# Research opportunities in transiting exoplanets

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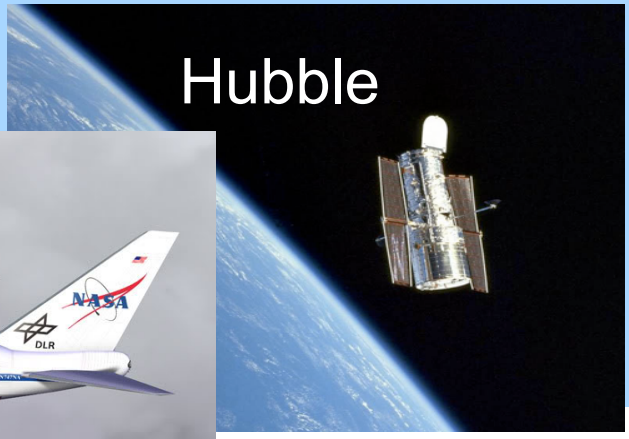
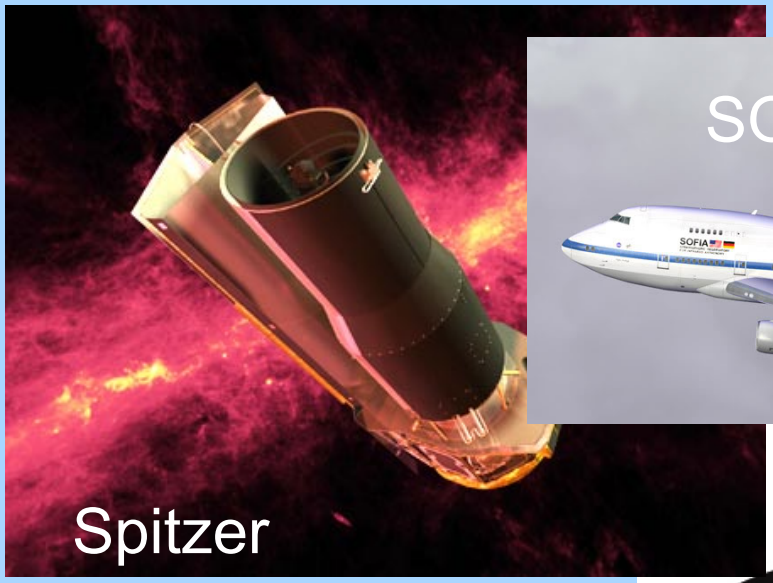
Oct 22, 2012

