Relativistic Streaming Instability and Generation of Electrostatic Solitary Waves

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Small scale, large-amplitude, field-aligned electric fields, called electrostatic solitary waves (ESW), are continuously observed in the plasma sheet boundary layer, the Earth's magnetotail, the magnetosphere, and the aurora acceleration region. Similar coherent electric field structures have also been measured by the Wind satellite in the solar wind. These structures are likely to be the result of nonlinear streaming instability that may occur in certain astrophysical systems. In this study, we examine the formation of ESW based on relativistic particle simulations; the effects of the free parameters of the problem on the evolution of ESW are particularly investigated.