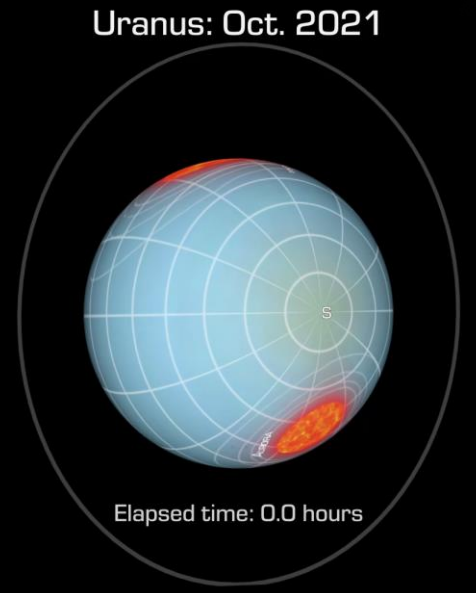
EGU23-577

Extending the NIR auroral map of Uranus through the 21st century



O'Donoghue, J., (2021).

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[3]Center for Space Physics, Boston University, MA, USA

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Observational Layout for 2006/2016

2006 – NIRSPEC/KECK

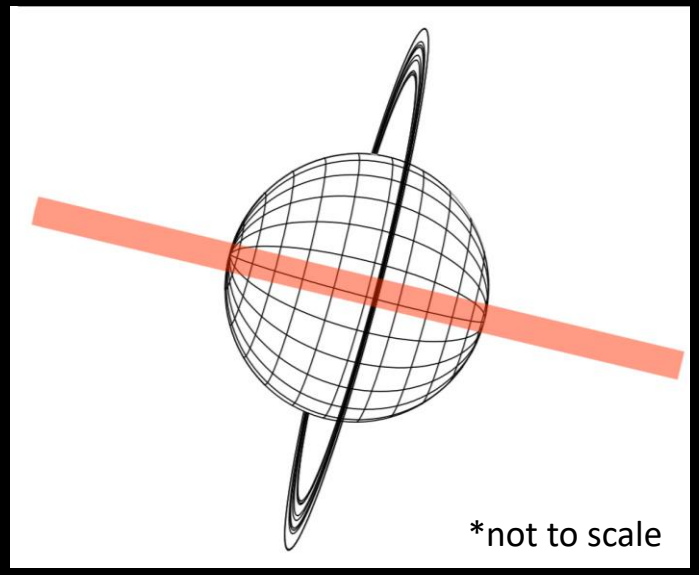

Figure SM1. Observational Layout for observations of Uranus taken in September 2006. The red rotated rectangle is the approximate position of the NIRSPEC slit (0.288x24 arcsecs) from the Keck telescope as it took data at Uranus. The slit was aligned with the N-S rotational axis of Uranus.

2016 – iSHELL/IRTF

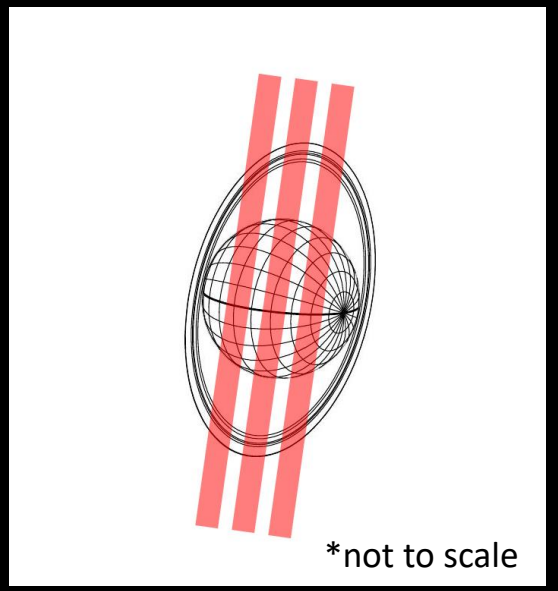

Figure SM2. Observational Layout for observations of Uranus taken in Octobr 2006. The red rotated rectangles are the approximate positions of the iSHELL slits (0.375x15 arcsecs) from the IRTF telescope as it took data at Uranus. The slits were aligned at three set positions (1 at equator, 1 in the northern hemisphere and 1 in the southern hemisphere) and were aligned perpendicular to the N-S rotational axis of Uranus.