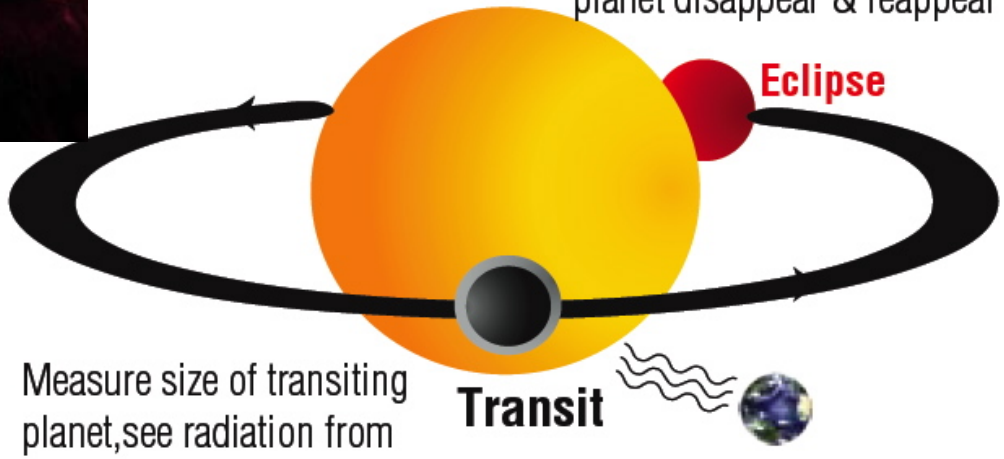








See thermal radiation from planet disappear & reappear

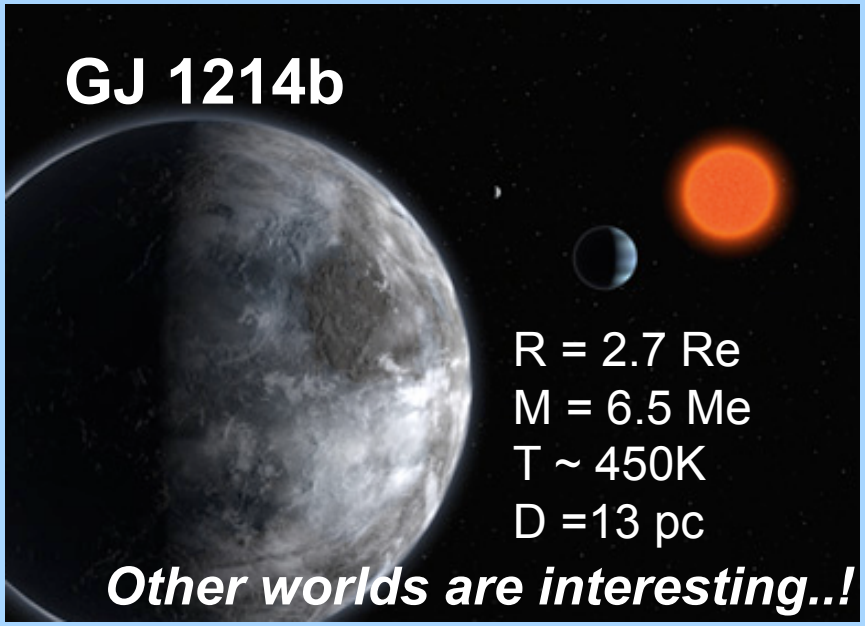



Measure size of transiting planet,see radiation from star transmittedthrough the planet's atmosphere

Gravitational tug of unseen planets alters transit times

TRA0009

# *Why* research extrasolar planets in Astr 695?




*Collaborators:*
Heather Knutson, Caltech
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Michael Gillon, Geneva
Jean-Michel Desert, Colorado
Adam Burrows, Princeton

