PERTURBATION OF THE BACKGROUND PLASMA DISTRIBUTION FUNCTION BY ION-ACOUSTIC SOLITONS

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Different waves play an important role in plasma dynamics. In particular, they are an effective mechanism for heating and accelerating charged particles. Many scientific works are devoted to the study of Alfven, Langmuir and electromagnetic waves [1-4]. At the same time, too little attention has been paid to solitons of the acoustic type (i.e., ion-, electron-, dust-acoustic) (see [5], [6]). Waves of this type are distributed in both space and laboratory plasmas [7]. This work is devoted to the analysis of the influence of ion-acoustic solitons on the background plasma distribution functions. In particular, the ionic velocity and energy distribution function perturbed by the wave is calculated. It is shown that for ion-acoustic solitons of arbitrary amplitude, the velocity distribution function can be described by the expression $f(\upsilon_i)=2[T(d\upsilon_i/dt)]^{-1}$, where T is the measurement time (processing time of instruments) of the distribution function; υ_i is the velocity of the test ion in the electric field of the soliton (see [6] for detail). For small amplitude, one can use the approximate formula $f(\upsilon_i)=\sqrt{2}/(\Phi_0\cdot T\cdot\mu\sqrt{(\mu-1)\cdot A})$, where Φ_0 is the soliton amplitude, $\mu=[M^2-(M-\upsilon i)2/2\Phi 0$, M is the Mach number.

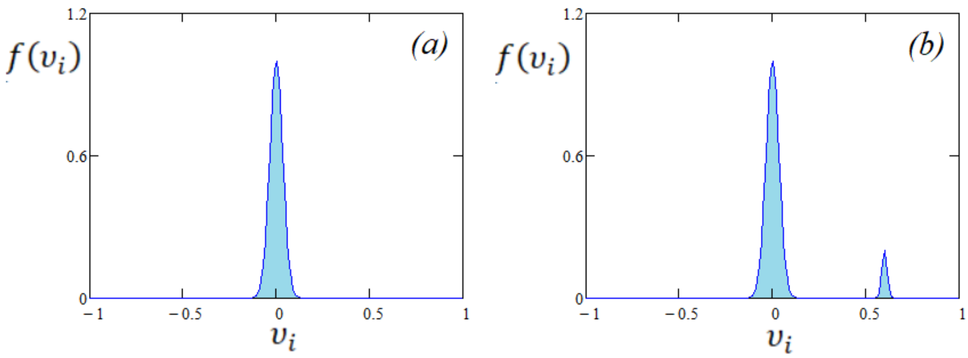

Fig. 1. The initial equilibrium ion velocity distribution function (a) and the distribution function perturbed by ion-acoustic solitons (b).

The perturbed ion velocity distribution function is shown in Figure 1 in comparison with the initial equilibrium distribution function. As can be seen, in the region occupied by ion-acoustic solitons, the ion distribution function takes on a beam-like shape.

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