High Efficiency Semiconductor Arrays for Hard X-Ray Imaging, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

The next generation of wide-field survey instruments with improved angular and energy resolution for research into astrophysical transient X-ray phenomena is currently under development. A scalable detector plane architecture has been developed at Harvard using CZT detector arrays for use in high resolution coded-aperture telescopes. Despite decades of research, the yield of device grade CZT is still quite low. In addition, internal defects cause spatial distortions in images. To meet the needs of hard X-ray astronomy a lower cost, more uniform and more readily available alternative to CZT is desirable. Thallium bromide (TlBr) has higher density and atomic number than CZT and therefore higher stopping power at hard X-ray energies. TlBr has a low melting point (460 ^{0}C, compared to ~ 1100 ^{0}C for CZT) and cubic crystal structure and can be grown from the melt by low cost techniques. As a result, TlBr has the potential to be a more efficient, lower cost alternative to CZT in the detector plane architecture developed by Harvard for use in high resolution coded-aperture telescopes.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: The TlBr based spectroscopic imaging array that we propose to develop should be suitable for the next generation of wide-field hard X-ray coded-aperture imagers currently under development (cf. the ProtoEXIST and HREXI programs). It is anticipated that this technology will eventually be employed as part of a Medium Class Explorer (MIDEX) mission similar to that of the proposed Energetic X-Ray Imaging Survey Telescope (EXIST) and will probe X-ray transient phenomena with an improved sensitivity, energy resolution and angular resolution. This will enable the monitoring of a variety of phenomena, including tidal disruption events (TDE), supernova (SN), soft-gamma repeaters (SGR), X-Ray Flashes (XRF), the mapping of Gamma-Ray Burst (GRB)

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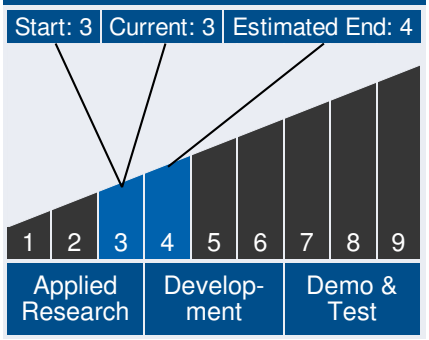
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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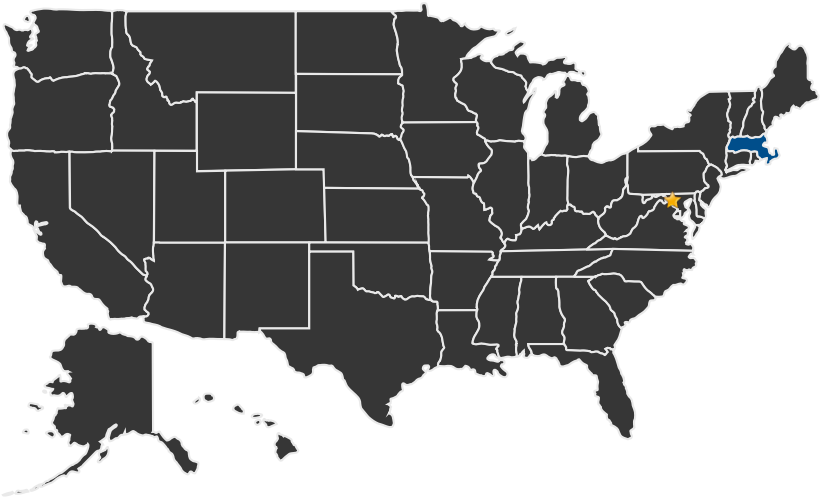
distribution out to redshifts exceeding z=10, as well as neutron stars (NS) and black holes (BHs) at all mass scales in a variety of environments.

To the commercial space industry:

Potential Non-NASA Commercial Applications: In addition to NASA-related space applications, this technology offers considerable potential in other areas, including nuclear and particle physics, nuclear non-proliferation, medical imaging, environmental monitoring, non-destructive testing, and geological exploration. Nuclear medicine techniques such as single photon emission computed tomography (SPECT) would also benefit from the development of this detector technology.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Goddard Space Flight Center

Other Organizations Performing Work:

- Radiation Monitoring Devices, Inc. (Watertown, MA)

Management Team *(cont.)*

Principal Investigator:

- Leonard Cirignano

Technology Areas

Primary Technology Area:
Science Instruments, Observatories, and Sensor Systems (TA 8)
└ In-Situ Instruments and Sensors (TA 8.3)
└ Fields and Waves (TA 8.3.2)

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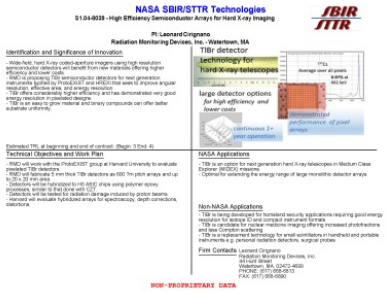
PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23234)

IMAGE GALLERY



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DETAILS FOR TECHNOLOGY 1

Technology Title

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Potential Applications

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