**Exoplanets are interesting**

**Data are available – Hubble, Spitzer**

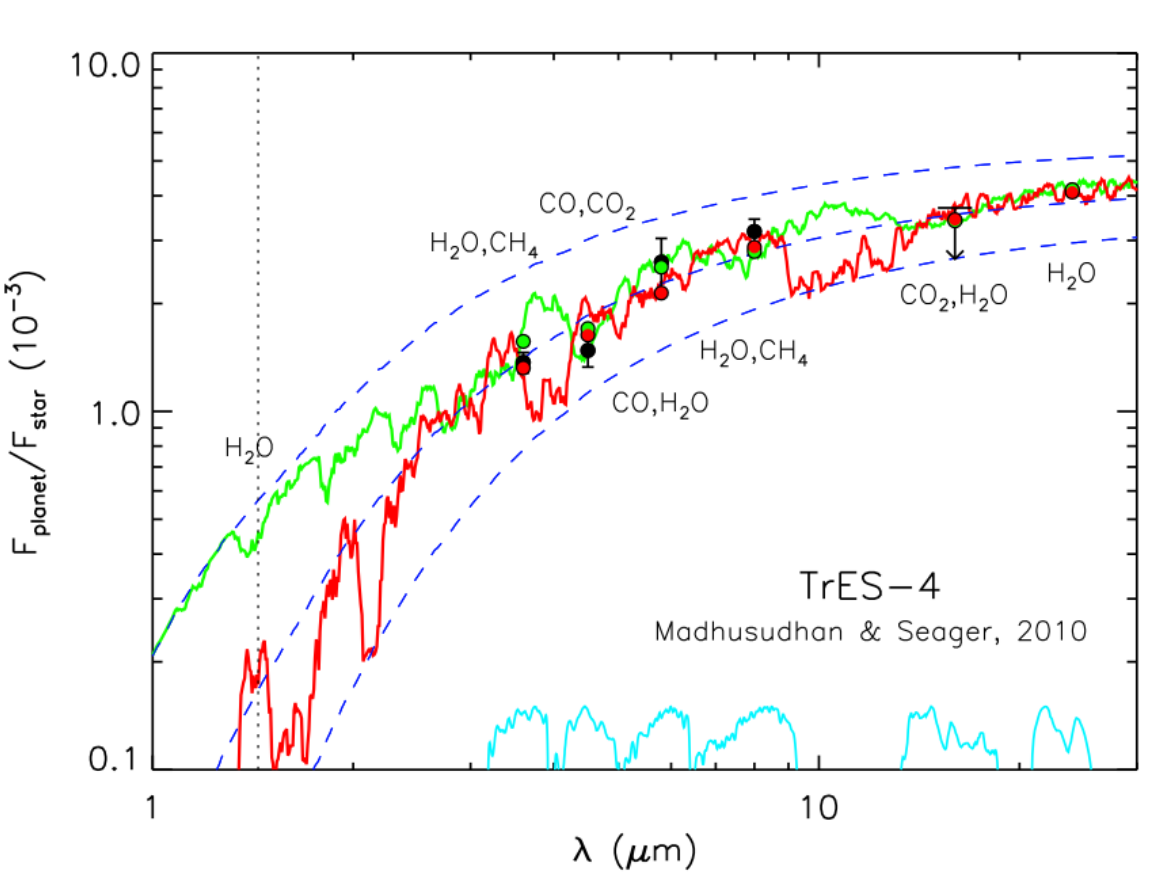
**Hot field, good job prospects**

**Opportunity to observe at the DCT or other observatory**

**I'm easy to work with… but very publication-focused**

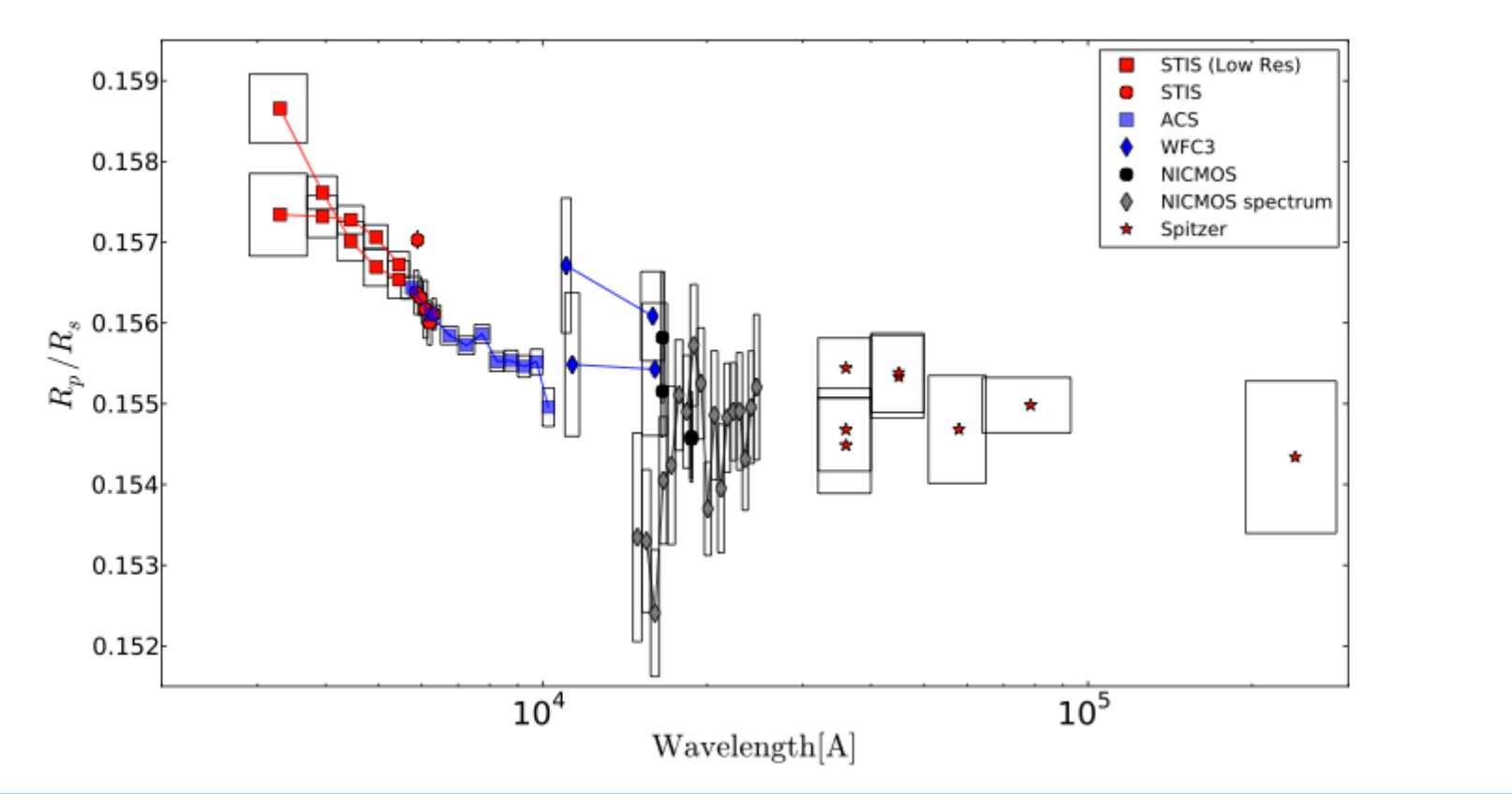
# Specific examples of possible projects

