

Relationships between auroral beads evolution and Pi pulsations at substorm onset

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Auroral beads often appeared during presubstorm onset phase, which has been considered as one of important auroral phenomena relating to substorm expansion onset. Recently Motoba et al.,(2012) have reported optical signatures of auroral beads evolution in all-sky images observed at a conjugate pair of stations, Syowa in Antarctica and Tjornes in Iceland, in which auroral beads appeared almost at the same time, as an inter-hemispheric signature and the evolution was stable in the first stage, and then developed to a larger scale spiral form (undulations), at the same time at both the conjugate stations. These interhemispheric similarities suggest that there must be a common driver in the magnetotail equatorial region. On the other hand, it has been well known that Pi pulsation is another important signature at substorm onset. In this paper we examined relationships between auroral beads evolution and Pi pulsation onsets during a few minutes before the substorm expansion onset for the 30 September 2012 substorm event. Results show that there exist very good relationships between Pi pulsation onsets and auroral beads evolutions, particularly on the signatures for auroral beads sudden evolution to spiral structures and/or undulations, which was coincident to appearance of Pi 2 pulsation, and auroral beads brightness enhancement, which accompanied Pi 1 pulsation onset. The appearances of these Pi 1 and Pi 2 pulsations show a good conjugacy. These results show very good one-to-one correspondence between auroral beads dynamics and Pi 1 and 2 onsets, suggesting a common physical mechanism controlling their dynamics in the magnetotail equatorial region.

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