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Consistent NIR Intensity Asymmetry

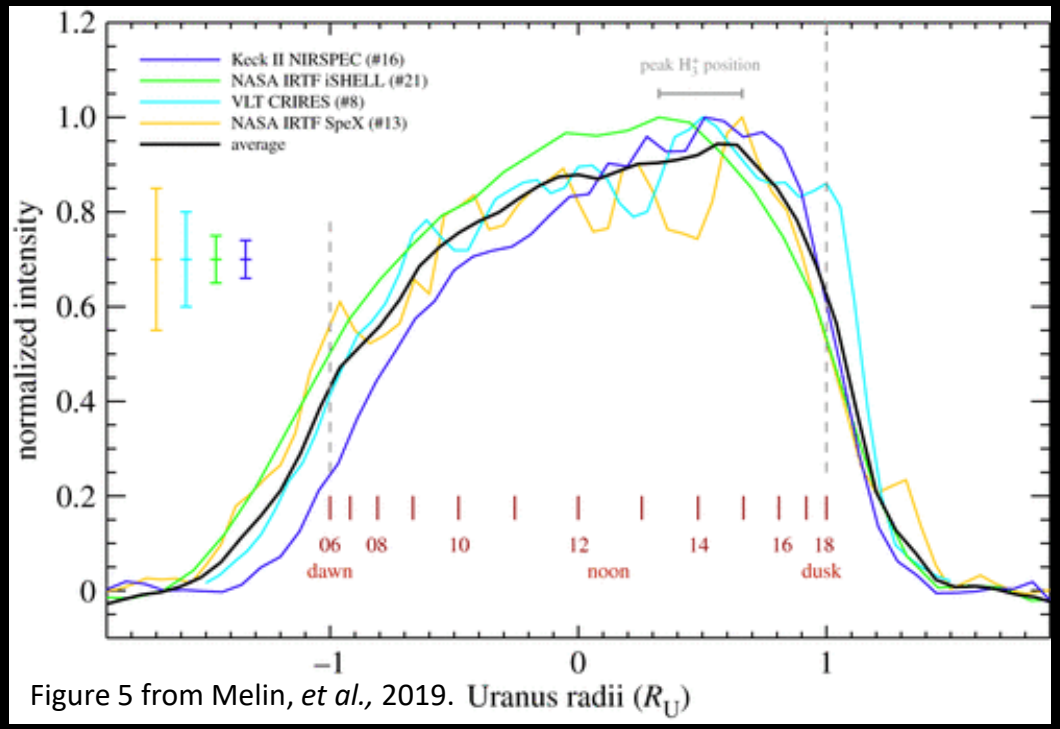

Figure 5 from Melin, *et al.,* 2019.

