Chorus acceleration of relativistic electrons in extremely low L-shell during geomagnetic storm

Zhenxia Zhang¹, Lunjin Chen², Si Liu³, Ying Xiong⁴, Xinqiao Li⁵, and Xuhui Shen¹

¹The Institute of Crustal Dynamics, Beijing, China (zxzhang2018@163.com)
²Department of Physics, University of Texas at Dallas, Richardson, Texas, USA
³School of Physics and Electronic Sciences, Changsha University of Science and Technology, Changsha, China
⁴Institute of Space Physics and Applied Technology, Peking University, Beijing, China
⁵Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China.

Based on data from the Van Allen Probes and ZH-1 satellites, relativistic electron enhancements in extremely low L-shell Regions (reaching L~3) were observed during major geomagnetic storm (minimum Dst`-190 nT). Contrary to what occurs in the outer belt, such an intense and deep electron penetration event is rare and more interesting. Strong whistler-mode (chorus and hiss) waves, with amplitudes 81-126 pT, were also observed in the extremely low L-shell simultaneously (reaching L~2.5) where the plasmapause was suppressed. The bounce-averaged diffusion coefficient calculations support that the chorus waves can play a significantly important role in diffusing and accelerating the 1-3 MeV electrons even in such low L-shells during storms. This is the first time that the electron acceleration induced by chorus waves in the extremely low L-shell region is reported. This new finding will help to deeply understand the electron acceleration process in radiation belt physics.