ELIOT YOUNG, MARK BULLOCK, YEON JOO LEE, KEVIN MCGOULDRICK, JAVIER PERALTA, CON TSANG

SPECTRAL PROPERTIES OF UNUSUAL NIGHTSIDE FEATURES ON VENUS

DATA ACQUISITION

IRTF/SPEX

- The IRTF is a 3-m telescope near the summit of Mauna Kea.
- The IRTF allocated 2-3 weeks of consecutive mornings (6 - 10 AM) for Venus observations in 2017/18.
- SpeX has a guide camera and a spectrograph. We used both to obtain simultaneous images and spectra.

Photo by Richard Wainscoat

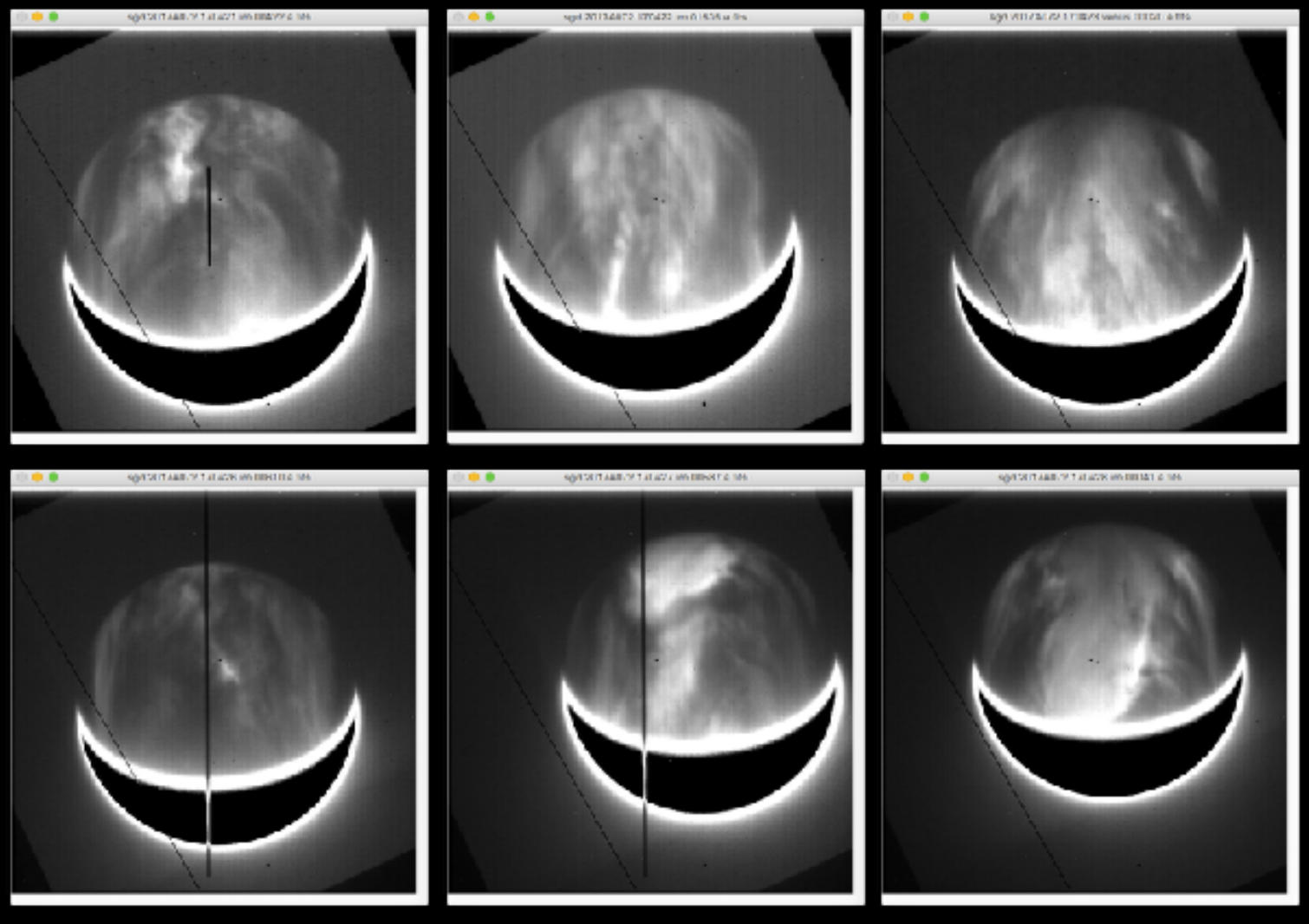

Photo by Elisabeth Newton

OVERVIEW: 2017 GUIDER IMAGES

Daily examples at 2.26 μm. North Pole is on the left.

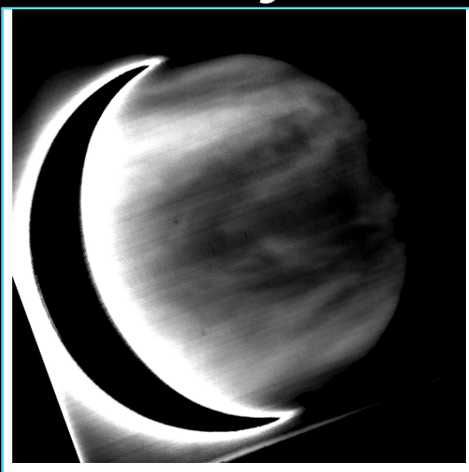
	Su	Mo	Tu	We	Th	Fr	Sa
APRIL	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
MAY	30	01	02	03	04	05	06

Allocated Morning Some Observations Obtained

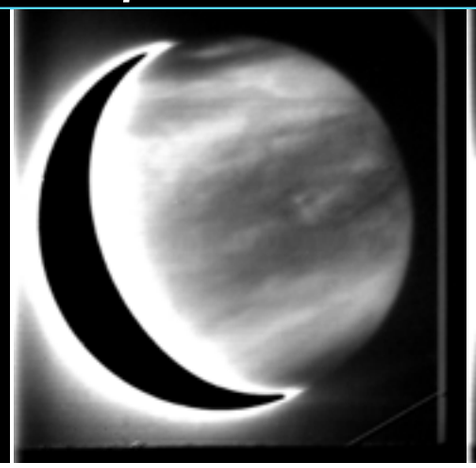


OVERVIEW: 2018 GUIDER IMAGES

Daily examples at 1.74 μm. North Pole is up.



Nov 19, 2018



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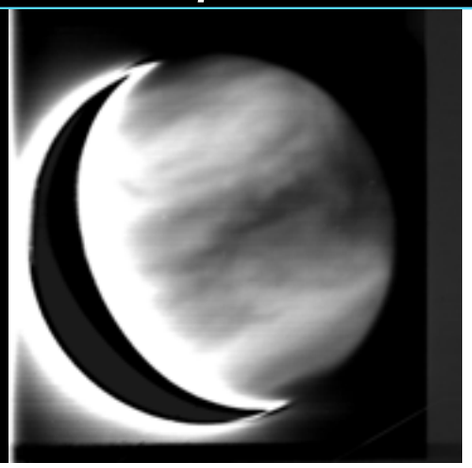

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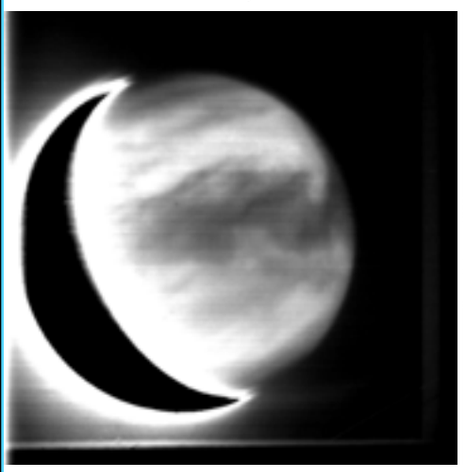

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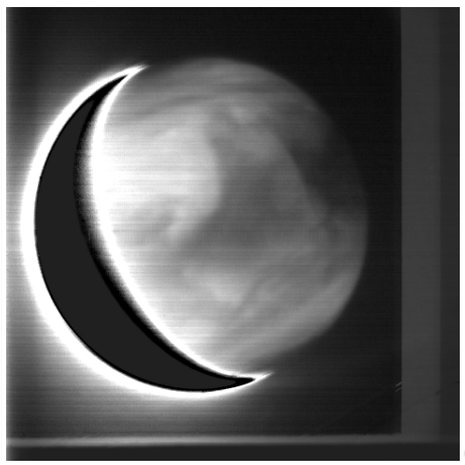

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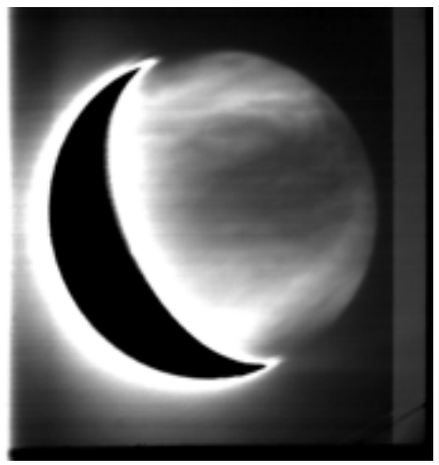

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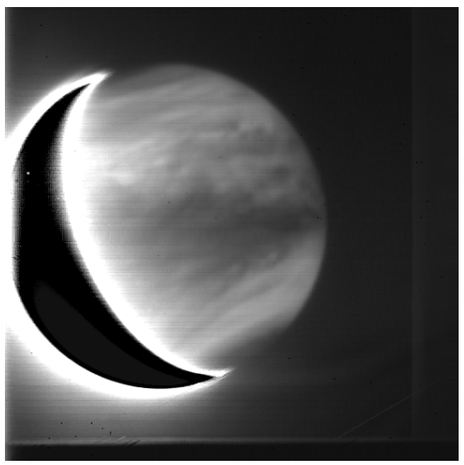

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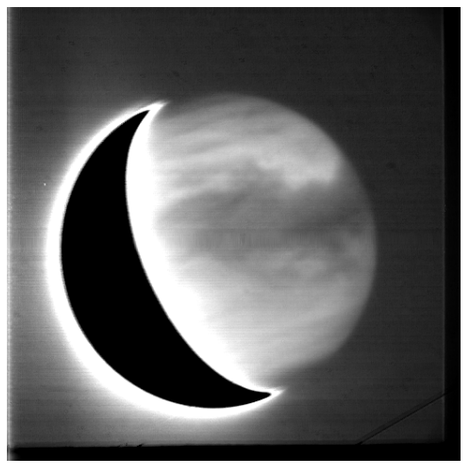

