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# Investigation of low energy plasma distribution in the magnetosphere using spacecraft potential

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Spacecraft in sunlight is generally charged to a positive potential relative to the ambient plasma in the solar wind and almost all the regions of the magnetosphere, except for the high-density plasmasphere. Therefore the spacecraft potential has been used to derive the electron number density surrounding the spacecraft.

We have investigated the relationship between the Geotail spacecraft potential, the electron number density and the electron temperature in the near tail regions during the period from November 1994 to March 1997, and obtained the empirical formula shown the relationship between the spacecraft potential and electron number density considering the electron temperature. The amount of scatter of the measured value from the empirical formula was about +/-20%. Therefore the electron number density in the solar wind and the magnetosphere could be estimated by the spacecraft potential and the empirical formula. The electron number density obtained from the spacecraft potential was determined by the electrons in wider energy range includes cold components that are not measured by the particle detectors. Using the spacecraft potential and the plasma particle density obtained by the low energy particle instrument (LEP) onboard Geotail, we investigated the distribution of low-energy plasma in the magnetosphere. The energy range of ions is between 32 eV and 39 keV for the LEP data. The number density (N) of low-energy plasma is estimated from $N = N_{s/c} - N_{LEP}$, where $N_{s/c}$ is the total density acquired from spacecraft potential and $N_{LEP}$ is the partial density acquired from LEP. Therefore N indicates the number density of low-energy plasma below 32 eV.

Then we intend to discuss the low-energy plasma quantitatively in the magnetosphere. In particular we will then attempt to construct a model that can explain the region supplied by the ionospheric plasma directly. With the completion of these models, we will better understand the existence of low-energy plasma in the outer magnetosphere.