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Nonlinear evolution of small perturbations In Ionospheric Plasma

Swarniv Chandra
Department of Physics, Government General Degree College at Kushmandi, Dakshin Dinajpur, India, 733121.
Department of Physics, Jadavpur University, Kolkata, India, 700032.
Institute of Natural Sciences and Applied Technology, Kolkata, India, 700032
e-mail (speaker): swarniv147@gmail.com

Ionospheric plasma causes nonlinear perturbations in regular EM wave propagation, which has a highly nonlinear effect on signal transmission and reception. Signals are frequently distorted by varying degrees of nonlinearity. Small perturbations impact the wireless communication system, causing massive rogue wave structures that have the potential to damage complex equipment. We used a three-component electron ion plasma system with degeneracy pressure and quantum diffraction effects to examine the evolution of rogue wave type solitons starting from tiny amplitude disturbances. The interaction of nonlinear and dispersive forces results in the formation of a solitary wave structure. Under the influence of an external force, the stability conditions of such a formation are altered. The behaviour of solitary wave structures under the influence of an external force was investigated in this work. Then we look at how nonlinear factors produce amplitude modulation and the formation of the envelop soliton. The nonlinear Schrodinger equation, which we develop later in the paper, is used to study such an envelop soliton. We conducted simulation simulations to compare our findings to those of other researchers. A discussion on dynamical system and Lyapunov exponents is carried out to understand the effect of parameters on the chaotic scenario of the problem.

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