**Abstract**

In this talk I will report our work of radiation belt seed population (Tang et al., JGR, 2017; Tang et al., JGR, 2018).

Using the particle data measured by Van Allen Probe A from October 2012 to March 2016, we investigate in detail the radiation belt seed population and its association with the relativistic electron dynamics during 74 geomagnetic storms. The period of the storm recovery phase was limited to 72 h. The statistical study shows that geomagnetic storms and substorms play important roles in the radiation belt seed population (336 keV electrons) dynamics. Based on the flux changes of 1 MeV electrons before and after the storm peak, these storm events are divided into two groups of “large flux enhancement” and “small flux enhancement.” For large flux enhancement storm events, the correlation coefficients between the peak flux location of the seed population and those of relativistic electrons (592 keV, 1 MeV, 1.8 MeV, and 2.1 MeV) during the storm recovery phase decrease with electron kinetic energy, being 0.92, 0.68, 0.49, and 0.39, respectively. The correlation coefficients between the peak flux of the seed population and those of relativistic electrons are 0.92, 0.81, 0.75, and 0.73. For small flux enhancement storm events, the correlation coefficients between the peak flux location of the seed population and those of relativistic electrons are relatively smaller, while the peak flux of the seed population is well correlated with those of relativistic electrons (correlation coefficients >0.84). It is suggested that during geomagnetic storms there is a good correlation between the seed population and ≤1 MeV electrons and the seed population is important to the relativistic electron dynamics.

To better understand rapid enhancements of the seed populations (hundreds of keV electrons) in the heart of the Earth’s outer radiation belt (*L\** ~ 3.5–5.0) during different geomagnetic activities, we investigate three enhancement events measured by Van Allen Probes in detail. Observations of the fluxes and the pitch angle distributions of energetic electrons are analyzed to determine rapid enhancements of the seed populations. Our study shows that three specified processes associated with substorm electron injections can lead to rapid enhancements of the seed populations, and the electron energy increases up to 342 keV. In the first process, substorm electron injections accompanied by the transient and intense substorm electric fields can directly lead to rapid enhancements of the seed populations in the heart of the outer radiation belt. In the second process, the substorm injected electrons are first trapped in the outer radiation belt and subsequently transported into *L\* <* 4.5 by the convection electric field. In the third process, the lower energy electrons are first injected at *L\** ~ 5.3 and then undergo drift resonance with ultralow-frequency waves. These accelerated electrons by ultralow-frequency waves are further transported into *L\* <* 4.5 due to the convection electric field. This process is consistent with the radial diffusion. Our results suggest that these specified processes are important for understanding the dynamics of the seed populations in the heart of the outer radiation belt.