Developing of the Next Generation Miniaturized Laser Heterodyne Radiometer

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Overview

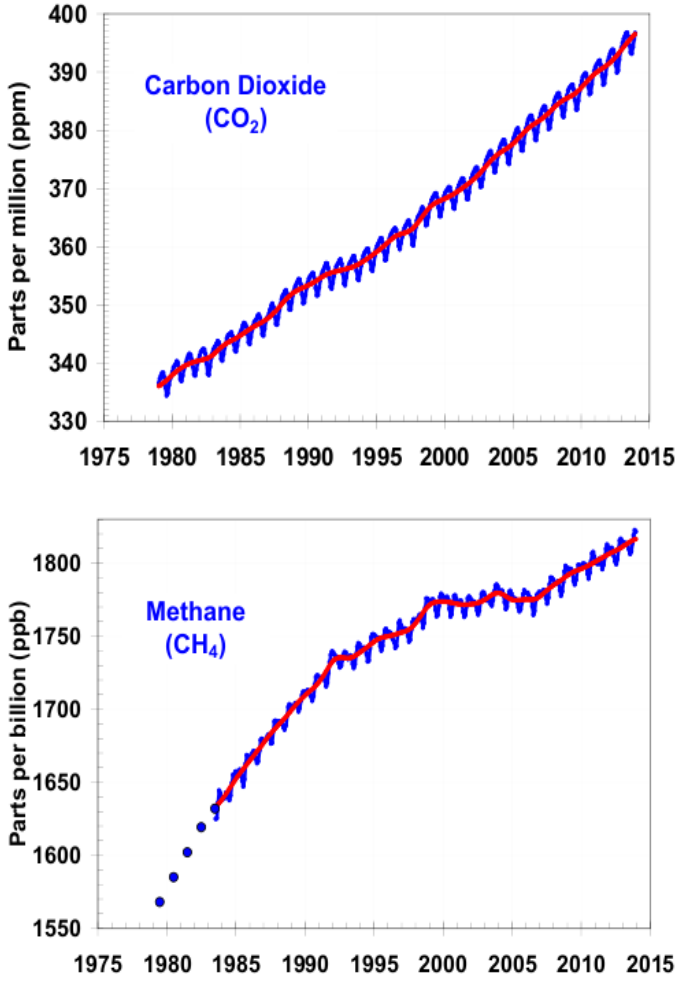
- What? Why?
- The Instrument
- Summer work
- Future work
- Questions

What? Why?

- Miniaturized Laser Heterodyne Radiometer (LHR)
- CO_2 and CH_4 measurement
- Low-cost
- High-portability
- Interfacing with existing systems

What? Why?

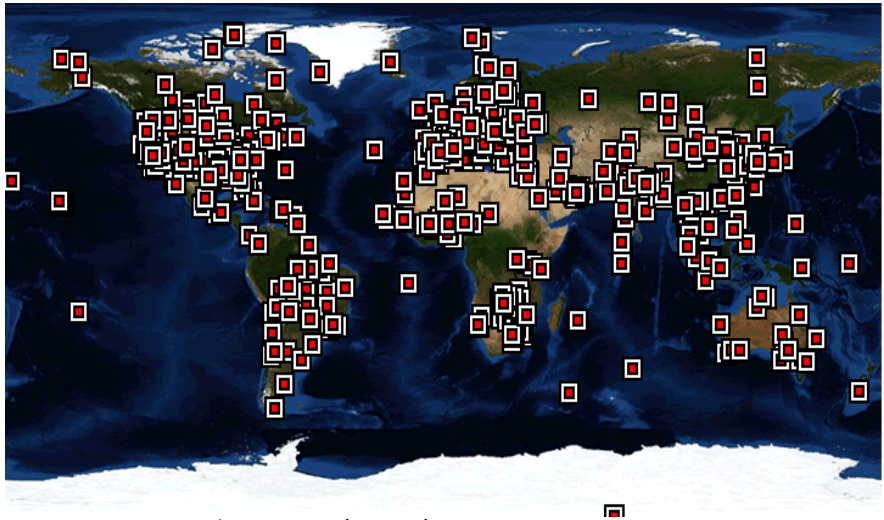
- Greenhouse gas contribution to climate change
  - CH_4 level-off in 90's/00's
- Global anomalies
- Absent data in Asia, Amazon, and Polar Regions



