# NASA SBIR 2009 Phase I Solicitation

## S1.01 Lidar and Laser System Components

**Lead Center: LaRC**

**Participating Center(s): GSFC**

Accurate measurements of atmospheric parameters with high spatial resolution from ground, airborne, and space-based platforms require advances in the state-of-the-art lidar technology with emphasis on compactness, efficiency, reliability, lifetime, and high performance. Innovative lidar component technologies that directly address the measurements of the atmosphere and surface topography of the Earth, Mars, the Moon, and other planetary bodies will be considered under this subtopic. Frequency-stabilized lasers for a number of lidar applications as well as for highly accurate measurements of the distance between spacecraft for gravitational wave astronomy and gravitational field planetary science are among technologies of interest. Innovative technologies that can expand current measurement capabilities to spaceborne or Unmanned Aerial Vehicle (UAV) platforms are particularly desirable. Development of components that can be used in planned missions or current technology programs is highly encouraged. Examples of planned missions and technology programs are: Deformation, Ecosystem Structure and Dynamics of Ice (DESDynI), Laser Interferometer Space Antenna (LISA), Doppler Wind Lidar, Lidar for Surface Topography (LIST), or earth and planetary atmospheric composition (ASCENDS).

Research should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 prototype demonstration. For the PY09 SBIR Program, we are soliciting only the specific component technologies described below.

- High speed fiber multiplexers for multimode fiber (200 micron core, 0.22 NA) operating at 1 micron wavelength. We require an N by M de-multiplexer (where M is 32 or greater and N is 2) capable of switching at speeds on the order of 10 microseconds with low insertion loss (
- Space-qualifiable high reliability frequency-stabilized CW laser source with 2 W output power at 1064 nm. A master oscillator power amplifier (MOPA) configuration is desirable since the source must be phase-modulated.
- Fiber-coupled pulse compressor device for 1064 nm and 532 nm for reducing 4-6 ns level pulses to sub-ns (0.4 - 0.6 ns) pulses, capable of input pulse energies > 2 mJ.
- Efficient and compact single frequency, near diffraction limited semiconductor lasers (interband cascade laser or quantum cascade lasers) operating in mid-infrared (3 - 4 Âµm). Requirements include room temperature operation, and pulsed lasers with repetition rates on the order of 10 KHz and pulse energies

greater than 0.5 mJ. CW lasers in multiwatt regimes are applicable. Wavelength tunability over 10s of nanometers is desirable for certain applications.

- Efficient and compact single mode solid state or fiber lasers operating at 1.5 and 2.0 micron wavelength regimes suitable for coherent lidar applications. These lasers must meet the following general requirements: pulse energy 0.5 mJ to 50 mJ, repetition rate 10 Hz to 1 kHz, and pulse duration of approximately 200 nsec.

- Single frequency semiconductor or fiber laser generating CW power in 1.5 or 2.0 micron wavelength regions with less than 10 kHz linewidth. Frequency modulation with about 5 GHz bandwidth and wavelength tuning over several nanometers are desirable.

- Development of efficient, compact, and space qualifiable laser absorption spectrometry-related technologies for measuring atmospheric pressure and density. Remote sensing of oxygen in the 1.26 micron or 760 nm spectral region for measuring atmospheric pressure is of particular interest.

- Photon counting detectors (single element and/or multi-element detector array) at near-IR (1 - 1.8 Âµm) and mid-IR (3 - 4 Âµm) with single photon sensitivity.

Proposals should show an understanding of one or more relevant science needs, and present a feasible plan to fully develop a technology and infuse it into a NASA program.