NASA SBIR Select 2015 Phase I Solicitation

S20.01 Novel Spectroscopy Technology and Instrumentation

Lead Center: GSFC

Participating Center(s): JPL

Passive remote sensing of the Earth provides essential observations of the properties needed to address NASA Earth Science objectives. Observations of climate-related phenomenon such as greenhouse gas (GHG) abundance, soil moisture (SM), and ice properties are required in the next few years. New technologies in infrared and microwave passive sensing that reduce the size and cost of instrumentation are needed. It is expected that a Phase I demonstrate a proof of concept and a Phase II deliver a working instrument or component.

Focus area 1 - Compact high-resolution infrared spectrometer-based instrumentation to measure GHG column abundance. Measurements are needed to determine GHG budgets and to validate space-based measurements of CO_2 and CH_4. Instruments with the capability of measuring the column abundance of CO_2 and CH_4 with precision and accuracy <0.5% are needed. Additional information, including other GHGâ€™s (N_2O, H_2O) and measurement information (profile abundance) are also useful.

Ground-based instrumentation with low or modest cost for deploying to multiple measurement locations is desired. Potential technologies include compact high-resolution grating based spectroscopy, heterodyne spectroscopy, Fabry-Perot based spectrometers, and Fourier transform spectroscopy. The performance of the new technology must compare favorably with the existing state of the art such as the spectrometers in the TCCON network (https://tccon-wiki.caltech.edu).

Focus area 2 - Reflectometry using existing terrestrial or space borne (GEO) transmitters as signal of opportunities. Microwave reflectometry applications include measurements of soil moisture, ocean altimetry, and ice properties, Root Zone Soil Moisture (RZSM) as well as others using airborne as well as space borne platforms.

The this SBIR select topic seeks development of multi-channel GNSS receiver technology for airborne demonstration of BSAR (Bi-Static Synthetic Aperture Radar) for Earth science measurement using GNSS reflectometry with following specifications:Â

- Multi-Channels GNSS receiver: One Channel to receive direct signal and other channels to receive reflected signal.
- Bandwidth: 20 MHz.
- Antenna array confirmable with NASAâ€™s manned /unmanned aircraft.
- SAR Processing Algorithms.

Focus area 3 - Compact radiometers from GHz to THz to measure GHG's from small satellites. The existing radiometers for space applications have more than 10 kg in mass and require more than 30 W to operate the RF and readout electronics. For future space applications it is necessary to reduce mass and power. To focus the

technology development it is desired to develop compact microwave radiometers to measure GHG's (for example water vapor concentrations around 185 GHz) in the upper troposphere and lower stratosphere (UTLS) for deployment on CubeSat and other small satellite applications.Â Â Â