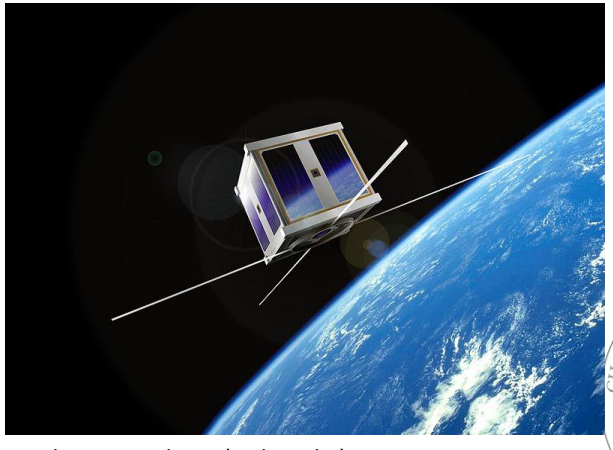
Greenhouse Gas Concentration Over Time (NOAA ESRL)

The Instrument

- Next-Gen Mini-LHR
  - Ground based
  - In conjunction with Aeronet systems in place worldwide
- LHR Cube
  - Cubesat version
  - Focus on polar regions
  - Verify larger satellite missions

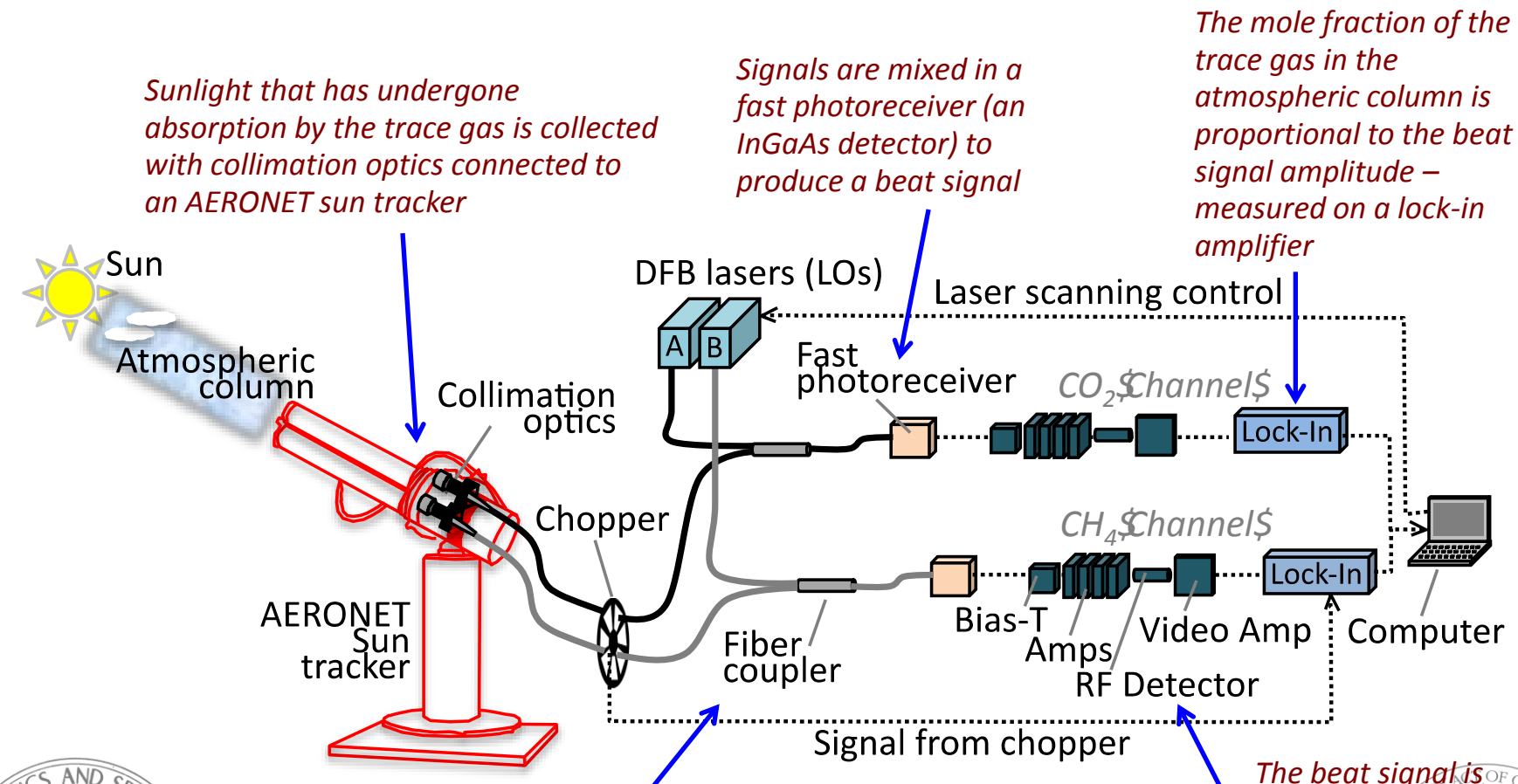


NASA Aeronet locations (NASA)

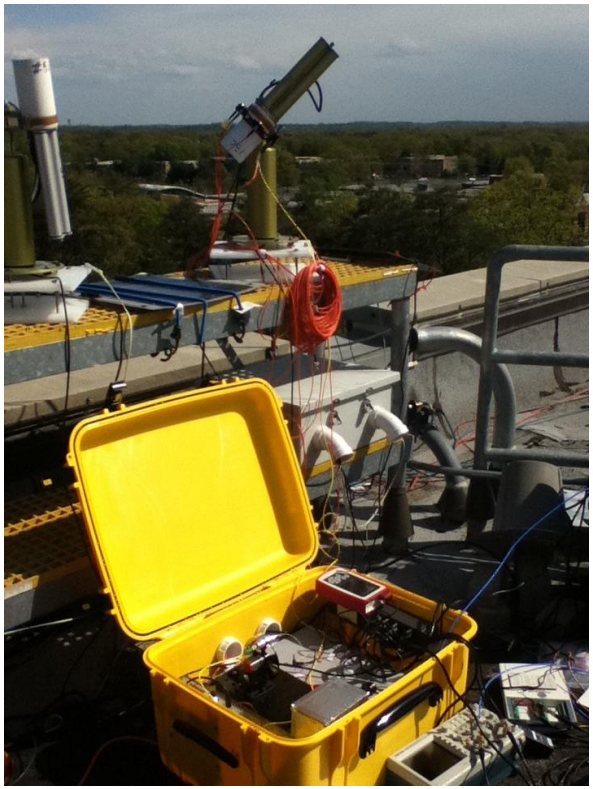


Cubesat Mock-Up (Wikipedia)

The Instrument | How It Works



The Instrument



The Instrument | Solutions

- Reduction of component size, removal of chopper & lock-in amps
- No lock-in amps in 2nd generation device
- Recent atmospheric correction algorithms yield ~6ppm difference

Summer Work

- Development of a rapid-scan
- Miniaturizing the mini-LHR
  - Simplifying RF signal chain
  - Laser control with DAQ card
  - Removal of optical chopper
- Construction of Satlink station for remote data acquisition
- Data analysis program written
- NextGen breadboarded and tested

Current/Future Work

- Solar array construction for complete off-grid data collection
- Design and manufacturing of parts using 3d printing technology
  - Cubesat and NextGen
- Finalize construction of NextGen
- Alaska this summer!
  - With next generation device

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