space charge

noun: The excess of electrons or ions in a given volume. noun: The net electric charge within a given volume. If both positive and negative charges are present, the **space charge** represents the excess of the total positive charge diffused through the volume in question over the total negative charge.

Space Charge an electric charge dispersed in a volume. A **space charge** determines the spatial distribution of electric potential and electric field intensity. In order for a **space charge** to arise, the concentrations of positive and negative charge carriers, such as ions and electrons in a plasma, must not be equal. The density of a **space charge** $Ï = eÎ£Z_in_i$, where n_i, is the concentration, Z_i, the charge of type *i* carriers, and *e* the charge of an electron.

Since the formation of a statically balanced three-dimensional system of free charges is impossible, the appearance of a **space charge** is usually connected with the passage of an electric current. **Space charges** arise near electrodes when a current flows through electrolytes and at the junction of two semiconductors with differing (electron or hole) conductivities. They also arise in processes of electron and ion emission in a vacuum and in electrical discharge in gases. A difference in the diffusion coefficient *D* of charge carriers with different signs promotes the formation of a **space charge**. (underline added)

When electrons move in a vacuum with zero initial velocity, the current density at the cathode varies according to the three-halves power law through the effect of the **space charge**. The solution of the analogous problem for positive ions in a gas depends on the character of the motion of the ions. The fields generated by **space charges** determine many important properties of gas discharge (development of the discharge over time, formation of streamers) and of the phenomena in plasma (plasma oscillations and waves) and semiconductors. Since *Ï* is the algebraic sum of charges of different signs, the charges of the **space charge** can partially or completely compensate one another. Examples are a plasma with nearly equal electron and ion concentrations and the region near the cathode in an arc discharge, where as a result of such compensation the potential drop near the cathode is small and practically independent of the current.

Space Charge in atmospheric electricity, a measure of the electric charge of the atmosphere, numerically equal to the difference between the number of positive and negative charges of all particles in a given volume. The value of the **space charge** is characterized by its density â€” the excess charge per unit volume.

The **space charge** results from the separation of oppositely charged particles in space (for example, in fog, clouds, and precipitation), when particles are torn away from the earth (for example, during dust storms) or from water (when the surface of a body of water is strongly agitated), in snowstorms, in volcanic eruptions, near high-voltage lines, and during the operation of automobile and aviation engines.

The value of the **space charge** varies with time as a function of the weather. In good weather, the density of the **space charge** at the earthâ€™s surface is about Â±(1â€“5) Ã— $10^{â^{˙}12}$ coulomb Î· $m^{â€“3}$, and in storm clouds it may reach Â±3 Ã— $10^{â€“8}$ coulomb Î· $m^{â€“3}$. In areas of good weather, the density of the **space charge** at the ground changes during both a day and a year and decreases exponentially with altitude; at altitudes greater than 10 km, it is less than 0.01 of its value at the earthâ€™s surface. A **space charge** of up to 5 Ã— $10^{â€“10}$ coulomb Â· $m^{â€“3}$ builds up at the earthâ€™s surface under the influence of the earthâ€™s electric field. As a whole, the atmosphere has a positive **space charge** of about 3 Ã— 10^5 coulombs.

REFERENCES Tverskoi, P. N. Atmosfernoe elektrichestvo. Leningrad, 1949. Chalmers, J. A. Atmosfernoe elektrichestvo. Leningrad, 1974. (Translated from English.) Imianitov, I. M., E. V. Chubarina, and Ia. M. Shvarts. Elektrichestvo oblakov. Leningrad, 1971. I. M. IMIANITOV from: The Great Soviet Encyclopedia, 3rd Edition (1970-1979).

Child's Law Also known as the Child-Langmuir Law or the Three-Halves Power Law, Child's Law states that the space charge limited current (SCLC) in a plane-parallel diode varies directly as the three-halves power of the anode voltage Va and inversely as the square of the distance d separating the cathode and the anode.
Wikipedia, Space Charge, Child's Law

See Also

3-Space 4-Space 6.0.5 - Space seen as Constructive Cubes 6.9 - Crystalline Space Atomic Clusters Bearden on Tesla and EM Source Charge charge Color Charge Figure 3.00 - Infinite Number of Atomoles or Alphanon filling all Space Figure 16.03 and Figure 16.04 - Electricity as Charged Life and Discharged Death Inverse Square Law Keely - Electricity from Space Latent Force in Interstitial Spaces Models of Laser Cluster Interactions Nanoplasma Space Spacetime Square Law Tesla - Electricity from Space Violation of quasi-neutrality