Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Understanding Earth's radiation belt electron dynamics: Van Allen Probes observations and simulations[1] WEN LI, QIANLI MA, RICHARD THORNE, JACOB BORTNIK, XIAOJIA ZHANG, University of California, Los Angeles — Various physical processes are known to cause acceleration, loss, and transport of energetic electrons in the Earth's radiation belts, but their quantitative roles in different time and space need further investigation. In the present paper, we evaluate the relative roles of various physical processes during geomagnetic storms using a 3D diffusion simulation. By quantitatively comparing the electron evolution observed by Van Allen Probes and simulation, we found that whistler-mode chorus waves play a critical role in accelerating electrons up to several MeV through efficient energy diffusion. By only including radial diffusion driven by ultra-low-frequency waves, the simulation underestimates the observed electron acceleration, while radial diffusion plays an important role in redistributing electrons. Although an additional loss process is required to fully explain the overestimated electron fluxes at multi-MeV, the combined physical processes of radial diffusion and scattering by whistler-mode waves reproduce the observed electron dynamics remarkably well, suggesting that quasi-linear diffusion theory is reasonable to evaluate radiation belt electron dynamics, and the importance of nonlinear wave-particle interaction may still remain as an open question.

[1]We would like to acknowledge AFOSR award FA9550-15-1-0158, NASA grants NNX15AI96G, NNX15AF61G, and the NSF grant AGS 1564510 for supporting this research.

Wen Li
University of California, Los Angeles

Date submitted: 07 Jul 2016 Electronic form version 1.4