AURORAL ELECTRON ESTIMATES FROM THE VOYAGER 2 PLASMA OBSERVATIONS DURING THE URANUS FLYBY AND COMPARISONS TO EARTHS AURORA

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ABSTRACT

We are fortunate enough to have plasma observations from the Voyager 2 flyby of Uranus in 1986. We revisit these data in the context of estimating what the auroral electrons in Uranus' magnetosphere would look like and how they would com- pare to what we know about Earth's aurora and how it is coupled to Earth's magnetosphere. The Voyager 2 flyby of Uranus provided us with valuable information about the plasma environment inside the magneto- sphere of Uranus (Sittler, et al., 1987).

The maximum energy of the Voyager 2 plasma instrument was 6 keV for electrons and it is clear from the data that the electron fluxes extended beyond that range to higher energies. Future measurements should extend up to around 30 keV in order to fully capture the full electron distribution within the magnetosphere and those corresponding to the aurora. The electron temperatures were around 2 keV throughout the magnetosphere of Uranus and the densities ranged from 0.001 to 1.0 per cubic centimeter.

These observed parameters will be compared to analogous structures within Earth's magnetosphere and be used to estimate the energy and fluxes of electrons that would be observed within the auroral zones on Uranus.

References:

[1] E. C. Sittler Jr., Ogilvie, K. W. and Selesnick, R. (1987) „*JGR, 92,* 15,263 – 15,281.

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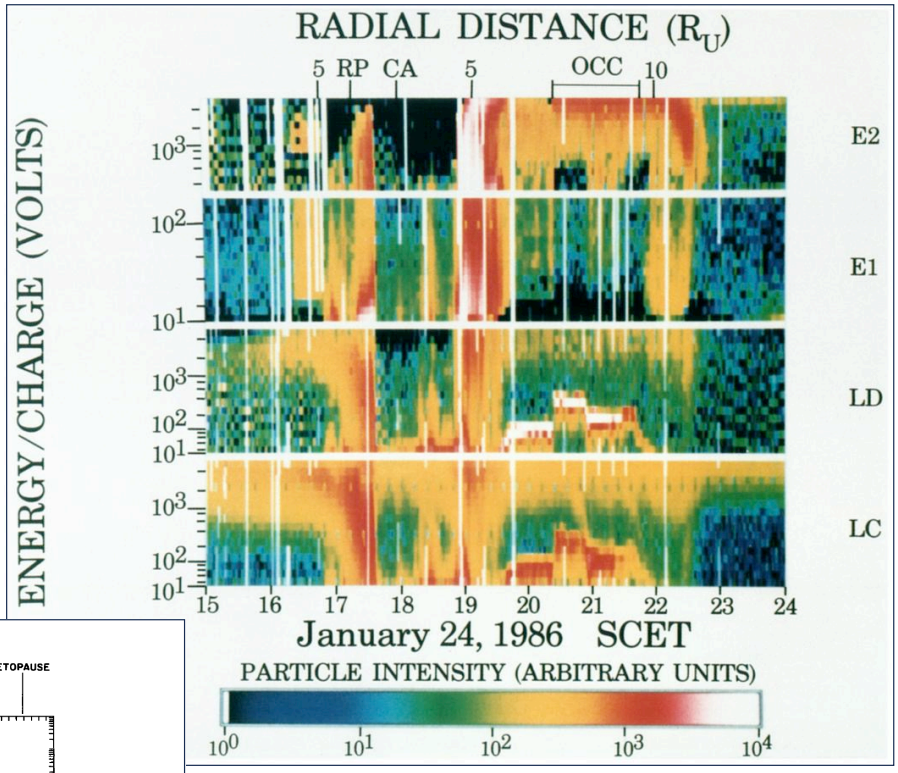


Energy-Time Spectrogram of ion and electron intensities within Uranus' Inner Magnetosphere. From Sittler, et al., 1987

