



NASA SBIR 2009 Phase I Solicitation

S1.05 Detector Technologies for UV, X-Ray, Gamma-Ray and Cosmic-Ray Instruments

Lead Center: GSFC

Participating Center(s): JPL, MSFC

This subtopic covers detector requirements for a broad range of wavelengths from UV through to gamma ray for applications in Astrophysics, Earth science, Heliophysics, and Planetary science. Requirements across the board are for greater numbers of readout pixels, lower power, faster readout rates, greater quantum efficiency, and enhanced energy resolution.

The proposed efforts must be directly linked to a requirement for a NASA mission. These include Explorers, Discovery, Cosmic Origins, Physics of the Cosmos, Vision Missions, and Earth Science Decadal Survey missions. Details of these can be found at the following URLs:

General Information on Future NASA Missions: <http://www.nasa.gov/missions>

Specific mission pages:

EXIST: <http://exist.gsfc.nasa.gov/>

IXO: <http://htxs.gsfc.nasa.gov/index.html>

Future planetary programs: http://nasascience.nasa.gov/planetary-science/mission_list

Earth Science Decadal missions: <http://www.nap.edu/catalog/11820.html>

Helio Probes: http://nasascience.nasa.gov/heliophysics/mission_list

Specific technology areas are listed below:

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- Significant improvement in wide band gap semiconductor materials, individual detectors, and detector arrays for operation at room temperature or higher for missions such as EXIST, Geo-CAPE and planetary science composition measurements.
 - Highly integrated, low noise (
 - Large format UV and X-ray focal plane detector arrays: microchannel plates, CCDs, and active pixel sensors (>50% QE, 100 Megapixels,
 - Advanced Charged Couple Device (CCD) detectors, including improvements in UV quantum efficiency and read noise, to increase the limiting sensitivity in long exposures and improved radiation tolerance. Electron-bombarded CCD detectors, including improvements in efficiency, resolution, and global and local count rate capability. In the X-ray, we seek to extend the response to lower energies in some CCDs, and to higher, perhaps up to 50 keV, in others. Possible missions are future GOES missions and International X-ray Observatory.
 - Wide band gap semiconductor, radiation hard, visible and solar blind large format imagers for next generation hyperspectral Earth remote sensing experiments. Need larger formats (>1Kx1K), much higher resolution (
 - Solar blind, compact, low-noise, radiation hard, EUV and soft X-ray detectors are required. Both single pixels (up to 1cm x 1cm) and large format 1D and 2D arrays are required to span the 0.05nm to 150nm spectral wavelength range. Future GOES missions post-GOES R and T.
 - Visible-blind SiC APDs for EUV photon counting are required. The APDs must show a linear mode gain >1E6 at a breakdown reverse voltage between 80 and 100V. The APD's must demonstrate detection capability of better than 6 photons/pixel/s at near 135nm spectral wavelength. See needs of National Council Decadal Survey (NRC, 2007): Tropospheric ozone.
 - Imaging from low-Earth orbit of air fluorescence, UV light generated by giant airshowers by ultra-high energy ($E > 10^{19}$ eV) cosmic rays require the development of high sensitivity and efficiency detection of 300 - 400 nm UV photons to measure signals at the few photon (single photo-electron) level. A secondary goal minimizes the sensitivity to photons with a wavelength greater than 400 nm. High electronic gain (~10⁶), low noise, fast time response (2 to 10 x 10⁻⁹ s). Focal plane mass must be minimized (2 g/cm² goal). Individual pixel readout. The entire focal plane detector can be formed from smaller, individual sub-arrays.

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.