

# EXOPLANET BIOSIGNATURES: DISPATCHES FROM THE CUTTING EDGE

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Theresa Mason Fisher

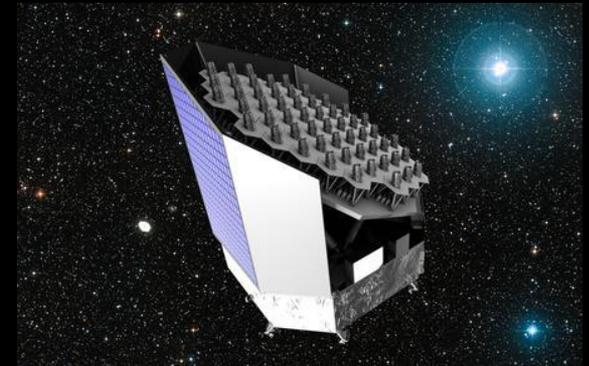
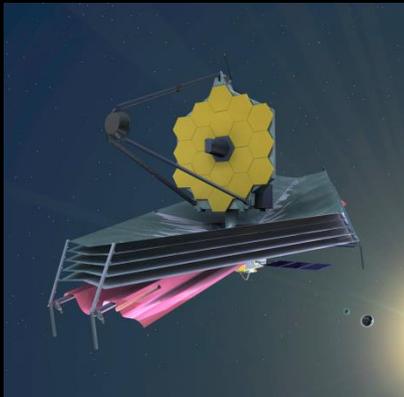
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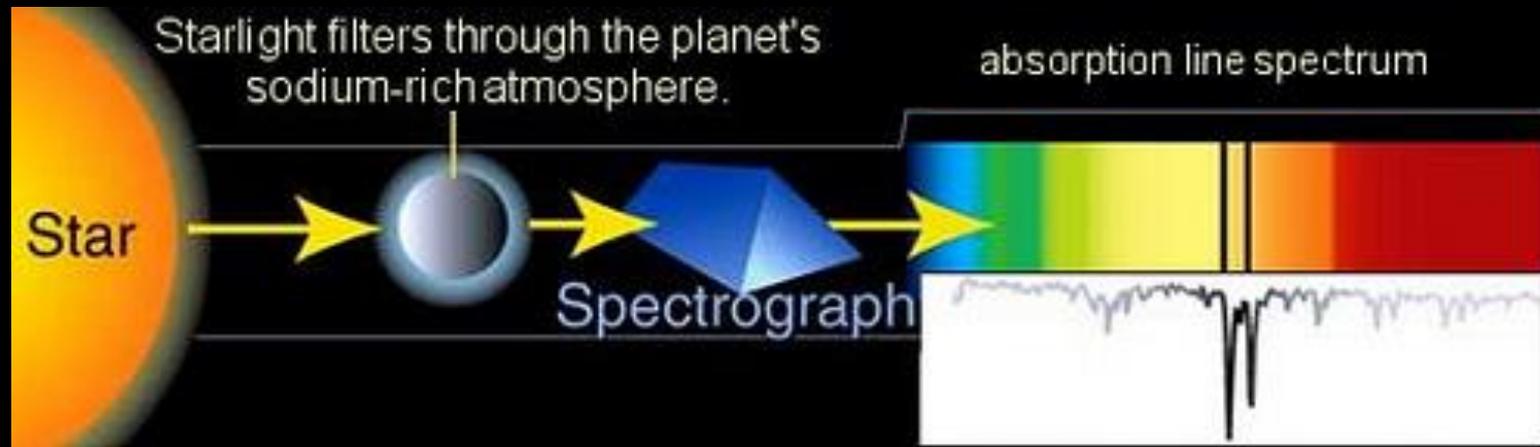
Arizona State University

