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Gradual Diffusion and Punctuated Enhancements of Highly Relativistic Electrons: Van Allen Probes Observations

Gradual Diffusion and Punctuated Enhancements of Highly Relativistic Electrons: Van Allen Probes Observations

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The dual-spacecraft Van Allen Probes mission has provided a new window into megaelectron Volt (MeV) particle dynamics in the Earth′ s radiation belts. Observations (up to E ˜10 MeV) show clearly the behavior of the outer electron radiation belt at different time scales: months-long periods of gradual inward radial diffusive transport and weak loss being punctuated by dramatic flux changes driven by strong solar wind transient events. Analysis of multi-MeV electron flux and phase space density (PSD) changes during March 2013 are presented in the context of the first year of Van Allen Probes operation. This March period demonstrates the classic signatures both of inward radial diffusive energization as well as abrupt localized acceleration deep within the outer Van Allen zone (L ˜4.0±0.5). This reveals graphically that both ″ competing ″ mechanisms of multi-MeV electron energization are at play in the radiation belts, often acting almost concurrently or at least in very rapid succession. It also shows in remarkable ways how the coldest plasmas in the magnetosphere intimately control the most highly energetic particles.

キーワード: Van Allen Probes, Radiation belts, Solar wind, Electron energization
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