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Transient small-scale structure in the main auroral emission at Jupiter

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Abstract

The main auroral emission at Jupiter is associated with the magnetosphere-ionosphere coupling current system generated by the corotation breakdown of Iogenic plasma in the current sheet. The morphology and brightness of the main auroral emission are generally suggested to be stable during time intervals of the order of an hour.

Here we identify for the first time a small-scale dynamic feature whose brightness is growing or decreasing over timescales of an hour. An example of this transient feature is given in Figure 1 which shows four polar projections of FUV images of the north pole of Jupiter obtained with the Hubble Space Telescope. The brightness of the transient feature indicated by the yellow arrows continuously increases during the 30-minute observation. The dynamic evolution of this small-scale structure is investigated in both hemispheres on the basis of HST observations between 1997 and 2007. A statistical analysis reveals the properties of this small-scale structure whose equatorial source region is fixed in magnetic local time, around noon.

Additionally, we present global MHD simulations of the Jovian magnetosphere for different solar wind conditions, using the model developed by Chané et al. (2013) [1]. The model predicts the formation of a localized small-scale feature around noon in the auroral region, compatible with the observed transient auroral structure. According to the simulations, a negative plasma radial velocity region is created in the current sheet close to magnetic noon. We suggest that the shearing motions occurring at the boundary of this region lead to a localized enhancement of the upward field aligned current density.

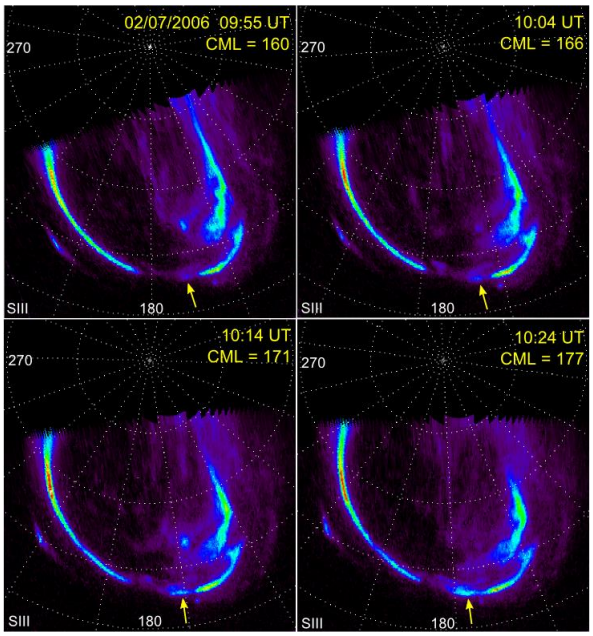

Figure 1: Sequence of four polar projections in System III of the northern aurora at Jupiter. The yellow arrows point to the transient small-scale structure. The color scale is the same for all the images.

References

[1] Chané, E., Saur, J., and Poedts, S.: Modeling Jupiter's magnetosphere: Influence of the internal sources, J. Geophys. Res. Space Physics, 118, 2157-2172.