# EXOPLANET BIOSIGNATURES: COMING SOON TO A TELESCOPE NEAR YOU!.....MAYBE

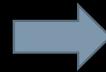
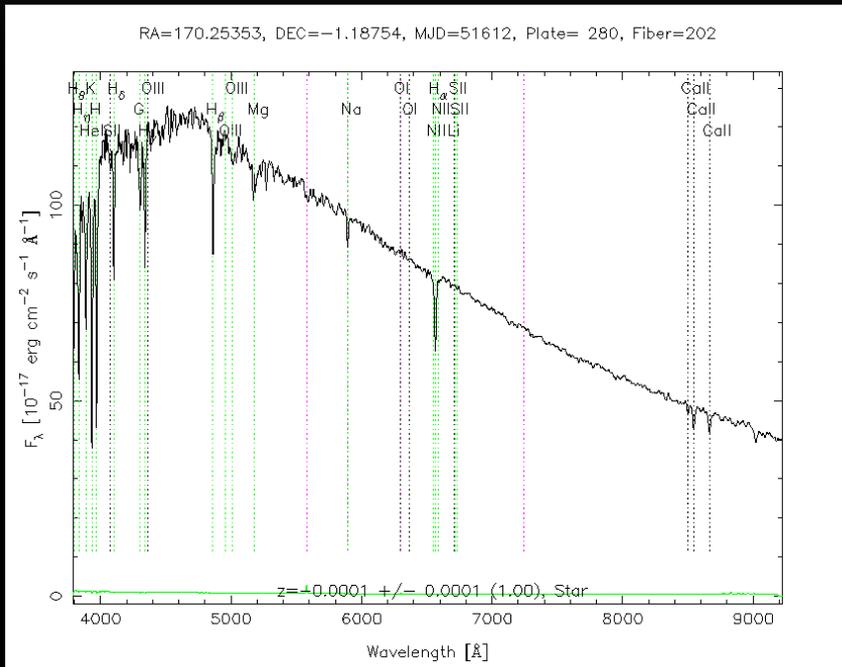
- Spectral analysis of exoplanets in the near-term future



