

# Estimating detectability of phosphine ( $PH_3$ ) in the Venusian atmosphere using spectral modelling

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A biosignature is a feature which can indicate the presence of life on a celestial body. **Phosphine is considered a biosignature.**

## Background

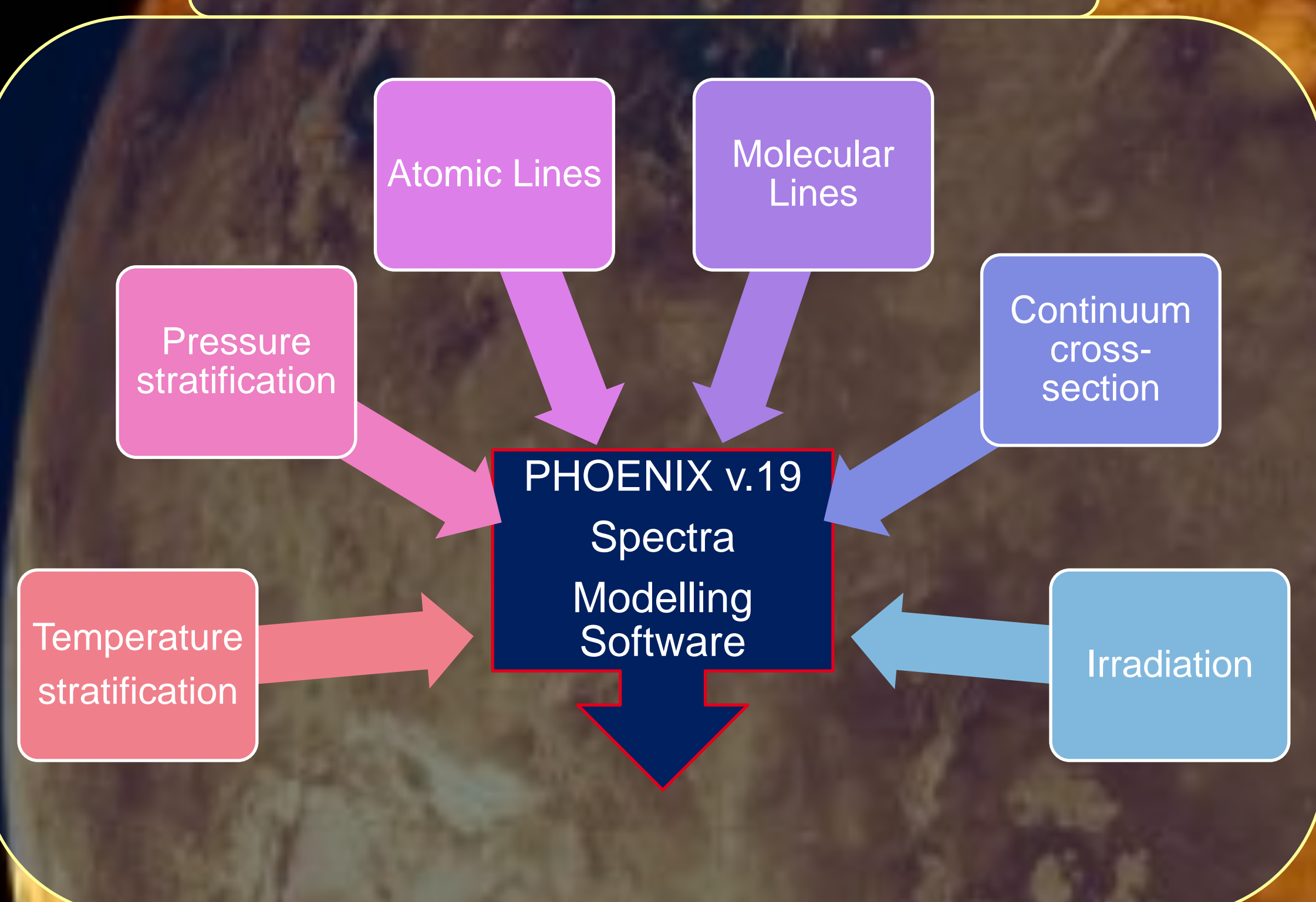
Three devices have detected the presence of phosphine in the Venusian atmosphere. The Atacama Large Millimeter/Submillimeter Array (ALMA), the James Clerk Maxwell Telescope (Bains et al., 2021; Greaves et al., 2020) and the pioneer Venus Large Probe Neutral Mass Spectrometer (Mogul et al., 2021). These detections have been contested. Trompet et al. (2021) have found no sign of phosphine on Venus from their methods. Others suggest that sulphur dioxide has been mistaken for phosphine and that the ALMA has calibration errors which impact the results (Lincowski et al., 2021, Villanueva et al., 2021). Our research seeks to refine the controversy.

