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Characteristics of polarization in auroral emissions based on wide-field polarization spectroscopic observation

TAKASAKI, Shimpei[1] ; SAKANOI, Takeshi[1*] ; KAGITANI, Masato[1]

[1]Graduate School of Science, Tohoku University

Recently the linear polarization (up to 17 %) of auroral 630 nm emission has been reported from ground-based measurements (Bommier et al., 2011). However, characteristics of auroral polarization, such as substorm dependence, are not understood well. This study we focus on the polarization in auroral 557.7nm emission as well as 630 nm emission, and developed the wide-field (130 deg) north-south meridian imaging polarization spectrograph. In addition, we also developed the polarization telescope with Wollaston prisms to calibrate polarization effect additionally caused by air particle in the line-of-light direction.

The wide-field imaging spectrograph consists of a fish-eye lens, wire-grid linear polarizer, VPH grating and EMCCD camera, covering 450 ? 710 nm range with 2.0 nm resolution. To obtain the auroral polarization with accuracy better than 1%, we developed the calibration LED lamp with a rotating linear polarizer and carried out the precise calibration of instrumental (artificial) polarization for the whole 130 deg FOV with interval of 3 deg.

We have performed continuous measurement of auroral polarization since November 2014 at Poker Flat, Alaska. For geomagnetically disturbed event on Nov. 20, 2014, the polarization in auroral 630 nm emission was maximized up to 8% at low-elevation angle (˜10 deg), and decreased toward the magnetic zenith, where the polarization was ˜1%. On the other hand, there was strong polarization in 557.7 nm emission (greater than 10%), which should not polarized from the theory of magnetic quadra-pole emission process.

We estimated the relative energy of precipitating electrons from the ration of 630nm and 557.7nm emissions, and found that the polarization of auroral 630nm emission increased as the energy of precipitating electron decreased. I this talk we will give the recent results and discuss issues for further study on auroral polarization.

Keywords: aurora, polarization, development