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The effects of ion beams on linear and nonlinear ion-acoustic waves in space plasmas

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A detailed theoretical investigation is conducted using the Sagdeev pseudopotential formalism to investigate the effects of ion beams on ion-acoustic modes in plasma models with two species of adiabatic ions and one or two (cool and hot) species of electrons which are Boltzmann distributed. One or both ion species are considered to be drifting (beam) components. The linear analysis shows that the slow ion-acoustic modes require a finite value of the beam speed to occur, while the fast ion-acoustic modes are supported in models with or without ion beams. In the one-beam model, the backward propagating slow mode changes direction and couples with the forward propagating slow mode and becomes unstable to the ion beam instability for intermediate beam speeds. "Forward" and "backward" refer to directions which are respectively aligned with or anti-parallel with respect to the beam direction. In the model with counterstreaming beams, the slow modes which propagate in the backward and forward directions which are aligned with the beam directions do not change direction for large values of the speeds of the counterstreaming beams. In the nonlinear regime, the ion-acoustic modes propagate as pulse-like disturbances in potential which are referred to as solitons. Slow solitons with unusual characteristics are found to propagate below the critical speeds corresponding to the phase speeds of the linear waves. On the other hand, negative potential fast solitons coexist with positive potential solitons in the model with two-temperature electrons, in contrast to the model with a single component of Boltzmann electrons for which only positive potential fast solitons are supported.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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