SPHERICAL KP EQUATION FOR DUST ACOUSTIC WAVES WITH VARIABLE DUST CHARGE AND TWO TEMPERATURE IONS

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Nowadays, there has been a great deal of interest in understanding different types of collective processes in dusty plasmas, which are very common in laboratory and astrophysical environments**.** It has been found that the presence of charged dust grains modifies the existing plasma wave spectra, whereas the dust dynamics may even introduce new eigenmodes in the plasma. Due to their importance, the solitary waves in unmagnetized plasma without geometry distorsion and the dissipation effects have been extensively investigated and found to be described by the Kotweg-de Vries (KdV) equation or Kadomtesv-Petviashvili (KP) equation. However, recent theoretical studies indicates that the properties of solitary waves in bounded nonplanar spherical geometry differ from that in unbounded planar geometry [3]. It is now well known that the transverse perturbation (which always exist in the higher dimensional system) may not only introduce anisotropy into the system but also modify the structure and stability. The combined effects of both nonplanar geometry and the transverse perturbation on the DAWs have been considered by several authors. Indeed, in a recent investigation, the KP equation of dust acoustic waves for hot dust plasma has been reported with constant dust charge because it is easier to study. Although, in real case, the dust charge must be treated as a dynamical variable. On the other hand, special complex plasmas containing electrons, both negative and positive ions, as well as dust grains appear in most space and laboratory plasmas, particularly, in Earth's mesosphere plasmas the negative ions are often present [5]. Wang *et al* shown the presence of the negative ions can significantly reduce critical Mach numbers of the dust acoustic soliton wave. Therefore, in this paper, we study, the nonlinear dust acoustic waves in dusty plasmas with both negative and positive ions and the combined effects of bounded spherical geometry and the transverse perturbation as well as the variable charge of dust grains are studied. Using the perturbation method, a spherical Kadomtsev-Petviashvili (SKP) equation that describes the dust acoustic waves is deduced.