M.V. Goldman, M.M. Oppenheim, Nonlin. Pro. Geophy **6**, 221 (1999).