Project Title:
Solar Proton Penetration at High Latitudes: Model Calculations of Cutoff Latitudes and Variations with Solar Wind Conditions

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Project Information:
Solar energetic particles (SEPs) produced during active periods on the Sun can penetrate Earth's polar regions. SEP protons with energies greater than a few MeV have been observed by spacecraft in high-inclination, low-altitude orbits. SEP protons with energies of order 5-300 MeV that enter the polar ionosphere can produce the well-know PCA (polar cap absorption) events. Because of the high dose rates associated with a single large SEP event, the importance of predicting these events in the context of manned spaceflight cannot be overstated. In addition, an entire discipline is devoted to shielding sensitive spacecraft instruments from these particles. Typically, spacecraft mass constraints drive critical payload decisions because of shielding, especially in high radiation environments. It is noteworthy that even minor changes in orbital design can reduce hazardous doses/shielding requirements dramatically. Surprisingly, little is known about how these solar energetic particles enter Earth's magnetosphere and this has limited our predictive models of these important intensities. In this proposal, we plan to use state-of-the-art modeling and a current magnetic field model to determine cutoff latitudes of penetrating protons for a number of solar wind conditions. We will also use modeling and published data to determine intensity levels at high latitudes and low altitudes. These calculations will aid future mission design and shielding requirements.

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