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Possible signatures of magnetospheric injections at Jupiter: Statistical study of HST FUV images

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Abstract

We investigate the characteristics of ultraviolet auroral features located equatorward of the main emission appearing in the Hubble Space Telescope (HST) images obtained in 2000-2007. Several properties of the auroral emissions are analyzed. The mapped radial position and System III longitude of the observed auroral features are in good agreement with those of the injections observed in the equatorial plane by Galileo. Finally, we discuss the processes causing auroral signatures of injections. This comparative study demonstrates that the structures under study are most probably related to magnetospheric injections and sheds light to the mechanism involved in the magnetosphere-ionosphere dynamics.

1. Injections

Mauk et al. [1997] [1] reported the first detection of energetic particle injection in Jupiter observed with the Energetic Particles Detector (EPD) on board the Galileo spacecraft. During a plasma injection, the magnetic flux lost through cold plasma outflow is balanced by inward injection of flux tubes containing hot plasma from the outer magnetosphere. Mauk et al. [1999] [2] performed a statistical analysis of these energy-time dispersed intensifications in energetic ions and electrons, based on Galileo EPD data, and found that energetic particle injections are commonly observed in the Jovian magnetosphere from 9 R_J to 27 R_J, at all System III longitudes and all local times. Later on, Mauk et al. [2002] [3] associated an isolated equatorward patchy auroral ultraviolet emission with energetic particle injections threading the same flux tube. Nevertheless this association is based on a single set of simultaneous observations. The goal of the present study is to statistically investigate the equatorward auroral emissions and establish their possible association with magnetospheric plasma injections.

2. Equatorward isolated auroral structures

The equatorward isolated auroral features (Figure 1) consist of quasi-corotating isolated structures spanning a region roughly bounded poleward by Jupiter's main emission, and equatorward by the magnetic footpath of Io. We analyze observations of the auroral regions of Jupiter and compare them with statistical results obtained with *in situ* instruments. We magnetically map the auroral structures to the equatorial plane using the VIPAL model and we compare their observed properties with those of magnetospheric injections observed by Galileo. The combined use of remote and *in situ* observations allows us to investigate the importance of plasma transport in the Jovian magnetosphere. Based on spectra data, we estimate the electron energy of the auroral features under study.

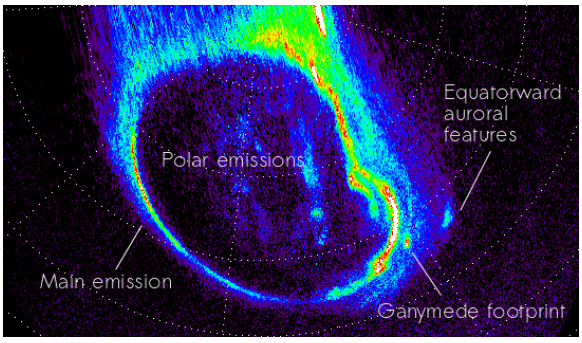

Figure 1: Polar projections of auroral images in the northern of Jupiter obtained by HST /STIS on 18 December 2000 at 14:09 UT. The central meridian longitude is 167° SIII. The main auroral features are indicated: the main emission, polar emissions, ganymede footprint and equatorward auroral features.

3. Summary and Conclusions

We examine the possibility that the selected UV auroral features are related to injections events in the Jovian magnetosphere. We show that these equatorward auroral features are common as they appear in more than half of the data sample. Our analysis shows that the auroral features are seen at all System III longitude and preferentially map to a region located between 7 R_J and 40 R_J. We compare these HST observations with *in situ* injections signatures obtained from Galileo energetic particle data and we demonstrate that the auroral and *in situ* measurements are present at the same location in the magnetosphere, indicating that the auroral features under study are most probably auroral signatures of injections. Finally, we discuss the auroral mechanisms associated to the auroral features studied.

References

[1] Mauk, B. H., D. J. Williams and R. W. McEntire. : Energy-Time Dispersed Charged Particle Signatures of Dynamic Injections in Jupiter's Inner Magnetosphere. *Geophysical Research Letters* 24, no. 23: 2949-2952, 1997

[2] Mauk, B. H., D. J. Williams, R. W. McEntire, K. K. Khurana and J. G. Roederer. : Storm-Like Dynamics of Jupiter's Inner and Middle Magnetosphere. *Journal of Geophysical Research* 104, no. A10 : 22759-22778, 1999.

[3] Mauk, B. H., J. T. Clarke, D. Grodent, J. H. Watte, Jr.,C. P. Paranicas and D. J. Williams. : Transient Aurora on Jupiter from Injections of Magnetospheric Electrons. *Nature* 415, no. 6875 : 1003-1005, 2002.

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