



NASA SBIR 2017 Phase I Solicitation

S1.04 Sensor and Detector Technology for Visible, IR, Far IR and Submillimeter

Lead Center: JPL

Participating Center(s): ARC, GSFC, LaRC

Technology Area: TA8 Science Instruments, Observatories & Sensor Systems

NASA is seeking new technologies or improvements to existing technologies to meet the detector needs of future missions, as described in the most recent decadal surveys:

- Earth science - (<http://www.nap.edu/catalog/11820.html>).
- Planetary science - (<http://www.nap.edu/catalog/10432.html>).
- Astronomy and astrophysics - (<http://www.nap.edu/books/0309070317/html/>).

1k x 1k or larger format MCT detector arrays with cutoff wavelength extended to 12 microns for use in missions to NEOs, comets and the outer planets.

Compact, low power, readout electronics for Kinetic Inductance Detector arrays with >10bit ADC at >1GHz sampling rate with >2000 bands, ~5kHz bandwidth each with an operating power <300mW and operation at both room temperature and cryogenic temperatures.

New or improved technologies leading to measurement of measurement of trace atmospheric species (e.g., CO, CH₄, N₂O) or broadband energy balance in the IR and far-IR from geostationary and low-Earth orbital platforms. Of particular interest are new direct detectors or heterodyne detectors technologies made using high temperature superconducting films (YBCO, MgB₂) or engineered semiconductor materials, especially 2Dimensional Electron Gas (2DEG) and Quantum Wells (QW). Candidate missions are thermal imaging, LANDSAT Thermal InfraRed Sensor (TIRS), Climate Absolute Radiance and Refractivity Observatory (CLARREO), BOREal Ecosystem Atmosphere Study (BOREAS), Methane Trace Gas Sounder or other infrared earth observing missions.

Development of un-cooled or cooled Infrared detectors (hybridized or designed to be hybridized to an appropriate read-out integrated circuit) with NE τ T<20mK, QE>30% and dark currents <1.5x10⁻⁶ A/cm² in the 5-14 μ m infrared wavelength region. Array formats may be variable, 640 x 512 typical, with a goal to meet or exceed 2k X 2k pixel arrays. Evolve new technologies such as InAs/GaSb type-II strained layer super-lattices to meet these specifications.

Development of a robust wafer-level integration technology that will allow high-frequency capable interconnects and allow two dis-similar substrates (i.e., Silicon and GaAs) to be aligned and mechanically 'welded' together. Specially develop ball grid and/or Through Silicon Via (TSV) technology that can support submillimeter-wave arrays. Initially the technology can be demonstrated at 1-inch die level but should be do-able at 4-inch wafer level.

New or improved, lightweight spectrometer operating over the spectral range 350 – 2300 nm with 4 nm spectral

sampling and that is capable of making irradiance measurements of both the sun and the moon.

Higher power THz local oscillators and backend electronics for high resolution spectroscopy for astrophysics. Local Oscillator capable of spectral coverage 2 – 5 THz; Output power upto >2 mW; Frequency agility with > 1GHz near chosen THz frequency; Continuous phase-locking ability over the THz laser tunable range with <100 kHz line width. Backend ASIC capable of binning >1GHz intermediate frequency bandwidth into 0.1-0.5 MHz channels with low power dissipation <0.5W.