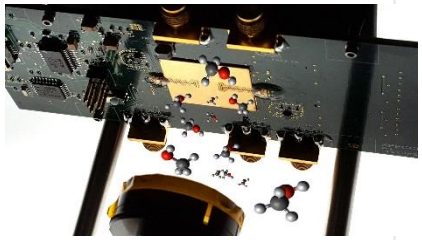
Two Spectrometers on a Chip

PI: Brian Drouin/Jet Propulsion Laboratory

Target: comet or icy surface, atmospheric probe, chemical analysis suite, capability for transient point source detections

Science:

- What is the composition and origin of volatile material?
- What is the bulk (water) H/D ratio?
- How are local environments chemically diverse?



Objectives:

- Expand high frequency limit of CMOS into G-band (170-190 GHz) to include the strong water feature at 183 GHz
- Increase detection range of compact CMOS mm-wave spectrometers at W-band (79-90 GHz)
- Enable simultaneous detections of HDO through extension and H_2O (G-band) without significantly increasing size, mass or power

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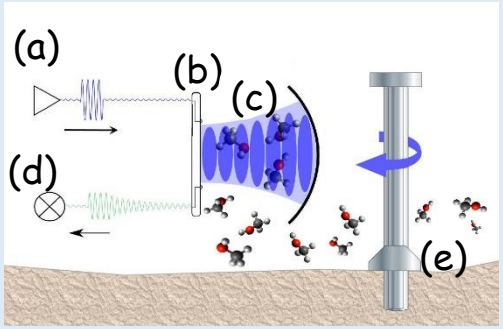
Volatile detection via molecular specific pump/probe radiation at millimeter wavelengths



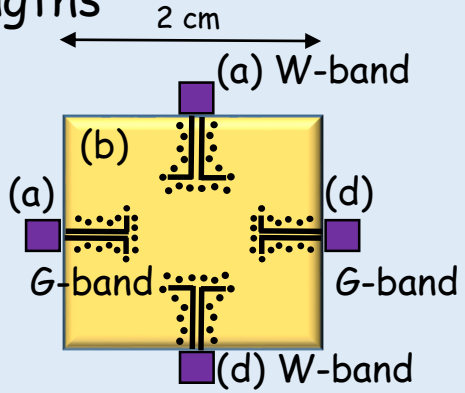


Figure Caption: The radiation from a CMOS transmitter (a) is injected into a cavity using a novel coupler (b) the cavity (c) amplifies the molecular response to a resonant pulse and the echo is detected with CMOS receivers (d). Volatiles are notionally produced during drilling (e) near the open structure cavity.

Key Milestones:

- Demonstrate CMOS molecular detections at W-band sensitivity to HDO of 3×10^{10} $cm^{-3}s^{-1/2}$ or 10 ppm in 100 mTorr
- Demonstrate sensitive water measurement at G-band, 2×10^{10} $cm^{-3}s^{-1/2}$ or 7 ppm in 100 mTorr
- Demonstrate W and G-band molecular detections in a single system, terrestrial H/D ratios (~155 ppm) measured with 10% precision in 1 second integration

TRL 1 to 3