Project Details

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Project Title:
Determining the Source of High Energy Electrons in the Inner Magnetosphere

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Summary:
A research program is proposed to understand the global process of electron transport and acceleration from the solar wind to the inner magnetosphere. After being launched in the upstream region, electron particle trajectories will be followed in a global magnetohydrodynamic (MHD) simulation of the solar wind and Earth's magnetosphere for geomagnetic storm-like conditions to understand the complete process of transport and heating that leads to high energy relativistic electrons in the vicinity of geosynchronous orbit. The primary goals of this research will be to understand the physical mechanisms that lead to the formation of relativistic electrons starting from the solar wind, and to determine what controls the response of relativistic electrons in the near-Earth region for geomagnetic storms. Of particular interest will be to determine the origin and flux of "seed" electrons in the near-Earth region at an equatorial radial distance of about 10 RE, which is where many inner magnetospheric models begin their calculations. The approach will be to run a global MHD simulation for different upstream solar wind driving conditions and follow electrons from the solar wind as they circulate in the Earth's magnetosphere. The upstream solar wind conditions to be run include high-speed solar wind flows and/or high density, for different interplanetary magnetic field orientations. Electron flux maps at different locations will be calculated, in particular at the seed electron location and near geosynchronous orbit. By running several cases with different upstream driving parameters, particular solar wind and/or magnetospheric conditions that lead to more strongly geo-effective storms will be determined along with a physical understanding as to why such conditions occur. The global model proposed here will help to understand the acceleration, global distribution and variability of electrons in the inner magnetosphere. This represents a step forward in the predictive capability of hazardous near-Earth conditions due to high-energy relativistic electrons that can lead to satellite damage.

Publication References:

Summary: "

Reference: Schriver, David UCLA - Determining the Source of High Energy Electrons in the Inner Magnetosphere