

Three-dimensional cylindrical Kadomtsev–Petviashvili equation in a dusty electronegative plasma

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Abstract.

The hydrodynamic equations of positive and negative ions, Boltzmann electron density distribution and Poisson equation with stationary dust particles are used along with the reductive perturbation method to derive a three-dimensional cylindrical Kadomtsev–Petviashvili equation. The generalized expansion method, used to obtain a new class of solutions, admits a train of well-separated bell-shaped periodic pulses. At certain condition, these periodic pulses degenerate to solitary wave solutions. The effects of the physical parameters on the solitary pulses are examined. Finally, the present results should elucidate the properties of ion-acoustic solitary pulses in multi-component plasmas, particularly in Earth's ionosphere.