Dust–ion Acoustic Solitary Waves in a Collision Less Magnetized Five Components Plasma

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A B S T R A C T

We have derived a Korteweg-de Vries-Zakharov-Kuznetsov (KdV-ZK) equation to study the nonlinear behaviour of dust-ion acoustic waves in a collisionless magnetized five components dusty plasma consisting of warm adiabatic ions, nonthermal hot electrons, isothermal cold electrons, nonthermal positrons and static negatively charged dust particulates. It is found that the coefficient of the nonlinear term of the KdV-ZK equation vanishes along different family of curves in different compositional parameter planes. In this situation, to describe the nonlinear behaviour of dust-ion acoustic waves, we have derived a modified KdV-ZK (MKdV-ZK) equation. When the coefficients of the nonlinear terms of both KdV-ZK and MKdV-ZK equations are simultaneously equal to zero, then we have derived a further modified KdV-ZK (FMKdV-ZK) equation which effectively describes the nonlinear behaviour of dust-ion acoustic waves. Analytically and numerically, we have investigated the solitary wave solutions of different evolution equations propagating obliquely to the direction of the external static uniform magnetic field. We have seen that the amplitude of the KdV soliton strictly increases with increasing whereas the amplitude of the MKdV soliton strictly decreases with increasing where is the nonthermal parameter associated with the hot electron species. Also, there exists a critical value of such that the FMKdV soliton exists within the interval whereas the FMKdV soliton does not exist within the interval. We have also discussed the existence of different solitary waves with respect to different parameters of the system.