Simultaneous pulsating aurora and microburst observation with ground-based fast auroral imagers and the Cubesat FIREBIRD-II

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We report the relationship between pulsating aurora and MeV-range high-energy electrons using simultaneous observations of ground-based pulsating aurora and the Cubesat FIREBIRD-II for the first time in the world. Although theory predicted that both the precipitation of several keV to several tens keV electrons that generate the pulsating aurora and the microburst (modulation of MeV electrons) are caused by the whistler-mode chorus (Miyoshi et al.,2020), there is no report of the observation. We examined data taken by ground-based all-sky EMCCD imagers (100 Hz sampling with a BG3 grass filter) installed at Sodankylä (67.37 ˚N, 26.63 ˚E) and Tjautjas (67.31 ˚N, 20.73 ˚E) and by the high-energy electron detector in the energy range from 219.7 keV to 984.95 keV on Cubesat FIREBIRD-II at low-altitudes (525 km). We found an event that simultaneous pulsating aurora and microburst was measured simultaneously when FIREBIRD-II (Flight Unit4: FU4) was located at 67.1 ˚N and longitude 23.1 ˚E in the geographical coordinates at 00:28:16-00:28:19 UT on October 8, 2018. Internal modulation with a period of less than 1 s was observed in the variations of pulsating aurora. Similar modulation was seen in the variation of high-energy electrons of FU4. We studied the observation results based on the model assuming that the chorus waves generate pulsating aurora and microburst simultaneously. We compared the variation of pulsating aurora with the timing of the electron precipitation in the energy range of more than 200 keV. The timing of the 200 keV electrons was ~300 ms ahead of pulsating aurora. From the model by Saito et al. (2012), the difference arrival timings of between 10 keV electrons and 200 keV electrons at the ionospheric altitude of 100 km is estimated to be 300 ms. Thus, the result is consistently explained by the model assuming that the pulsating aurora was generated by 10 keV electrons.

Keywords: pulsating aurora, microburst