## Scientific questions

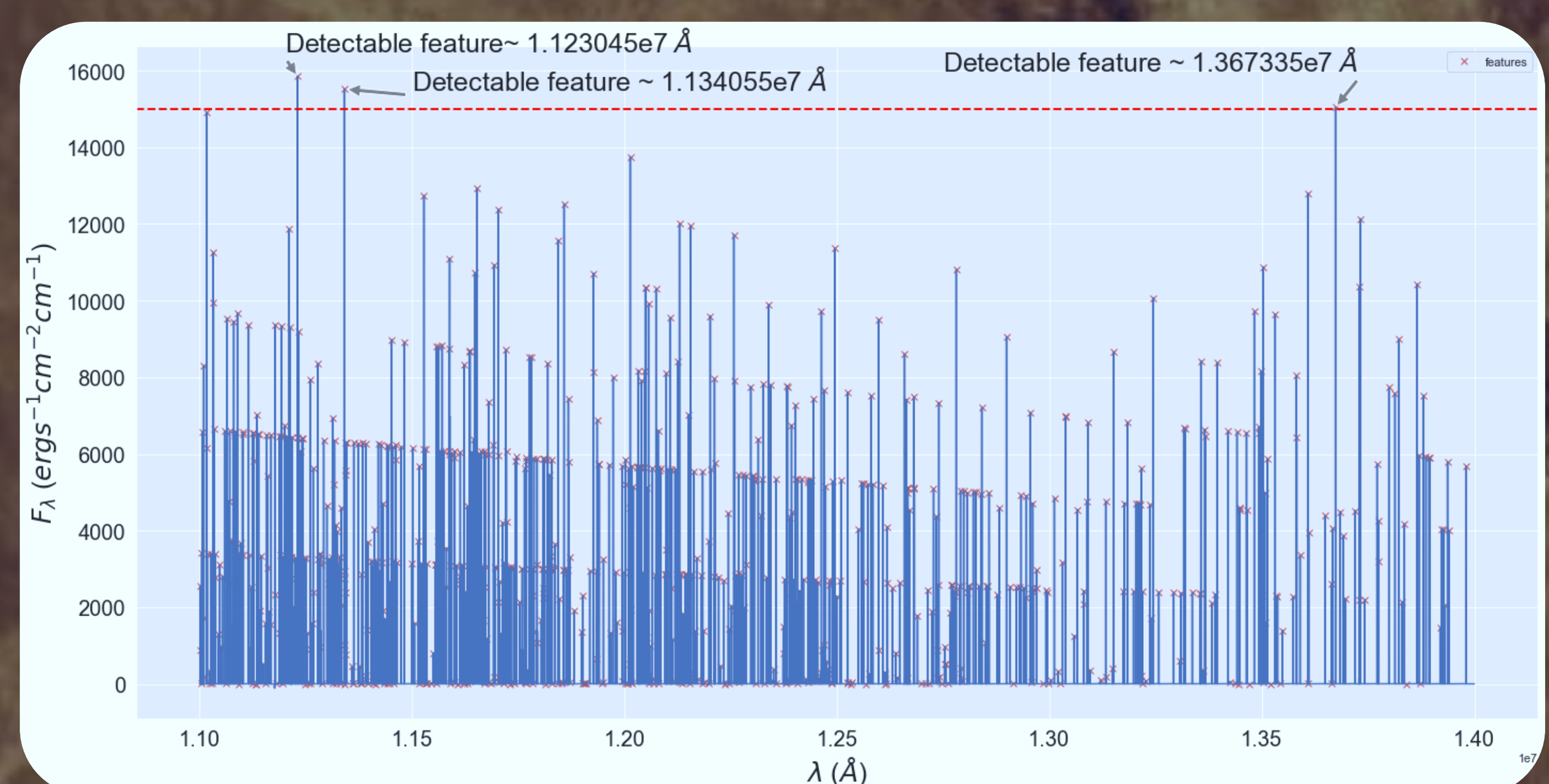
If phosphine is present in the Venusian atmosphere at what:

- ✓ concentrations can it be detected?
- ✓ wavelengths can it be detected?

