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Analysis and Application of Space Plasma

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Review Article

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ABSTRACT

The universe is completed of space plasma. Plasma is the word which is given to the fourth part or state of substance (solid, liquid, gas, plasma). Plasma is a gas, i.e., so hot that some or all its essential atoms are split up into electrons and ions, which can move independently to each other. Because they are made up of electrically charged particles, plasma may be intensely partial by electro-static and electro-magnetic fields and forces, which can be lead to very difficult and fascinating performance. Plasmas are found through the Solar System and beyond in the solar corona and solar wind, in the magneto-spheres of the Earth and other planets, in extensions of comets, in the inter-stellar and space media and in the layer disks around black holes. There are similarly plasmas here on Earth, ranging from the inside of a nuclear fusion reactor to a candle glow. In the Space Plasma, we studied plasmas in the Earth's magnetosphere and the solar wind and plasma sphere, and what happens when they interact.

INTRODUCTION

Phenomenon involved in the expansion of space plasma into a solar panel, wind, and planets. Availability of inexpensive or not expensive electrical power in quantity is the fundamental pre-requisite of technological advancement in every mainframe and payload system of space craft and nowadays, spacecraft manufactured world-wide are always for developing the technologies to maximize the efficiencies of power generators to meet the future power and necessity of energy^[1,2]. In the space plasma analysis the SPS is constructed in SPE which will be an interaction with its surrounding plasma analysis.

We will consider the many possible influences to the SPS on the SPE. And we will also consider the particularly focus on to the effect of low frequency electro-statics plasmas wave which is associated with the microwave emission.

In the analysis of application of space plasma is used in the solar wind, panel and planets or an array. One of the systems occupied by the power of the solar wind in the space that are called as solar space plasma power system (SSPS).

BACKGROUND

Solar wind or panels are the sole source for the power generation for the most of the spacecraft mission. It is not unexpected that the spacecraft manufacturing attempt to works the solar wind and panels for the generation of higher current for met the increasing the demand or at higher level of voltage to the cut-down on losses. In the presence of SPE in the most useful for an orbit, namely that is geostationary orbit and PSSO (polar sun synchronization orbit) and threat posed by this environment to space-craft solar wind, panels, planets, and an array were recognized^[3].

After in 1990s an ISRO was contemplating its first 70V solar wind or solar array for space craft that is GSAT-4 which configure to the demand and that a part of the solar wind or panels which drives the power at 70 volts. And an ISRO was also contemplating its first high power ranging imaging spacecraft (RISAT) in the polar SSO operating on a 70Volt. But it was the period when a space of in an orbit failure of solar array or panel due to arcing reports was happening.

The solar panel space plasma project started in 2002. There is some kinds of goal of the SPIX which as follows:-

1. To developing the fundamental of basic understanding of a space plasma and an arcing in SPE.
2. An attempt to develop the models of charging and an arcing.
3. To build an experimental facility for an arcing simulation to validate the models.
4. Making a database for an arcing simulation for thresholds and its rates on the different-different variety of solar panel configuration.

There are two type of space plasma interaction example which is:-

1. SPIXFP
2. SPIXARC

SPIXFP

The SPIXFP (Spacecraft Plasma Interaction Experiment Floating Potential finder) code was deliberate to estimation the floating potentials of the various material used in the solar array when located in a plasma environment ^[4]. Any material located in a charging environment becomes charged to a steady state voltage, characteristic of the material and the plasma environment, known as the floating potential. When the floating potential is reached, the net current flow into (and out of) the material is zero.

The SPIXFP model takes into account the various elements of current during the plasma charging process, which includes the following:-

- Flux due to ambient electrons and ion
- Plasma (electron and ion) impact induced secondary electrons

SPIXARC

The SPIXARC (Spacecraft Plasma Interaction Experiment ARcing estimation) code was deliberate to independently solve the differential equations suggested through SCILAB procedures ^[5]. In this methodology, the electrical equivalent circuit in terms of L, C, R and current and voltage sources signifies the arcing simulation.

There are some reasons behind it which is as follows:-

1. To develop and understand of underlying space plasma physics of charging and arcing phenomenon for both IPR & ISRO teams and
2. Non-availability of NASA's charging codes to an ISRO in 1990s.

Nowadays, the improvement of spacecraft and an increasing payload of launching have increased their costs. In the search for means of prolonging an effective lifetime of new spacecraft has been pursued ^[6,7].

For instance, launching the small space devices that is micro or Nano-sat to LEO are being preferred for reasons of costs and efficiency but in that region (200-800Km Altitude), ruin of assured space craft materials of ultra-violet radiation become relevant issues ^[8].

THE EARTH'S PLASMA SPHERE

The Earth's plasma sphere is an inner part of the magnetosphere. It is located just outside the upper ionosphere located in Earth's atmosphere.

It is a region of dense, cold plasma that surrounds the Earth. Although plasma is found throughout the magnetosphere, the plasma sphere usually contains the coldest plasma ^[9] (**Figure 1**).

SPACE PLASMA EFFECTS DIFFERENT PLASMA ENVIRONMENTS

Plasma effect in environment is shown in **Table 1**.

CONCLUSION

This paper deals with the development of a new method of an analysis and application of space plasmas property of an electromagnetic radiation sources in the near earth and solar wind, planet, panel, and array plasma ^[10].

This method is based on the theory of resonant responses of receiving antennas in plasma. In recent years, many efforts to improve the integration of the front end electronics of space plasmas instrument have emerged, and these instruments are designed to the study of ionized environment of earth and solar wind interactions with planets.

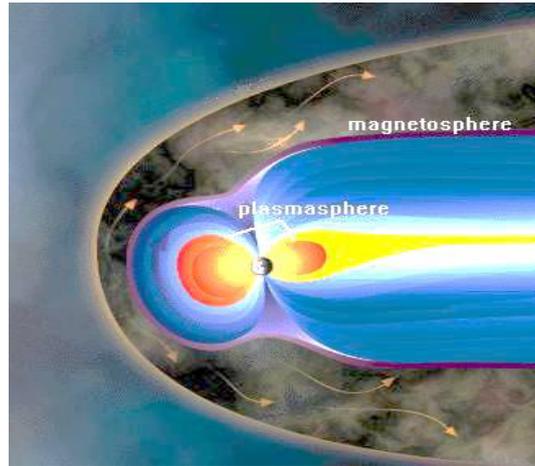


Figure 1. Earth's plasma sphere.

Table 1. Plasma effect in environment.

	Surface density	Plasma density	Ion temp	Electron Temp	Surface field
Solar wind	-	2-20	0.001-0.3	0.01-0.2	2e-5 to 1e-6
Earth	1.3	3e+3 to 3e+6 in ionosphere	-	-	0.3 in magnetosphere
Moon	Trace Na, K (sodium and potassium)	-	0.02-0.3 in ionosphere	Photo-electrons in ionosphere	Less than 1e-4 in magnetosphere
Mars	1.8e-2	1e+3 to 1e+5 in ionosphere	2e-5 to 2e-4 in ionosphere	2e-4 to 8e-4 in ionosphere	Less than 1.6e-2 in magnetosphere

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