

Auroral intensification in conjunction with Pi2 and EMIC wave enhancements in the magnetotail

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This paper presents an interesting observation for an auroral intensification event, which was observed in conjunction with the magnetotail Pi 2 and EMIC wave enhancements at 08:32 UT during a substorm event on 04 April 2009. The substorm onset was identified with an auroral initial brightening and an initiation of Pi 2 oscillations at 08:26 UT on the GBO stations, which preceded about 6 minutes before the auroral intensification. The Pi 2 and EMIC wave enhancements were observed when THEMIS B satellite encountered the outer boundary of the dense plasmaspheric plume, which was located at $X \sim -7 \sim -8$ Re far from the usual location of the plasmopause boundary in the mid-night magnetotail. The generation of the EMIC waves was associated with the newly injected westward-drifting ions, which were modulated with Pi 2 period. Wave modes showed electro-acoustic modes (ordinary sound wave, slow mode wave and electromagnetic ion-cyclotron (EMIC) waves) at the same time. The frequency of these waves was found to be near He+ gyro-frequency, implying that the presence of heavy ion (He+) might provide new couplings (instabilities) for these EMIC waves. The velocity field oscillations observed in the magnetotail showed a same oscillation period of Pi 2 observed on the ground, and the phase relations represent that the velocity field Pi 2 oscillation in the magnetotail leads a quarter cycle for the Pi 2 oscillations observed on the ground, implying that the field-aligned currents (FAC's) generated in association with the velocity field oscillations in the equatorial magnetotail might propagate along the magnetic field line with an Alfvén speed and provide the ground Pi 2 oscillations and further the auroral intensifications of this substorm.