

Observation of the Reactive Component of Langmuir Wave-Electron Phase Bunching

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Observations from the Rocket Auroral Correlator Experiment (RACE), launched on February 6, 2002 from Poker Flat, Alaska, show clear evidence of phase bunching of the electrons by Langmuir waves. The measurements were made by a new wave-particle correlator during a period when the Langmuir waves were very monochromatic and the amplitude varied slowly in time. The electrons, which are at energies well below the inverted-V peak energy, are found to be bunched at 90 degrees with respect to the wave field indicating that they are the reactive component of the perturbed distribution function. Electrons with this phase relation are trapped in the wave field. Analysis of the observed wave packets leads to two interpretations. The first is that phase bunching may be understood as arising from a linear interaction with a short wave packet. The second is that a non-linear interaction with a long wave packet of many hundreds of wavelengths has occurred. The latter model is suggested as the more likely of the two and future experiments are discussed which can resolve the question of which model is applicable.