# EXOPLANET SPECTRA: HOW WE GET IT



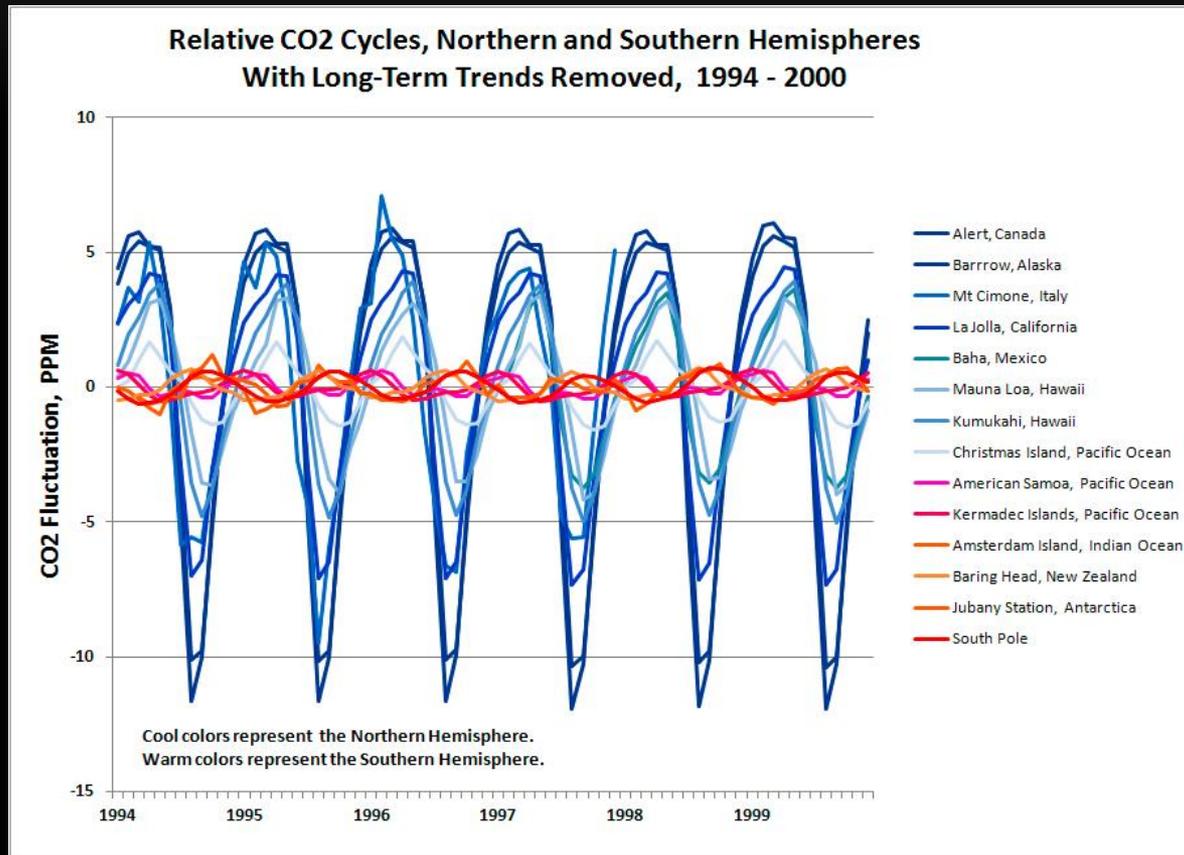
# THE PROBLEM



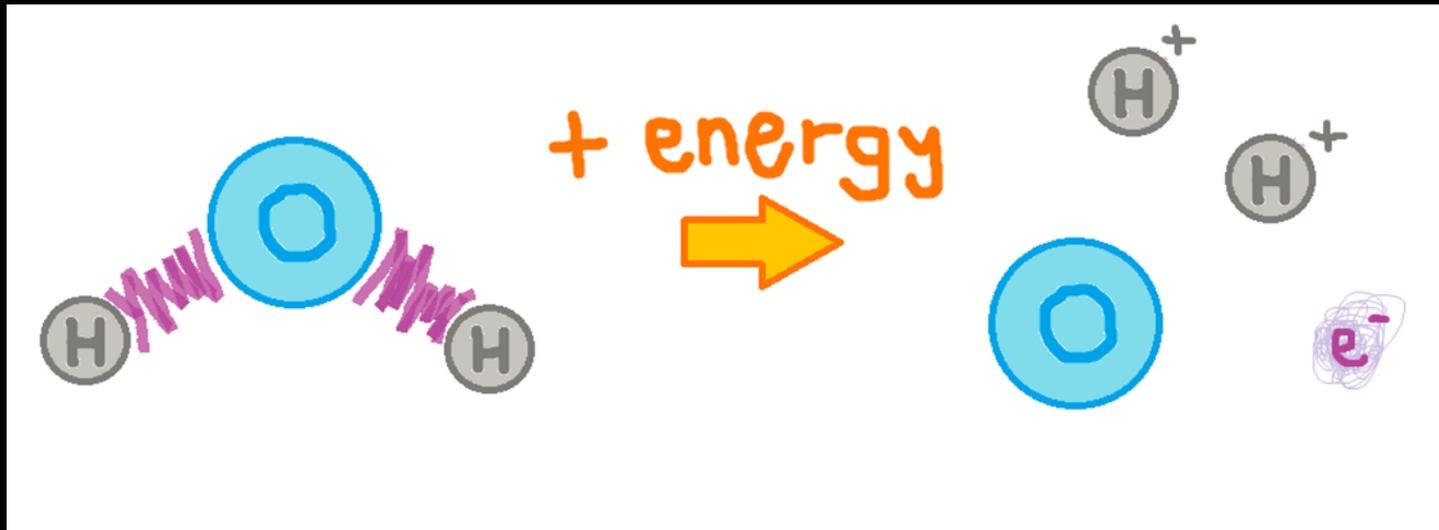
# SOLUTIONS: TRACE GASES

- O<sub>2</sub>, CH<sub>4</sub>, DMSO, etc
- “Smoking gun”

