Spacecraft Solar Charging

What is Spacecraft charging?
Spacecraft charging,defined as the buildup of charge in and on spacecraft materials,is a significant phenomenon for spacecraft in certain Earth and other planetary environments.

How long does it take to charge a spacecraft?
Typically,the time scale of the surface charging (frame potential of spacecraft with respect to plasma) is less than one second(though differential potentials between surfaces can take hours to be established) and that of the internal charging is longer than one hour.

What causes a spacecraft to charge?
Spacecraft charging occurs when charged particles from the surrounding plasma and energetic particle environment stop on the spacecraft, either on the surface, on interior parts, in dielectrics, or in conductors. Other factors affecting charging include biased solar arrays or plasma emitters.

What determines a spacecraft's charging rate?
The rate of charging in the interior of the spacecraft (e.g.,after propagation through shielding) is a function of the flux versus energy,or spectrum,of the plasma at energies well in excess of the mean plasma energies (for GEO,the plasma mean energy may reach a few 10s of keV).

Where do spacecraft charging data come from?
Launched in 1979,the SCATHA satelliteis another major source of spacecraft charging data. In addition to numerous experiments for measuring and controlling spacecraft charging,SCATHA measured the space environment between 5.5 and 7.7 Re for a number of years.

What is the physical process for spacecraft charging?
The fundamental physical process for all spacecraft charging is that of current balance; at equilibrium,all currents sum to zero. The potential at which equilibrium is achieved is the potential of the surface with respect to the space plasma ground.

phenomenon for spacecraft in certain Earth and other planetary environments. Design for control and mitigation of surface charging, the buildup of charge on the exterior surfaces of a spacecraft related to space plasmas, was treated in detail in NASA TP-2361, Design Guidelines for Assessing and Controlling Spacecraft Charging Effects (1984 ...

Spacecraft charging - Download as a PDF or view online for free. Submit Search. Spacecraft charging o Download as PPTX, PDF o 1 like o 2,820 views. Hassaan Bin Jalil Follow. This document provides an overview of the space environment and its effects on satellites. It discusses several factors in space including solar activity and radiation, the solar wind, solar ...

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Space solar arrays must survive in the hostile space environment. The most dangerous space solar array environmental interaction is spacecraft charging, which can lead ...

address the concerns associated with the in-flight buildup of charge on internal spacecraft components and on external surfaces related to space plasmas and high-energy electrons and the consequences of that charge buildup.

As plasma environments change with the solar cycle and short-term solar activity, these spacecraft effects change, and yet the effects are extremely important in determining the spacecraft charging and arcing conditions.

This project aims to reduce the risk of spacecraft charging for complex, high power spacecraft in both steady-state and transient conditions. Using data from the ISS and DSCS-III B-7 in conjunction with ground experiments, the plan is to create a hybrid model of spacecraft charging behavior and predict effective mitigation techniques ...

Auroral charging in low Earth polar orbits remains a design consideration for NASA programs and has recently been considered in a number of anomaly investigations. Space weather launch constraints use to protect James Webb Space Telescope during radiation belt transit from

Spacecraft charging studies in polar orbit conditions are in their infancy. Numerical and computational studies can aid in interpretation of the interaction phenomena and, to a lesser extent, in spacecraft design. The assumptions inherent in sevral codes limit their application to design activities, until a more fundamental understanding of the basics behind the interactions ...

Such charging can lead to discharges within and on the surfaces of the outer spacecraft layers such as thermal blankets and solar arrays that can cause significant damage and spacecraft anomalies. In the past ...

Spacecraft in the solar wind (including the Sun-Earth L1, L3, L4 and L5 Lagrange points), magnetosheath, Earth"s outer magnetosphere, lobes of the distant magnetotail, and the Sun-Earth L2 Lagrange point will charge positive to + 10?s of volts on sunlit surfaces with extremes of about + 50 V to + 70 V since the photoelectron ...

Solar arrays supply electrical power to spacecraft equipment and also provide charging of electrochemical batteries used in the shadow sections of the orbit.

The simulations show that for a typical solar wind environment the spacecraft will charge to around 6 V, with the different dielectric parts of the spacecraft charging to potentials from around -36 to 8 V. For the studied extreme solar wind environment, similar to the environment found in the sheath region inside the shock front of an Interplanetary Coronal ...

Spacecraft Solar Charging

NASA-STD-4005, Low Earth Orbit Spacecraft Charging Design Standard, for spacecraft electrical power systems using voltages greater than 55 volts that operate in the low Earth orbit (LEO) plasma environment encountered in altitudes up to 2000 km and latitudes between -50 and +50 degrees. Such power systems, particularly solar arrays, are the ...

o Charging and electrodynamic processes leading to high voltages in space o Examples of spacecraft potentials due to surface charging in GEO and LEO o Lunar surface potentials o ...

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