

Progress on Nonlinear Langmuir Waves in Interplanetary Type III Sources and Earth's Foreshock

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Electron beams are observed to drive Langmuir waves in the source regions of interplanetary type III solar radio bursts and the foreshock regions upstream of planetary bow shocks and interplanetary shock waves. Two main ideas exist for limitation of the wave growth and persistence of the electron beam: (1) stochastic growth theory (SGT), in which wave growth in density irregularities leads to a marginally stable state with bursty wave growth, and (2) nonlinear processes rapidly move wave energy away from the unstable region of phase space. Relevant nonlinear processes include wave collapse, in which modulational self-focusing leads to intense short-scale wave packets, and electrostatic decay, in which a beam-generated Langmuir wave decays into a backscattered Langmuir wave and an ion acoustic wave. Modern plasma wave data can now often resolve individual wave packets, leading to the discovery by Ulyssesof very intense and localized