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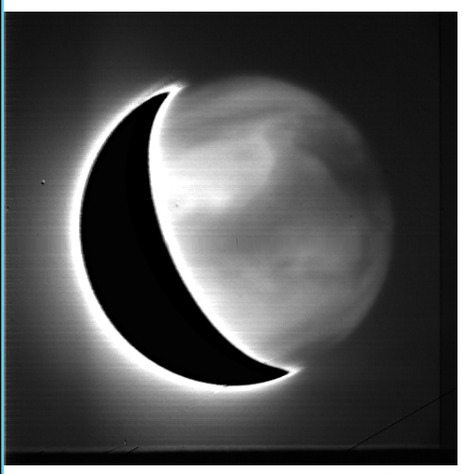

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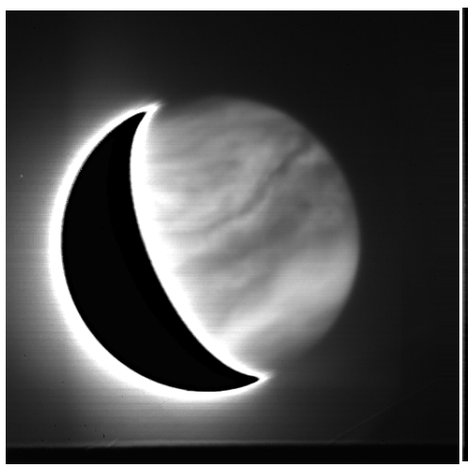

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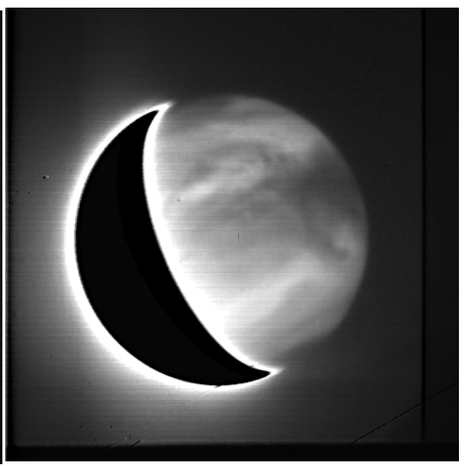
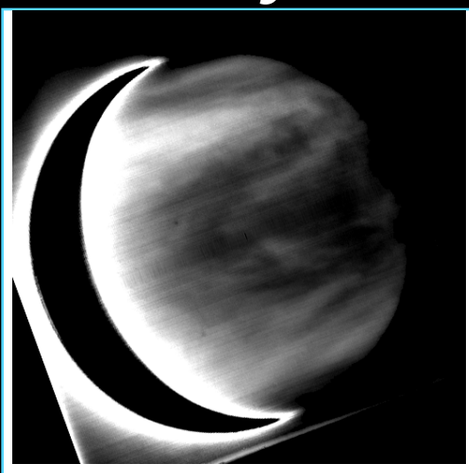


Dec 06, 2018

OVERVIEW: 2018 GUIDER IMAGES

Daily examples at 1.74 μm. North Pole is up.



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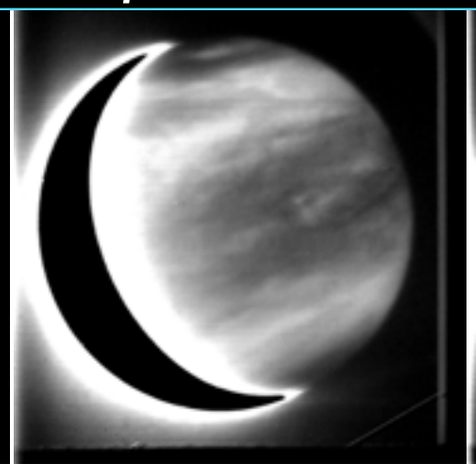

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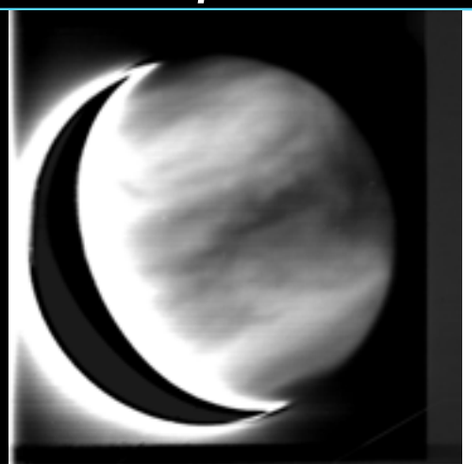

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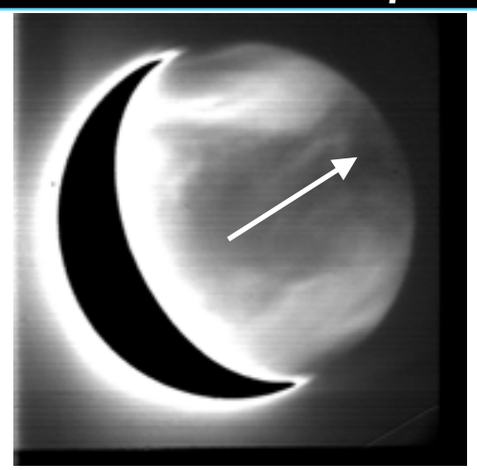

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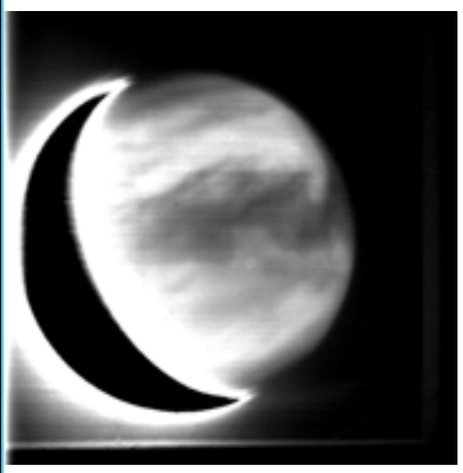

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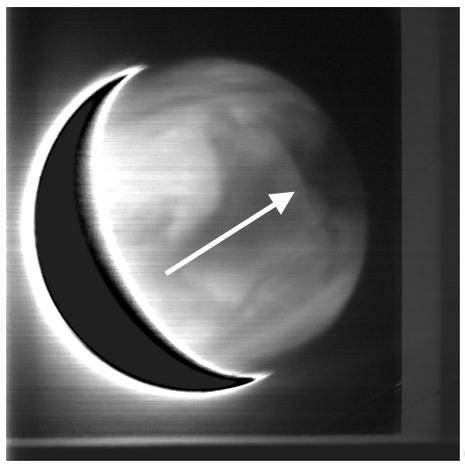

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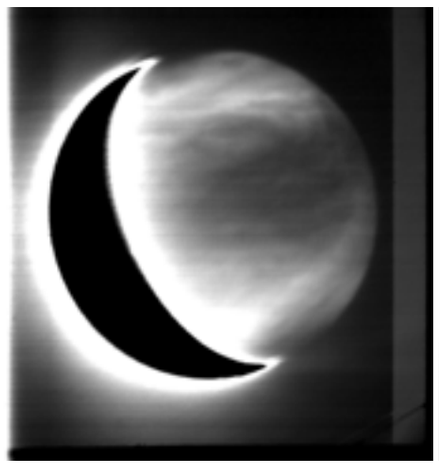

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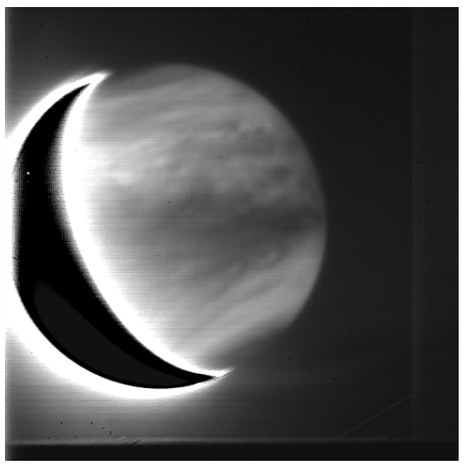

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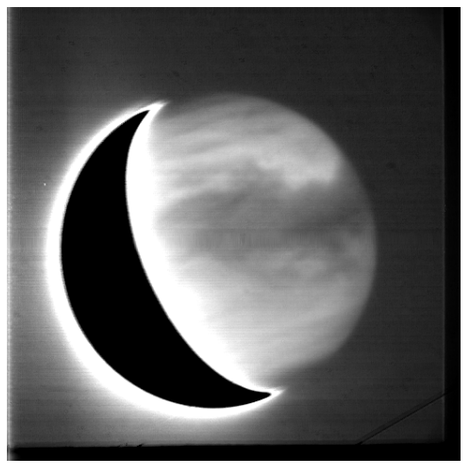

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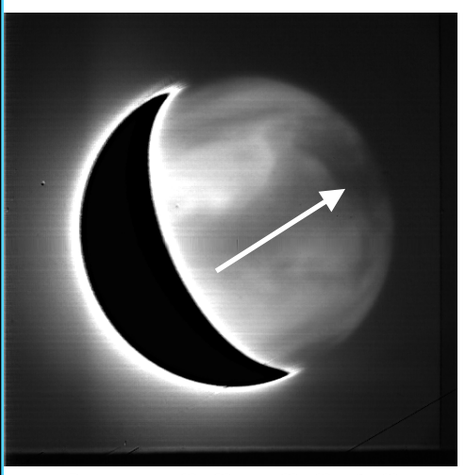

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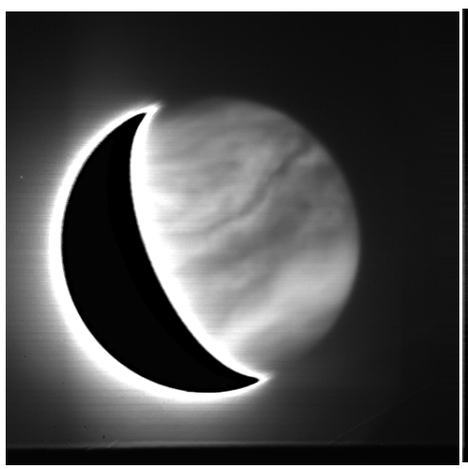

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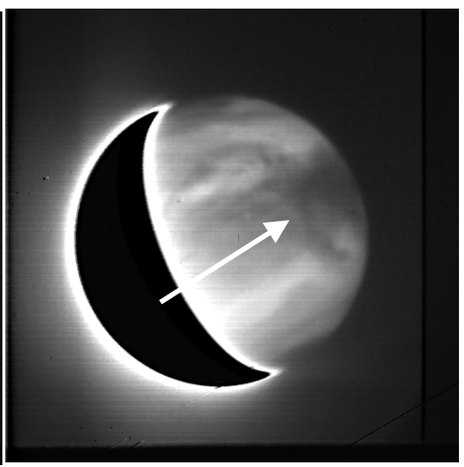

