

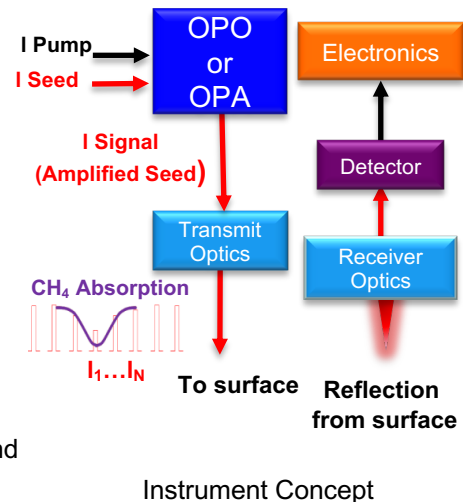
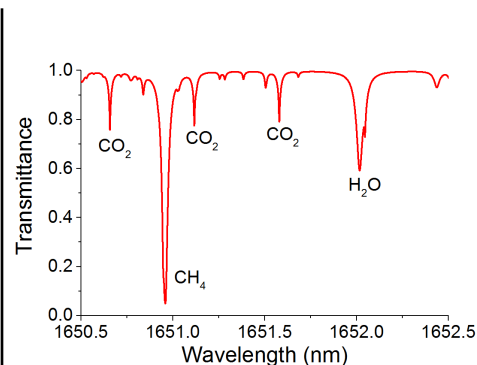


# A Compact Trace Gas Lidar for Simultaneous Measurements of Methane and Water Vapor Column Abundance

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## Objective

- Develop key laser technology to enable methane and water vapor measurements at 1651 nm and 1652 nm respectively from airborne and spaceborne platforms
- Demonstrate and validate simultaneous, high precision methane and water vapor measurements
- Demonstrate methane column abundance with 1% precision
- Advance the TRL of the pump laser by scaling its power and reducing Stimulated Brillouin Scattering (SBS)
- Improve laser cavity tuning of the seed laser for multi-wavelength operation



## Accomplishments

- Developed and demonstrated key technologies to enable integrated-path differential absorption (IPDA) lidar measurement of CH<sub>4</sub> and H<sub>2</sub>O at 1651 nm and 1652 nm respectively from airborne and spaceborne platforms
  - Successfully demonstrated a fast-tunable seed laser was available at 1.65um. Seed laser developed under SBIR by Freedom Photonics.
  - Successfully demonstrated dynamic optical Phase Locked Loop technique at the target CH<sub>4</sub> lines (1651 and 1645.5 nm)
  - Developed and patented dual side-band locking single laser technique for future measurements.
- Characterized DRS' HgCdTe electron avalanche photodiode (e-APD) detector for CH<sub>4</sub> measurements. Demonstrated use of the detector for CH<sub>4</sub>/H<sub>2</sub>O detection from an aircraft and open path measurements.
- Demonstrated IPDA lidar CH<sub>4</sub> detection with <20 ppb precision from an aircraft and extended the measurement to H<sub>2</sub>O in a laboratory (open path) environment.

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TRL<sub>in</sub> = 3

TRL<sub>out</sub> = 4