

# Ground-based Water Vapor Atmospheric Vertical Profiler

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## ARM/ASR PI Meeting

Breakout Session on New and Emerging Technologies

October 24, 2022

DoE DE-SC0019543  
(DOE Phase II SBIR)



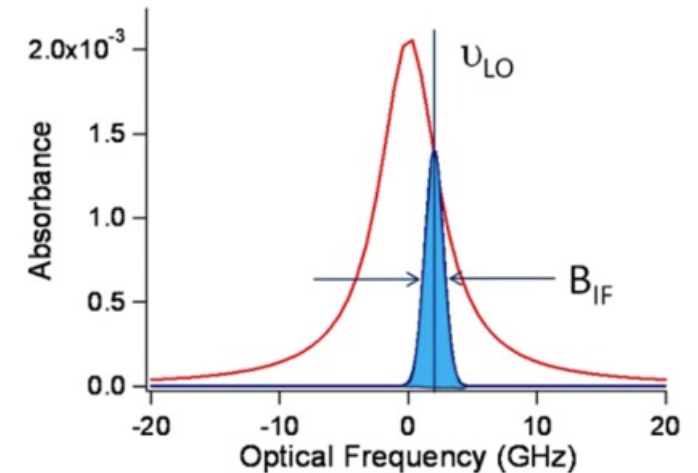
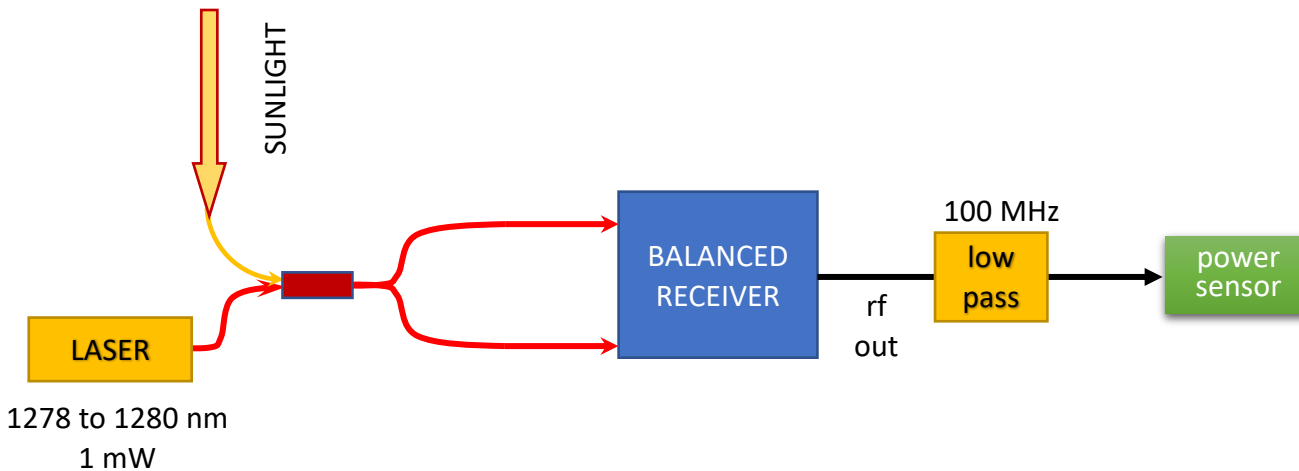
# Ground-based Water Vapor Atmospheric Vertical Profiler Overview

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- Technology precision heterodyne oxygen-corrected spectrometer (PHOCS)
- Project goal is determining full atmospheric column H<sub>2</sub>O profiles at > 99% precision
- Advances & improvements:
  - Spectral resolution 100 MHz ( $.003\text{ cm}^{-1}$ ), or better
  - Absorbances < 1%
  - Statistical retrieval methods
  - Automated long-term deployment
- TRL 7 to 8

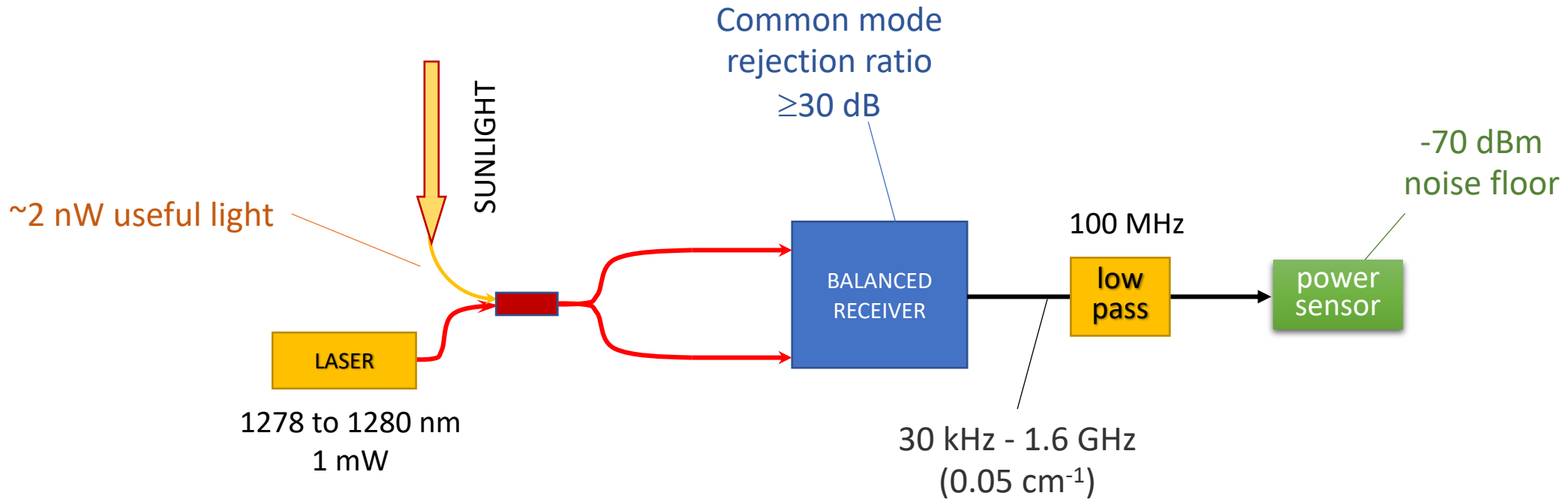
# Ground-based Water Vapor Atmospheric Vertical Profiler PHOCS