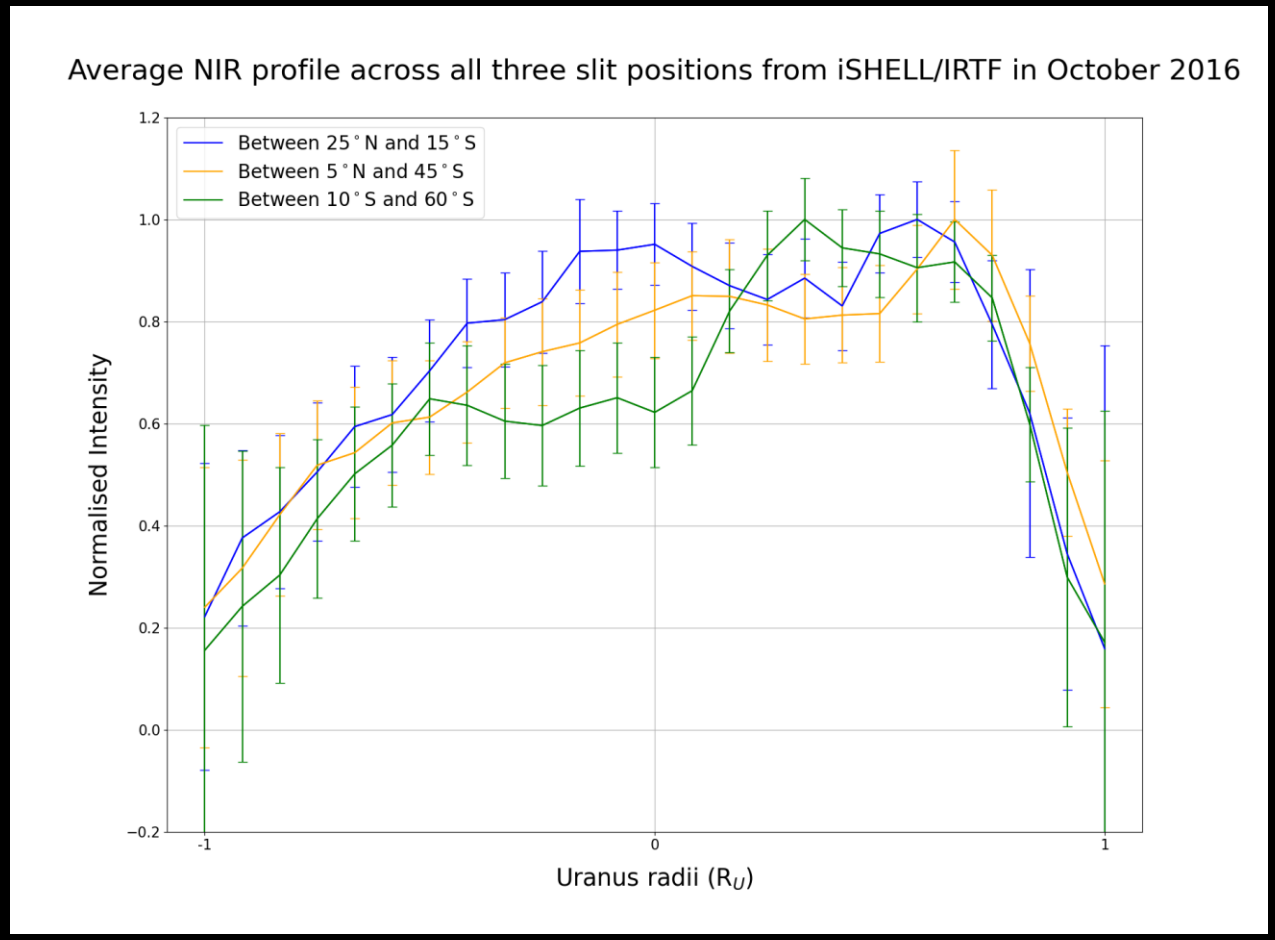

Figure SM4. Average NIR Intensity profiles across all three latitude positions and presented similarly to Figure 5 of Melin, *et al*., 2019. A significant decrease in intensity is observed at close to 0 U_R between the blue and green profiles, suggesting for this observation the dawn-dusk asymmetry profile is not consistent across these latitudes.

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Analysis from iSHELL/IRTF 11th October 2016 observations

