Mid- and Long-Wave Infrared Digital Focal Plane Arrays for Earth Science Applications

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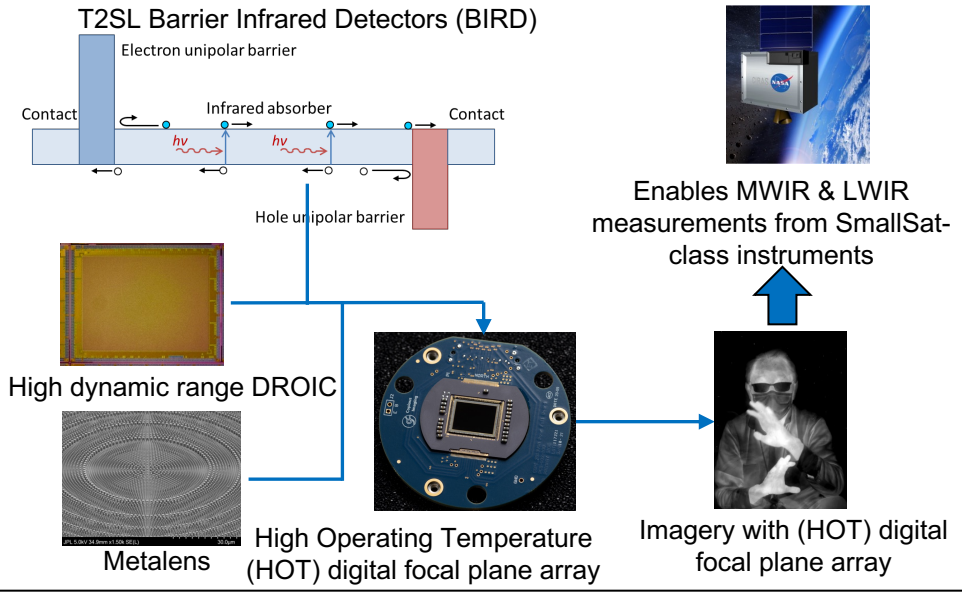
Objective

- Demonstrate high-performance, mid-wave & long-wave infrared digital focal plane array (FPA) technology with significantly higher operating temperature and sensitivity than previously attainable, and with the flexibility to meet a variety of Earth Science measurement needs, particularly those associated with Small Satellite missions. Targeted performance include:
- Operating temperature: >180K for MWIR & > 80K for LWIR, thus, significantly relax the cryocooling requirement for spaceborne operations
- Quantum efficiency: >50%
- Noise equivalent temperature: ≤ 25 mK with f/2 & 300K BG
- Demonstrate the use of meta-lens technology to raise the operating temperature of MWIR detectors



Accomplishments

- Successfully demonstrated 640x480 pixel format MWIR type-II superlattice (T2SL) high dynamic range digital FPA operating up to 200K (characteristics at 160K: 4.5 μm cut off wavelength, 24 mK NEDT, 99.7 % NEDT operability with F/3.5, 300K background). NEDT increased with increasing operating temperature and reached 75mK at 200K operating temperature. In contrast, the same detector material could operate only up to 180K with an analog read out integrated circuit (ROIC).
- Demonstrated 640x480 pixel format LWIR T2SL high dynamic range digital FPA operating up to 900K (characteristics at 80K: 11.5μm cut off wavelength, 38 mK NEDT, 99.8 % NEDT operability with F/3.5 , 300K background). In contrast, the same detector material could operate only up to 65K with an analog read out integrated circuit (ROIC).
- Integrated metasurface-based lenses were leveraged as optical concentrators with MWIR BIRD. This resulted in more than 10x improvement in the detector signal and led to an increased operating temperature of the detectors by 40K.

Co-Is/Partners:

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TRL_{in} = 2 **TRL_{out} = 4**