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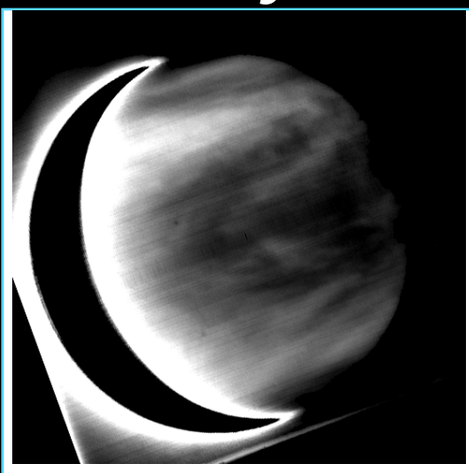

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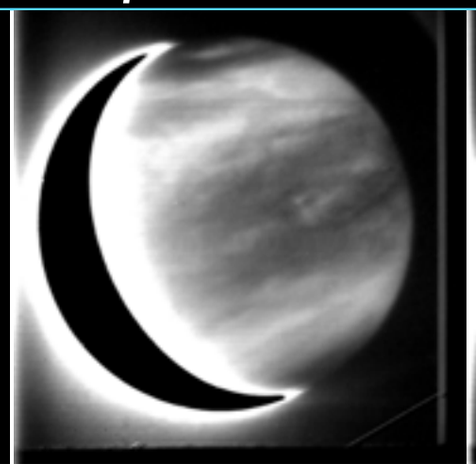

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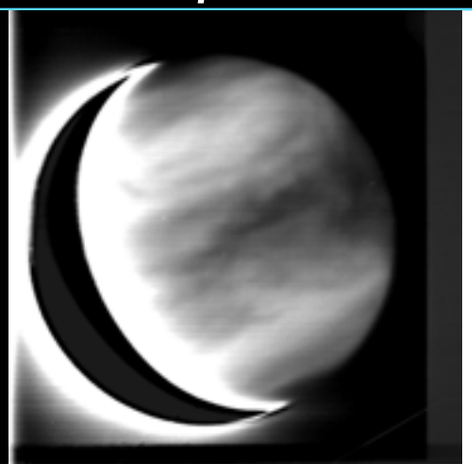

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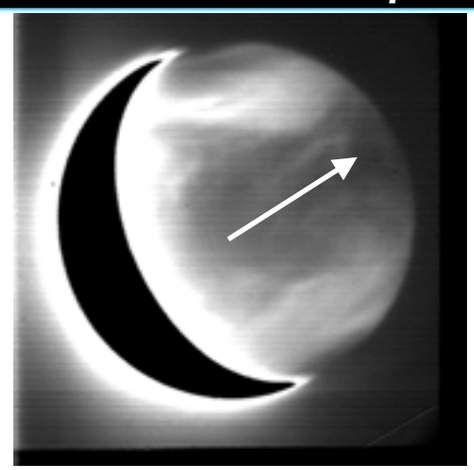

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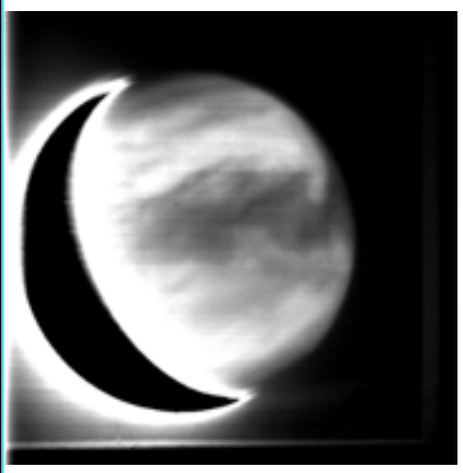

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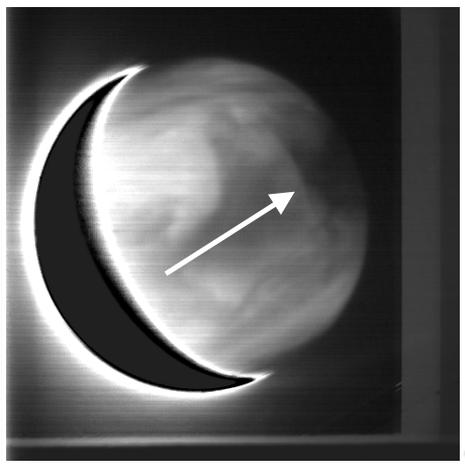

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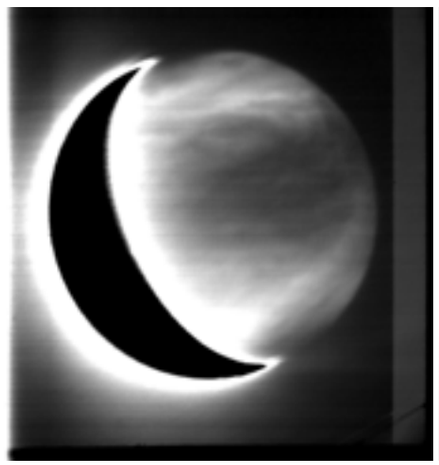

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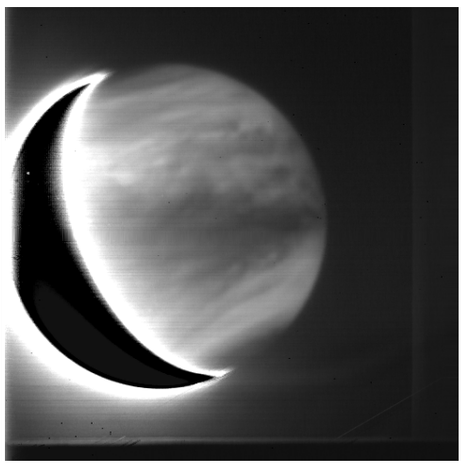

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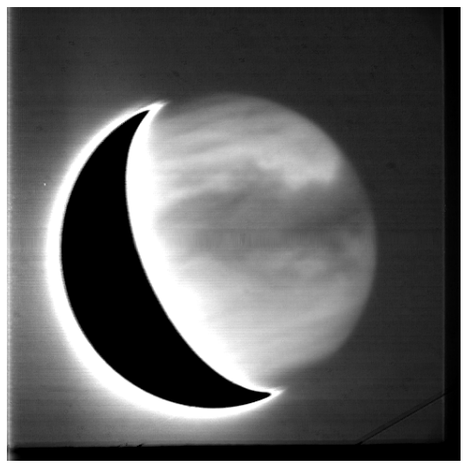

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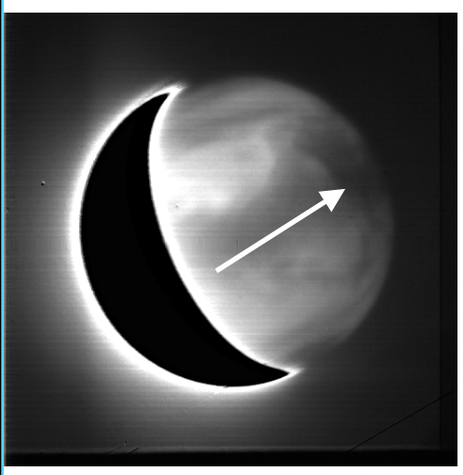

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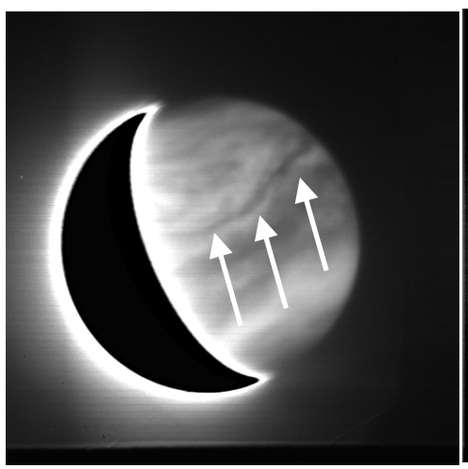

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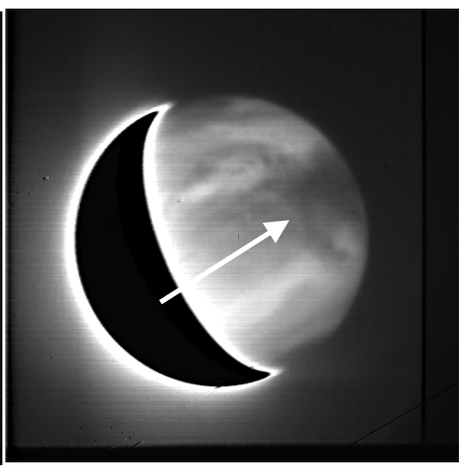
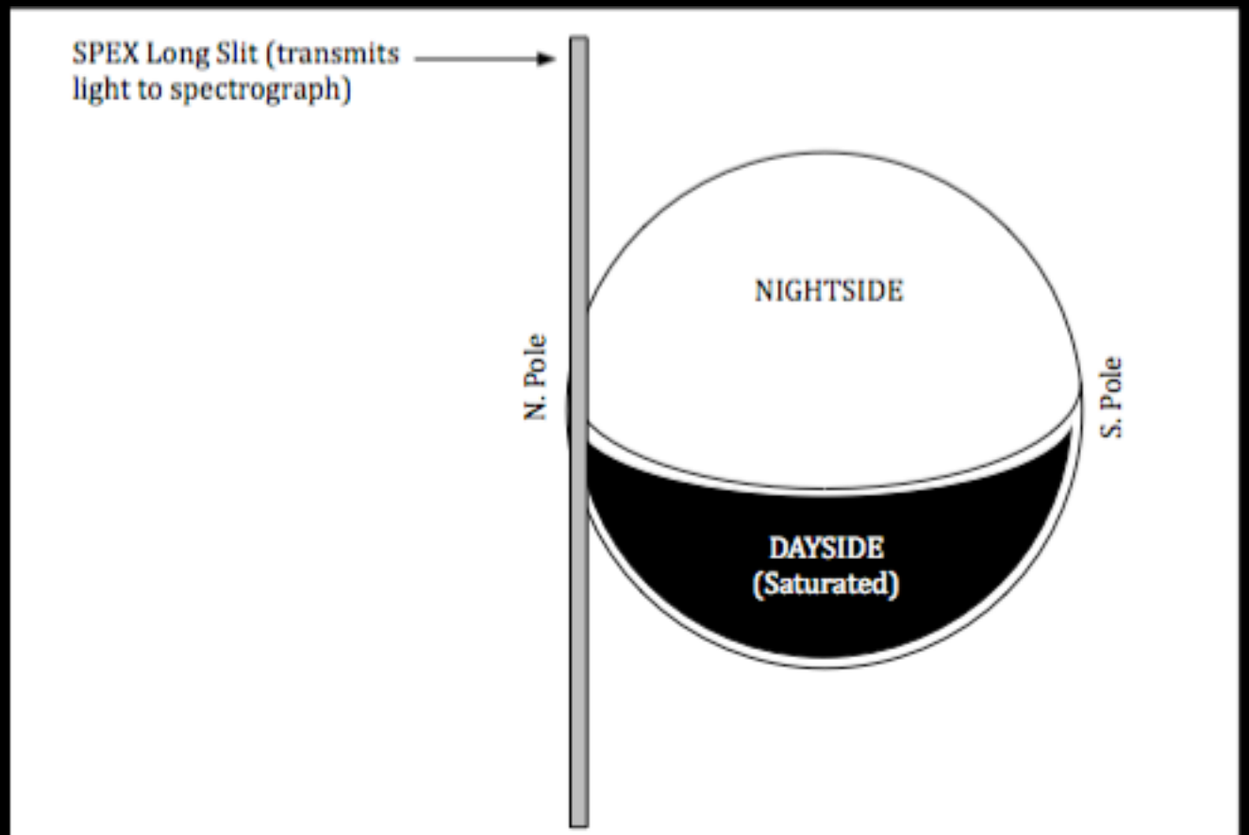
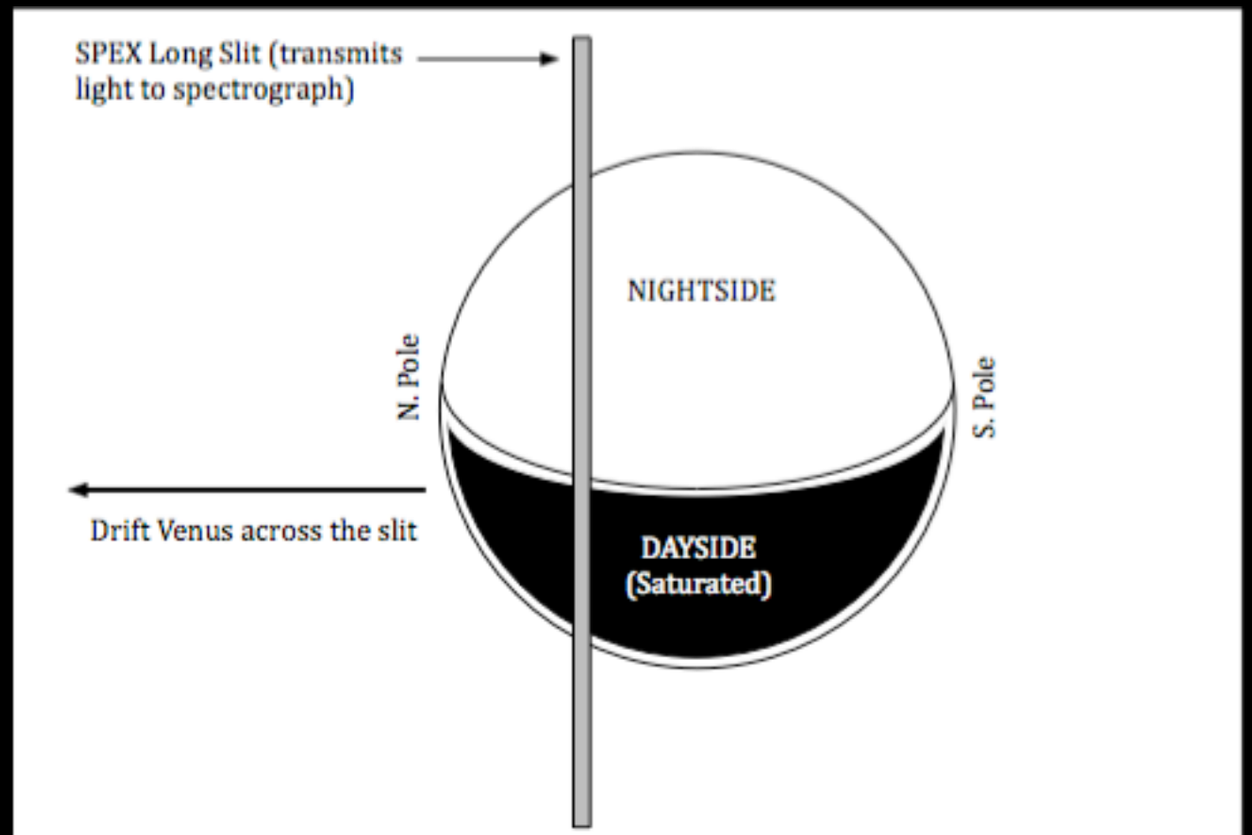


Dec 06, 2018

IMAGE CUBES

OBSERVING STRATEGY: SPECTRA





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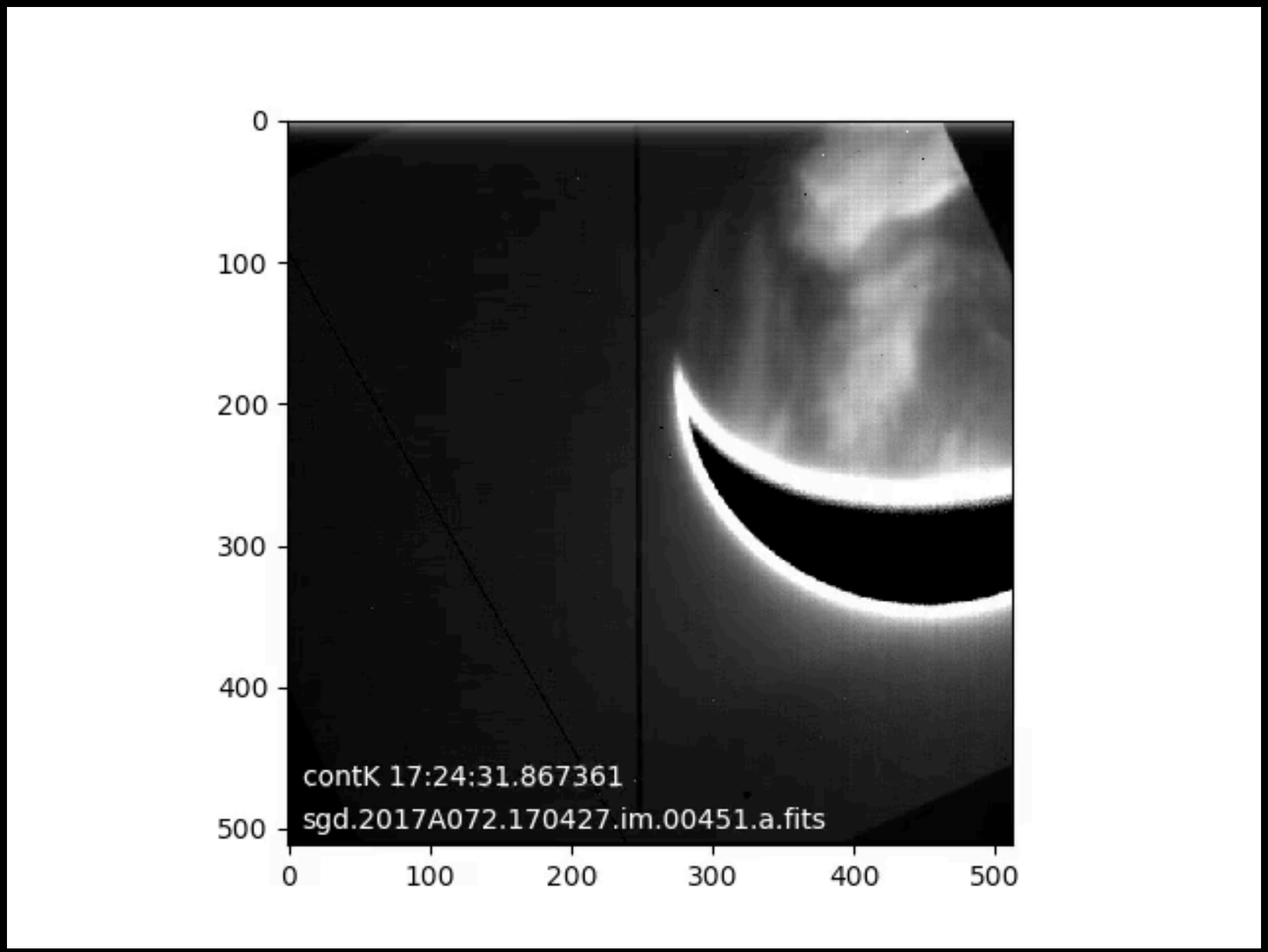
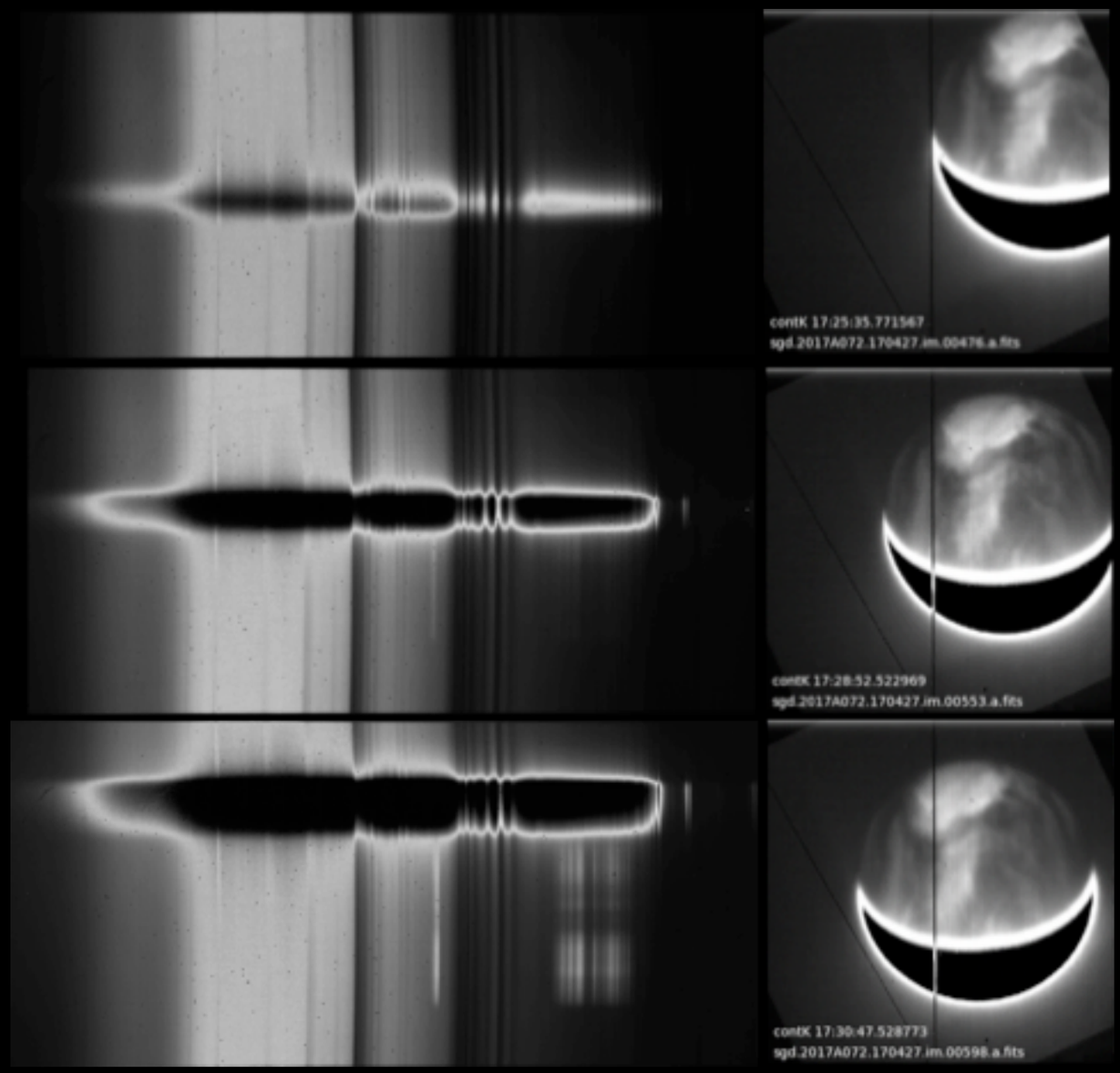


OBSERVING STRATEGY: SPECTRA

- We acquire THREE types of Image Cubes: PRISM mode (0.8 – 2.5 μm at R = 300), Single Order H-band (1.47 – 1.80 μm, R = 2000), Single-Order K-band (1.92 – 2.52 μm, R = 2000).
- Sideways orientation gives us two crescent cusps, which we plan to use as a "solar" calibration spectrum.
- Resulting image cubes have poor spatial resolution (cross-slit). Expect to recover CO, H_2O and OCS, not SO_2.



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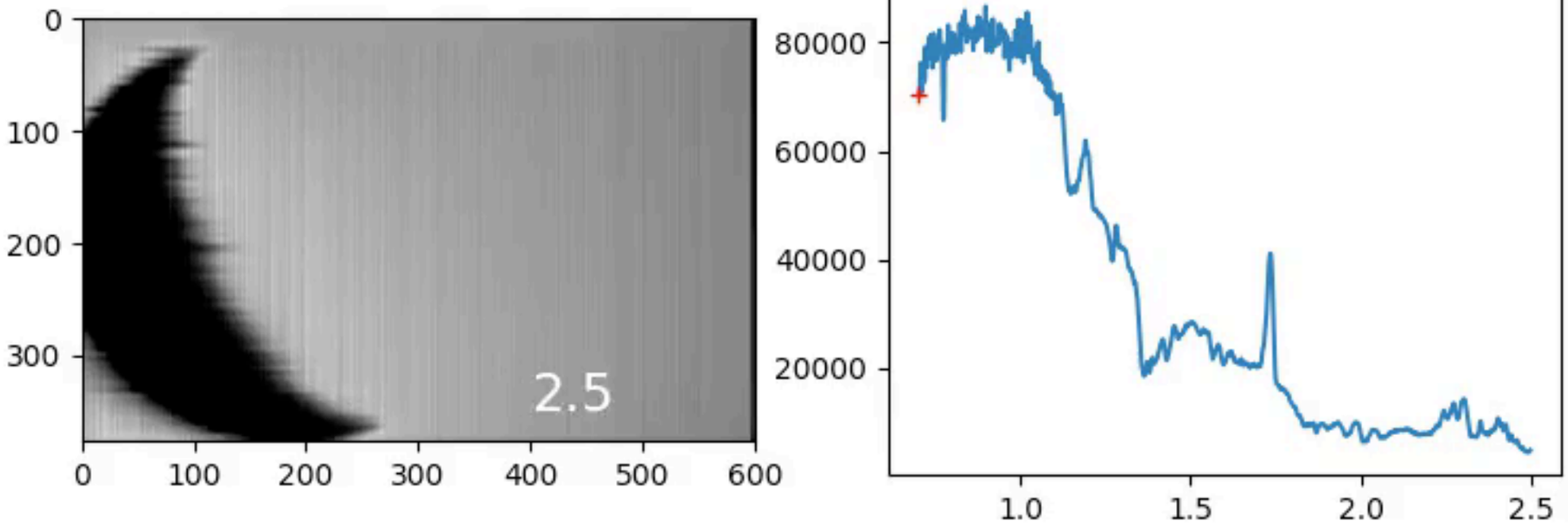
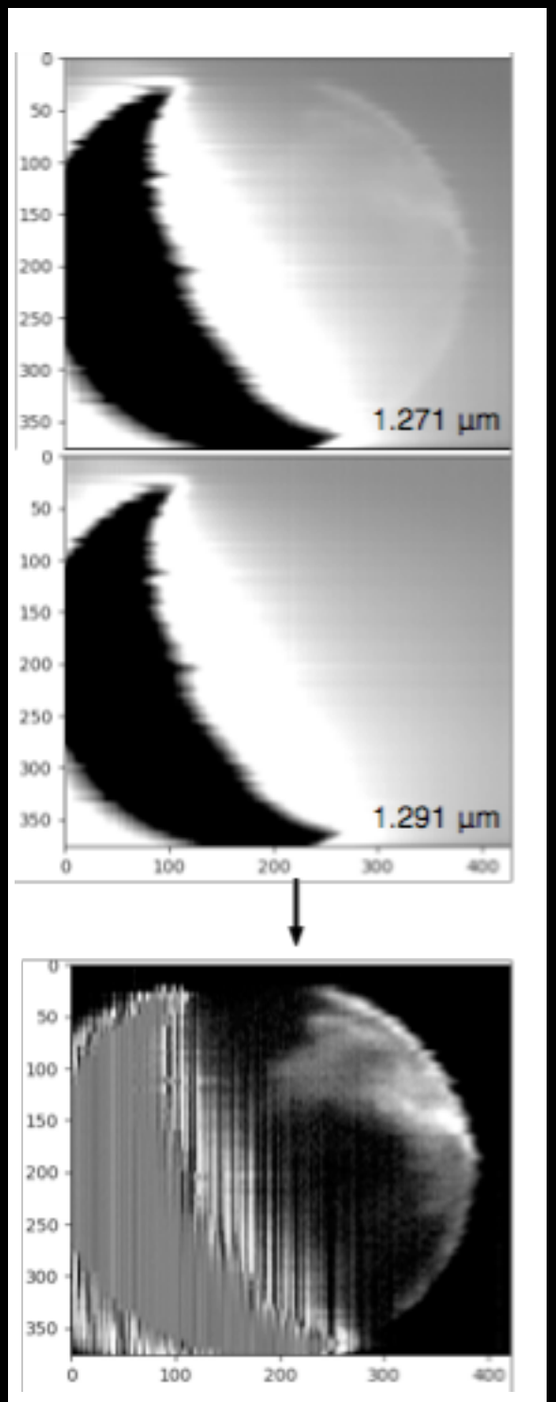
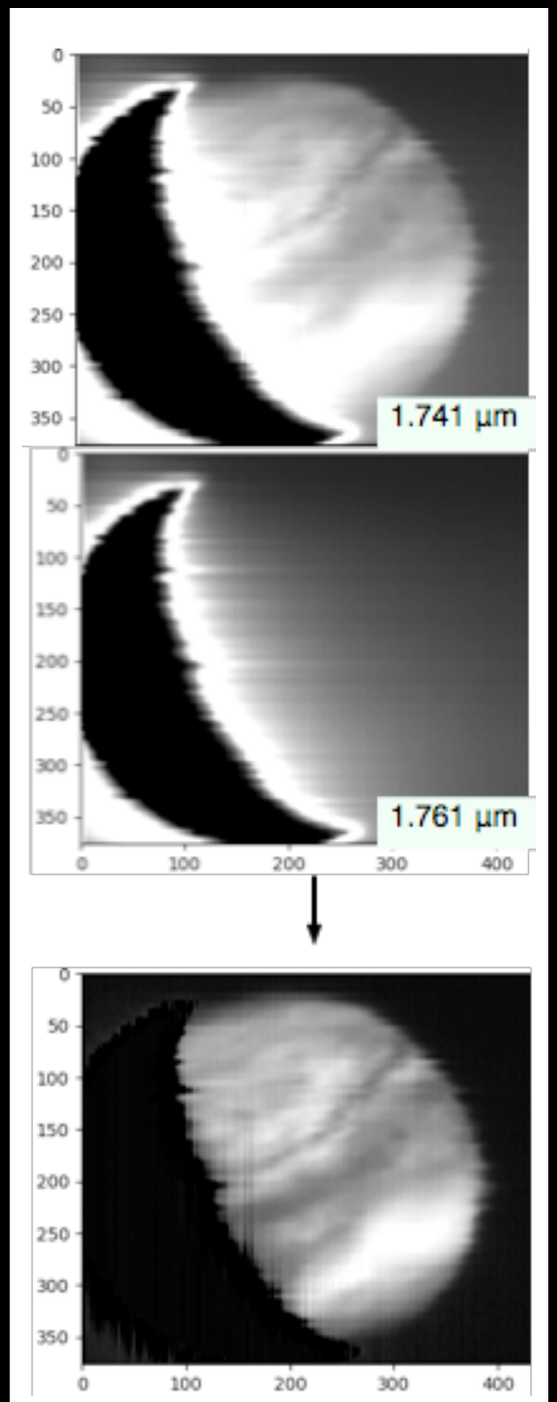


IMAGE CUBES: REMOVING SCATTERED LIGHT

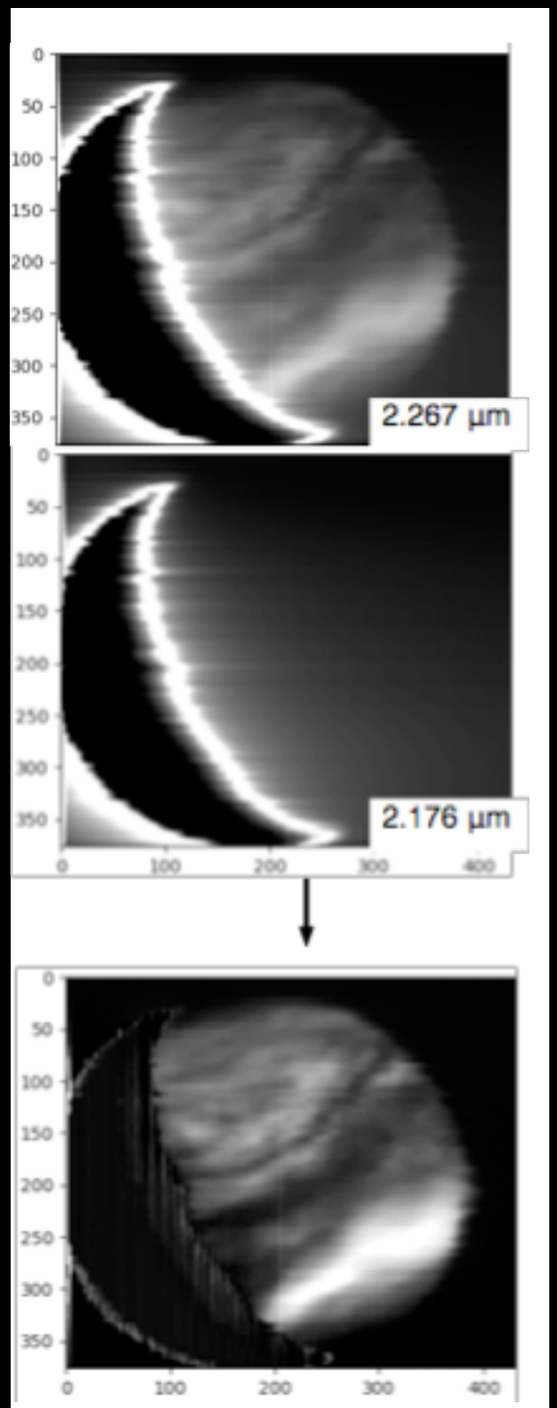
O2 Airglow



1.74 µm

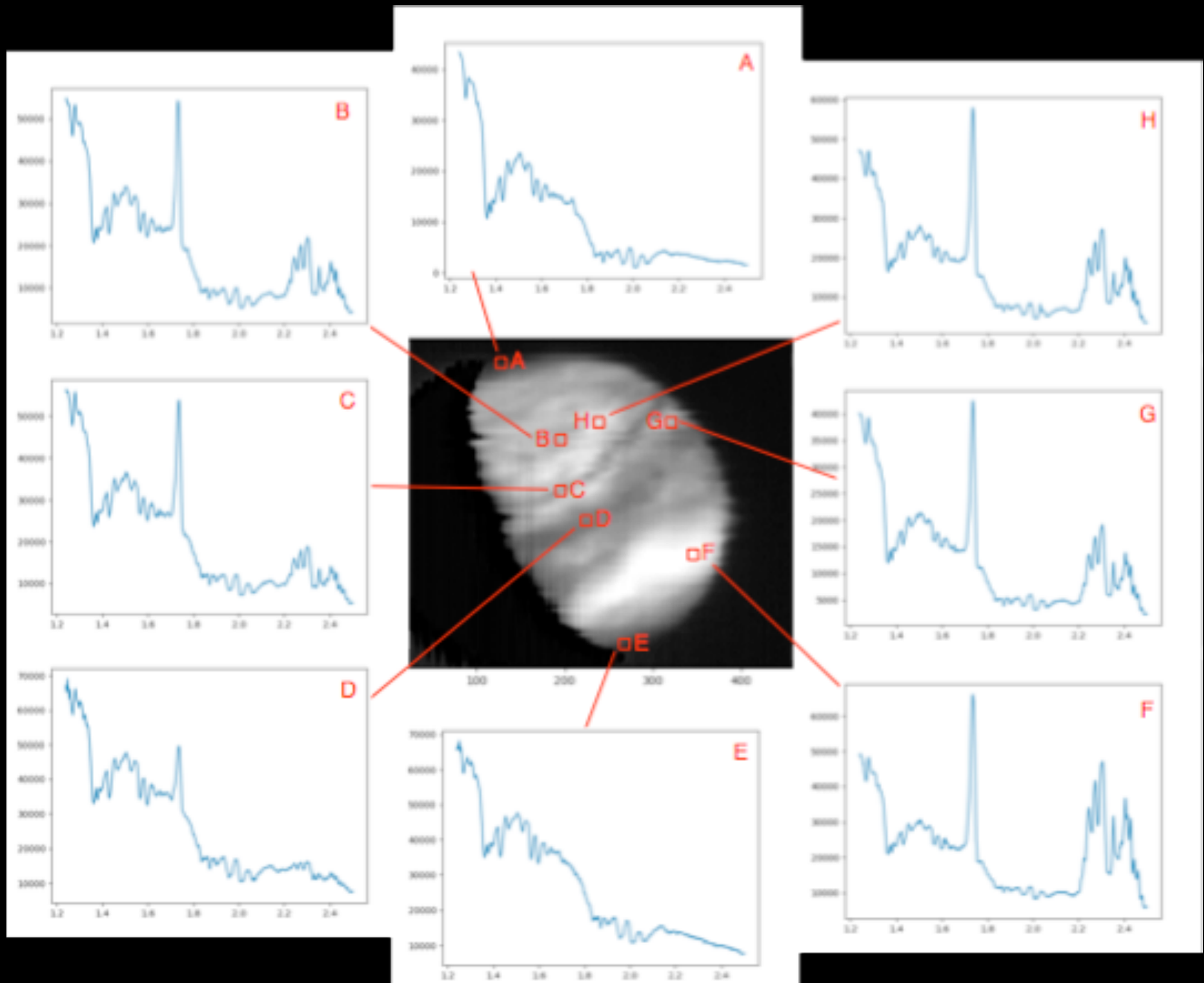


2.26 µm



SPECTRAL PROCESSING

QUESTION: DO UNUSUAL NIGHTSIDE CLOUD FEATURES HAVE UNUSUAL SPECTRA?



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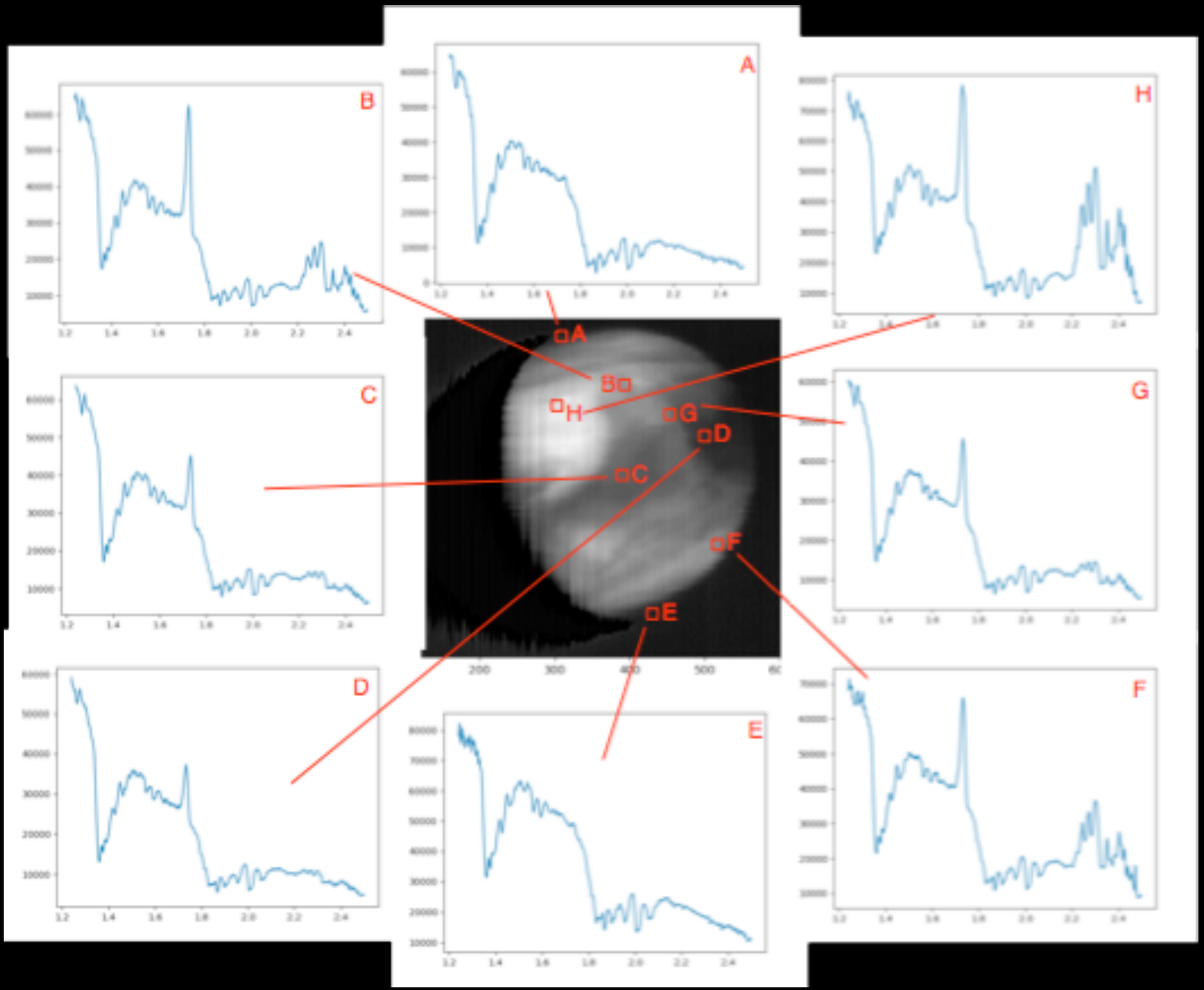
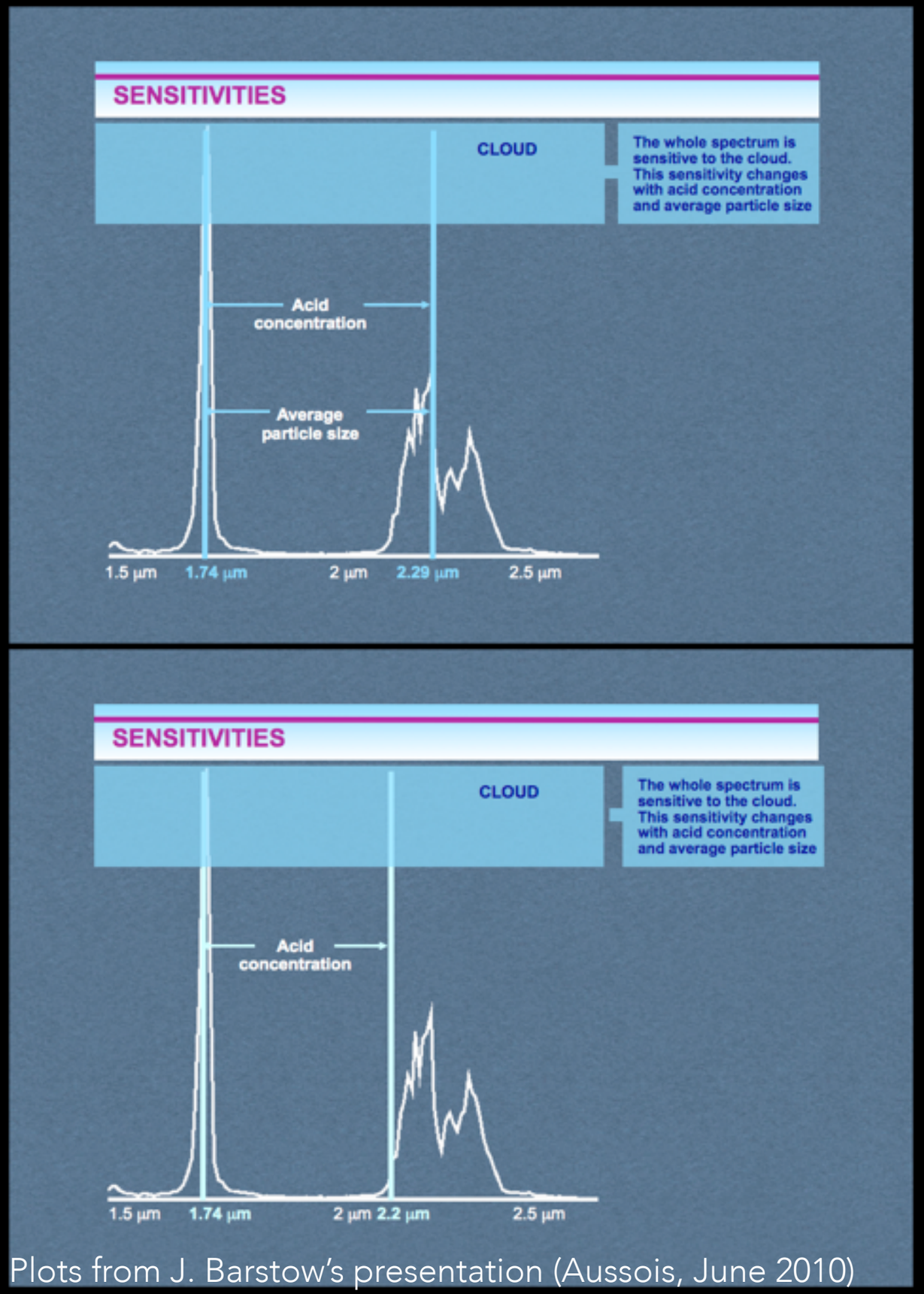


USE BRANCH PLOTS TO ESTIMATE PARTICLE SIZES

- Compare irradiance ratios (1.74/2.30 μm) over the nightside
- Basic idea: flux from larger particles is attenuated more at 2.30 μm than at 1.74 μm.
- The “sharp discontunities” are visible in dayside 0.94 μm images, so they reach high altitudes (~65 km). Are these sites of large particles?



Plots from J. Barstow’s presentation (Aussois, June 2010)

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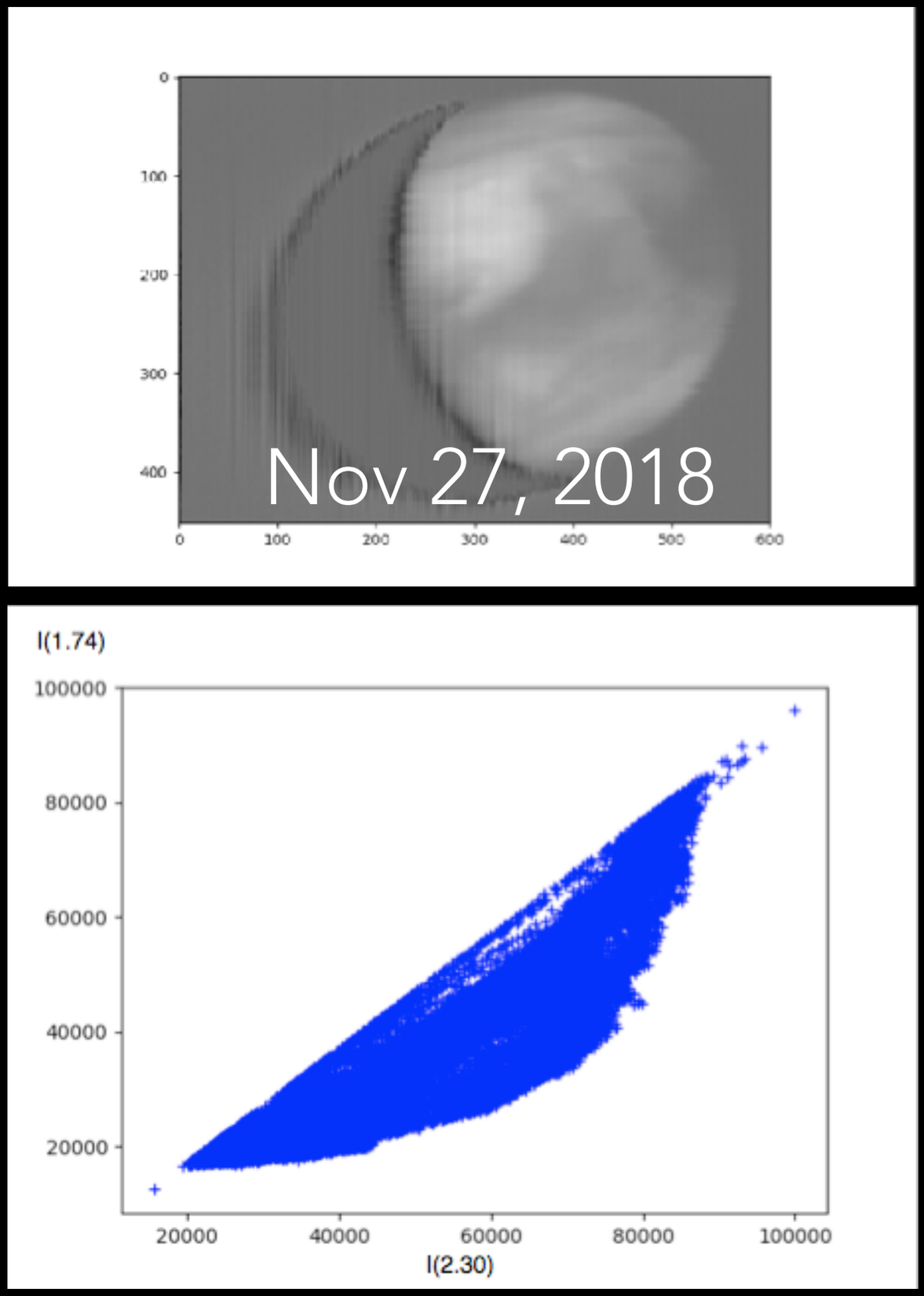

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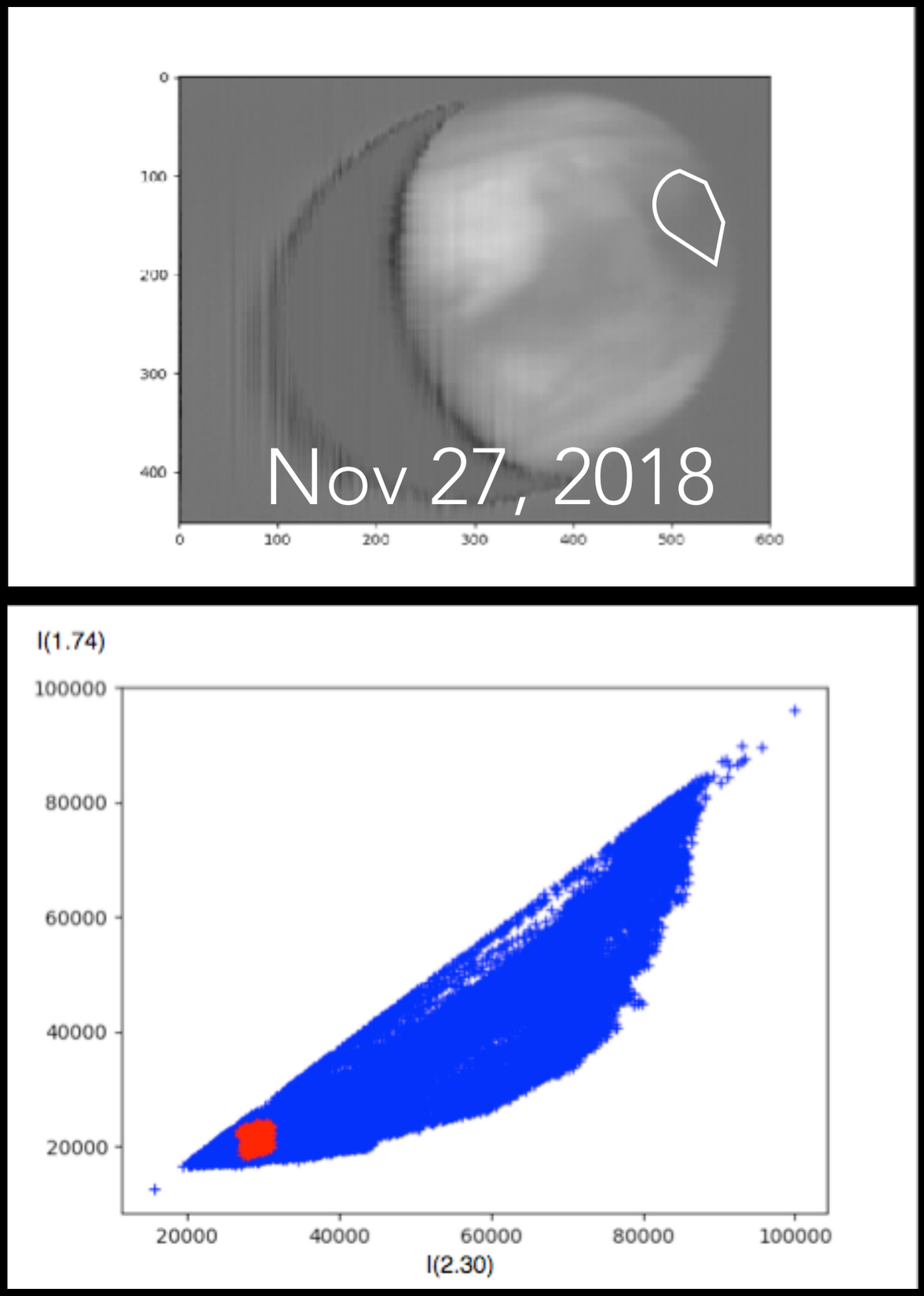

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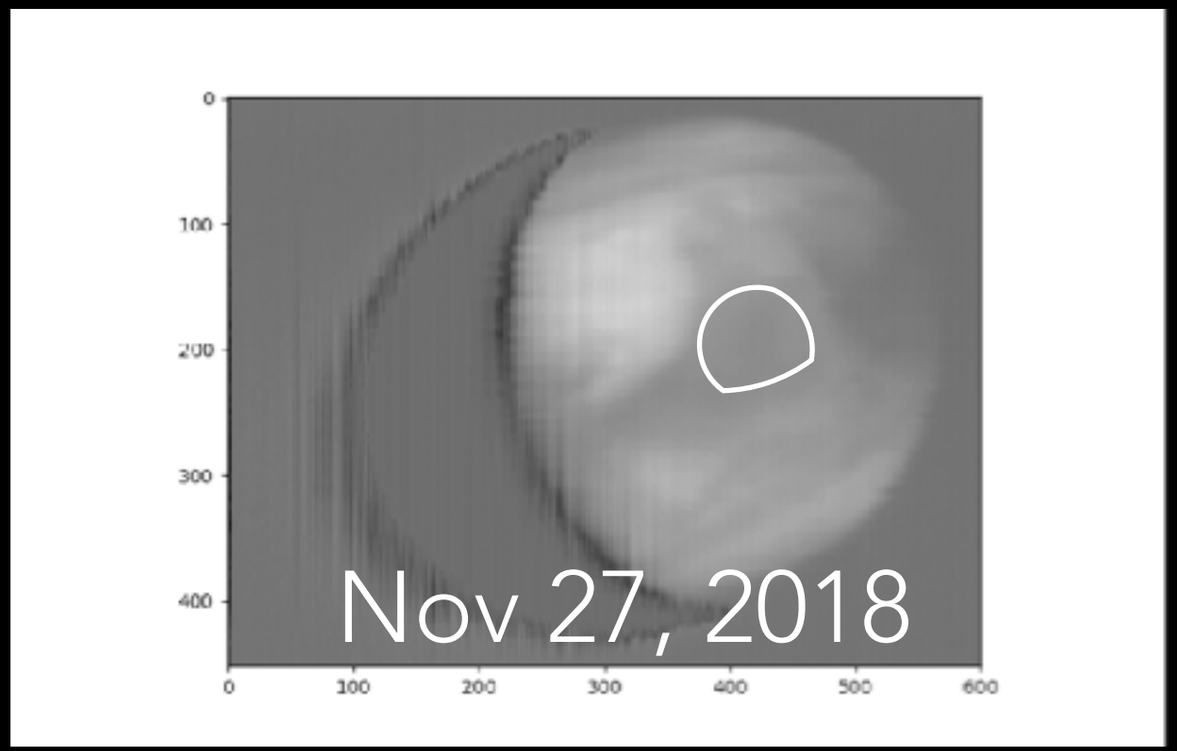

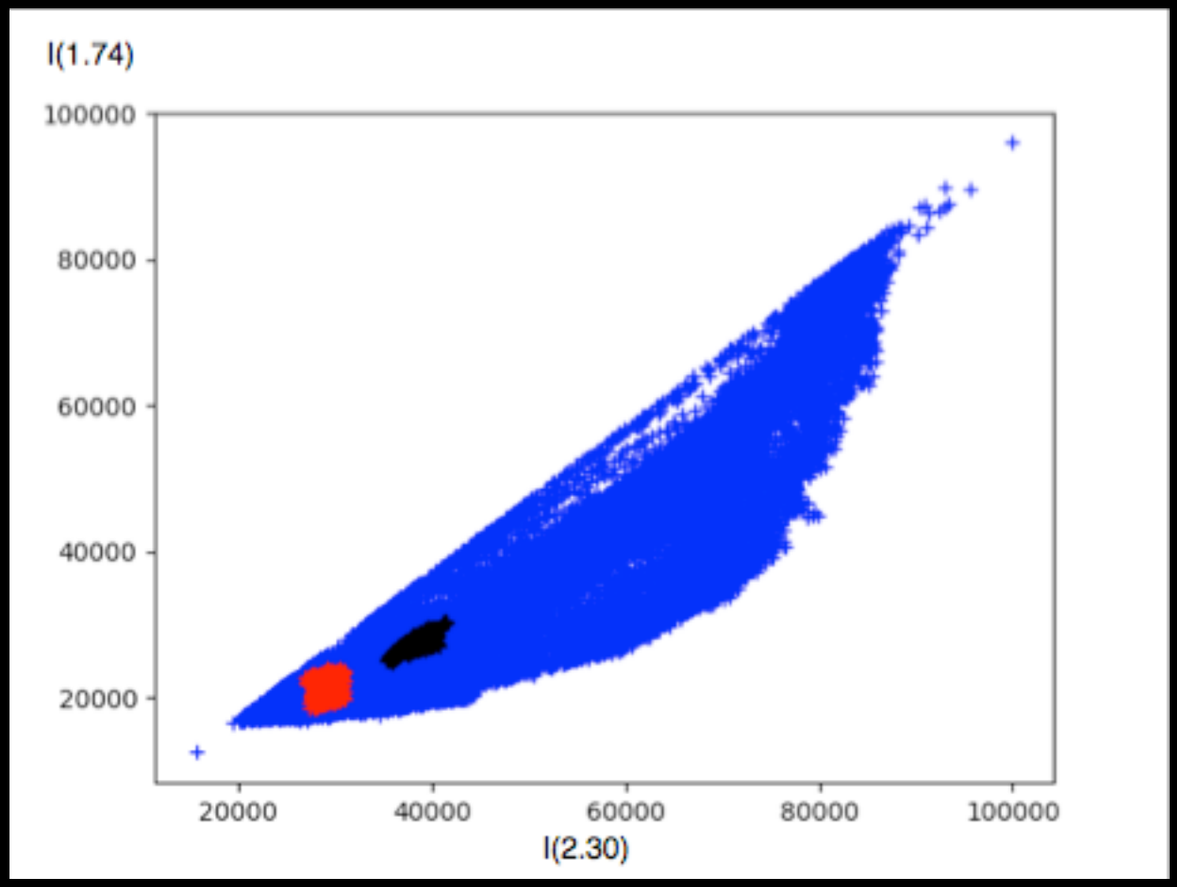

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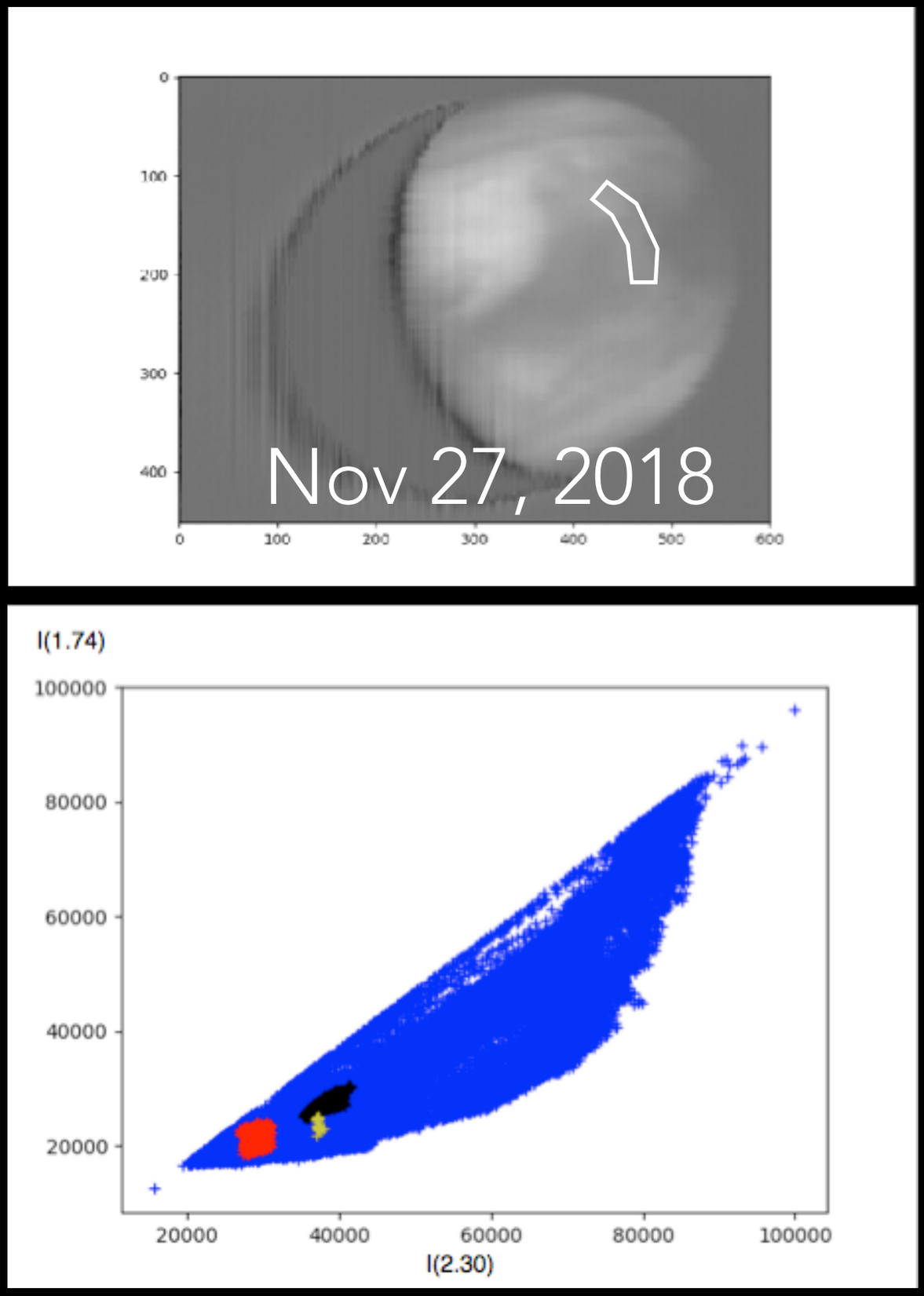
- Basic idea: flux from larger particles is attenuated more at 2.30 μm than at 1.74 μm.
- The “sharp discontunities” are visible in dayside 0.94 μm images, so they reach high altitudes (~65 km). Are these sites of large particles?



PARTING THOUGHTS

- There are suggestions that particles near the sharp discontinuity lie on a different branch than particles in other clouds of similar optical depth.
- Follow-up: this really needs a radiative transfer approach – use entire spectrum to fit for particle sizes, cloud opacity, cloud altitude range and trace gas abundances.

Note: the entire IRTF data set is available. Contact Eliot Young: <*efy@boulder.swri.edu*>