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P5.4007 Ion Acoustic Supersolitons in a Plasma Consisting of Nonthermally Distributed Electrons and Positrons

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Supersolitons are qualitatively different solitary structures from conventional solitons in terms of the potential profile and the phase portrait of the corresponding dynamical system. It has been established that the existence of a soliton after the formation of double layer confirms the existence of a sequence of supersolitons after the formation of double layer [1]. According to Dubinov & Kolotkov [2], the separatrix corresponding to a supersoliton envelopes one or several inner separatrices and several equilibrium points, whereas the separatrix corresponding to a conventional soliton encloses only one non-saddle equilibrium point. In the present paper, using the Sagdeev pseudo-potential approach, we have investigated the ion acoustic (IA) solitary structures in a collisionless unmagnetized plasma consisting of adiabatic warm ions, Cairns [3] distributed nonthermal electrons and positrons. We have drawn the existence domains of solitary structures with respect to the nonthermal parameter of electrons. In a parameter regime, we have found the existence of positive potential solitons after the formation of positive potential double layer and consequently the system supports positive potential supersolitons. To confirm the existence of positive potential supersolitons we have showed the phase portraits of the dynamical system of the corresponding IA solitary structures. With the help of phase portraits, we have observed that there exists a critical value Mcr of the Mach number M such that the system supports supersolitons just after the formation of double layer (at M=MDL) up to the Mach number Mcr, whereas for M>Mcr, the system supports solitons after the formation of double layer and there is no qualitative difference between the solitons for M>Mcr and the conventional solitons. Consequently, there must be a smooth transition of solitary structures, viz., soliton before the formation of double layer double layer supersoliton soliton after the formation of double layer. We have explained the mechanism of such transition process by plotting the equilibrium points of the corresponding dynamical system.

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