Effects of the Betatron Drift of the Plasma Detected by the Semi Equatorial Orbiting Satellite Jikiken (EXOS-B)

Hiroshi Oya[1], Hideyuki Hirahara[2], Takeo Tsuji[3]

[1] Geophysical Ist. Tohoku Univ., [2] Astrophysics and Geophysics,Tohoku Univ, [3] Geophys., Tohoku Univ.

The Betatron-Drift theory has been established being based on the plasma density distribution data obtained by the PWS experiments on board the Akebono (EXOS-D) satellite. The profiles of the electron density and temperature distributions have been investigated using the data obtained by the semi equatorial orbiting satellite Jikiken (EXOS-B). The results show that the plasma density distributions are consistently varying as the results of the Betatron-Drift rather than following the convection and refilling procedure. It is also clarifed that the formation processes of the bulge region and plasma tail should be reinvestigated by the Betatron-Drift effects.

1. Introduction

From the observation data of PWS onboard the Akebono(EXOS-D) satellite, the "donkey ears phenomena" have been found; the phenomena become origin of the studies on the Betatron Drift for the plasma in the plasmasphere and inner plasma sheet across the plasmapause. The feature of the plasma distribution relating to the Betatron-Drift effects has been studied based on the Jikiken data.

2. Handling of Jikiken data

For the case of the Jikiken satellite that was launched in September 1978, the principal data of the natural plasma wave observation (NPW) are acquired through FM telemetry channel with the analog data form. In this study all of the possible analog data are converted into digital form through A-D transform processes and put into a constructed data base. The present results are then based on this data base.

3. Results

From the data analyses for selected data of the Jikiken satellite observation during April to July, 1979, seven profiles of the plasma distributions from the plasmasphere to the outside region of the plasmapause have been obtained together with distributions of the electron temperature. The results show that the electron density distributions and temperature distributions are varying with response to the time derivative of Dst values rather than Kp values. We can conclude that the plasmaspheric plasma does not follow the previously established convection-refilling process but sensitively follows the Betatron-Drift effects given by the time derivative of Dst value.

4. Discussion on Buldge region (the region of Sudden increment of the Plasma density).

It has long been understood that the buldge regions is formed in the evening side of the plasmapause due to the uniqueness of the convection pattern and the effects of the convection change causing the formation of the tail which results the sudden increment of the plasma density distribution outside of the plasmapause.

After the discovery of the Betatron-Drift effects the formation processes of these sudden increment of the plasma density distribution such as buldge and plasma tail have been considered as the results of penetration of the hot plasma into the plasmasphere or covering function of the cold plasma in the phase of negative value of the time derivative of the Dst value. It is however required that the radial component of the electric field is making affection on the movements of plasma in the period of the motion due to the Betatron-Drift.