

# THE INFLUENCES OF GEOCORONAL VARIABILITY

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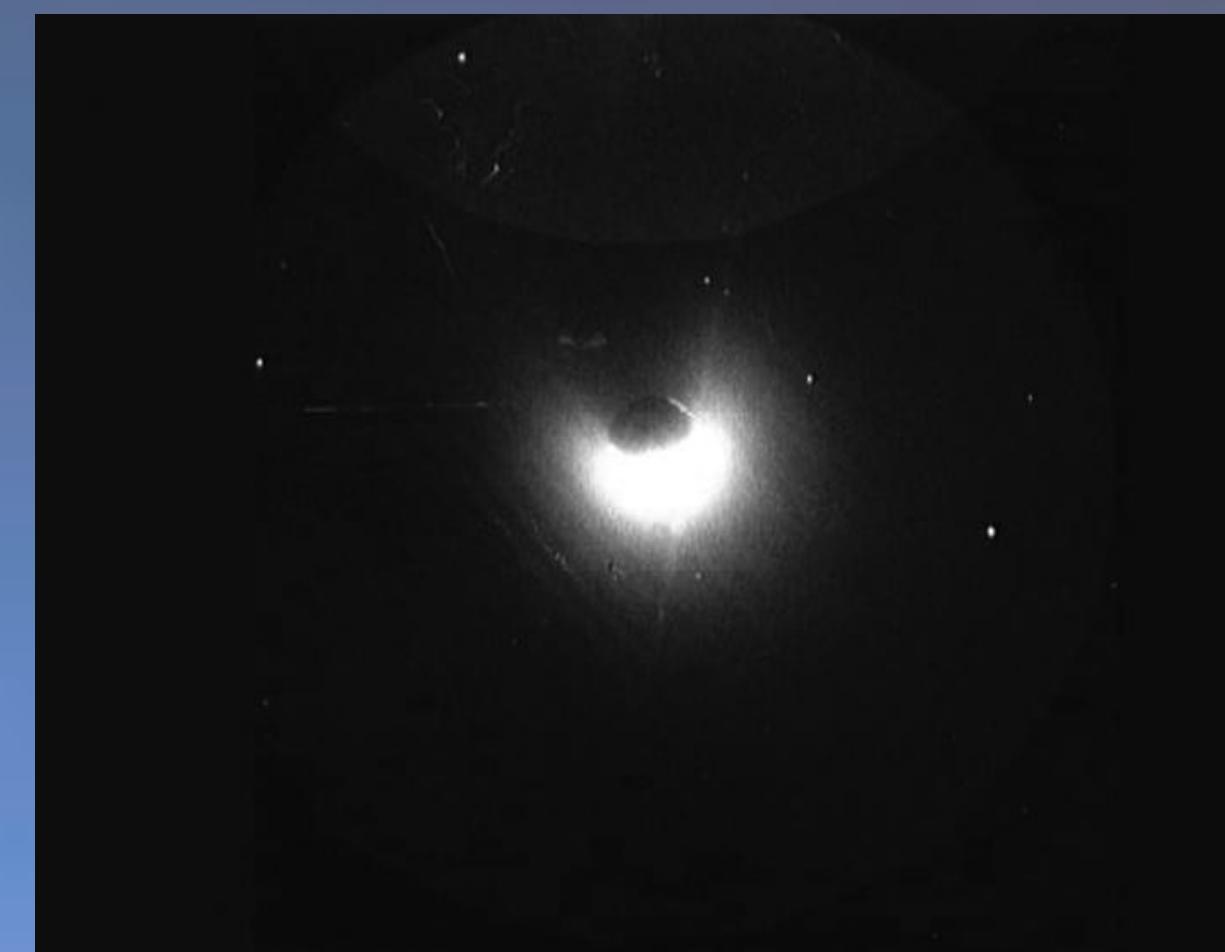
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## INTRODUCTION

The geocorona is an extension of the Earth's atmosphere comprised of neutral hydrogen atoms. Incoming solar radiation within the UV spectrum, more specifically Lyman-alpha (121.5 nm), is scattered among this atmosphere, and as a result produces airglow. This airglow signal can aid in the understanding of geocoronal variability throughout a given solar cycle.