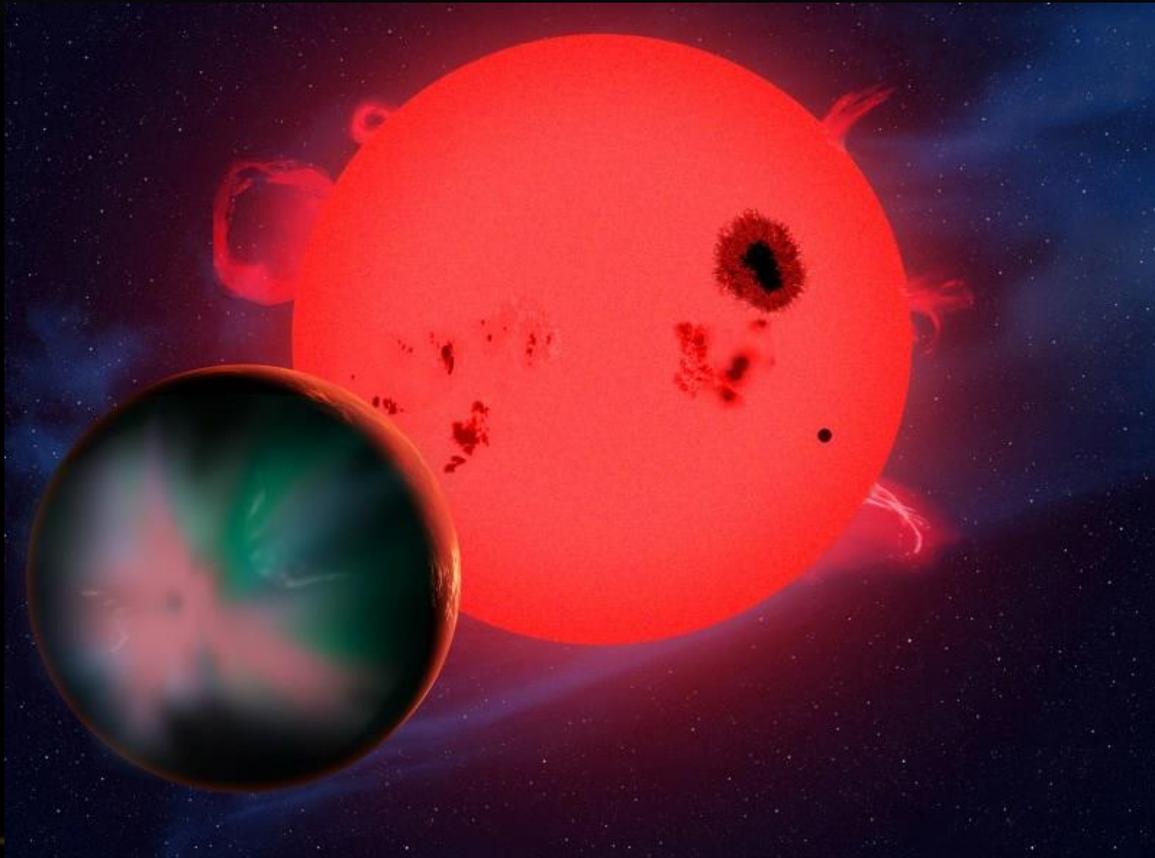
# TRACE GASES: ACROSS TIME



# THE PROBLEM: FALSE POSITIVES



# FALSE POSITIVES



# ANOTHER PROBLEM: LIFE AS WE DON'T KNOW IT

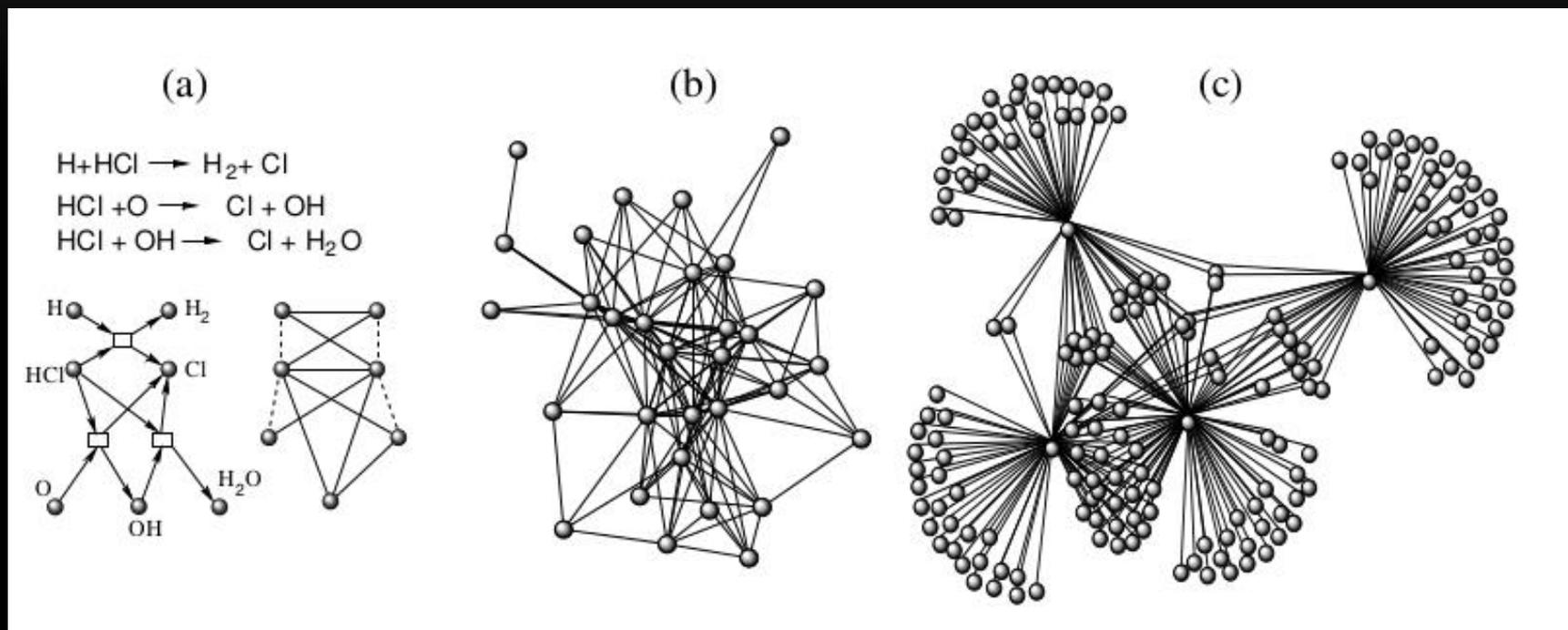