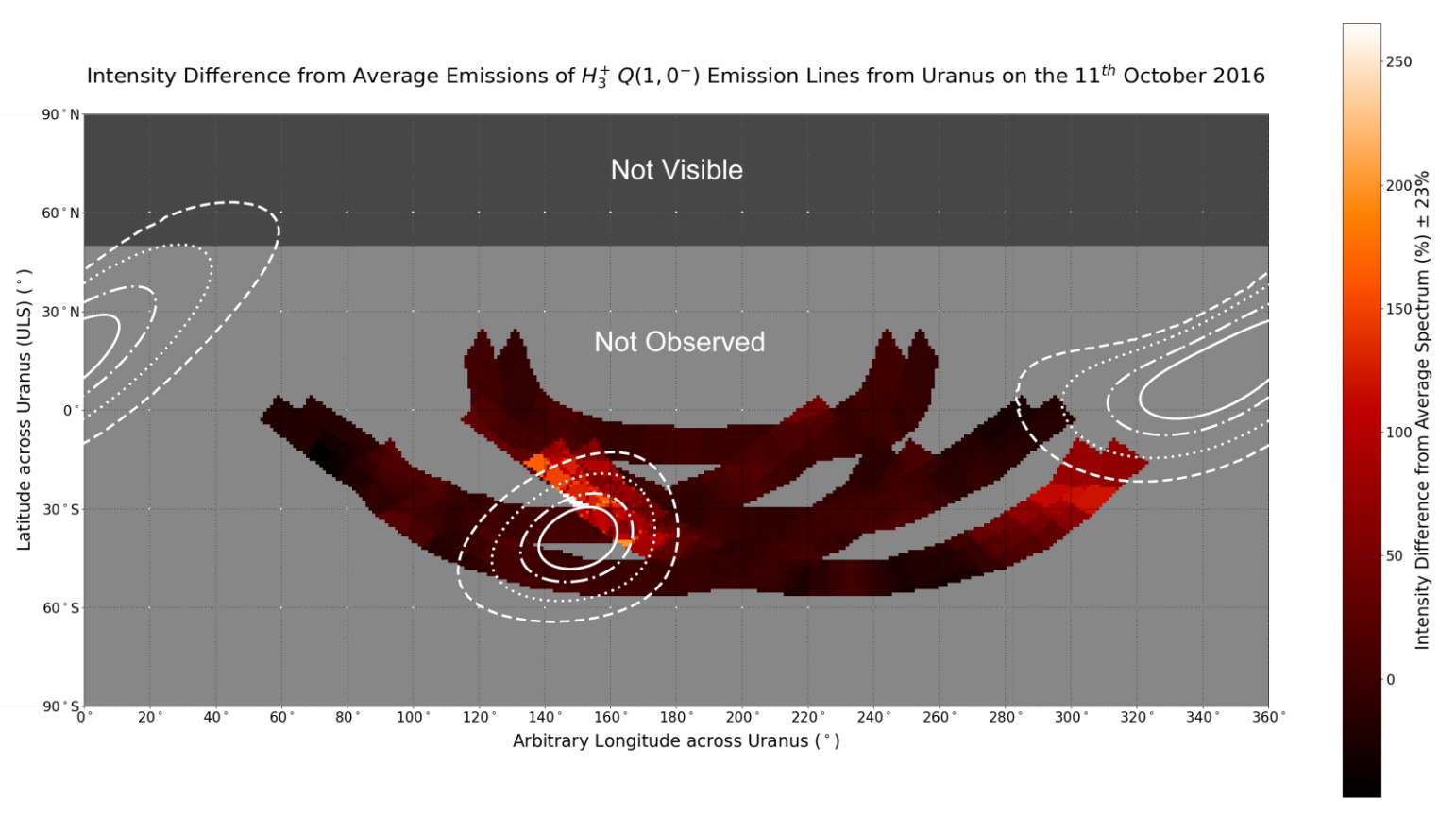

Figure SM5. Mapping of combined Q(1,0$^-$) and Q(3,0$^-$) emission lines observed on the 11th October 2016, with iSHELL/IRTF.

Shown in a white solid/dashed/dotted and both lines are the L shells of the Q_3 model (Connerney, 1987) that trace out to specific locations in Uranus's magnetosphere. The L shells shown are 3,5,10 and 20 and link out to 3,5,10 and 20 R_U.

An arbitrary longitude has been used for this investigation which when compared to the ULS longitude is approximately 75°W of the Q_3 model, though a change in ULS longitude between now and 1986 is expected due to the ± 0.01 hr error in rotational period.

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Analysis from iSHELL/IRTF 11th October 2016 observations