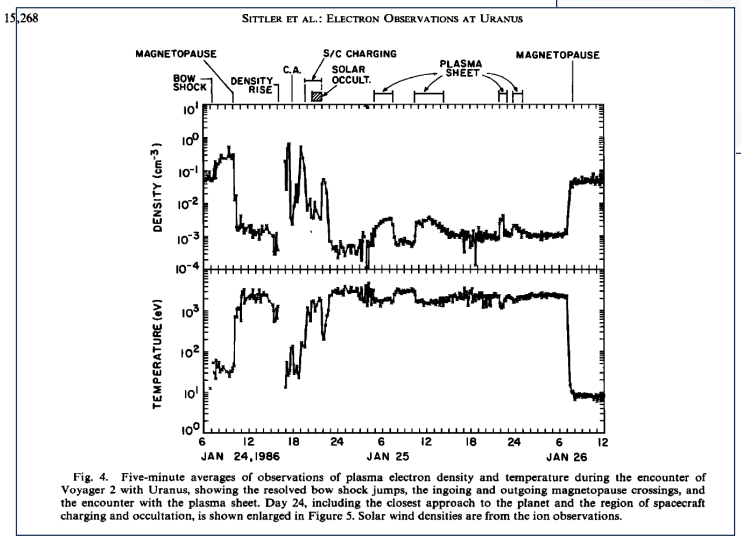


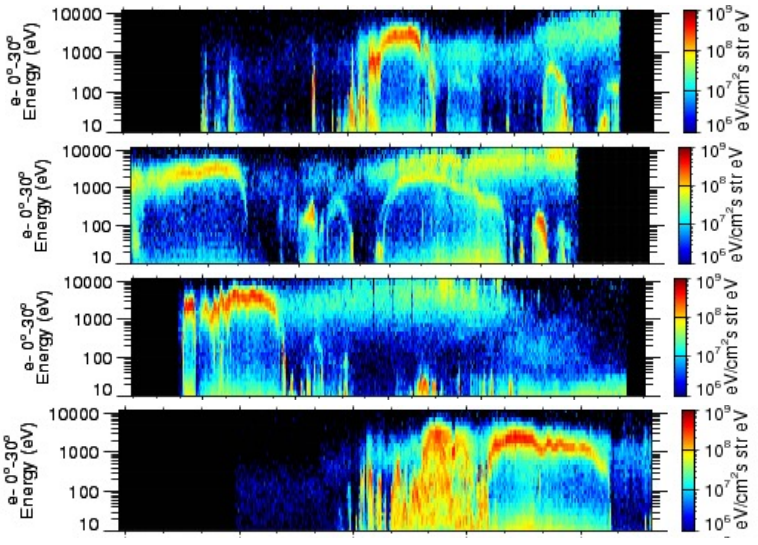
Fig. 4. Five-minute averages of observations of plasma electron density and temperature during the encounter of Voyager 2 with Uranus, showing the resolved bow shock jumps, the ingoing and outgoing magnetopause crossings, and the encounter with the plasma sheet. Day 24, including the closest approach to the planet and the region of spacecraft charging and occultation, is shown enlarged in Figure 5. Solar wind densities are from the ion observations.

Observations and Open Questions:

Comparing between Earth and Uranus, there are a lot of electron features in the same energy ranges and L-value ranges.

The spatial-temporal ambiguity is going to be important consideration for our understanding of the Uranian auroral system. We know it is important at Earth, the aurora often moves and changes faster than even LEO satellites can pass through. Uranus is likely going to have an even more dynamic auroral system given the faster planetary rotation rate (~17 hours), the large dipole tilt and the orientation of the spin axis relative to the solar wind.

Earth's Aurora Examples: From the Reimei satellite



These are from Low Earth orbit (~600 km altitude), so the timescales are minutes, but they cover roughly the same range of L-values (5-10) during these auroral zone passes. This shows analogous features and similar structuring between Earth and Uranus.