Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Unified view of nonlinear wave structures associated with whistler-mode chorus waves[1] XIN AN, JINXING LI, JACOB BORTNIK, VIKTOR DECYK, University of California, Los Angeles, CRAIG KLETZING, GEORGE HOSPODARSKY, The University of Iowa — A range of nonlinear wave structures, including Langmuir waves, unipolar electric fields and bipolar electric fields, are often observed in association with whistler-mode chorus waves in the near-Earth space. We demonstrate that the three seemingly different nonlinear wave structures originate from the same nonlinear electron trapping process by whistler-mode chorus waves. Only a single quantity, the ratio of the Landau resonant velocity to the electron thermal velocity, controls the type of nonlinear wave structure that will be generated. When the tail of the electron distribution is trapped by chorus, the trapped electrons form a spatially modulated bump-on-tail distribution and excite Langmuir waves. When the thermal electrons are trapped by chorus, they form phase space holes and hence produce bipolar electric fields. Between these two regimes, trapped electrons generate nonlinear electron acoustic waves, which in turn disrupts the trapped electrons and accumulates them in a limited spatial region, leading to the unipolar electric field structures. This study connects a variety of seemingly unrelated nonlinear field structures and provides a simple, integrated picture of the microscopic interactions between whistler waves and electrons.

[1]This research was funded by NASA grant NNX16AG21G.

Xin An
University of California, Los Angeles

Date submitted: 03 Jul 2019 Electronic form version 1.4