アラスカポーカーフラットにおける地上光学観測による酸素原子630nmオーロラの偏光特性

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Characteristics of 630nm auroral polarization observed at Pokar Flat, Alaska

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We report the result of OI 630 nm auroral polarization observation at Poker Flat Research Range (Glat=65.12N, Glon=147.43W, Mlat=65.72N) during the period from December 2013 to April 2014. OI 630nm auroral emission is theoretically expected to show linear polarization with degrees up to 17% [Bommier et al., 2011]. The important point is that, the degree of linear polarization depends on energy and velocity anisotropy of precipitating electrons [Fujimoto et al., 1997]. Recent observation data also showed that 630nm auroral emission related to polar rain at high-latitudes linear polarization parallel to field with degrees of 2-7%[Lilensten et al., 2013]. However, these past measurements were limited in the polar cap region and its polarization characteristics are not clear.

To examine auroral polarization with an accuracy of 1% polarization degree, we developed an imaging spectrograph which can measure auroral polarization in the wide field-of-view of 130 deg covering the wavelength range from 420 nm to 680 nm (resolution 2 nm). This new instrument enables us to obtain the linear polarization degrees at 557.7 nm and 630 nm auroral emissions simultaneously. Here, we can regard 557.7 nm aurora as a standard polarization light source because it does not produce polarization theoretically. We installed the spectrograph at Poker Flat and carried out precise calibration to estimate artificial polarization which is produced inside the optical system using an LED light source with a linear polarizer every 3 hours on five nights in December 2013. Since then, automatic operation was continuously carried every night out till the beginning of April 2014.

We obtained the linear polarization of 630 nm aurora with degree of 5% showing elevation angle dependence. On the other hand, we unexpectedly measured the polarization of 557.7 nm emission which shows similar polarization property as 630 nm. We are considering two possibilities to interpret the results as follows. First is that the auroral emissions are additionally scattered and polarized through atmospheric particles and dusts in the middle and lower altitudes in the line-of-sight direction. Second is that we could not correct instrumental artificial polarization effect with the calibration we did last year and further accurate calibration will be required.

In the future, we discuss the fluctuation of pitch angle distribution with auroral activity from the results.