Dust acoustic dressed solitons in dusty plasma in the presence of polarization forces

M. Benzekka[1], M. Tribeche[2]

[1]Faculty of Physics, Ecole Normale Superieure, ENS, kouba, Algeria

[2]Plasma Physics Group (PPG), Theoretical Physics Laboratory (TPL), Faculty of Physics, University of Bab-Ezzouar, USTHB, Algeria

Recently, low-temperature plasmas containing, in addition to electrons and ions, finite-sized highly charged particulate matter have been studied by many authors because of the frequent occurrence of such plasmas in space, astrophysical plasma environments and even laboratory. These dust particles are many orders of magnitude heavier than ions and source of ionization and recombination for electrons. 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. It has been found that the presence of static charged dust grains modifies the existing plasma wave spectra. Furthermore, dust dynamics introduces new eigenmodes, such as dust-acoustic mode[1], dust lattice mode[2] and dust Bernstein Greene Kruskal modes. Dust particles embedded in plasma are subject to various forces. Most likely, the electric force, which is a direct consequence of the charging of the dust particles. The electric force is mainly responsible for the confinement of the negatively charged particles in the positive plasma potential. Another force acting on the dust is the polarization force which results to the deformation of the Debye sheath around the particulates in the background of nonuniform plasmas. Solitary wave propagation in unmagnetized plasmas without the dissipation and geometry distortion can be described by Korteweg de Vries equation or Kodomstev Petviasville equation. Recent studies in certain regions of space such as Earth's mesosphere, Jupiter's magnetosphere, Cometary tail, etc. suggest that KdV or KP description do not match well with experimental observations. This leads a modification to amplitude and width of the solitons[3]. One such modification is followed using higher order perturbation corrections in velocity, amplitude and width of KdV solitons. This work aims is to study, in presence of polarization forces, small-amplitude dust acoustic dressed soliton in a three components plasma consisting of a Boltzmann distributed electrons and ions and dust grains. We show, by introducing the effect of fourth order nonlinearities of electric potential in Sagdeev potential approach, the existence, and possible realization of dressed acoustic soliton and compared the result with the soliton's exact solution.

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