



Relativistic Electron Acceleration in Earth's and Jupiter's Radiation Belts

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In the late 1950s, Earth's radiation belts were discovered by NASA's Explorer satellite, and the Jupiter's radiation belts were discovered after the detection of Jovian decametric radio emission. The source of Earth's radiation belts was not directly revealed until the launch of Van Allen Probes mission in 2012. The relativistic electrons in the planetary radiation belts could originate from radial diffusion or local wave-particle interactions [1]. Professor Richard M. Thorne provided the first solid demonstration that electron acceleration by whistler-mode chorus waves plays a key role in the built-up of Earth's outer radiation belt during geomagnetic storms [2]. The quantitative agreement between the Van Allen Probes observation and Fokker-Planck simulation paved the path for the modeling and forecast of Earth's radiation belt environment.

After Professor Richard M. Thorne's pioneering work, we applied the Fokker-Planck simulation technique to various electron flux enhancement events in Earth's radiation belts. Through the comparison with satellite observations, we quantified the roles of radial diffusion and chorus-driven electron acceleration during geomagnetic storms and quiet periods [3].

Juno arrived at Jupiter's magnetosphere on July 4th, 2016, with the capability to measure energetic electron fluxes and whistler-mode waves in the radiation belts. With the initial guidance from Professor Richard M. Thorne, we analyzed the electron distributions near the magnetic equator in Jupiter's outer radiation belts and plasma sheet. The electron phase space density profiles show important evidence for the energetic electron source from radial diffusion and the electron loss at distances close to Jupiter [4]. We analyzed the dynamics of whistler-mode waves and energetic electrons during injection events observed by Juno. The electron injections provide both chorus wave generation and seed electrons for faster relativistic electron acceleration in Jupiter's radiation belts.

In this talk, I will first review Professor Richard M. Thorne's work on the chorus-driven electron acceleration in Earth's radiation belts. Then I will present our recent advances on the role of radial diffusion and local acceleration in Earth's radiation belts, and the electron phase space density profiles and the importance of electron injections in Jupiter's radiation belts.

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