§25. An Investigation on a New Nonlinear Wave in a Plasma with Hot Positrons

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The increases in recent interest in plasmas containing positrons with the finite temperature and charged, micrometer-sized dust grains have arizen not only from increased observations of such plasmas in space environments, but also from their presence in laboratory devices. In actual siruations, the hot positron component are frequently observed in space. Here, we focus our attention on the nonlinear waves in a plasma with hot positrons. We make an attempt to investigate the possibility of the existence of nonlinear positron-acoustic waves.

We apply the fluid equations for electrons, beam electrons, and hot positrons. The oscillatory solution of nonlinear positron-acoustic waves exists when the proper conditions are satisfied. We show a bird's eye view of the pseudopotential when the positron to electron temperature ratio β equal 5.0, in Fig.1, where α is the ratio of beam ion to electron density.

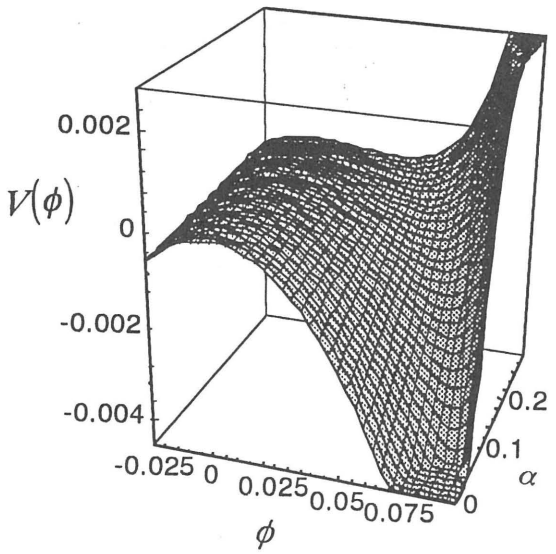

Fig.1

We illustrate the region of existence of positron-acoustic waves depending on α in Fig.2. The curves *a* and *b* correspond to β=5.0 and 20.0, respectively. Positron-acoustic waves propagate in the lower region of the curves but do not exist in the other region.

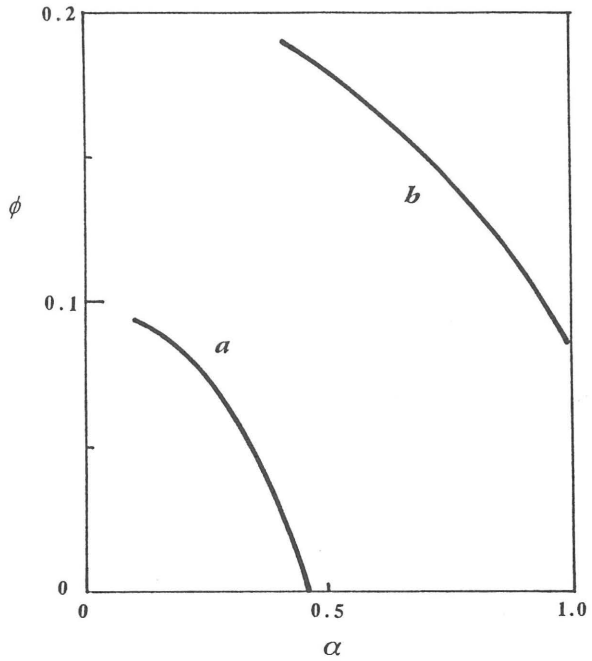

Fig.2

The results are summarized as follows[1),2)]: The conditions of existence for nonlinear positron-acoustic waves sensitively depend on the beam density, positron temperature and plasma potential. Supersonic positron-acoustic waves can propagate in this system. The presence of positrons increases the Mach number and an increase of the electron beam density reduces the speed of the wave. The present study predicts new findings on positron-acoustic waves in an electron-positron plasma with an electron beam.

References

1) Nejoh,Y-N., Phys. Plasmas **3**, p.1447 (1996).
2) Nejoh,Y-N., Austr. J. Phys. **49**, p.967 (1996).