## IT



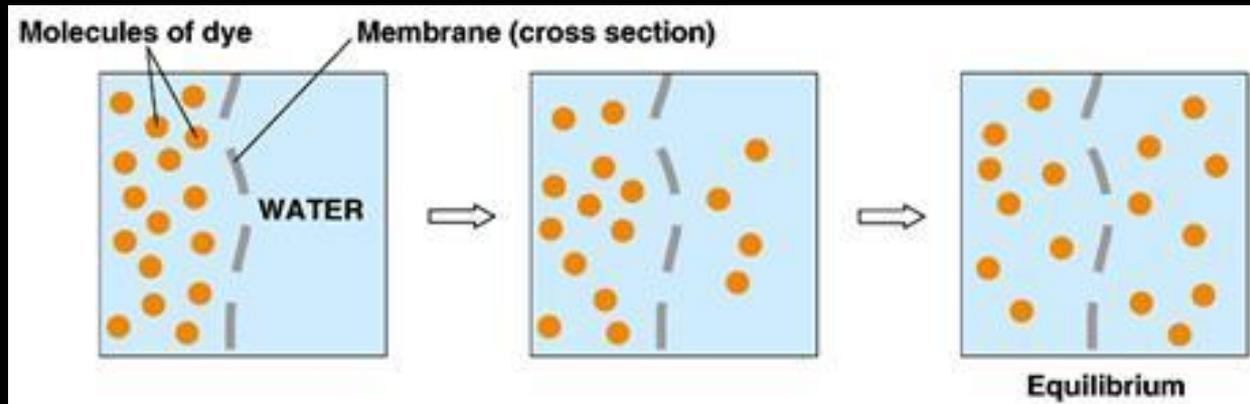
# LIFE AS WE DON'T KNOW IT

- H<sub>2</sub>-dominated atmospheres?
- CO<sub>2</sub>-dominated (early earth)
- N<sub>2</sub>-dominated?