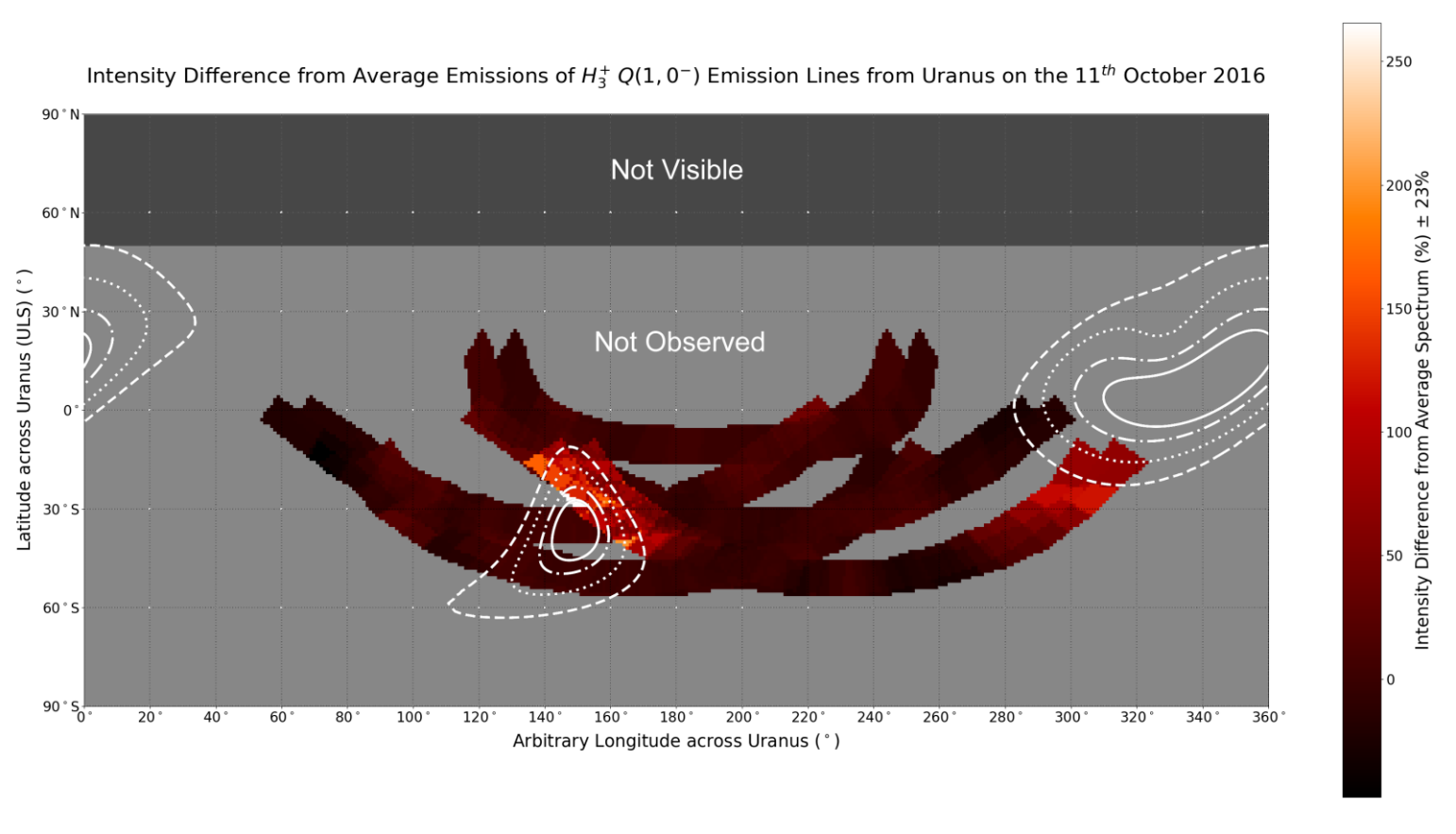

Figure SM6. Mapping of combined $Q(1,0^-)$ and $Q(3,0^-)$ emission lines observed on the 11th October 2016, with iSHELL/IRTF.

Shown in a white solid/dashed/dotted and both lines are the L shells of the AH_5 model (Herbert, 2009) that trace out to specific locations in Uranus's magnetosphere. The L shells shown are 3,5,10 and 20 and link out to 3,5,10 and 20 R_U.

An arbitrary longitude has been used for this investigation which when compared to the ULS longitude is approximately 85°W from the AH_5 model, though a change in ULS longitude between now and 1986 is expected due to the ± 0.01 hr error in rotational period.

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Complete analysis of iSHELL/IRTF 11th October 2016 Observations

