

UNUSUAL NARROW RADIATION RINGS OBSERVED BY VAN ALLEN PROBES.

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The Van Allen radiation belts consist of energetic electrons and ions at energies above 100 keV trapped by the Earth's magnetic field. These very energetic particles may be harmful to satellite electronics and humans in space. In particular, relativistic electrons are responsible for deep dielectric charging in sensitive electronic components and cause frequent satellite failures and operational problems.

The historic overview of the radiation belt research starting from the discovery of the Van Allen radiation by Explorer 1 is presented. Five decades after the beginning of the space age and the discovery of the trapped radiation, understanding the Van Allen radiation belts presents a major challenge. The dynamical evolution of the radiation belt fluxes results from the competition of various acceleration and loss mechanisms.

Recent observations together with predictive and data assimilative modeling showed that energetic electrons can be accelerated to relativistic energies by taking energy from ULF and VLF plasma waves during resonant wave-particle interactions. Recent observations by NASA's Van Allen Probes showed an event where three radiation zones were observed at ultra-relativistic energies. The additional middle, and unusually narrow, belt persisted for approximately 4 weeks. We demonstrate that different physical processes are responsible for the formation of this unusual ring.