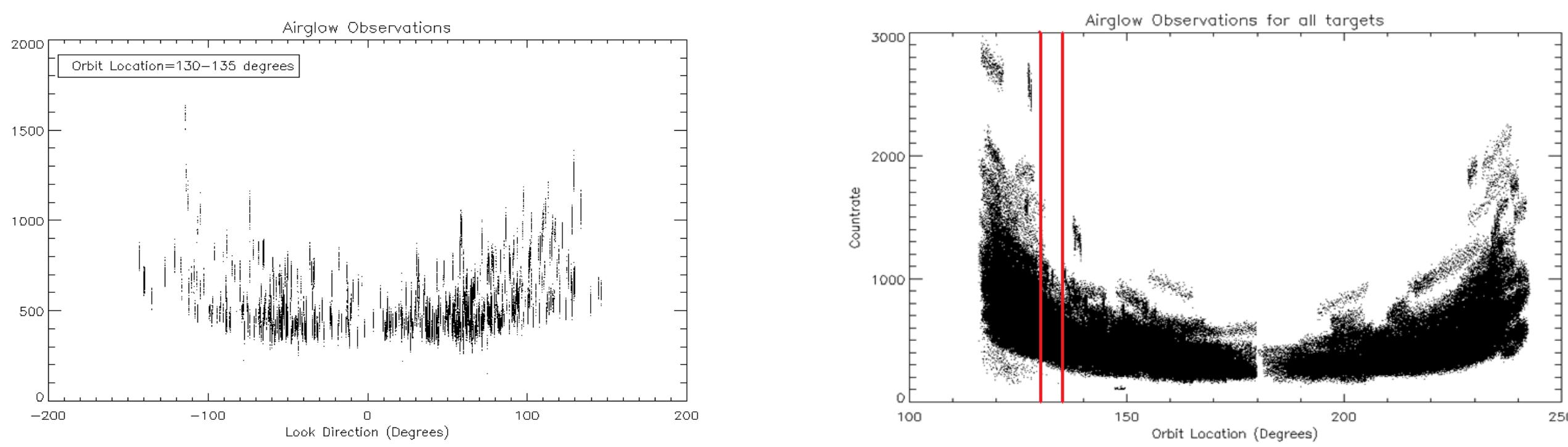
*Left: A view of the hydrogen geocorona from space. Photo taken with a UV filter by Apollo 16 commander John Young. April 21, 1972*

## INSTRUMENTATION

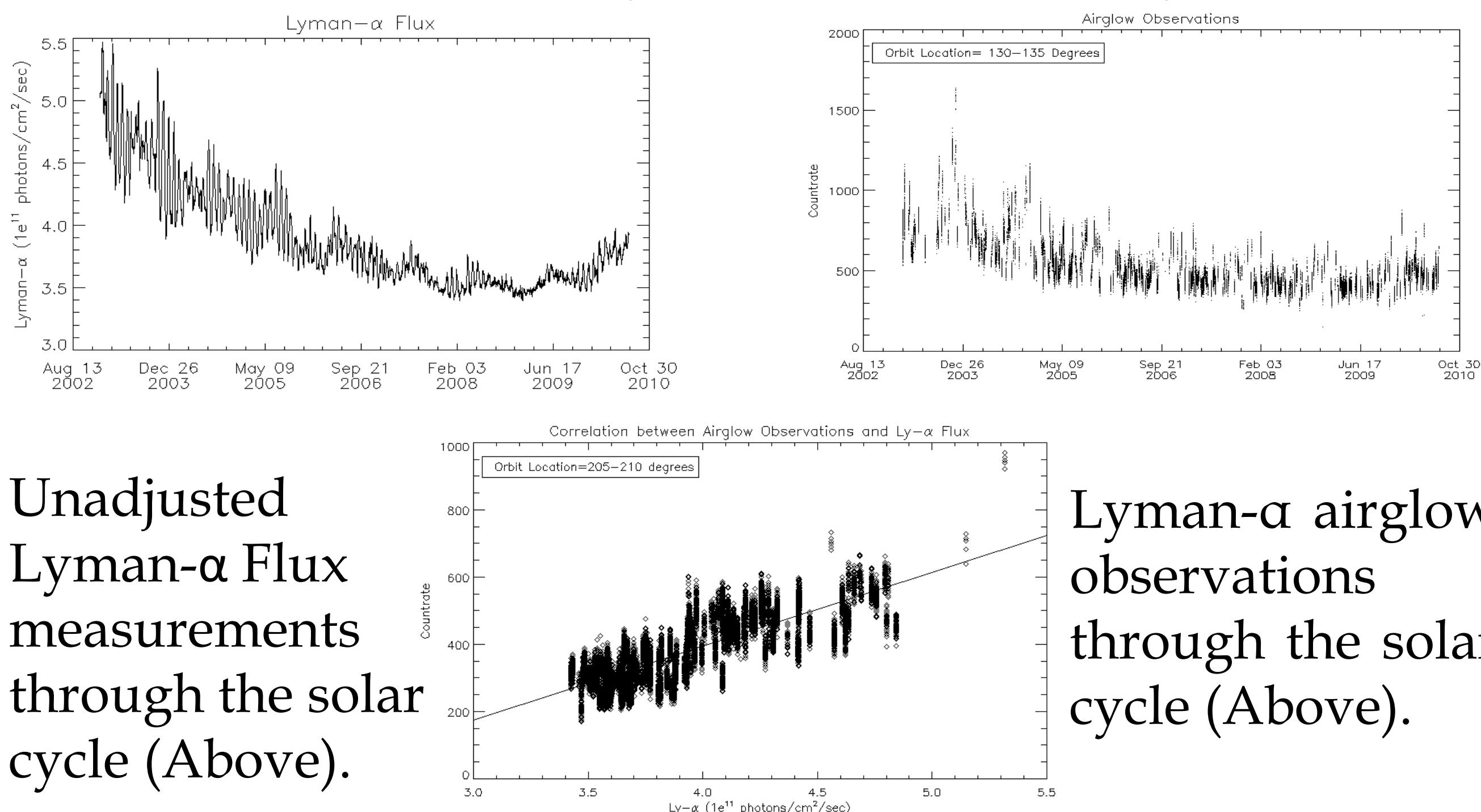
- Solar Radiation Climate Experiment (SORCE) is a NASA sponsored satellite launched on January 25, 2003. There are four different instruments on board this satellite including, SIM, TIM, XPS, and the Solar Stellar Irradiance Comparison Experiment (SOLSTICE). Together, these instruments take daily measurements across the entire spectrum to encourage investigating the relationships between the Sun and Earth. SORCE is orbiting the Earth at about a 40° angle, 600km in altitude every 90 minutes.
- SOLSTICE data was used for this unique project due to its sensitivity to measure within the ultraviolet spectrum. Lyman- $\alpha$  radiation can be detected and is used for comparative analysis. SOLSTICE has two modes, solar and stellar. Stellar mode is utilized intentionally for taking measurements within the Earth's shadow.

