High resolution observations of structuring and temporal variability in dual-frequency pulsating aurora

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Periodic temporal variations of diffuse aurora with periods of 1 to 30 s are often observed in the recovery phase of a geomagnetic substorm. These pulsations are widely believed to be caused by pitch-angle scattering of plasma sheet electrons into the loss cone by whistler chorus waves. Measurements from rockets and satellites have shown the occurrence of a faster modulation superimposed on slower pulsations. Only a few observations of these modulations have been made from ground-based instruments, and it is not clear whether they are a common feature of pulsating aurora, what typical characteristics they exhibit or what their generation process is.

We present high temporal and spatial resolution ground-based observations of pulsating aurora with superimposed 2-3 Hz modulations as measured by the ASK (Auroral Structure and Kinetics) optical instrument. Both thin bright auroral filaments and dark striations are seen in the diffuse aurora during the 'on' time of the pulsations. Variations of the modulation frequency and their relation to any structuring in the aurora are discussed, as well as their relation to the slower pulsations. From the multi-spectral observations in combination with ion chemistry modelling it is possible to estimate the spatial and temporal variations of the energy of the precipitation, to help shed light on the possible formation mechanism of the faster modulations. We also report on observations of a different population of low energy precipitation, which appears superimposed on the high energy pulsating aurora.