Project Details

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Project Title:
Comprehensive Survey of Magnetospheric Relativistic Electron Dynamics over Complete Solar Cycle

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Summary:
Many geomagnetic storms result in the energization of electrons in the inner magnetosphere to relativistic energies with electron fluxes increasing by several orders of magnitude. It is well known that high solar wind velocity and southward component of the interplanetary magnetic field are the fundamental causative agents. Physical models of energization are many and invoke processes ranging from purely-adiabatic radial diffusion to in-situ acceleration by both stochastic and resonant wave-particle interactions. It is unclear under what circumstances a particular process or processes may be the dominant mechanism. This remains a major open scientific question in magnetospheric physics. It is also important from a space weather perspective since relativistic electrons are implicated in spacecraft anomalies and failures. The research proposed here will be to systematically survey electron energization over a complete solar cycle. The research undertaken will explore the internal magnetospheric dynamics and the dependence of electron energization upon external causative agents. We will measure characteristics of electron acceleration such as the spatial extent, temporal evolution of energy spectra, and acceleration, decay and isotropization times. We will compare relativistic electron events that occurr during different phases of a solar cycle. It is well known that during the declining and ascending phases of a solar cycle the magnetosphere is driven by recurrent high speed solar wind streams (HSS) and Coronal mass ejections (CME) respectively. The proposed work will also study of the relationship between the characteristics of relativistic electron enhancements and geomagnetic storm parameters. We will investigate the correlations between geomagnetic storm strength and duration, and the magnitude and extent of the relativistic electron fluxes. The uniqueness of our study comes from our use of data collected by the same suite of instruments over an entire solar cycle. These instruments provide a complete coverage of the entire outer zone over a wide range of energies. This research will be based upon data collected from PET, LICA and HILT sensors onboard SAMPEX and the HIST sensor onboard Polar. Both spacecraft provide energetic electron data over a wide energy and L-shell range. SAMPEX sensors cover the time periods starting from Aug 1992 to present and Polar from March 1996 to present. The use of high quality data collected from the same sensors over a long period of time reduces uncertainties in comparing different events. Interplanetary data will be obtained from sensors onboard ACE, Wind and other spacecraft. This study will provide valuable observational constraints on the various physical models of electron acceleration in the inner magnetosphere. Our results will also be a catalog of the properties of electron enhancement events over a complete solar cycle which will be highly useful in space weather studies.

Publication References:

Summary: "

Reference: Shrikanth Kanekal / Catholic University of America - Comprehensive Survey of Magnetospheric Relativistic Electron Dynamics over Complete Solar Cycle