

Evolution of Earth's Plasmasphere in Response to the Solar Wind Variations and Magnetic Storms

*Chao Shen^{*1}, Ya Huang¹, Ronglan Xu¹, Yanyan Yang¹, Hermann Lühr², M. Dunlop³, Huaning Wang⁴, Bo Chen⁵, Fei He⁵ and Xiaoxin Zhang⁶*

¹State Key Laboratory of Space Weather and National Space Science Center, Chinese Academy of Sciences, Beijing 100190 China

²Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences

³Rutherford Appleton Laboratory, Chilton, DIDCOT, Oxfordshire OX11 0QX, United Kingdom

⁴National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China

⁵Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, Changchun, China

⁶National Center for Space Weather, China Meteorological Administration, Beijing, China

Abstract

Earth's plasmasphere originates from the ionosphere, which is controlled by the magnetic and electric fields in the inner magnetosphere. The dense low energy plasmas in the plasmasphere have critical influences on both the ionosphere and magnetosphere, thus play important roles on the magnetospheric space weather. The multiple spacecraft missions, i.e., Cluster, THEMIS, Swarm, etc, and the imaging missions, such as IMAGE and Changer 3, have provided precious opportunities for investigating the dynamics of plasmasphere. In this research, with the 4-point magnetic observations by Cluster, we have analyzed the distortion of the configuration of the geomagnetic field during the strong magnetic storms and the corresponding effects on the structure of the plasmasphere. With IMAGE and Changer 3 EUV measurements, the comparative study is made on this effect. With the 4-point measurements of WHISPER on Cluster, we have explored the spatial distribution of the electrons of the plasmasphere in variations with the magnetic shell L, magnetic local time and field lines, which is very valuable for the improvement of the empirical plasmasphere model. Furthermore, the joint investigations with Swarm ionosphere observations and Changer 3 EUV measurements are made to obtain the relationship between the ionospheric origin and distributions of plasmasphere as well as the influences of solar wind conditions.