

Generation of pulsating aurora: Role of cold electron and electric field

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Pulsating auroras are common phenomena, which are observed universally during the recovery phase of substorm in the auroral and subauroral zones. But, even today, generation mechanism of fundamental characteristics of pulsating aurora, such as, their periodicity, their shapes, and their motion are not understood. Simultaneous observations onboard satellites and on the ground are important method to examine such fundamental characteristics of pulsating aurora. We examined some selected pulsating auroral events, which obtained onboard THEMIS spacecraft and the THEMIS ground-based all-sky camera network. THEMIS satellites were located in the post midnight sector near the equatorial plane in the magnetosphere. We found following signatures of particle, field and wave in the magnetosphere at the onset and during pulsating aurora; 1) All pulsating aurora associate with high-energy (>5 keV) electron flux enhancement, 2) Cold electron flux (<20 eV) and electric field intensity show QP (quasi-periodic) modulation in association with pulsating aurora, 3) and their QP modulation sometimes show one-to-one correspondence to QP modulation of ELF wave intensity, for both type of electromagnetic lower-band chorus wave and electrostatic ECH (electron cyclotron harmonic) wave, 4) But, not all pulsating aurora associate with ELF wave enhancement.

In this talk we focus on the event which THEMIS-A, D, E spacecraft crossed a clear boundary between strong pulsating auroral region and non-pulsating auroral region. In this strong pulsating auroral region, electric field, ULF-ELF (<300 Hz) electric field waves, and cold electron flux are modulated in association with pulsating aurora, but the activity of lower-band chorus wave is very low or nothing. When the spacecraft entered into non-pulsating auroral region all of QP activity became quiet/stop. It is interesting to note that high-energy electron (>10 keV) flux was almost the same for both of the regions, but cold electron flux suddenly decreased and temperature suddenly increased when the spacecraft entered into non-pulsating auroral region. We will discuss the role of cold electron, electric field and ELF waves for the generation of pulsating aurora.

Keywords: aurora, pulsating aurora, chorus wave, magnetosphere, ionosphere, polar region