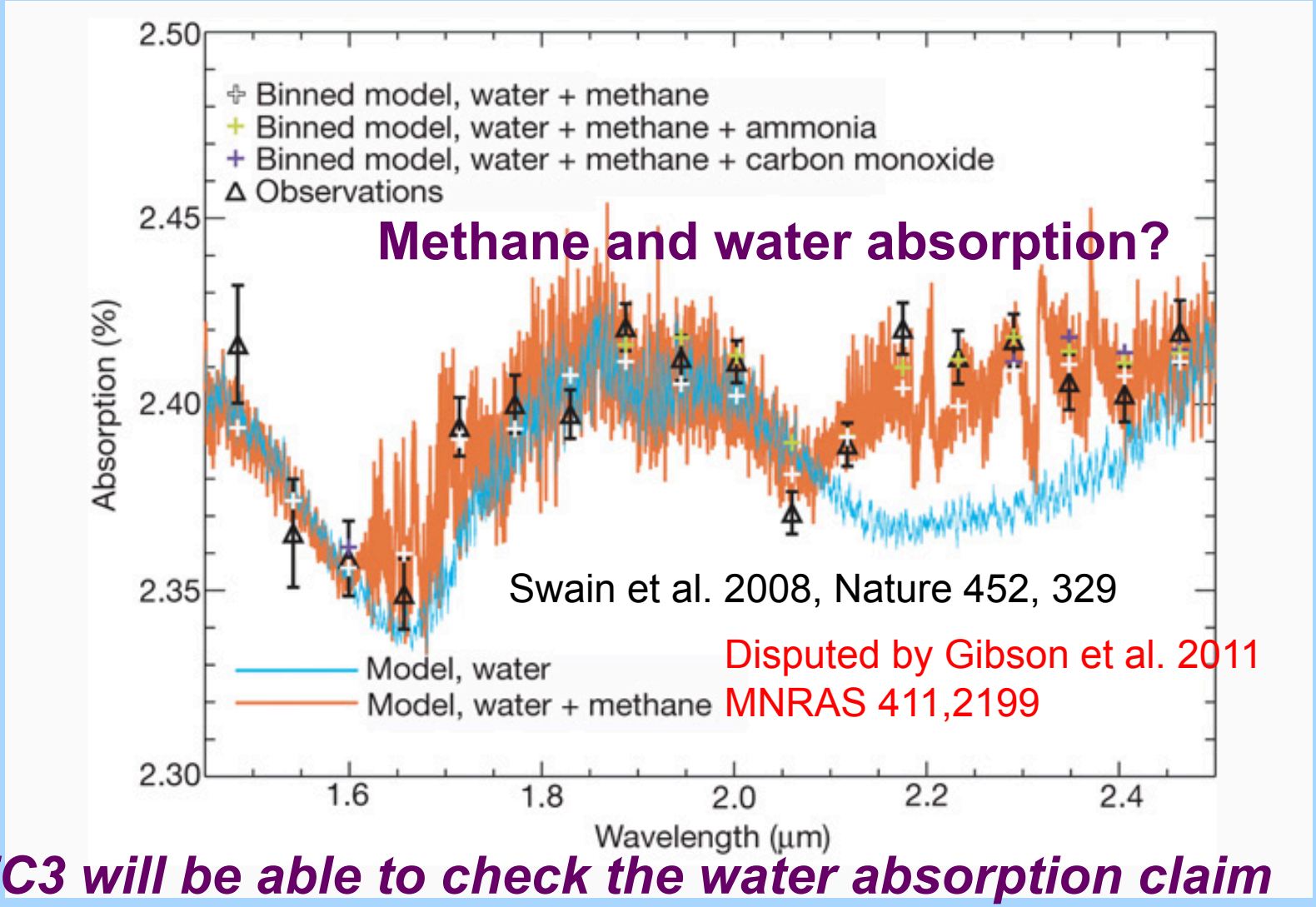
Hubble WFC3 grism spectroscopy of water in emission and transmission



