A Compact Adaptable Microwave Limb Sounder (CAMLS) for Atmospheric Composition

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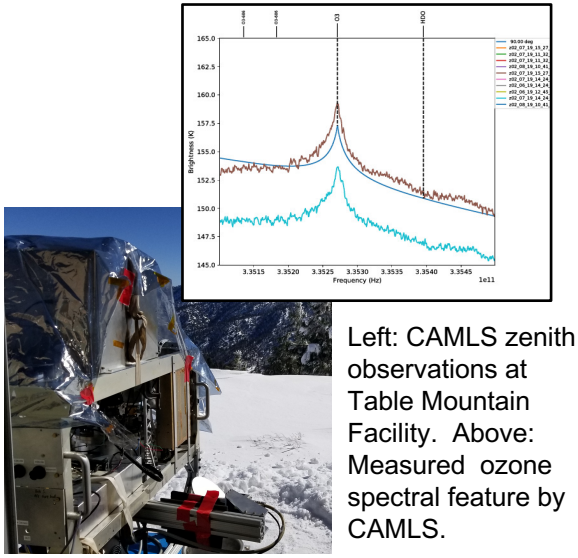
Objective

- Develop the engineering model of a compact, light-weight, low-power CAMLS receiver/spectrometer core system at 340 GHz for observations of composition, humidity, temperature and clouds in Earth's upper troposphere and stratosphere. The CAMLS core system will:
  - consist of only four subsystems, as compared to 46 for the Microwave Limb Sounder (MLS) on the Aura satellite
  - achieve an order of magnitude reductions in size, weight, and power consumption over the Aura MLS
- Verify the core system's functions and performance in airborne test flights

Above: CAMLS in A-SMLS structure at Table Mountain Facility



Left: CAMLS zenith observations at Table Mountain Facility. Above: Measured ozone spectral feature by CAMLS.

Accomplishments

- Developed Indium Phosphide Low Noise Amplifier (LNA)-based 340 GHz sideband-separating Receiver Front End (RFE) that operates in both ambient and cryo-cooled (20-70K) configurations
  - Demonstrated noise performance of 1500K and 400K in ambient and 55K, respectively, for a variety of science applications
  - Achieved an order of magnitude reductions in size, weight, and power consumption over the Aura MLS
- Developed 3-GHz bandwidth, 4096 channel, ASIC system-on-a-chip spectrometers with low-power (<2W) consumption using 65-nm CMOS technology, and integrated them into CAMLS electronics system
- Integrated CAMLS onto the airborne scanning MLS (A-SMLS) structure; successfully performed ground-based sky observations at JPL's Table Mountain Facility and demonstrated end-to-end measurement capability of ozone and carbon monoxide
- CAMLS/A-SMLS instrument is ready to fly on NASA ER-2 aircraft in November 2019 to demonstrate measurements of water vapor, ozone and carbon monoxide

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$TRL_{in} = 3$ $TRL_{out} = 5$