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On the existence of new spin dependent linear and nonlinear waves in quantum plasma

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Abstract

Interest in quantum plasma physics has increased due to possible applications ranging from nanoscale electronics and dense astrophysical environments to intense laser-solid density plasma interaction experiments. Various acoustic type of waves is extensively studied in the regime of quantum plasma in which quantum effects are introduced via the Bohm Potential term. Here we have studied the linear and nonlinear longitudinal acoustic type of waves in quantum plasma and the quantum effects are included via electron spin rather than Bohm potential. Using the separate spin evolution quantum hydrodynamic model [1] in which each species is treated as a separate fluid we have investigated the spectra of longitudinal waves in the electron-ion (e-i) and electron-positron-ion plasma (e-p-i). We find the existence of new spin dependent waves in both the e-I and e-p-I plasmas [2,3,4]. Further using the reductive perturbation method, we explained that weakly nonlinear dynamics of each wave lead to the soliton formation. It is also noted that the spin polarization and positron imbalance can change the nature of potential i.e., from negative to positive. The present investigations are useful to explain the existence of new wave in the regime of quantum plasma.

References:

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