## The Method



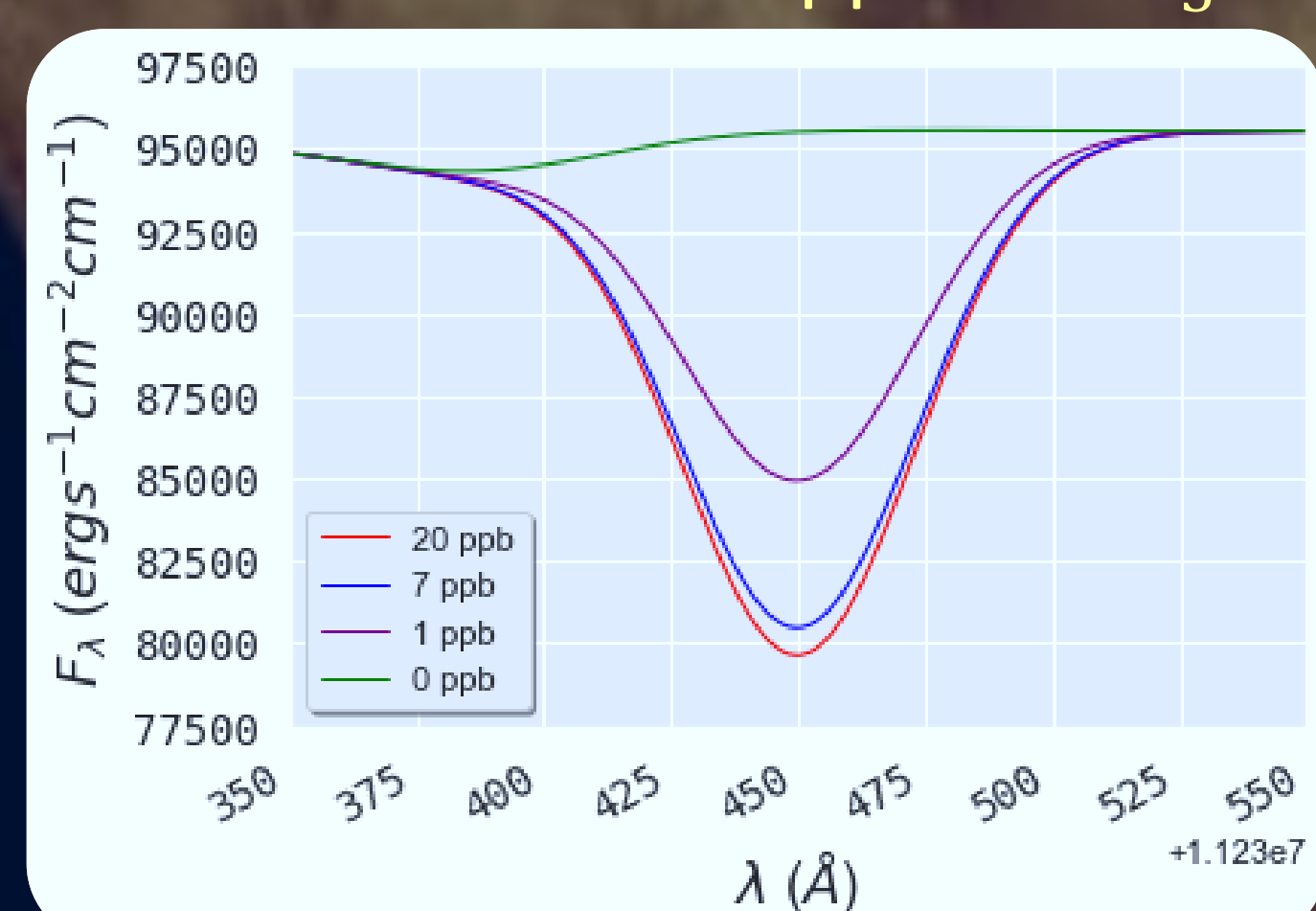
Synthetic  $F_{\lambda_{0ppb}} - F_{\lambda_{20ppb}}$  for an ALMA  $\lambda$  range of band 6



## Synthetic spectra produced

Detection feature at  $\sim 1.123045 \times 10^7$  Å ( $\sim 266.95$  GHz) is in agreement with location of empirical detections of Greaves et al. (2020).

Radiation flux vs. wavelength for various concentrations in ppb of  $PH_3$



## Conclusion

A synthetic atmosphere containing 20 ppb phosphine produces a radiation flux feature at  $\sim 1.123045 \times 10^7$  Å ( $\sim 266.95$  GHz) which agrees with empirical telescopic data. Features at  $\sim 1.367335 \times 10^7$  Å ( $\sim 219.25$  GHz) and  $\sim 1.123045 \times 10^7$  Å ( $\sim 266.95$  GHz) should also be detectable assuming that they are not lost in noise at these wavelengths.

A synthetic Venusian atmosphere with a concentration of 20 ppb phosphine produces a  $F_{\lambda}$  feature in agreement with empirical telescopic results.

## References

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Title image source: Sleepy Lion. 2019. Background image source: Siddiqi, 2018. 'Credit: NASA/PI'



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