

# Planetary Raman Spectroscopy for Venus

Remote Raman --  
atmospheric profile &  
atmosph-surface reaction

*In situ* Raman –  
surface mineralogy &  
atmosph-surface reaction



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**Science -- Molecular information**

**Technology: TRL 6, category "1" by MSL, *2-in-1***

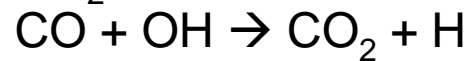
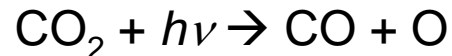
**Deployment – **No** sample prep, just shoot the laser !**

# Remote Raman for Venus

## Science

Molecular profile of atmosphere  
especially below <22 km  
major CO<sub>2</sub>, N<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>O, CO, H<sub>2</sub>S  
minor O<sub>2</sub>, H<sub>2</sub>, SO, OCS, HDO, S, C  
both ID and % (known  $\sigma$ s)

Reactions in atmosphere:



Atmosph - surface reaction

unknown UV absorber (S, C, ...)

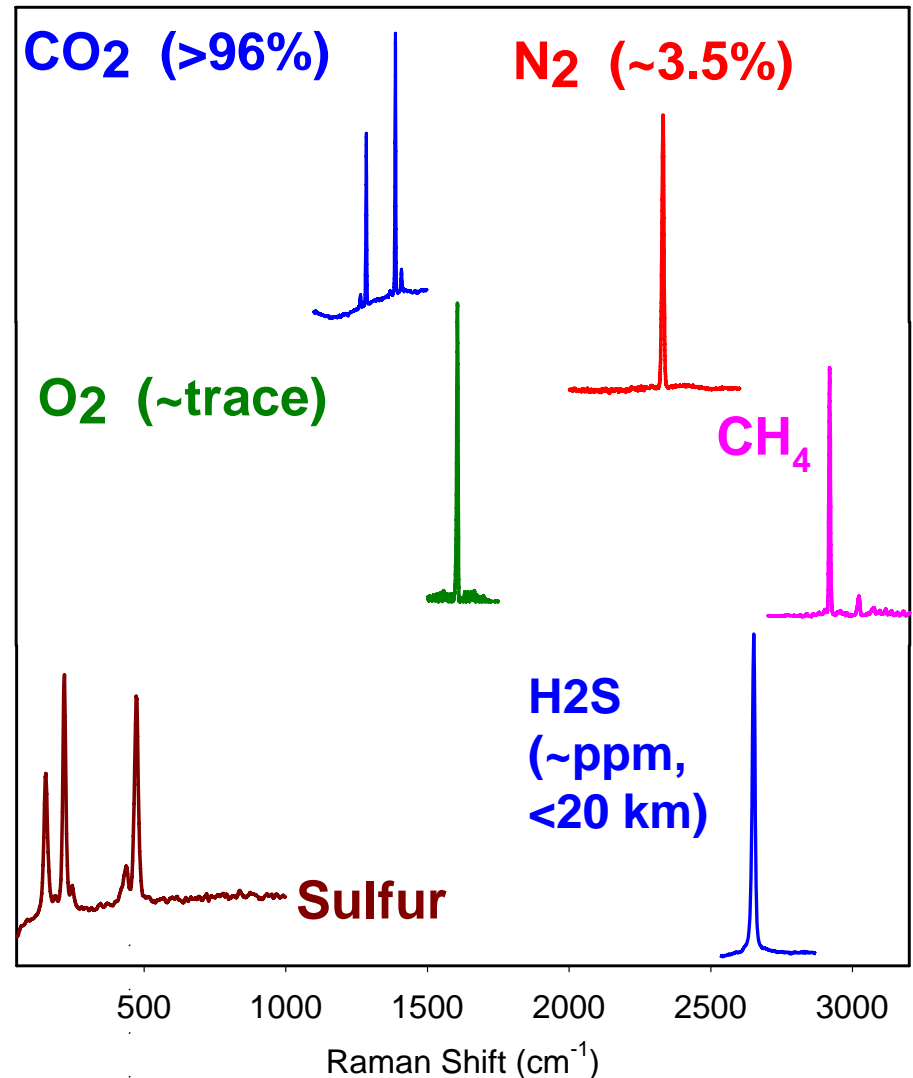
sulfates  $\leftarrow$  acid + basalt

## Technology Maturity

- Field tested -- rock target at 100 m
- Engineering partner – NASA Langley

## Deployment

- Shooting laser toward “air”,
- Receiving signals by telescope
- Fast measurement (s to min)



# In situ Raman for Venus

## Science – Definitive Mineralogy

Igneous mineralogy

Olivine ID & Mg/(Mg+Fe)

Pyroxene ID & Mg/(Mg+Fe+Ca)

Feldspar ID & approx. Or, Ab, An

Fe-Ti-Cr oxides & phosphates

% by Raman point counting

H<sub>2</sub>O-bearing Phases

Amphiboles

Hydroxides

Atmosph - surface reaction

sulfates ← acid + basalt

## Technology Maturity

- TRL 6, category “1” by MSL
- Engineering partner – NASA JPL

## Deployment

- Shooting laser through window
- Receiving signals behind window
- Fast measurement (s to min)

Igneous minerals

