Importance of ULF waves on auroral luminosity variations

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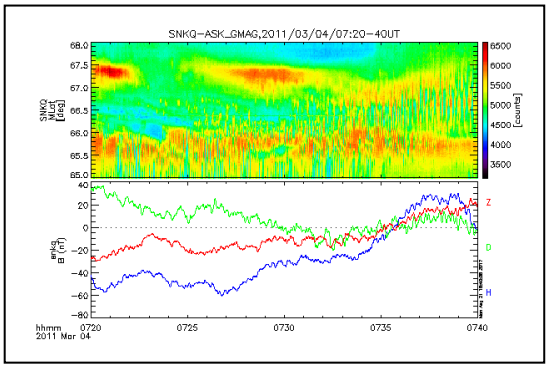
Although there have been many reports on pulsating aurora (Lessard,2012), it seems to be insufficient for analysis on frequency variations of auroral luminosity yet. In this paper we tried to the frequency analysis of auroral luminosity variations by using the IUGONET analytical system for a substorm recovery phase pulsating aurora, which was observed on a ground station of the Time History of Events and Macroscale interactions during Substorms (THEMIS), SNKQ (Sanikiluag) (Mag.Lat.= 66.45, Mag.Long.= 356.99E, Mag. M.N.=5.12UT) in Canada. The analysis in this work has revealed that pulsating aurora appeared in a complicated manner by a superposition of different frequencies of luminosity variations, such as the frequencies from Pc 1 to Pc5. These different frequency luminosity variations appeared separately at the specific magnetic latitudes. The analysis has been done on the pulsating auroral image, which data were obtained during a recovery phase of a substorm observed on 4th March 2011. The following plate shows that the temporal variations of the auroral keogram (upper panel) during 20 min interval from 07:20 to 07:40 UT. The left-side vertical and horizontal axes indicate the magnetic latitude and universal time (U.T.), respectively.



The important point to be notified is that it is clear that the different frequency luminosity variations appeared separately at the specific magnetic latitudes, i.e., the Pc 5 frequency luminosity variations appeared at the higher latitude around 67.5 mag. lat., and at around 67.0 mag. lat. the luminosity variations in the frequency range of Pc4. The most higher frequency variations appeared at the lowest latitude around 65.5 ~ 66.0 mag. lat., whose frequencies belong to Pc 2 to Pc3 pulsation frequency ranges. The simultaneous observation of the magnetic field ULF wave pulsations are shown in the lower panel, which indicates that the different frequency magnetic field oscillations were superposed in this observation. These frequencies are compatible to the auroral luminosity variations.

In this presentation we would like to discuss on how these frequencies relate to the ULF waves oscillations in the magnetosphere by using the physical data (i.e., Electric field, energetic particles and velocity oscillations, etc.) observed by the THEMIS probes. This is the basic question, and/or process that causes the pulsating.

Reference

Lessard, M.R., A review of pulsating aurora, Auroral Phenomenology and magnetospheric processes: Earth and other planets, Geophysical Monograph Series 197, 212, American Geophysical Union, 10.1029/2011GM001187.