World Academy of Science, Engineering and Technology
International Journal of Physical and Mathematical Sciences
Vol:11, No:07, 2017

Nonlinear Propagation of Acoustic Soliton Waves in Dense Quantum Electron-Positron Magnetoplasma

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Abstract : Propagation of nonlinear acoustic wave in dense electron-positron (e-p) plasmas in the presence of an external magnetic field and stationary ions (to neutralize the plasma background) is studied. By means of the quantum hydrodynamics model and applying the reductive perturbation method, the Zakharov-Kuznetsov equation is derived. Using the bifurcation theory of planar dynamical systems, the compressive structure of electrostatic solitary wave and periodic travelling waves is found. The numerical results show how the ion density ratio, the ion cyclotron frequency, and the direction cosines of the wave vector affect the nonlinear electrostatic travelling waves. The obtained results may be useful to better understand the obliquely nonlinear electrostatic travelling wave of small amplitude localized structures in dense magnetized quantum e-p plasmas and may be applicable to study the particle and energy transport mechanism in compact stars such as the interior of massive white dwarfs etc.

Keywords : bifurcation theory, phase portrait, magnetized electron-positron plasma, the Zakharov-Kuznetsov equation
Conference Title : ICTPMM 2017 : International Conference on Theoretical Physics and Mathematical Models
Conference Location : Paris, France
Conference Dates : July 20-21, 2017