- Technology precision heterodyne oxygen-corrected spectrometer (PHOCS)
  - Optical analogue of FM radio
  - Optical resolution determined by rf lowpass filter
  - Balanced receiver reduces laser common mode noise (30 dB or better)



# Ground-based Water Vapor Atmospheric Vertical Profiler

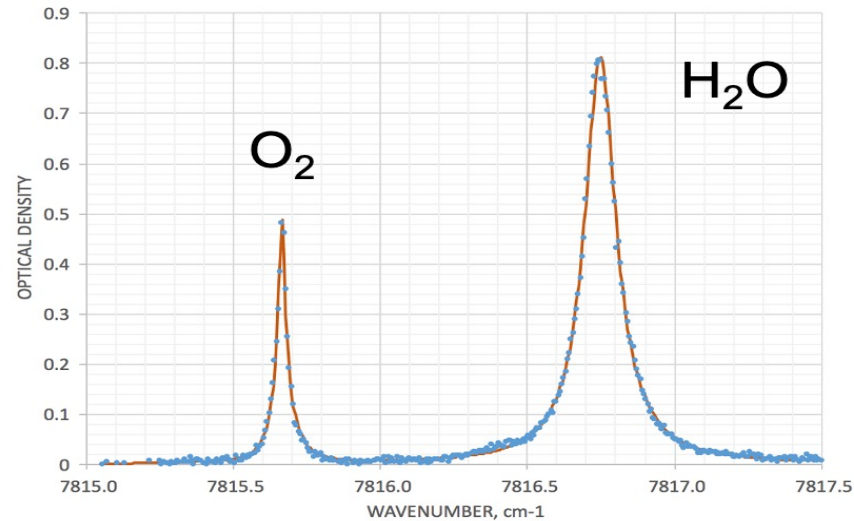
## PHOCS Details



# Ground-based Water Vapor Atmospheric Vertical Profiler

## Goal

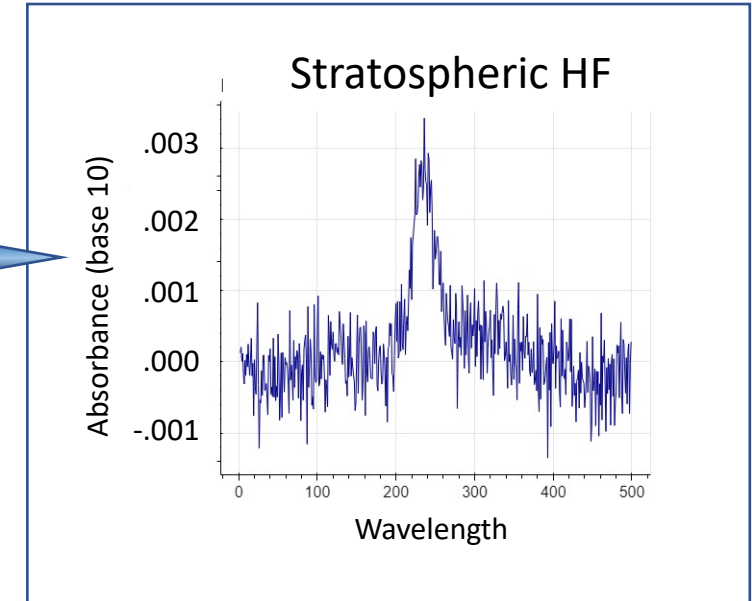
- Project goal is determining full atmospheric column H<sub>2</sub>O profiles at > 99% precision



*Observed and fit water and oxygen  
lines near 1278 nm.*

# Ground-based Water Vapor Atmospheric Vertical Profiler Advances & Improvements

- Advances & improvements:
  - Spectral resolution 100 MHz ( $.003 \text{ cm}^{-1}$ ), or better
  - Absorbances  $< 1\%$
  - Statistical retrieval methods
  - Automated long-term deployment



Flores, M. M., et al. (2021). "Statistical characterization of temperature and pressure vertical profiles for the analysis of laser heterodyne radiometry data." *Sensors* **21**(16): 5421.

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