Jupiter’s mesmerizing auroral show (PJ13); HST ultraviolet observations near and far from Juno perijovess

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“QUIET” aurora probably resulting from a long period (days?) of low SW activity.
od8k1op1q
05/22/2018 16:20:27
Max. Brightness: 1.81MR

DDY: 142
CML: 132.815
Total Power: 15300W
Connerney (2018) JRM09
preliminary work

“QUIET” aurora
Connerney (2018) JRM09 preliminary work

“QUIET” aurora
od8k1qw5q
05/24/2018 03:04:02
Max. Brightness: 4.15MR

DDY: 144
CML: 133.748
Total Power: 10250W
“QUIET” aurora
compression, while the day after the aurora had dropped to the opposite Q morphology, presumably corresponding to an unperturbed magnetosphere and stayed in that state for a day or two, followed by a new episode of strong injections. During the week that preceded PJ03, the magnetosphere might have encountered more than one IM compression regions and saw several episodes of strong injections, both of which contributed to a rapidly changing morphology. These morphological changes have an impact on the emitted power, as shown in Figure 1 (and Figure S1.3). During the same period, the total emitted power varied by a factor of ~3 from 0.7 to 2.4 TW. The largest power was emitted during the week preceding PJ03, when the very strong emissions in the equatorward subregion combined with the enhancement of the ME subregion. The smallest power was observed for the Q family members. Near the time of perijove, the total power peaked to 1.36 TW and rapidly dropped to its minimum at 0.7 TW, which is also the smallest value measured during the period covered by this study. It is interesting to note that the power emitted in the poleward subregion followed the same trend as in the ME subregion. This is surprising since these two subregions are presumably mapping to very different regions of the magnetosphere and, so far, were expected to behave independently. We cannot ignore the possibility that

Figure 4. Graphical representation of the evolution of the auroral morphology over Juno orbits 3 to 7 (see also detailed parameters in Table 1). Like Figure
Dawn side CS
above below inside
Bx < 0 >0 = 0
By < 0 >0 = 0
Bz < 0 <0 ≃ 0

Yao et al., in preparation
Sun State coordinates

Khurana 2001
Current sheet flapping around Juno (in equatorial plane)
compression, while the day after the aurora had dropped to the opposite Q morphology, presumably corresponding to an unperturbed magnetosphere and stayed in that state for a day or two, followed by a new episode of strong injections. During the week that preceded PJ03, the magnetosphere might have encountered more than one IM compression regions and saw several episodes of strong injections, both of which contributed to a rapidly changing morphology. These morphological changes have an impact on the emitted power, as shown in Figure 1 (and Figure S1.3). During the same period, the total emitted power varied by a factor of ~3 from 0.7 to 2.4 TW. The largest power was emitted during the week preceding PJ03, when the very strong emissions in the equatorward subregion combined with the enhancement of the ME subregion. The smallest power was observed for the Q family members. Near the time of perijove, the total power peaked to 1.36 TW and rapidly dropped to its minimum at 0.7 TW, which is also the smallest value measured during the period covered by this study. It is interesting to note that the power emitted in the poleward subregion followed the same trend as in the ME subregion. This is surprising since these two subregions are presumably mapping to very different regions of the magnetosphere and, so far, were expected to behave independently. We cannot ignore the possibility that

- **Figure 4.** Graphical representation of the evolution of the auroral morphology over Juno orbits 3 to 7 (see also detailed parameters in Table 1). Like Figure 1, the upper left panel presents all the data in a single plot, while the subsequent panels show the results for each individual orbit. The individual panels are also available in the supporting information (Figures S4.1 and S4.3–S4.7). Each family is assigned a qualitative index: Q = 1, U = 2, N = 3, i = 4, I = 5, and X = 6. This index reflects the typical power level measured in the families and is also such that the indexes of related families, like I and i, differ by 1 unit. Morphologies observed in the north are marked with a diamond, and those observed in the south are marked with a star. The time is given in decimal DOY 2017. For observations obtained in 2016, we subtracted 366 days, resulting in negative DOY 2017. The times of perijoves 3 to 7, corrected for the Juno-HST light travel time, are marked with a vertical bar at the top of the plot. The horizontal dashed lines are guiding lines. The upper one separates the X family, influenced by the external perturbations, from the strong and moderate injection I and i families, influenced by plasma injections. The lowest line separates the Narrow and Unsettled (N and U) families, corresponding to the most frequent auroral morphologies, from the Quiet (Q) family, characterized by very low emitted power. 

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PJ04 “Perturbed case”
3.1. Uncertainties on the Emitted Power

The intrinsic variability of the auroral emission power is well illustrated in Figure 1 by the vertical distribution of the data points over one HST visit (~41 min). During this time the subregion or total power may change by as much as one third. This level of variation is comparable to the estimated uncertainty on the emitted power, which is mainly influenced by three processes: the background subtraction, the conversion from STIS counts per second to emitted power, and the correction for the viewing geometry. The background subtraction procedure described by Bonfond et al. (2011) is based on the generation of a model planetary disk simulating the reflected sunlight. A conservative uncertainty of 25% on this simulation gives rise to ~6% inaccuracy on the auroral power. This inaccuracy is systematic and remains constant over an HST visit. Therefore, it is not affecting the relative variability of the emission. The conversion factor from STIS counts to emitted power depends on the emission spectrum passing through STIS + F25S R2 filament optical assembly. It is affected by the amount of methane absorption, related to the energy of the impinging electrons through the $H_2$ UV color ratio.
"Conclusion" (work in progress)

1. Perturbations of B and of energetic $\bar{e}$ [50-80R$_J$] are highly correlated with auroral dynamics $\implies$ middle to outer magnetosphere dynamics is important in driving Jovian auroral emissions.

2. Apparent anti-correlation between JEDI signatures of CS expansion and HST auroral size and bulk morphology.

3. Potential connection between CS thickening (reconnection?) and auroral injections.

4. CS expansion and plasma energisation events observed by Juno and HST are global effects.