WHAT NEW OBSERVATIONS AND KINETIC SIMULATIONS OF THE PLASMASPHERE REVEAL ON THE INNER MAGNETOSPHERE

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Using CRRES, Cluster and THEMIS observations, we analyzed how the plasmapause is formed in the post-midnight sector when the geomagnetic activity is enhanced; the plasmasphere is first eroded deeper in the magnetosphere, and its newly formed outer Plasmapheric Boundary Layer (PBL) is subsequently transmitted to other MLT sectors by co-rotation. The results of these satellites measurements are generally in excellent agreement with the prediction of plasmapause formation mechanism based on plasma quasi-interchange process [1] which is implemented in the numerical simulations codes developed at IASB-BIRA.

Our Kp-dependent 3D-model of the plasmasphere enables not only to calculate the equatorial position of the plasmapause as a function of MLT and UT, but it gives also the cold plasma density and temperature within as well as outside the plasmasphere [2]. Our 3D time-dependent model of the plasmasphere is coupled to a standard model of the ionosphere [3]. It enables to simulate the dynamical development of plasmaspheric plumes. The latter are initially generated as growing shoulders formed in the dawn sector at the onset of geomagnetic storms; then they propagate into the afternoon MLT sector where they stretch radially toward the magnetopause to form an extended plume. The continuous radial flow of plasma known as Plasmaspheric Wind [4] has also been implemented in our 3D-numerical model. Plasma densities and drift velocities from the THEMIS mission will be used as initial conditions to model the overall distribution of the plasmaspheric wind velocity.

Using CLUSTER particle flux measurements for different energy ranges, we found that the observed plasmapause positions and the observed boundaries of the radiations belts are correlated with each other [5]. These connections are currently studied in greater details by using the observations available from the *Energetic Particle Telescope (EPT),* the specific instrument that has been developed in Belgium by *IASB-BIRA, CSR/UCL,* and *QinetiQ-Space.* The *EPT* is a high time-resolution (2 sec.) spectrometer which was launched in May 2013 onboard of the *PROBA-V* satellite of ESA [6]. This energetic particle detector is still operating at the altitude of 820 km on a *LEO* polar orbit. This unique new type of detector has a field of view angle of 52°, and is providing continuously for already 5 years valuable electrons count rates in 7 energy channels (0.5 – 8 MeV), in 11 channels (9.5 – 248 MeV) for the protons, and in 11 channels (38 – 900 MeV) for the helium ions. The detailed observations of *EPT* confirm that the calibrated fluxes of outer belt electrons drop drastically and abruptly during the main phase of geomagnetic storms [7]; these fluxes recoup eventually gradually over 1 or 2 days during the subsequent recovery phases. Sometimes at the end of such recovery periods, the fluxes of relativistic electrons can have smaller values, or else they reach values orders of magnitude larger than their pre-storm intensities. Furthermore, our *EPT* measurements clearly confirm that following geomagnetic storm events the outer belt fluxes slowly decrease with a time constant ranging between 6 and 18 days. The positions of the maximum flux of relativistic electrons shift toward the Earth during the enhanced geomagnetic activity events, in a rather similar way as the surface of the plasmapause does it also during such enhancements. The fluxes of particles in the Inner Radiation Belt and South Atlantic Anomaly can also be significantly affected by geomagnetic activity, but only during the strongest storms.

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