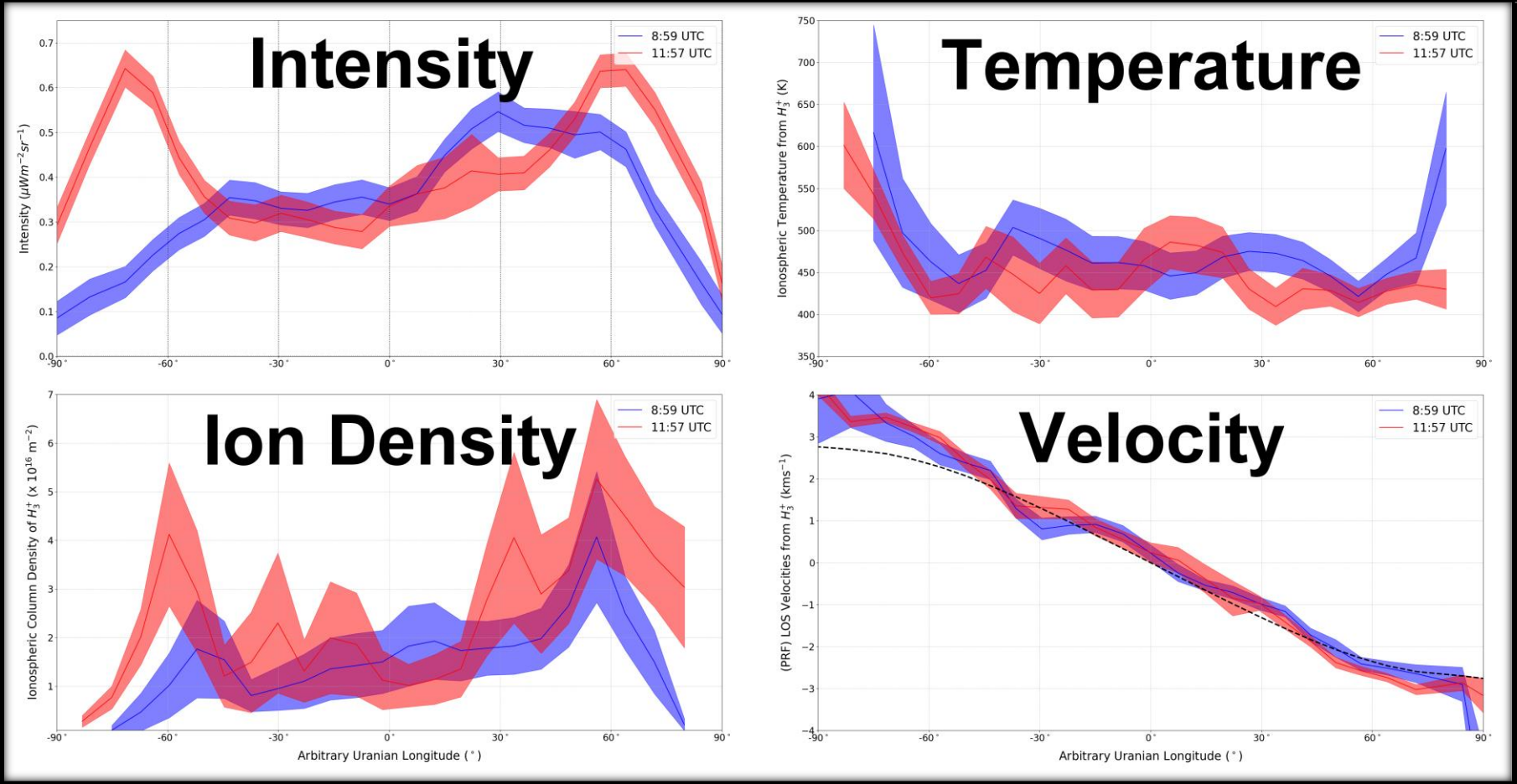

Figure SM7. Average Intensity (top left), Temperature (top right), H_3^+ column density (bottom left) and Velocity (bottom right) profiles for NIR observations at ~9:00 UTC (blue) and ~12:00 UTC (red) on the 11th October 2016. Arbitrary Longitude is used in these investigations as the actual ULS longitude is unknown.

We observe significant enhancements between -45° to -90° for the 12:00 UTC data, with partial increases between 60° to 90°.

At these regions we observe no significant variation in temperature between -45° to -90° with >400% increase in ion density suggesting auroral activity at this location.

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Comparison of NIR observations in 2006 with 2016.

