Opportunity Title: Infrared Detector Technology Development
Opportunity Reference Code: 0201-NPP-MAR22-JPL-EarthSci

Organization	National Aeronautics and Space Administration (NASA)
Reference Code	0201-NPP-MAR22-JPL-EarthSci
Application Deadline	3/1/2022 6:00:00 PM Eastern Time Zone
Description	Sensor systems based on high performance infrared (IR) detectors can make significant contributions to NASA's Earth Science (e.g., observables related to Surface, Biology, and Geology, Landsat) and Planetary Science missions (e.g., Venus, Mars, and Ocean Worlds), and to science in general. IR detectors are ubiquitous to almost all areas of measurement, and detector arrays flown on space missions have provided exquisite visual and scientific images, instrumental in advancing our understanding of our planet and the universe . Our goal is to pursue the development of emerging IR detector technologies which promise extensions in sensitivity, resolution, array size and other mertrics relevant to the full set of NASA quests, while simultaneously decreasing their size, weight and power requirements (SWAP) so critical for space missions, as well as their cost. The general area of our research is to develop infrared detectors, avalanche photodiodes, focal plane arrays (FPAs), and focal plane array subsystems and systems architectures for Earth and planetary science applications. Special interest in studying meta materials, nano-structures and novel ""artificial"" band-gap materials for infrared and detectors and imaging FPAs. The specific research objectives include: 1. Perform trade study to determine the best approach for the detector using advancements such as III-V heterostructure engineering 2. Determine key metrics for success such as spectral range, SNR, operating temperature, pixel uniformity, operability, etc. 3. Develop the necessary analysis and simulation to justify that the proposed approach has a reasonable chance of meeting the key metrics 4. Develop and demonstrate proposed approach that is consistent with the analysis/simulation results. This include test detectors 5. Analyze how environmental variables such as vibration, radiation environment, etc. may limit the usefulness of these IR detector in space environments 6. Pursue in development of novel detector approaches to achieve single photon counting 7. Integration of nanostructured flat lens technology and other meta-surfaced components such as filters and polarizers into FPAs to increase performance and reduce SWAP

References:

1. David Z. Ting, Alexander Soibel, Arezou Khoshakhlagh, Sir B. Rafol, Sam A. Keo, Linda Höglund, Anita M. Fisher, Edward M. Luong, and Sarath D. Gunapala, ""Mid-wavelength high operating temperature barrier infrared detector and focal plane array"", Appl. Phys. Lett. 113, 021101 (2018);

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https://doi.org/10.1063/1.5033338 2. Shuyan Zhang, Alexander Soibel, Sam A. Keo, Daniel Wilson, Sir. B. Rafol, David Z. Ting, Alan She, Sarath D. Gunapala, and Federico Capasso, ""Solid-immersion metalenses for infrared focal plane arrays"", Appl. Phys. Lett. 113, 111104 (2018); https://doi.org/10.1063/1.5040395. 3. S. D. Gunapala, S. V. Bandara, S. B. Rafol, and D. Z. Ting, ""Quantum Well Infrared Photodetectors,"" Semiconductors and Semimetals, Vol. 84, 59-151, Academic Press, 2011.

Location:
Jet Propulsion Laboratory
Pasadena, California

Field of Science: Earth Science

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: https://www.nasa.gov/oiir/export-control. Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents;
- Foreign nationals who are in the U.S. at the time of application and on a valid J1 visa; and,
- Foreign nationals, asylees or refugees in the U.S. at the time of application with a valid EAD card and pending I-485 or I-589 forms.

These temporary eligibility limitations have been put in place due to inaccessible U.S. consulates and travel restrictions resulting from the COVID-19 pandemic. Foreign nationals have made many substantive contributions to NASA, as well as to the greater scientific community throughout the life of the NPP. Therefore, we look forward to the time when the program will be open, once again, to all qualified scientists and engineers.

Eligibility Requirements

- **Degree:** Doctoral Degree.