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Global Scale Ring Feature Electric Fields Raised in Plasmasphere

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1.Introduction

For long periods in study fields of the plasmasphere , a regime to understand the plasmasphere as quiet features of the plasma distribution has been accepted. That is, the plasma is filled by transportation from the ionosphere and lost by magnetospheric convection which control the formation of the plasmapause being associated with corotation of the plasmasphere.

The observation results of plasmaspheric plasma distribution by the Akebono satellite, however, are revolutionarily changing the previously formed concept of the plasmasphere dynamics that is based on the convection ?refilling processes of the plasma. We here propose a extremely dynamical feature of plasma dynamics in the plasmasphere including behavior of the high energy particles in the inner magnetosphere by presenting new concept called the betatron drift that is caused by global scale ring feature electric fields raised in the periods of magnetic storms.

2.Evidences of Dynamical Motion of Plasmaspheric Plasma

After the launching of the Akebono satellite in February 1989, in the semi-polar orbit with initial apogee of 10500km, the PWS experiments on board the satellite havecurrently provided plasma density which are deducted from the detected upper hybridfrequency surrounding the spacecraft(Oya et al, 1991). One of remarkable results forlong term observations of plasma distribution in the plasmasphere are storm time behaviors of the plasma distribution which suggest the exodus and immigration of the plasma between plasmasphere and outer magnetosphere. That is, in the main phase of the magnetic storm, the plasma-spheric plasma moves towards the outer magnetosphere and the plasmapause is disappeared while the hot plasma in the outer magnetosphere moves deep inside plasmasphere.

The behavior of the movement of the plasma is explained as results of betatron drift which are caused by the global scale ring feature electric fields generated by the induction effects of the time varying ring currents. In the time of growing ring currents during the main phase of the magnetic storm, the plasma start to move towards outside by ExB effect with the ring feature electric fields having unti-clock wise sense, observed from the north pole, while the plasma drifts inwards by the ring feature electric fields which show clock wise sense. The existence of these global scale ring feature electric fields indicate the temporal violation of the MHD condition in the plasmasphere. For the underlying physics of this violation of the MHD condition we consider the microscopic processes caused by the local plasma waves that impede the free movement of electrons.

3. Effects of Betatron Drifts on High Energy Particles in the Inner Magnetosphere

Interaction modes of high energy particles to plasmaspheric plasma are understood to be two holds depending on the energy range. An apparent effects are made by group of ring current particles. The time varying feature results in the time varying ring current; therefore distribution of these group of particles contros the movement of plasma in the plasmasphere. The particles with higher energy but fewer flux than the ring current forming group of the energetic particles show the same tendency of drifts with warm plasma in the plasmasphere. Thus, we can give the interpretation for the storm time behavior of high energy group particles ,with energy larger than 500keV, in the inner magnetosphere as results of the betatron drifts that are caused by global scale ring feature electric fields.

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