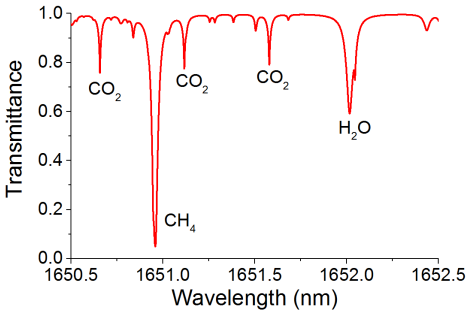
A Compact Trace Gas Lidar for Simultaneous Measurements of Methane and Water Vapor Column Abundance

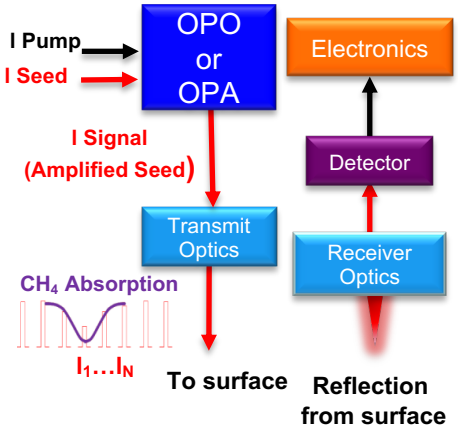
PI: Haris Riris, NASA GSFC

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



Atmospheric transmittance for U.S. standard atmosphere of 1976 of CH_4 and H_2O at 1650-1653 nm from 400 km



Instrument Concept

Accomplishments

- Developed and demonstrated key technologies to enable integrated-path differential absorption (IPDA) lidar measurement of CH_4 and H_2O 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 CH4 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_4 measurements. Demonstrated use of the detector for CH_4/H_2O detection from an aircraft and open path measurements.
- Demonstrated IPDA lidar CH_4 detection with <20 ppb precision from an aircraft and extended the measurement to H_2O in a laboratory (open path) environment.

Co-Is/Partners: Kenji Numata, Univ. of Maryland; Randy Kawa, Stewart Wu, GSFC

TRL_{in} = 3 **TRL_{out} = 4**