Impact of Suprathermal and Beam Electrons on Nonlinear Electrostatic Waves in an Electron-Positron Plasma

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Electrostatic waves are commonly generated in high-energy astrophysical plasmas such as pulsars and microquasars having electron populations with distinct temperatures, which may also contain a fraction of positrons and magnetic field-aligned beam electrons, while background hot electrons seem to follow a suprathermal κ-distribution. We therefore consider the nonlinear formation of electrostatic acoustic solitary waves in an electron-positron plasma that consists of an electron fluid, a suprathermal hot electron background, an electron beam, and a positron fluid. We explore how the nonlinear properties and existence domain of electrostatic solitary waves are altered by the electron suprathermality and the physical conditions of beam electrons and positrons. Our results will help us understand better the formation and propagation of electrostatic acoustic waves in astrophysical electron-positron plasmas, where field-aligned beam and suprathermal electrons exist.

References

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