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Stopbands of fast ion-acoustic solitons in non-thermal plasmas with two-temperature adiabatic ions

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The existence of a stopband in soliton speeds associated with the fast ion-acoustic wave was reported for the very first time by Nsengiyumva et al. (Physics of Plasmas 21, 102301, 2014) in a model which is composed of cold ions, adiabatic ions (both positive) and Boltzmann electrons. The stopband, which, is an intermediate range of speeds for which solitons cannot propagate, arises when the limiting value of the potential beyond which the adiabatic ion density becomes complex valued, yields two solutions for the speed. The lower (higher) valued solution is the lower (upper) boundary of the stopband. The model of Nsengiyumva et al. was extended by Maharaj and Bharuthram (Physics of Plasmas 24, 022305, 2017) by considering non-thermal effects of the electrons on the stopbands through adopting Cairns and kappa distributions for the electrons. The two earlier studied models are extended in this paper to consider finite temperature effects of the cool ions on the stopbands. Transitions from the existence of the stopband to the disappearance of the stopband are studied for increasing temperature of the cooler ions and increasing non-thermal effects of the electrons, considering both a Cairns and kappa velocity distribution of the electrons. This study will endeavour to provide deeper insights into what may be the driving mechanisms for the existence of a stopband.

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