



## NASA SBIR 2015 Phase I Solicitation

### S1.03 Sensor and Detector Technology for Visible, IR, Far IR and Submillimeter

Lead Center: JPL

Participating Center(s): ARC, GSFC, KSC, LaRC

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/>).

Development of un-cooled or cooled infrared detectors (hybridized or designed to be hybridized to an appropriate read-out integrated circuit) with  $T < 20\text{mK}$ ,  $QE > 30\%$  and dark currents  $< 1.5 \times 10^{-6} \text{ A/cm}^2$  in the 5-14  $\mu\text{m}$  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.

New or improved technologies leading to measurement of trace atmospheric species (e.g., CO, CH<sub>4</sub>, N<sub>2</sub>O) or broadband energy balance in the IR and far-IR from geostationary and low-Earth orbital platforms. Of particular interest are new direct, nanowire or heterodyne detector technologies made using high temperature superconducting films (YBCO, MgB<sub>2</sub>) or engineered semiconductor materials, especially 2-Dimensional Electron Gas (2-DEG) and Quantum Wells (QW) that operate at temperatures achieved by standard 1 or 2 stage flight qualified cryocoolers and do not require cooling to liquid helium temperatures. 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.

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 KID arrays. Enables mega pixel arrays for mm to Far IR telescopes and spectrometers for astrophysics and earth observation.

Development of a robust wafer-level integration technology that will allow high-frequency capable interconnects and allow two dissimilar 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 the '1-inch' die level but should be do-able at the 4-inch wafer level.

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Development of an un-cooled (single element or array) infrared detector with an active area of 1x1 mm or greater, a sensitivity ( $D^*$ ) of  $10^9 \text{ cmHz}^{1/2}\text{W}^{-1}$  or greater, and a response speed of 10 kHz or greater in the 5  $\mu\text{m}$  to 50  $\mu\text{m}$  wavelength region. This new detector will be useful for the Climate Absolute Radiance and Refractivity Observatory (CLARREO).