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Rapid flickering of pulsating proton aurora associated with Pc1 geomagnetic pulsations at subauroral latitudes: PWING ground observations as part of Arase-ground coordination

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We report a clear observational evidence of rapid luminous variations of pulsating proton aurora associated with simultaneously observed Pc1 geomagnetic pulsations at subauroral latitudes [1]. The pulsating proton aurora was observed at Athabasca (54.7 N, 246.7 E, L = 4.5), Canada, which is one ground site of the PWING longitudinal network as part of Arase-ground coordinated observations. The fastest luminous variations of pulsating proton aurora were observed at a frequency range of 1 Hz, which was the same as the twice generation frequency range of related Pc1 geomagnetic pulsations on the ground. If the Pc1 geomagnetic pulsation is represented as $A\exp(j\omega t)$, where A is the wave amplitude, j is the imaginary unit, ω is the angular wave frequency, and t is the time, then the instantaneous wave power is proportional to $|A|^2\exp(j2\omega t)$. Thus, we think that the 1-Hz range variation of pulsating proton aurora was remarkable correlated with the wave power of Pc1 geomagnetic pulsations. Additionally, we estimated the source location of this rapid luminous variation of pulsating proton aurora by using the observed time difference between pulsating proton aurora and Pc1 geomagnetic pulsations. The observed time difference suggests that the source region is near the magnetic equator in the magnetic latitudes within -14 to + 11 degrees, as a result of wave-energetic proton or relativistic electron interaction. Although the detailed generation mechanism of this rapid (1 Hz) luminous variation of pulsating aurora is open issue, we consider that the fast variation of pulsating proton aurora is caused by rapid nonlinear pitch angle scattering process via wave-particle interactions in the inner magnetosphere.

In this presentation, we will discuss the temporal characteristics of pulsating proton aurora correlated with the Pc1 geomagnetic pulsations in detail.

1. M. Ozaki, K. Shiokawa, Y. Miyoshi, R. Kataoka, M. Connors, T. Inoue, S. Yagitani, Y. Ebihara, C.-W. Jun, R. Nomura, K. Sakaguchi, Y. Otsuka, H. A. Uchida, I. Schofield, and D. W. Danskin, "Discovery of 1-Hz rage modulation of isolated proton aurora at subauroral latitudes," Geophysical Research Letters, 2018, doi: 10.1002/2017GL076486.