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MONITORING STORM TIME RELATIVISTIC ELECTRON ENHANCEMENT IN LOW EARTH ORBIT ON A NANOSATELLITE PLATFORM

Abstract

Monitoring Storm-time Relativistic Electron Enhancement in low earth orbit gains importance as this phenomenon poses a serious threat to satellites in low earth orbit during the main and recovery phase of solar storms. The low orbit satellites, being less prone to cosmic charged radiation, generally have less radiation shielding compared to those in higher orbit. But due to relativistic electron enhancement, even low earth orbit satellites especially nano-satellites would get affected. This phenomenon is caused due to pitch angle scattering or radial diffusion of high energy electrons into low altitudes because of wave particle interaction during a solar storm. A significant increase in total electron content will be observed at low altitudes. The payload device selected for the task is the conjunction of a scintillator with a electron pass band filter, a photo-multiplier tube (PMT) and a multichannel analyzer. The electron pass filter will allow only high energy electrons into the scintillator system. The scintillator output is connected to a photo-multiplier tube where signal amplification takes place. This output signal obtained is processed by a multichannel analyzer which consists of a wave shaper and a digital counter.The output will be an amplified electrical signal. Using Scintillography techniques, the intensity and the energy of the incident electrons will be found. Based on this data, relativistic electron enhancement during the solar storm will be monitored and this will give an idea of the dynamic nature of electron flux density with solar activity. The nano-satellite will also be equipped with a MEMS based Hall-effect sensor to monitor changes in geomagnetic field due to the solar storm and to observe correlations between the electron enhancement and the geomagnetic storm. Thus, relativistic electron enhancements will be monitored and studied by the data obtained from the device and radiation modelling will be done for the same. Based on this, necessary shielding could be undertaken in future to safeguard nano-satellites against this phenomenon as its impact on nano-satellites is not yet exactly known.