

Over-darkening pulsating aurora: simultaneous observations with Arase and an all-sky camera in Scandinavia

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Pulsating aurora (PsA) is one of the major classes of aurora often seen in the lower latitude part of the auroral region in the morning side. PsAs are characterized by quasi-periodic variations in the optical intensity whose period typically ranges from a few to a few tens of second. Coordinated ground/satellite observations in the last decade demonstrated that the main optical pulsation well correlates with the intensity modulation of whistler mode chorus waves in the magnetosphere. Recent analyses of high time resolution ground-based optical observations have reported that the brightness of PsA decreases below the diffuse background immediately after the ON phase of the main pulsation. To date, however, the generation mechanism of such “over-darkening PsA” is still unclarified. In this paper, we investigate the characteristics of the over-darkening PsA by using simultaneous observations of PsA with an EMCCD all-sky camera in Sodankylä, Finland (67°N , 26°E , 64°MLAT) and the Arase satellite. The EMCCD all-sky camera captures auroral emission with a temporal resolution of 100 Hz. We make use of data from the PWE/OFA instrument to analyse the temporal variation of chorus wave as a source of PsA. During one of the conjunction events in Scandinavia on March 29, 2017, almost all the PsA pulses showed clear over-darkening characteristics. By analysing the 2D all-sky images at the times of over-darkening we identified that over-darkening areas appeared in the trailing edge of PsA patches and moved in tandem with the poleward propagating patches. It was also found that similar over-darkening characteristics were not seen in the chorus data from PWE/OFA onboard Arase located at the magnetospheric counterpart of PsA. These results indicate that the over-darkening PsA is not caused by a temporal variation of chorus at a fixed point, but is produced by a propagation of over-darkening area with PsA patches. That is, the over-darkening PsA is a spatial structure rather than a temporal variation. In the presentation, we discuss several possible scenarios that can explain the over-darkening along the edge of PsA patches.

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