

Occurrence property of flickering aurora

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Flickering auroras typically appear within active and bright auroral arcs just prior to and during auroral breakup, and their typical frequencies are 3–15 Hz which correspond to oxygen ion cyclotron frequency at altitudes of 3000–10000 km. The flickering aurora has been considered to be generated by Landau resonance interactions between electrons and electromagnetic ion cyclotron (EMIC) waves. The necessary condition of their appearance remains unsolved due to lack of continuous observations. We have conducted 50–320 fps sCMOS camera observations at Poker Flat Research Range, Alaska for more than 3 winter seasons to elucidate the occurrence property and to reconsider the generation mechanism.

We report statistical results of the correlations between the occurrence of the flickering aurora and magnitudes of AE index, non-flickering background auroral intensities, and microscale (1–10 km) flow speeds in the non-flickering background aurora, which appeared at the same time of the flickering aurora, based on 50 fps data obtained for the 2014 winter season. It is found that the flickering aurora was likely to occur in case of the high AE index and the bright background aurora with the fast microscale flow speeds. These results indicate that the occurrence of the flickering aurora is likely to be affected by the intense parallel potential drop of the auroral acceleration region because the EMIC waves are considered to be excited by the electron beams. In comparison with the background auroral intensity and the microscale flow speed, it is also found that the former largely contributed to generate the flickering aurora. We also report the first evidence of the fastest flickering of >60 Hz from new data obtained during the winter of 2015, which is possibly generated by the proton-band EMIC waves.