# Spitzer (infrared) versus STIS (ultraviolet) radii

(Hubble Cycle-19 + Spitzer Cycle-9 approved programs)



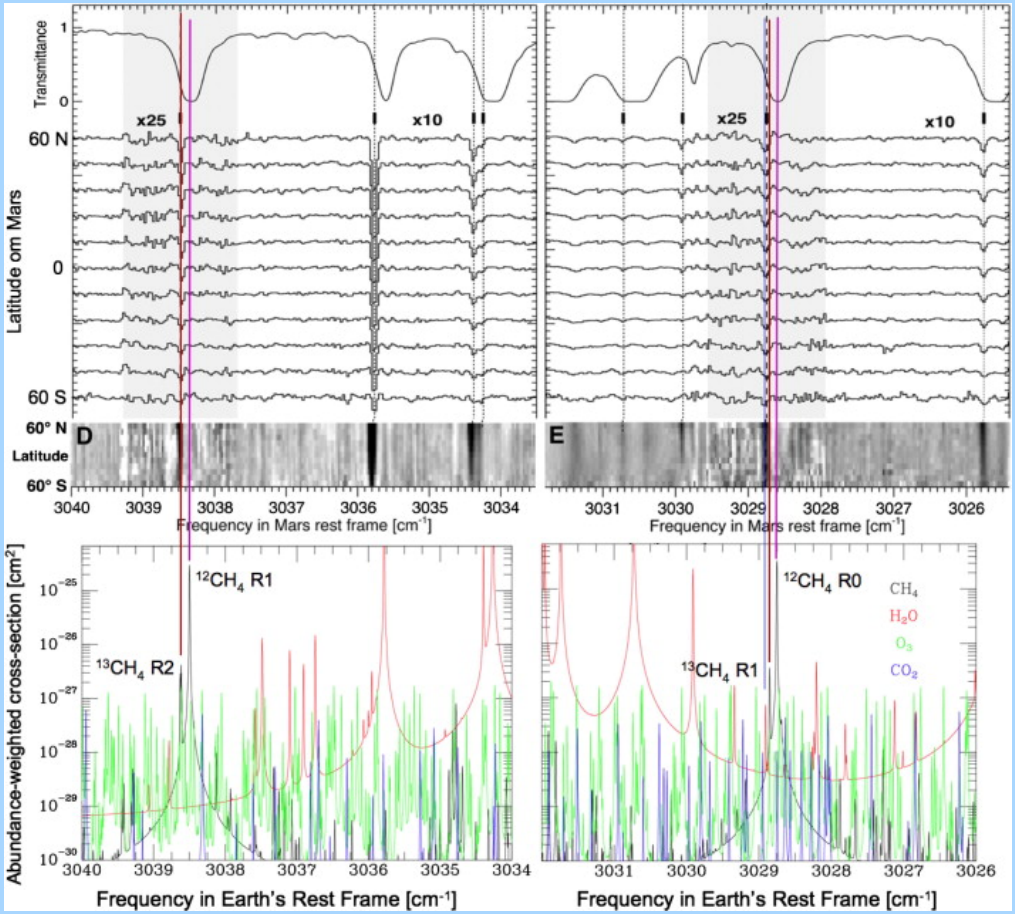



***WFC3 will be able to check the water absorption claim***

***and I'm currently doing a re-analysis of the NICMOS data***

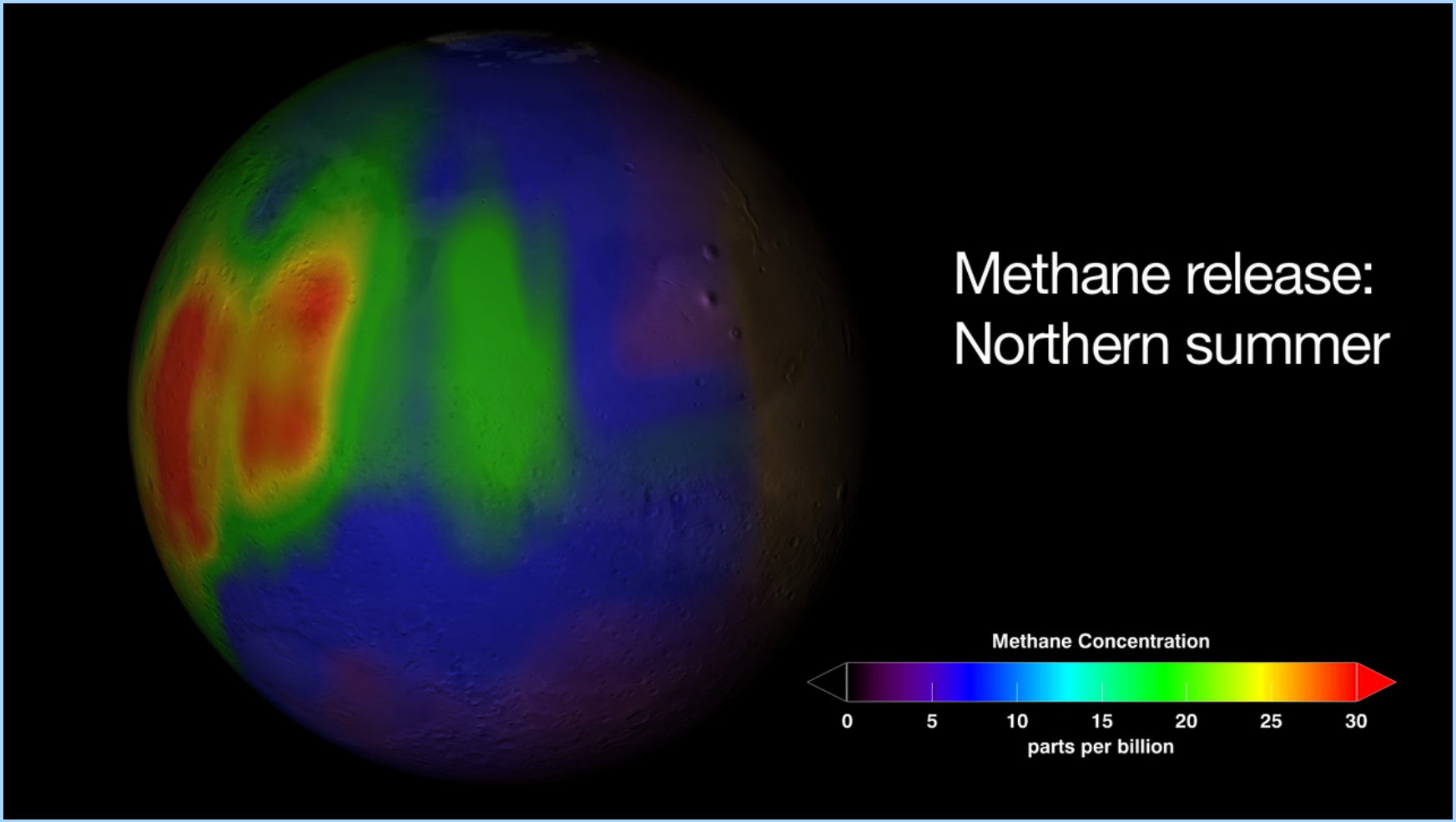
# Methane on Mars

Several groups have reported the detection of methane in the Martian atmosphere - potentially produced by bacteria




the best measurement is from Earth-based high-resolution infrared spectroscopy (M. J. Mumma et al. 2009)

# Only seen in certain regions....
# and *variable* over months



# Disputed by Zahnle et al.

## "extraordinary claims require extraordinary evidence"

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### Is there methane on Mars?

observed variability of the methane is inconsistent with known chemistry, by a factor of 1000

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ABSTRACT

There have been several reports of methane on Mars at the 10–60 ppbv level. Most suggest that methane is both seasonally and latitudinally variable. Here we review why variable methane on Mars is physically and chemically implausible, and then we critically review the published reports. There is no known mechanism for destroying methane chemically on Mars. But if there is one, methane oxidation would deplete the $O_2$ in Mars's atmosphere in less than 10,000 years unless balanced by an equally large unknown source of oxidizing power. Physical sequestration does not raise these questions, but adsorption in the regolith or condensation in clathrates ignore competition for adsorption sites or are inconsistent with clathrate stability, respectively. Furthermore, any mechanism that relies on methane's van der Waals' attraction is inconsistent with the continued presence of Xe in the atmosphere at the 60 ppbv level. We then use the HITRAN database and transmission calculations to identify and characterize the absorption lines that would be present on Earth or Mars at the wavelengths of the published observa-

## EPOXI may observe Mars with its IR spectrometer, covering the nu-3 fundamental band at 3.3 microns