脈動オーロラ降下電子スペクトルの全体像:PARMロケット実験に向けて

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Simulation of full energy spectrum of pulsating aurora electrons:Implication for the PARM sounding rocket experiment

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Pulsating aurora is caused by intermittent precipitations of a few – tens keV electrons from the plasma sheet. These precipitations are caused by the pitch angle scattering with whistler mode chorus waves. We have proposed a model on precipitations for wide energy electrons from a few keV to more than MeV [Miyoshi et al., 2010, 2015a, Saito et al., 2012]. If the chorus waves propagate to the higher magnetic latitude along the magnetic field line, the resonance energy becomes high enough to cause precipitations of MeV electrons. Several observations have supported this model; sub-relativistic and relativistic electrons simultaneously precipitate into the atmosphere associate with the pulsating aurora. In order to investigate detail of energy spectrum of pulsating aurora electrons, we conduct a simulation on the wave-particle interactions between chorus waves and bounced-electrons along the field line. The simulation result shows that the lower-band chorus waves can cause wide energy electron precipitations from a few keV to more than MeV. At the low-altitude, we observe elements of precipitating electrons with the energy dispersion in the energy-time diagram. The consecutive rising tone elements cause both the internal modulations of precipitating electron flux around 10s keV and the individual bursts at sub-relativistic and relativistic energy range, i.e., microbursts of energetic electrons. The results indicate that the internal modulations of the pulsating aurora electrons and microbursts of sub-relativistic/relativistic electrons are same origin through the wave-particle interactions with the chorus waves. This possibility will be confirmed by the PARM observations onboard the sounding rocket experiments RocSAT-XN (Andoya, Norway) in January 2019 and LAMP (Poker Flat Research Range, Alaska, US) in January 2020.