Determining the Loss of Radiation Belt Electrons: What Measurements and Models are Required?

The overall flux of the outer radiation belt electrons, and their variability, are controlled by the competition between source and loss processes, thus a detailed understanding of the loss is a required step towards really understanding the dynamics. While spacecraft in a geotransfer orbit with low inclination will be able to measure the full electron distribution, but the electron's bouncing loss cone in the inner magnetosphere is only a few deg near the equator and it is hard to resolve the loss cone distribution from direct measurements there. Thus measurement at a low altitude and highly inclined orbit is needed.

During this presentation, I will describe some recent modeling results in determining the actual loss rate of the outer radiation belt electrons and also introduce our CubeSat mission funded by US NSF. The objective is to address fundamental questions relating to the relationship between solar flares and energetic particles and the acceleration and loss mechanism of outer radiation belt electrons. Our CubeSat, carrying a single instrument, in a highly inclined low earth orbit, will measure differential fluxes of relativistic electrons in the energy range of 0.5-3.5 MeV and protons in 10-40 MeV. This project is heavily involved with graduate students, who have been designing and manufacturing, and will calibrate and operate the spacecraft with close supervision from faculty and professional engineers at University of Colorado.

美国Colorado大学CubeSat小卫星计划

外辐射带电子的全球分布是粒子源和损失过程动态平衡的结果，对外辐射带电子的损失过程的精细研究对真正认识其动力学过程具有重要意义。尽管低倾角的穿越地球同步轨道的卫星可以测量电子的全分布，但是由于内磁层中电子的弹跳损失锥在赤道附近只有几度的分布，因此通过直接测量来解决电子的损失锥分布是比较困难的。因此，迫切需要一颗低高度和高倾角的卫星进行探测和分析。

在这个报告中，李炘璘教授将着重论述计算外辐射带电子的精确损失率的最近的一些模型结果，同时介绍美国科学基金资助的CubeSat小卫星计划。CubeSat小卫星计划的科学目标将解决一些基础的科学问题：太阳日冕和高能粒子的关系，以及外辐射带电子的加速和损失机制等。CubeSat小卫星只携带一个测量仪器，运行在一个高倾角低高度的轨道上，探测0.5-3.5MeV的相对论电子和10-40MeV的质子的微分通量。此小卫星计划主要是在大学研究生的高度参与下进行的，研究生们在科罗拉多大学的科学家及工程师的指导下设计和制造这些仪器，并且将校正和运行在轨的CubeSat卫星。