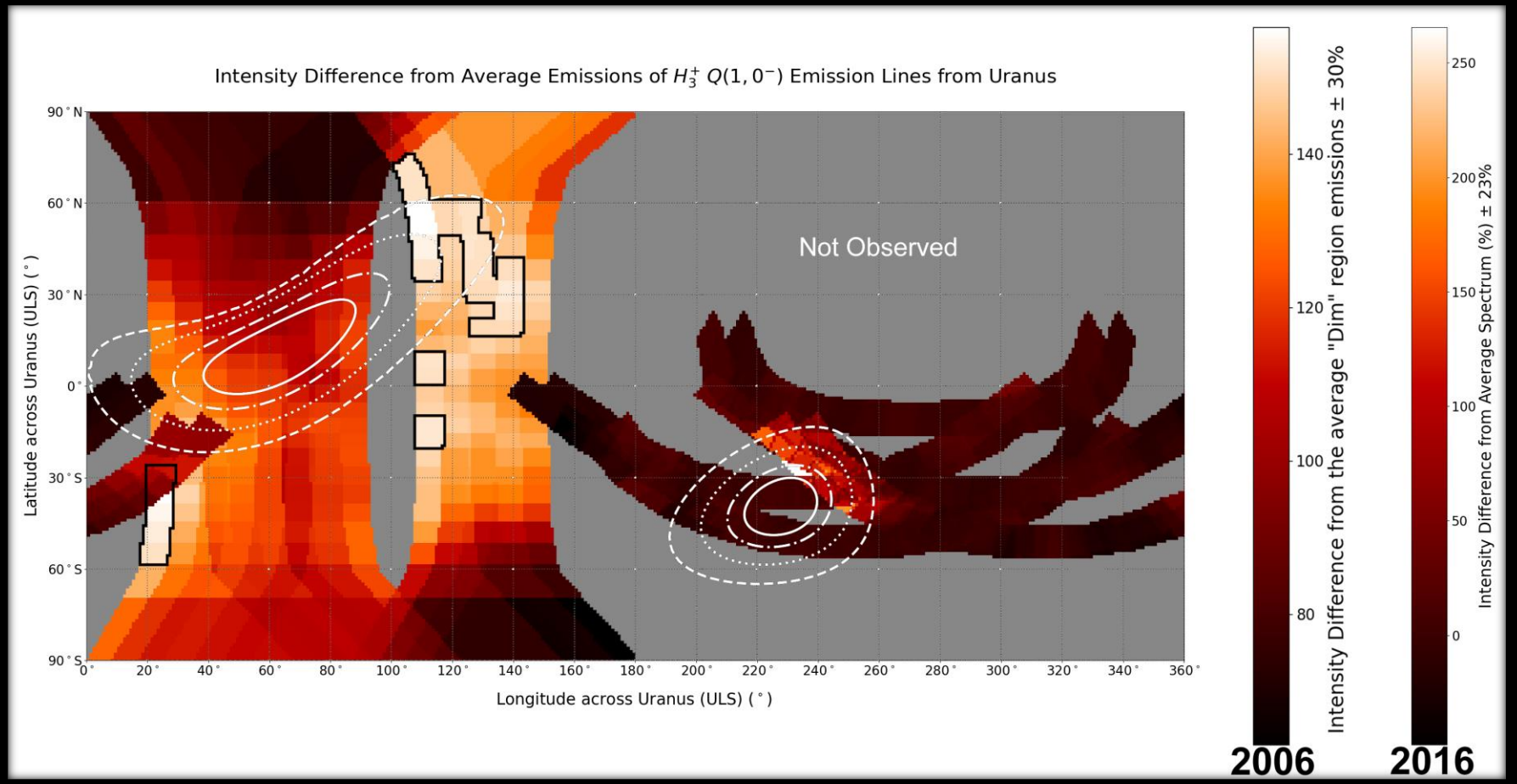

Figure SM8. Mapped H_3^+ intensities from both the 2006 and 2016 NIR observations, fitting them both with the best approximations of their longitudes with respect to the Q_3 model (white lines), which indicate L shells of 3, 5, 10 and 20.

Different maximum and minimum values are used for the colour scales for the 2006 and 2016 data, to help with comparison as the 2016 contains a larger range of intensities. This is thought to be due to a CME which hit Uranus approximately on the 10th/11th October ± 7 days.

In the first half of NIR observations, black lines indicate the exact pixels suspected to be auroral.

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Comparison of NIR observations in 2006 with 2016.