# TRACE GASES: NETWORK APPROACH?



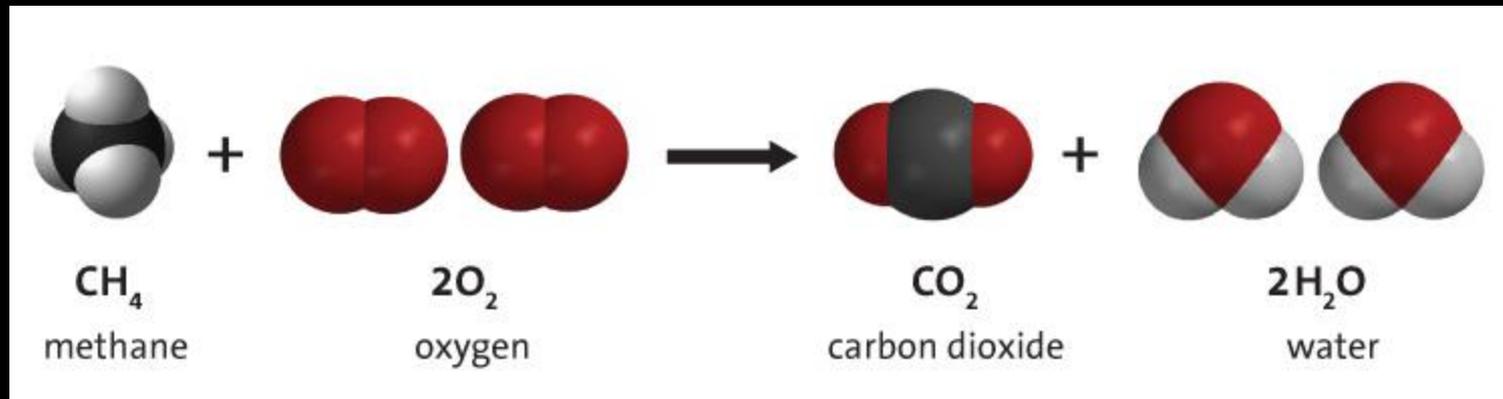
# TRACE GASES: EQUILIBRIUM AND DISEQUILIBRIUM



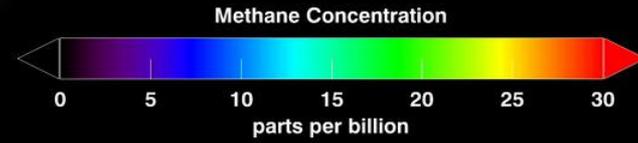
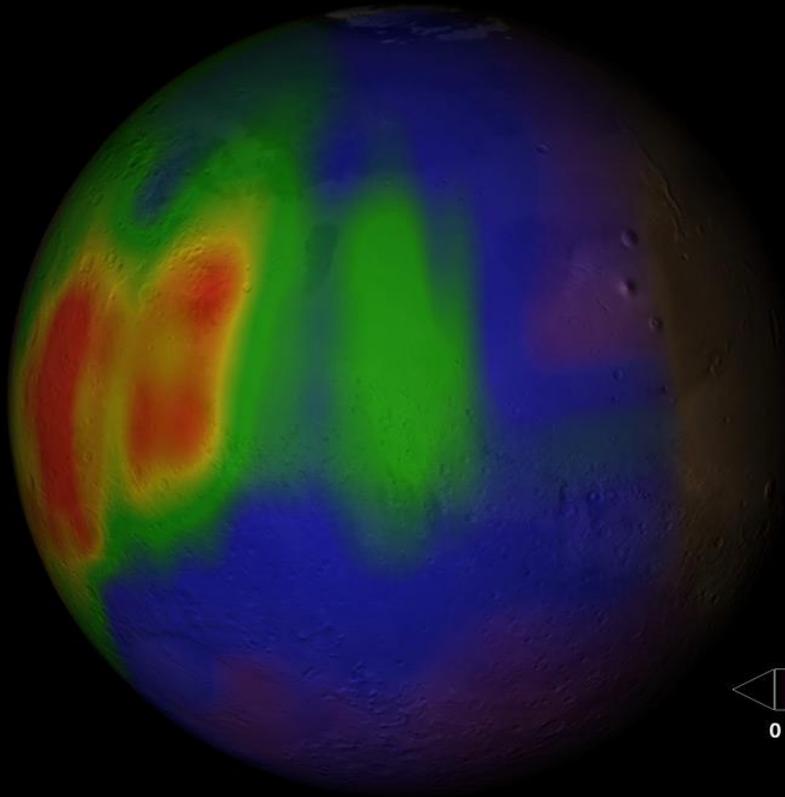
# TRACE GASES: EQUILIBRIUM AND DISEQUILIBRIUM



