2009-2010年冬期におけるEMCCDカメラを用いたパルセーティングオーロラの高速撮像観測

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Observation of pulsating auroras by high-speed imaging technique using an EMCCD camera in 2009/2010 winter campaign

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Pulsating aurora is a phenomenon which shows periodic changes of emission intensity in the diffuse aurora. The emission is characterized by not sinusoidal change but pulsation, and its typical period is from a few seconds to a few tens of seconds [e.g., *Oguti et al*., 1981; *Yamamoto*, 1988; *Nemzek et al*., 1995]. Precipitating electrons which generate pulsating aurora were observed with quasi-3 Hz modulations by rockets and low-altitude satellites and the energy ranges from a few keV to a few tens keV [*Sandahl et al*., 1980; *Yau et al*., 1981; *Sato et al*., 2004]. Since pulsating aurora appears in diffuse aurora, electrons are thought to undergo cyclotron resonance with whistler mode waves in the equatorial region of the magnetosphere and to precipitate into the Earth's upper atmosphere by pitch angle scattering. Moreover, some simultaneous optical and VLF whistler mode wave observations have been carried out to demonstrate this idea [*Tsuruda et al*., 1980; *Hansen and Scourfield*, 1990; *Tagirov et al*., 1998]. These studies suggested that appearance of auroral pulsations were related to VLF emission activity, however, one-to-one correspondence of order of a few hundred ms between auroral fine-scale structures with high temporal fluctuations and each element of VLF emission have not been shown yet.

The purpose of this study is to investigate the characteristic of temporal variations in pulsating auroras using a high-speed camera equipped with an Electron Multiplying CCD (EMCCD). We have made simultaneous observations with three cameras, EMCCD camera and two other cameras for guiding, and an ELF magnetometer (400 Hz sampling). EMCCD camera takes an image at 670.0 nm (N2 1st Positive Band) wavelength at intervals of 10 ms. The field of view is 9.3 degrees and the spatial resolution equals to 280 m at altitude of 110 km. The initial observations were operated at Toolik field station (MLAT 68.4 deg) in Alaska between December 9, 2009 and January 16, 2010, and then the observations were carried out at Poker Flat Research Range (PFRR, MLAT 66.8 deg) between January 19, and April 10, 2010. Through the campaign, many image data of pulsating aurora were obtained.

We estimate peak frequencies of temporal variations in pulsating auroras using auroral images that consist of 64∗64 bins and FFT analysis technique; one is corresponding to period of auroral pulsations between a few and a few ten second, the other is faster variations reaching at ten Hz. We also try to investigate spatial distributions of the peak frequency and dynamics of pulsating auroras. In addition, we are planning a new observation that addresses especially pulsating auroras. We design new optics with wide field of view for EMCCD, and estimate sensitivity of optics equipped with a photometer that has a narrow field of view and high sampling rate about 1 kHz to investigate faster temporal variations of auroral phenomena. In this presentation, we report the results of data analysis of pulsating aurora obtained at Toolik and PFRR, and a plan for the campaign observations of this year.