## METHODOLOGY

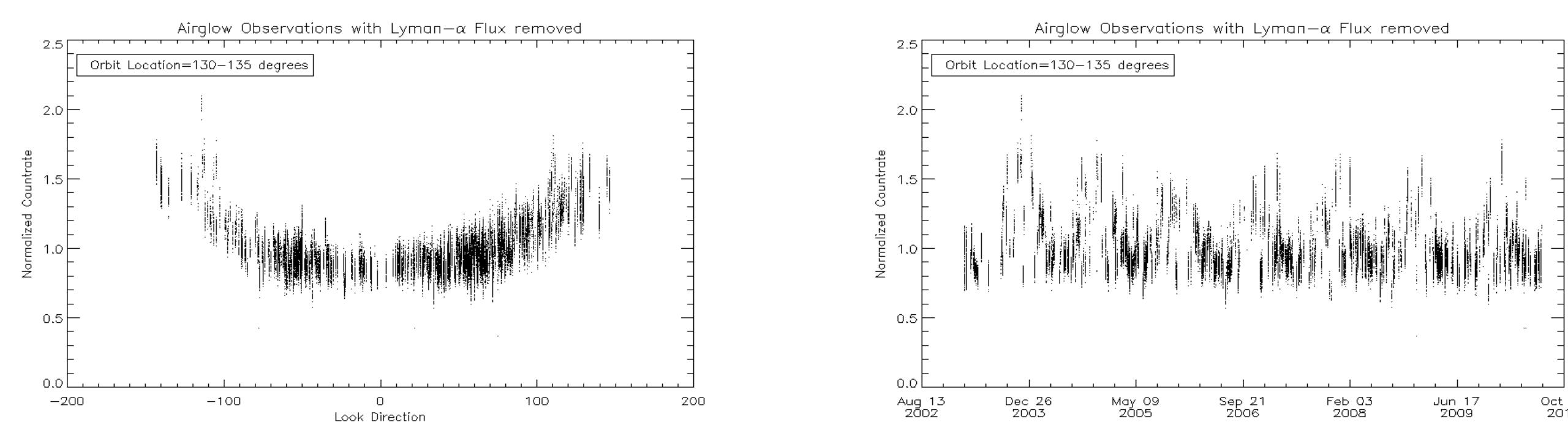
In order to make conclusions about the optical thickness of the geocorona, we first need to determine the location of the spacecraft in its orbit and the look direction of the instrument.



When plotting the airglow observations as a function of both look direction (above left) and orbit location (above right), it becomes apparent that they both behave similarly.



By plotting Lyman- $\alpha$  flux (used as a measure of solar cycle) as a function of the airglow observations, we learn that they have a linear correlation.



Solar cycle measurements are removed from observations.

## RESULTS

Several different processes occurring throughout the geocorona can be addressed solely by analyzing the plots provided in the "Methodology" section:

- Atmospheric Rotation- The higher count rates on the dusk side of the Earth simulate that the illuminated sections of the atmosphere are rotating into the shadow of the Earth in a cyclonic fashion.
- Removing the solar cycle measurements from the airglow observations flattens and normalizes the signal.
- Due to the significant variation of count rates as a function of both orbit location and look direction, we can conclude that the geocorona is optically thin at the altitude of the spacecraft.

## CONCLUSIONS

In many topics of research, the airglow signal is removed as a factor of noise, while this project exists on the need for those observations to make empirical conclusions. By determining that the geocorona is optically thin, further analysis can be completed in order to understand the physical properties of this extended atmosphere. Properties such as the density, temperature, and indirectly, the dynamics of the atmosphere can then be modeled. Other scientific models can also be formulated to forecast the behavior of airglow in the shadow if the Earth and, in turn, later be removed in stellar and lunar observations. It would also be interesting to investigate more influences on the geocorona, such as geomagnetic activity and the 27 day cycle.

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