The actual status of high-speed imaging observation plan for flickering aurora

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Since flickering aurora was first well defined by Beach et al. [1968], several works on flickering aurora have been reported. Optical observations of flickering aurora have so far been carried out using TV cameras or photometers in the past [e.g. Oguti, 1978; Berkey et al., 1980; Sakanoi et al., 2004, 2005]. Basic characteristics of flickering aurora ovserved in the past are; modulation frequency is usually 10+/-3 Hz, and width and vertical extent of each flickering column are in a range of 1-10 km and over 40 km, respectively. By coordinated ground-based optical observation and sounding rocket particle measurements, intensity variation of flickering aurora is thought to be caused by periodic modulation of precipitating electron flux. Temerin et al. [1986, 1993] proposed a model of field-aligned electron flux acceleration modulated by electromagnetic ion cyclotron (EMIC) wave to produce flickering aurora. No ground-based optical observations with spatial resolution better than a few km has been realized so far, and therefore, fine structures of flickering aurora are not well understood.

It is expected to realize observation of flickering aurora with sufficiently high temporal and spatial resolutions by using a highly sensitive EMCCD camera, which became available in recent years. We carried out calibration experiment of an EMCCD camera using a 2-m integrating sphere at NIPR to evaluate a possibility of observation. Observation is supposed to be made with N2 1st positive band (1PG) emission as a source, and expected intensity of the emission ranges from a few kR to a few tens kR based on the observation made by REIMEI satellite. Amplitude of flickering modulation is expected to be 10-20%, in average, relative to the background aurora intensity. The system used in the calibration experiment was a combination of Andor DU-897 EMCCD camera and a F1.2 camera lens with an interference filter (FWHM 38nm centered at 670nm) in front of it. Results of the experiment showed that modulation of the emission intensity is detectable for 4kR emission intensity with sampling rate of 100Hz, spatial resolution of 256m (when auroral altitude of 100km is assumed), and multiplying factor of 1000 for the EMCCD. This result is promising for observation of flickering aurora. When such observation is realized, it is expected to obtain fine structures in flickering aurora. We also made a test observation of aurora using a Watec video CCD camera at Longyearbyen in last December. In actual observation, the video CCD camera with a wide field of view will be used as monitor camera. In the presentation, detailed results of the calibration experiment, and the test observation with video CCD camera at Longyearbyen will be given along with development status of the equipment to be used for the observation and the observation strategy.