Contribution of Higher-Order Dispersion to Nonlinear Dust Ion Acoustic Waves in Inhomogeneous Mesospheric Dusty Plasma with Dust Charge Fluctuation

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Abstract

The propagation of dust ion acoustic waves (DIAWs) in a weakly inhomogeneous, weakly coupled, collisionless, and unmagnetized four components dusty plasma are examined. The fluid system considered in this work consists of cold positive ions, cold negatively and positively charged dust particles associated with isothermal electrons. For nonlinear (DIAW) waves, a reductive perturbation method was employed to obtain the variable coefficients Kortewege-de Vries (KdV) equation for the first-order potential. For local inhomogenity, the present system admits the coexistence of rarefactive and compressive solitons. As a matter of fact, when the wave amplitude enlarged, the width and velocity of the wave deviate from the prediction of the KdV equation. It means that we have to extend our analysis to obtain the variable coefficients Kortewege-de Vries (KdV) equation with fifth-order dispersion term. For locally constant parameters, the higher-order solution for the resulting equation has been achieved via what is called perturbation technique. The effects of positive and negative dust charge fluctuations on the higher-order soliton amplitude and width of electrostatic solitary structures are outlined.

Author Keywords: Inhomogeneous Dusty Plasma; Dust Ion Acoustic Waves; Positive and Negative Dust Charge Fluctuation; Variable Coefficients KdV Equation; Higher-Order Solution

KeyWords Plus: SOLITARY WAVES; PROPAGATION

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On Galerkin Technique for Transient Radiative Heat Transfer in Finite Thin Media

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Abstract

The transient radiative heat transfer problem in an absorbing and isotropically scattering plane-parallel medium is proposed. The medium is considered to be nonemitting and the boundaries are nonreflecting and nonrefracting, exposed to an external incident flux. The transient problem is transformed into a stationary-like one. Then, Galerkin technique is extended to obtain the analytical solution for the transient radiative heat transfer problem. The transient reflectivity and transmissivity of the medium are calculated for various values of optical thickness and scattering albedo at different times. The results are in fair agreement with those available in the literature using Pomraning-Eddington approximation.

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The effect of higher-order corrections on the propagation of nonlinear dust-acoustic solitary waves in a dusty plasma with nonthermal ions distribution

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Abstract

Propagation of nonlinear dust-acoustic (DA) waves in a unmagnetized collisionless mesospheric dusty plasma containing positively and negatively charged dust grains and nonthermal ion distributions are investigated. For nonlinear DA waves, a reductive perturbation method is employed to obtain a Korteweg-de Vries (KdV) equation for the first-order potential. As it is well-known, KdV equations contain the lowest-order nonlinearity and dispersion, and consequently can be adopted for only small amplitudes. As the wave amplitude increases, the width and velocity of a soliton can not be described within the framework of KdV equations. So, we extend our analysis and take higher-order nonlinear and dispersion terms into account to clarify the essential effects of higher-order corrections. Moreover, in order to study the effects of higher-order nonlinearity and dispersion on the output solution, we address an appropriate technique, namely the renormalization method.

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Author(s): MENDIS, DA; ROSENBERG, M
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Author(s): Mendis, D.A.; Horanyi, M.
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Author(s): RAO, NN; SHUKLA, PK; YU, MY
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Author(s): WADATI, M
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Author(s): WATANABE, S; JIANG, B
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DOI: 10.1063/1.860526 Abstract Number: A1993-10-5235-006 Published: FEB 1993

Effect of higher-order corrections on the propagation of nonlinear dust-acoustic solitary waves in mesospheric dusty plasmas

Author(s): Elwakil, SA (Elwakil, Sayed A.); Attia, MT (Attia, Mohamed T.); Zahran, MA (Zahran, Mohsen A.); El-Shewy, EK (El-Shewy, Emad K.); Abdelwahed, HG (Abdelwahed, Hesham G.)
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Source: ZEITSCHRIFT FUR NATURFORSCHUNG SECTION A-A JOURNAL OF PHYSICAL SCIENCES Volume: 61 Issue: 7-8 Pages: 316-322 Published: JUL-AUG 2006

Times Cited: 6 (from Web of Science)

Abstract: The contribution of the higher-order correction to nonlinear dust-acoustic waves are studied using the reductive perturbation method in an unmagnetized collisionless mesospheric dusty plasma. A Korteweg-de Vries (KdV) equation that contains the lowest-order nonlinearity and dispersion is derived from the lowest order of perturbation, and a linear inhomogeneous (KdV-type) equation that accounts for the higher-order nonlinearity and dispersion is obtained. A stationary solution is achived via renormalization method.

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Research Areas: Chemistry; Physics

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Author(s): BARKAN, A; MERLINO, RL; DANGELO, N
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Author(s): Barkan, A; DAngelo, N; Merlino, RL
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Author(s): Elwakil, SA; El-Shewy, EK; Zahran, MA

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Author(s): NORTHROP, TG
Conference: SPECIAL SESSION OF THE SPRING COLLEGE ON PLASMA PHYSICS : DUSTY PLASMAS Location: TRIESTE, ITALY Date: JUN 14-21, 1991
Sponsor(s): INT CTR THEORET PHYS; EUROPEAN ECON COMMUNITY

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Two alternative methods for solving the Vlasov Fokker-Planck equation

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Source: INTERNATIONAL JOURNAL OF COMPUTER MATHEMATICS Volume: 83 Issue: 12 Pages: 951-957 DOI: 10.1080/00207160601140323 Published: 2006

Abstract

The expansion of moments technique for generating short time expansions for the moments with the distribution function is used to solve the reduced Vlasov Fokker-Planck equation. The obtained results are compared with those found by other theories such as the operator technique. The results obtained by expansion of moments confirm the correctness of those obtained by the operator method. The method is straightforward and concise, and its applications are promising and can be applied to other moment equations arising in physics.

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Author Keywords: expansion of moments; operator method; Vlasov Fokker-Planck equation

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Author(s): BEALS, R; PROTOPOPESCU, V
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Pages: 109-127 DOI: 10.1080/00411458308224572 Abstract Number: A1984-004360 Published: 1983

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Author(s): BURSCHKA, MA; TITULAER, UM
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Author(s): Elhanbaly, A.; Abdou, M. A.
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Author(s): SUZUKI, M
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