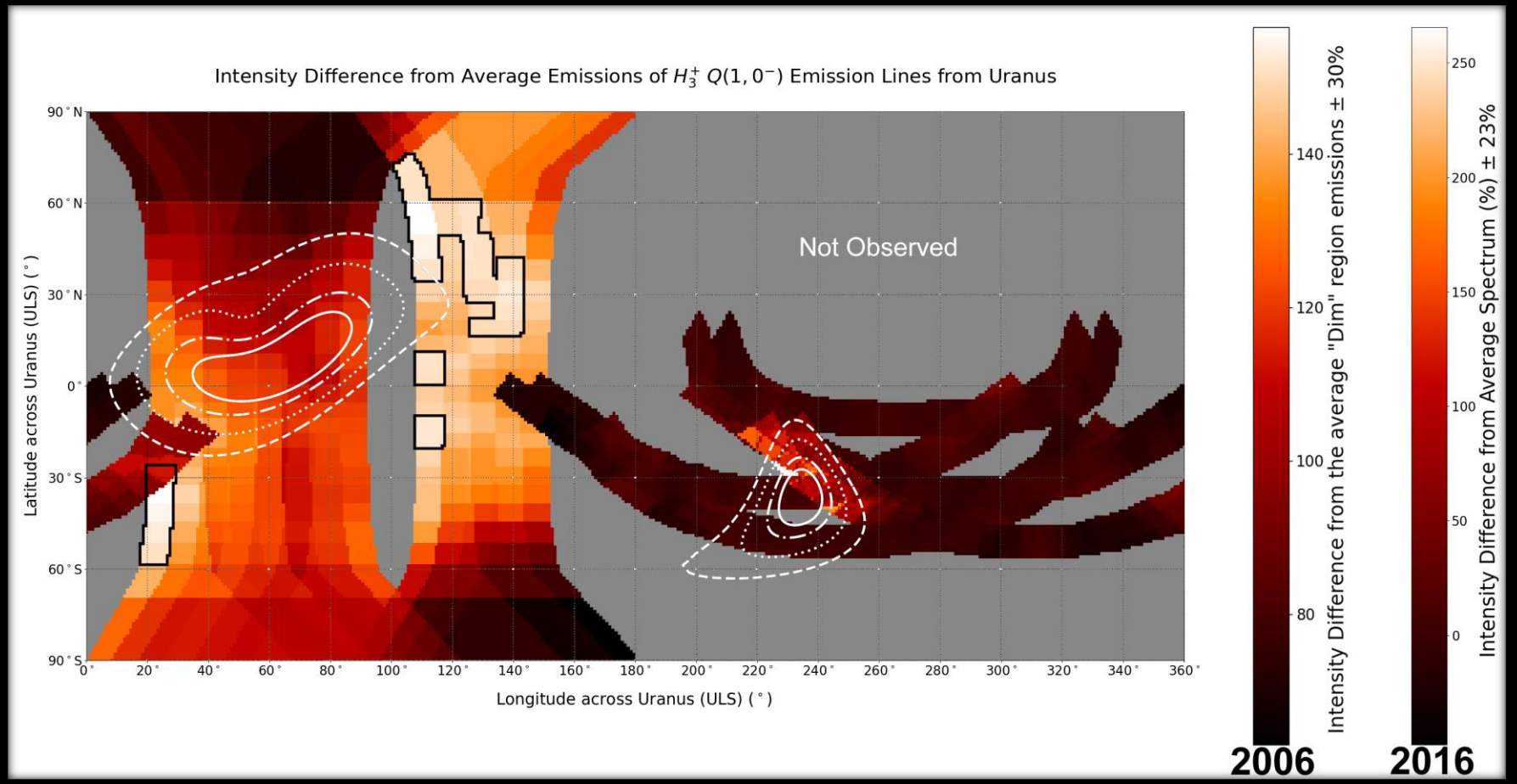

Figure SM9. Mapped H_3^+ intensities from both the 2006 and 2016 NIR observations, fitting them both with the best approximations of their longitudes with respect to the AH_5 model (white lines), which indicate L shells of 3, 5, 10 and 20.

Different maximum and minimum values are used for the colour scales for the 2006 and 2016 data, to help with comparison as the 2016 contains a larger range of intensities. This is thought to be due to a CME which hit Uranus approximately on the 10th/11th October ± 7 days.

In the first half of NIR observations, black lines indicate the exact pixels suspected to be auroral.