

Spherical Nonlinear Wave Propagation in Relativistic Quantum Plasma

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Abstract : By assuming a quantum relativistic degenerate electron-positron (e-p) plasma media, the nonlinear acoustic solitary propagation in the presence of the stationary ions for neutralizing the plasma background of bounded cylindrical geometry was investigated. By using the standard reductive perturbation technique with cooperation the quantum hydrodynamics model for the e-p fluid, the spherical Kadomtsev-Petviashvili equation was derived for small but finite amplitude waves and was given the solitary wave solution for the parameters relevant for dense astrophysical objects such as white dwarf stars. By using a suitable coordinate transformation and using improved F-expansion technique, the SKP equation can be solved analytically. The numerical results reveal that the relativistic effects lead to propagate the electrostatic bell shape structures and by increasing the relativistic effects, the amplitude and the width of the e-p acoustic solitary wave will decrease.

Keywords : Electron-positron plasma, Acoustic solitary wave, Relativistic plasmas, the spherical Kadomtsev-Petviashvili equation

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