Formation of the "Seed" Population of 1-10 keV Electrons in the Outer Van Allen Radiation Belt by Time Domain electric Field Bursts

Agapitov, Oleksiy (1,2), agapitov@ssl.berkeley.edu; Forrest Mozer (1); Anton Artemyev (3); Vladimir Krasnoselskikh (4); and Solene Lejosne (1).
(1) Space Sciences Laboratory, University of California, Berkeley, CA, USA
(2) Taras Shevchenko National University of Kyiv, Astronomy and Space Physics Dept., Kyiv, Ukraine
(3) Space Research Institute, Moscow, Russia
(4) LPC2E, CNRS - University of Orleans, Orleans, France

A huge number of different non-linear structures (double layers, electron holes, non-linear whistlers, etc.) have been observed by the electric field experiment on the Van Allen Probes in conjunction with relativistic electron acceleration in the Earth's outer radiation belt. These structures, found as short duration (~0.1 msec) quasi-periodic bursts of electric field in the high time resolution electric field waveform, have been called Time Domain Structures (TDS). They can quite effectively interact with radiation belt electrons. Due to the trapping of electrons into these non-linear structures, they are accelerated up to ~10 keV and their pitch angles are changed, especially for low energies (~1 keV). Large amplitude electric field perturbations cause non-linear resonant trapping of electrons into the effective potential of the TDS and these electrons are then accelerated in the non-homogeneous magnetic field. These locally accelerated electrons create the "seed population" of several keV electrons that can be accelerated by coherent, large amplitude, upper band whistler waves to MeV energies in this two step acceleration process. All the elements of this chain acceleration mechanism have been observed by the Van Allen Probes.