Project Introduction

CoolCAD Electronics, LLC, is proposing the design and fabrication of silicon-carbide based active pixel sensor, comprising a very LARGE AREA SiC UV photodiode (>4mm² in Phase I and >4cm² in Phase II) with a monolithically-integrated readout circuit. SiC photodiodes offer advantages in sensitivity, low dark current, high temperature operation, and higher UV responsivity compared to other commercial UV detector technologies such as GaP. These sensors have applications relevant to Earth and planetary sciences and heliophysics-focused NASA missions. Our technical objectives are the fabrication of very large area SiC photodiodes, in fact larger than what is currently commercially available, and monolithically integrating them with readout circuit components to extend the manufacturability benefits of Si CMOS to the SiC UV sensor arena. As deliverables, we propose to fabricate and deliver large area photodiodes, readout circuit components such as JFETs, and an integrated large area sensor/readout active pixel. We will design the photodiode and other circuit components from the ground-up, with process and electrical performance simulations forming the bases of the structural and fabrication step design, including the development of models for use in circuit simulators. We will optimize and perform the fabrication steps, and electrically and optically characterize the fabricated components using our in-house UV test system.

Anticipated Benefits

Potential NASA Commercial Applications: The proposed work is to advance the state of the art in UV and low energy particle sensing similar to those used in (potential) missions that are part of the Earth Observing System (EOS) project, such as include the Global Atmospheric Composition Mission (GACM) and the Geostationary Coastal and Air Pollution Events (GEO-CAPE) mission. Other uses could be as part of the Geostationary Operational Environmental Satellite (GOES) system, especially for solar flare and similar observations. In general, deep UV detectors can find extensive usage in the next generation of hyperspectral remote sensing experiments, for ozone and hydrogen detection and similar uses. Solar system exploration missions such as the Europa Clipper or Uranus orbiter would also be able to utilize UV detectors. Potential and planned missions such as the Jupiter-Europa Orbiter (JEO) and the Jupiter-Ganymede Orbiter (JGO) and their successors have requirements in the EUV-FUV and the FUV-MUV ranges.

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Primary U.S. Work Locations and Key Partners

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<th>Organizations Performing Work</th>
<th>Role</th>
<th>Type</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>★ Goddard Space Flight Center(GSFC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Greenbelt, MD</td>
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<tr>
<td>CoolCAD Electronics, LLC</td>
<td>Supporting Organization</td>
<td>Industry</td>
<td>Takoma Park, MD</td>
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Closeout Documentation

- Final Summary Chart
  (https://techport.nasa.gov/file/20421)
- Final Summary Chart Image
  (https://techport.nasa.nasa.gov/file/21677)

Organizational Responsibility

- Responsible Mission Directorate: Space Technology Mission Directorate (STMD)
- Lead Center / Facility: Goddard Space Flight Center (GSFC)
- Responsible Program: SBIR/STTR

Project Management

- Program Director: Jennifer L Gustetic
- Program Manager: Carlos Torrez
- Principal Investigator: Akin Akturk

Technology Maturity (TRL)

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<th>Level</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Applied Research</td>
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<tr>
<td>2</td>
<td>Development</td>
</tr>
<tr>
<td>3</td>
<td>Demo &amp; Test</td>
</tr>
<tr>
<td>4</td>
<td>Current</td>
</tr>
<tr>
<td>5</td>
<td>Estimated End</td>
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For more information and an accessible alternative, please visit:
https://techport.nasa.gov/view/33259
Images

**Briefing Chart**
Large Area Silicon Carbide Photodiode Active Pixel Sensor
Briefing Chart
(https://techport.nasa.gov/image/)

**Briefing Chart Image**
Large Area Silicon Carbide Photodiode Active Pixel Sensor, Phase I
(https://techport.nasa.gov/image/22017)

Technology Areas

**Primary:**
- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes