

How JWST MIRI Will Improve upon Spitzer IRS Observations of Titan

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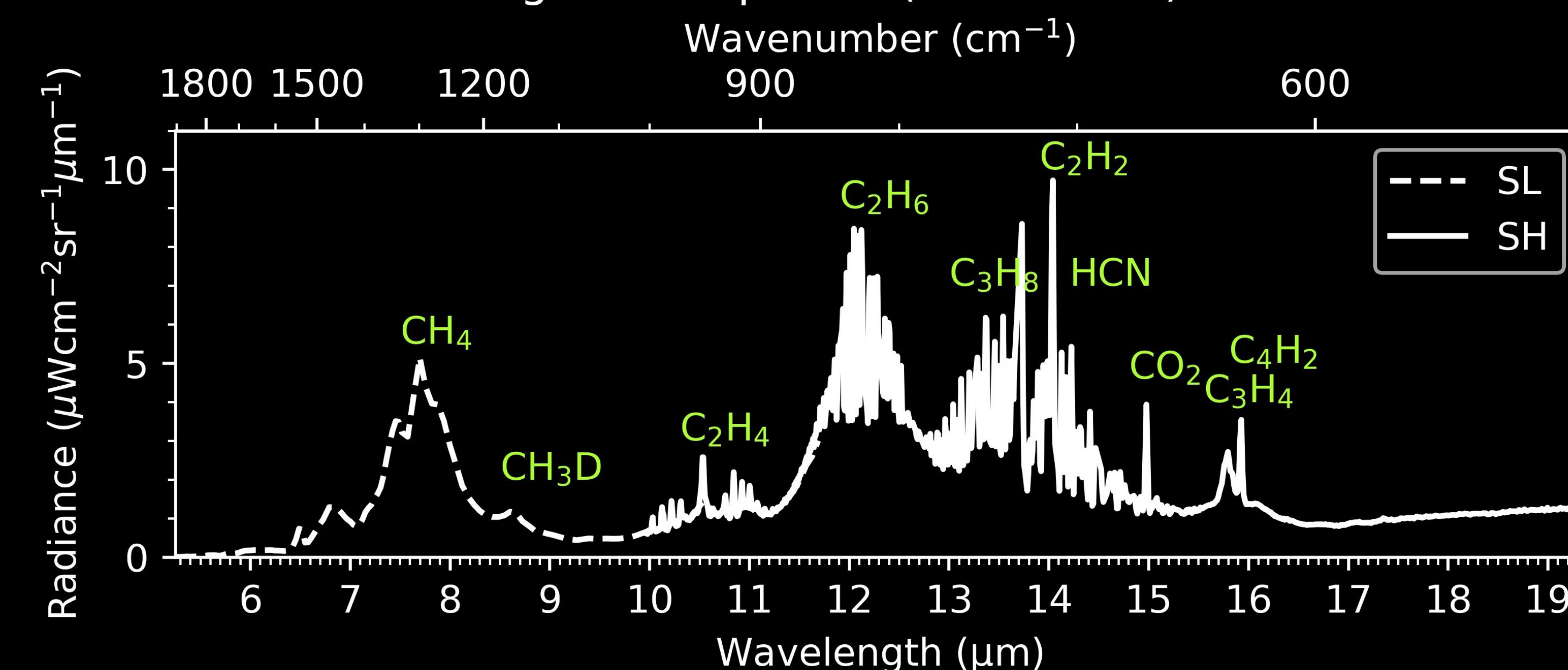
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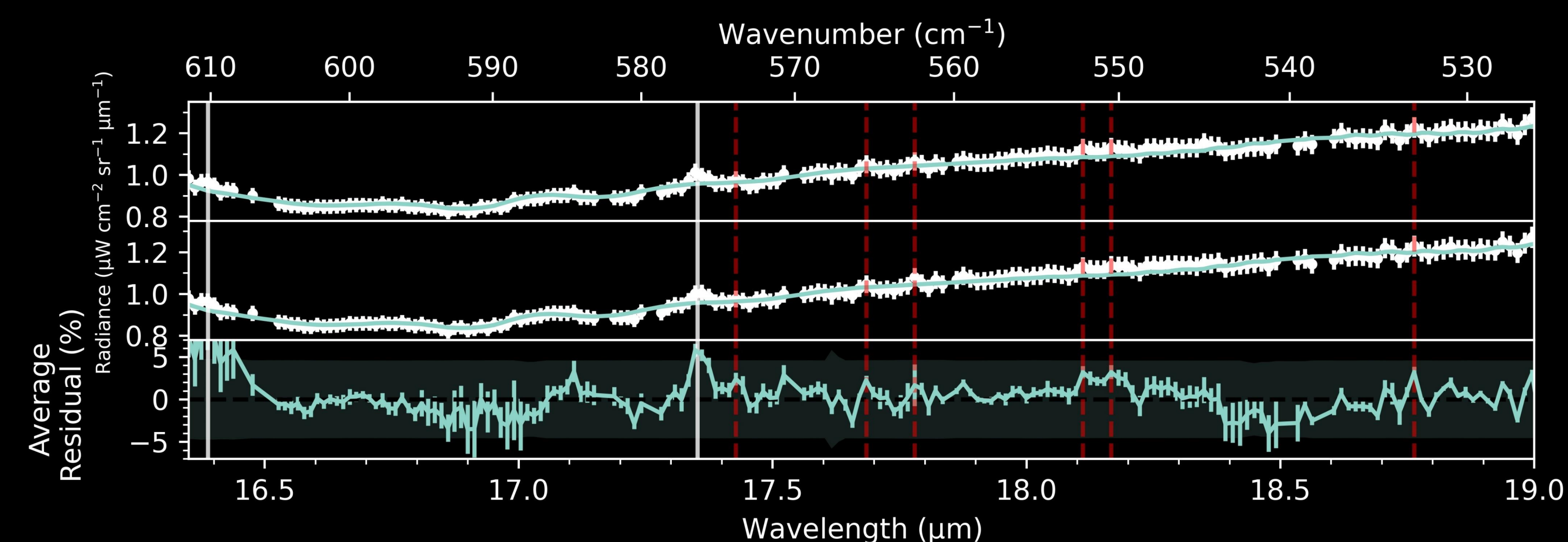
KEY POINTS

- ❖ Spitzer was able to provide updated **haze extinction cross sections** for regions noisy in Cassini CIRS
- ❖ Spitzer discovered **strong emission features at 16.39 and 17.35 micron** and several weaker features in the 16-19 micron range (17.35 micron feature is possibly C_3H_6)
- ❖ **JWST observations and new line lists will be required** to pinpoint the origins of spectral features detected by Spitzer
- ❖ Full results will soon be available in Planetary Science Journal

Averaged IRS Spectra (2004-2006) of Titan

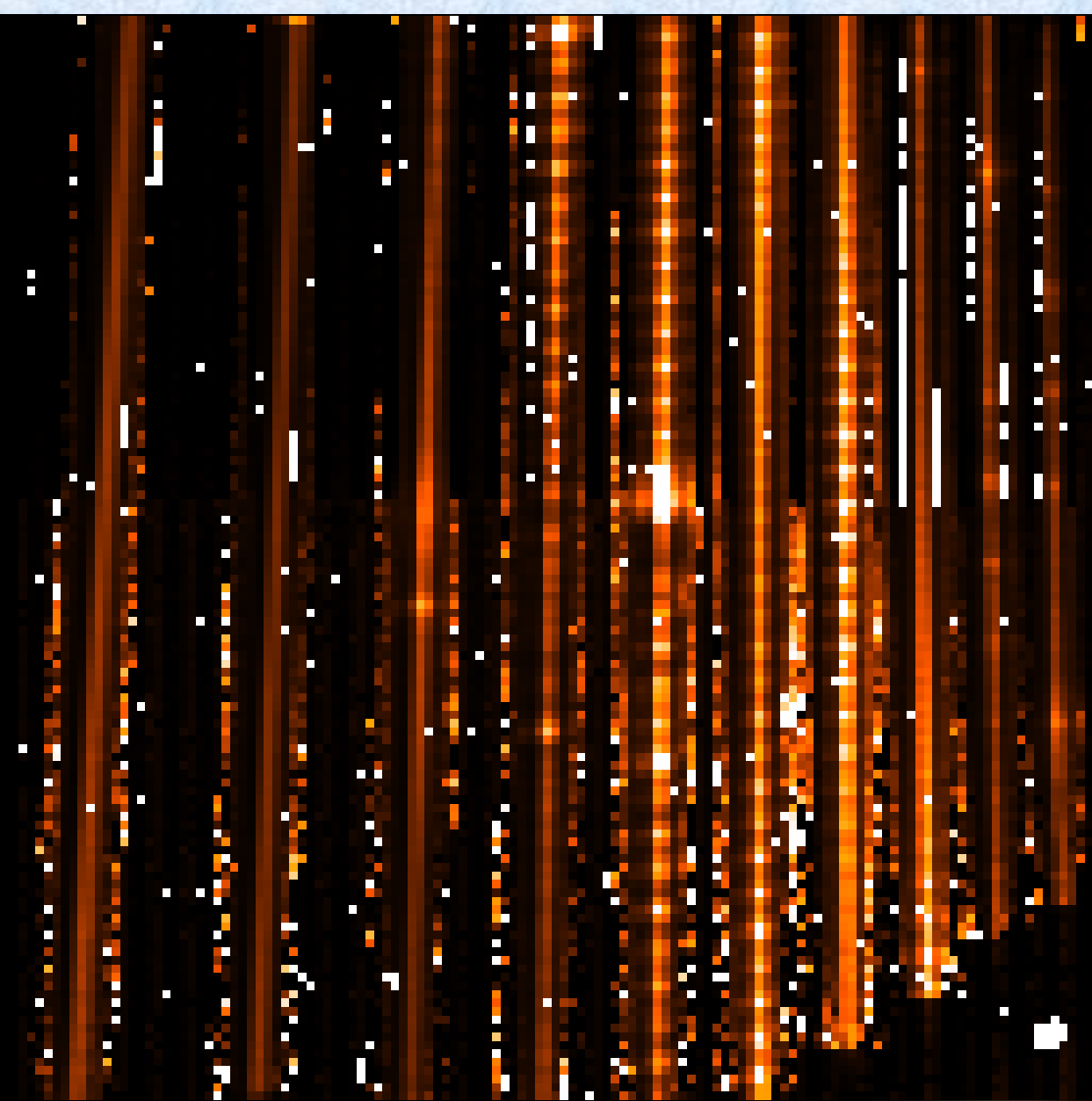


NEW SPECTRAL FEATURES



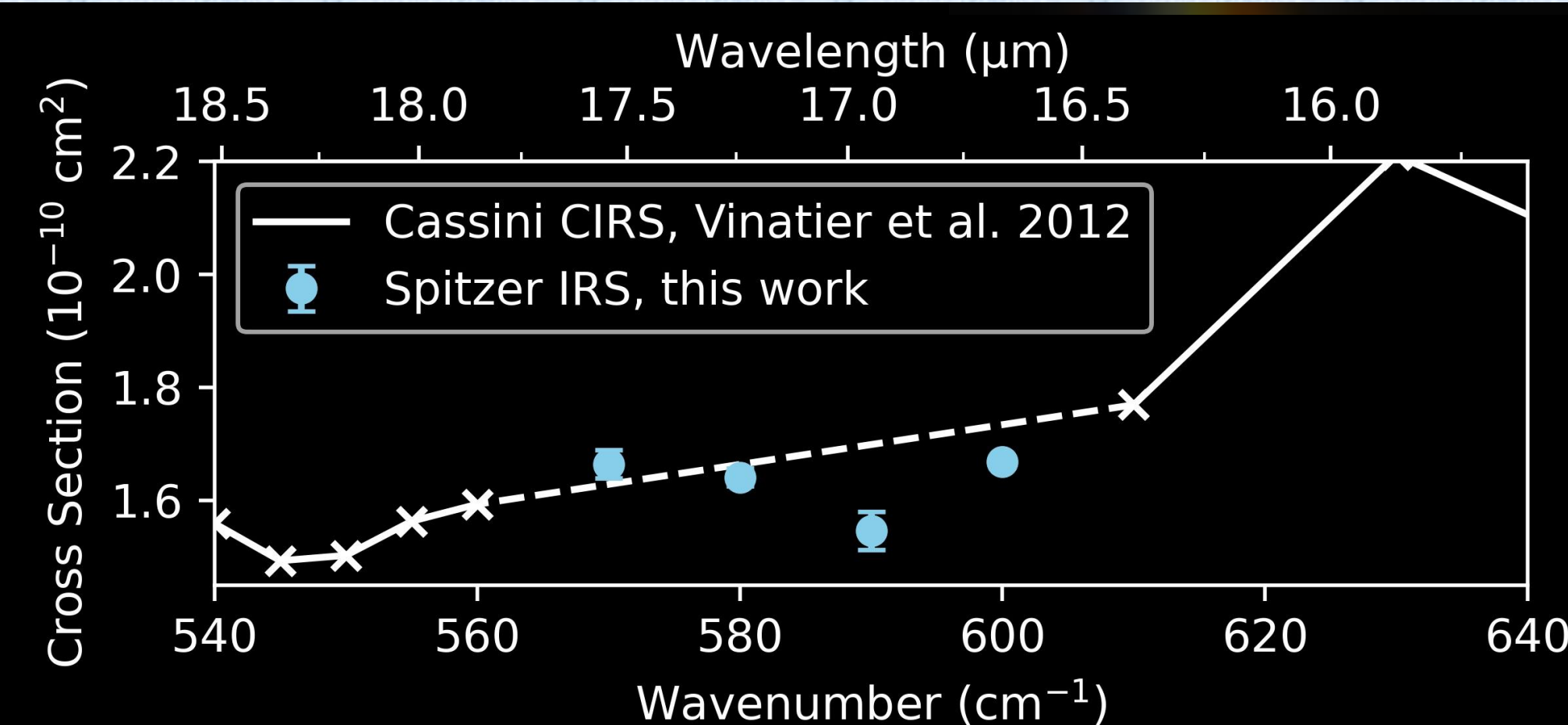
- ❖ Strong emission features discovered at 16.39 and 17.35 μm
- ❖ Several smaller *candidate* features in the 17.4-18.8 μm range
- ❖ Polyaromatic hydrocarbons? C_3H_6 ? H_2O ? C_{60} ?

BACKGROUND



- ❖ Spitzer IRS took moderate resolution ($R \sim 600$) observations of Titan over 2004-2009
- ❖ These observations cover the 5.2-38.0 μm range largely covered by JWST MIRI (5.0-28.3 μm)
- ❖ The time span and wavelength range also overlap with Cassini CIRS (2004-2017, 7-1000 μm)
- ❖ IRS also covers the ~ 16 -19.5 μm range noisy in Cassini CIRS

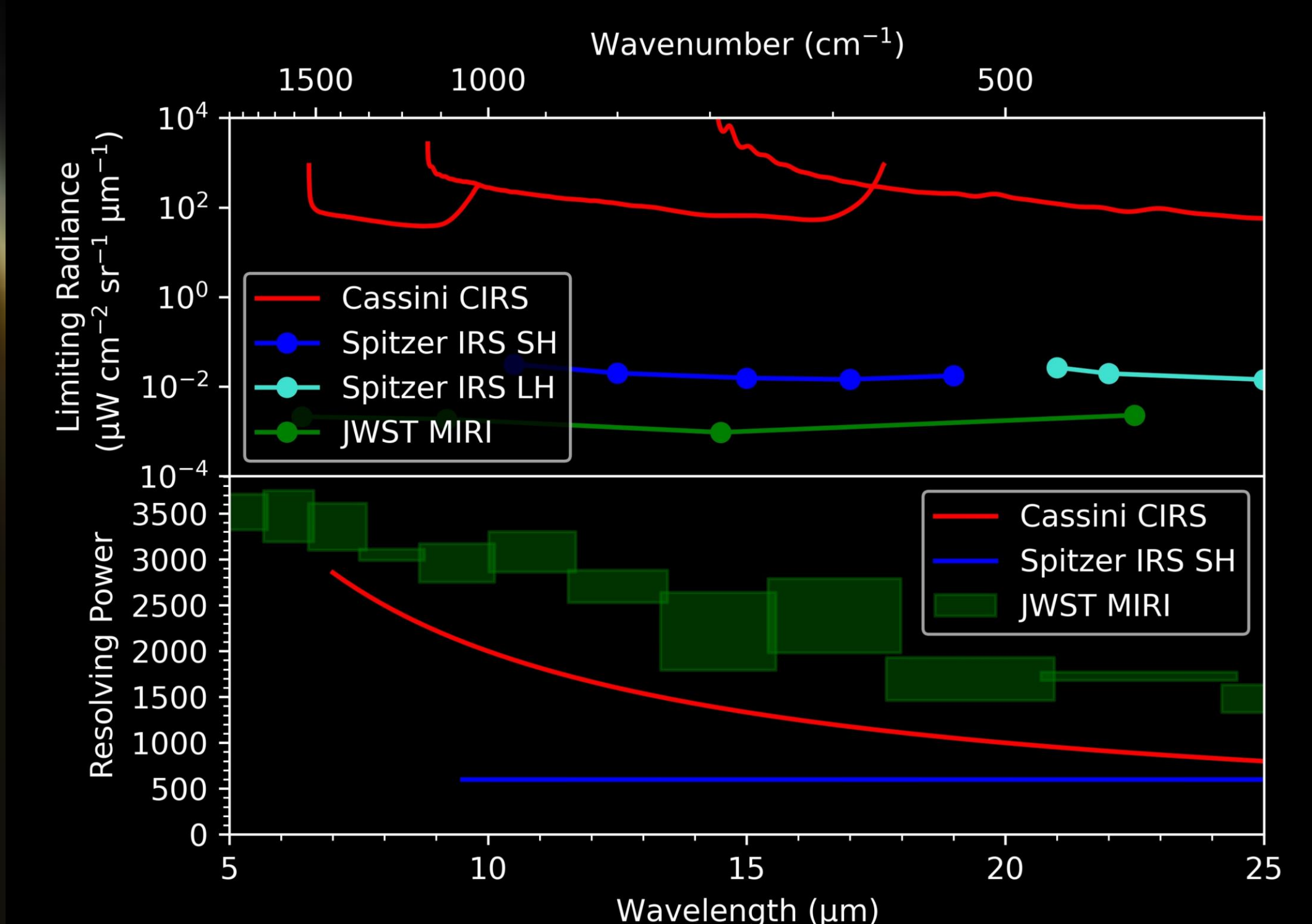
HAZE CROSS SECTIONS



- ❖ We used Spitzer observations to fill a crucial gap (560-610 cm^{-1}) in haze measurements
- ❖ Measurements will help reveal underlying trace gases with JWST and future IR observations

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JWST MIRI



- ❖ MIRI will provide a $\sim 21x$ increase in sensitivity and $\sim 3x$ increase in spectral resolution ($R \sim 1800$ vs $R \sim 600$) in the 16-20 micron region
- ❖ A tenfold increase in spatial resolution (0.20-0.27" vs. 2.3" per pixel) will allow MIRI to partially resolve Titan's disk (diameter $\sim 0.84''$)
- ❖ JWST will allow for trace gas detection, especially in 5-7 and 16-20 micron windows, constraining organic chemistry in the atmosphere

ACKNOWLEDGEMENTS

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