Higher Order Solutions for Dust Ion Acoustic Solitons in Complex Plasmas with Relativistic Ions and Cairn's Distributed Electrons

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For this supercritical composition of complex plasma, relativistic ions and Cairn's distributed electrons are introduced to investigate dust ion-acoustic (DIA) solitons by reductive perturbation approach. For this investigation, higher order non-linearity (upto cubic) for the plasma is incorporated to derive Modified Korteweg-de Vries (mKdV) equation and expressions for amplitude and width of solitary waves are obtained and examined under different plasma parameter regimes. The non-thermal parameter (β) and the number of dust charge contained in a dust particle (Z_d) reflexes a new light in the formation of compressive and rarefactive relativistic DIA mKdV solitons. For some values of the electron to ion temperature ratio (Ω) only compressive mKdV soltons exists and rarefactive solitons exists for another mode but for the same set of values of the other plasma parameters. Also, for some set of parametric values of the plasma, the nature of solitons becomes compressive, rarefactive and rarefactive to compressive for three different modes which is a salient feature of this investigation. Application of this plasma model to astrophysical and space plasma are also briefly discussed.

Keywords: Relativistic mKdV solitons, Cairn's distributed electrons, Complex plasma.