

Ultra-low-frequency wave-driven diffusion of radiation belt relativistic electrons

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Van Allen radiation belts are typically two zones of energetic particles encircling the Earth separated by the slot region. How the outer radiation belt electrons are accelerated to relativistic energies remains an unanswered question. Recent studies have presented compelling evidence for the local acceleration by Very Low Frequency (VLF) chorus waves. However, there has been a competing theory to the local acceleration, radial diffusion by Ultra Low Frequency (ULF) waves, whose importance has not yet been determined definitively. Here we report a unique radiation belt event with intense ULF waves but no detectable VLF chorus waves. Our results demonstrate that the ULF waves moved the inner edge of the outer radiation belt earthward 0.3 Earth radii and enhanced the relativistic electron fluxes by up to one order of magnitude near the slot region within about 10 hours, providing strong evidence for the radial diffusion of radiation belt relativistic electrons.

Keywords: Van Allen radiation belts, Ultra Low Frequency (ULF) waves, Radial diffusion, Electron acceleration