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Occurrence characteristics of Jovian auroral emissions in the low-latitude region

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Jupiter has large magnetosphere and bright auroral emissions in the polar region. In the low latitude region, defined between the main oval region and the Io footpath latitudinal region, ”patchy emission” and/or ”extended emission” sometimes appear at the postnoon sector as an extended emission from the main oval region to near the Io footpath latitudes. Although these emissions reflect some activities of the Jovian inner to middle magnetosphere, it is little known what magnetospheric activities contribute to the auroral emission. In this study, we have researched their variations and occurrence characteristics to understand physical processes of the inner to middle magnetospheric activities using the data of Jovian UV and IR auroras observed with Hubble Space Telescope (HST) and NASA InfraRed Telescope Facility (IRTF). From the HST campaign observations in 2007, it is suggested that the low-latitude emissions have the duration time of several tens of hours and shift their emission regions in the direction of positive system 3 longitude; i.e., the emission region lagged from the corotation. . The shift velocities were derived to be several percent to more than ten percent. The velocities cannot be explained only by magnetic drift of electrons with the energy of several tens keV which is typical for UV aurora. The past in-situ plasma observations by Voyager and Galileo showed that the plasma bulk velocity in the inner to middle magnetosphere is a few to ten-odd percent slower than corotation speed. These values are similar to the lag of the extended auroral emissions. Thus, it is plausible that the lag of the low-latitude emissions is mainly caused by the corotation lag of the plasma in the Jovian magnetosphere.

In order to investigate causality of occurrence of the low latitude auroras, we have surveyed the IR aurora data for the Galileo’s Jupiter observation period. Mauk et al. [Nature, 2002] indicates one event of low-latitude patchy emission corresponding injection. In this study, we have examined correspondence between low-latitude emission and the phenomena relating to injection; i.e., injection, the location of Galileo satellites, solar wind and nKOM. We identified four low-latitude emission events for totally 43 days of the observation by IRTF for 1996 ? 2000. As the result, we could not confirm the correspondence between the low-latitude emission and injection due to lack of the Galileo data. Furthermore, we could not find relationship between the low-latitude emission and injection relating phenomena. The duration time of low-latitude emission identified in this study was a few dozen hours, while it is reported that the duration time of injection is at most 12 hours. This implies that the low-latitude emissions identified in this study are a new type and different from the event identified by Mauk et al. (2002). The confirmation of types of the low-latitude auroras and investigation of their occurrence processes are deferred in the future studies.

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