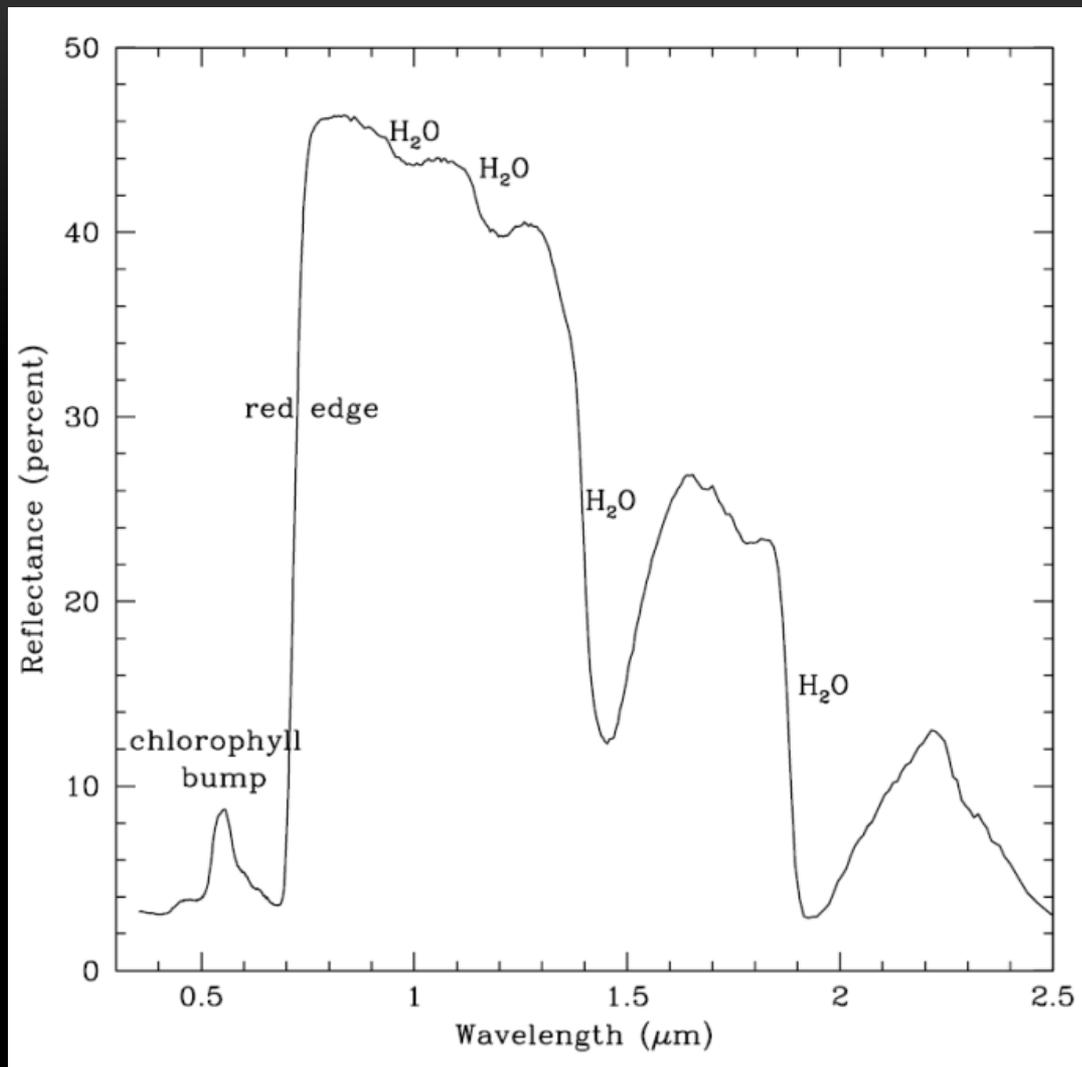
# TRACE GASES: EQUILIBRIUM AND DISEQUILIBRIUM



# Methane release: Northern summer







# NON-OXYGENIC PHOTOSYNTHESIS



....Still works!

# BIOLUMINESCENCE



# CONCLUSION

- This is not an easy problem to solve
- In the next 30 years? “Maybe”
- Multiple lines of evidence needed

# QUESTIONS?



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