Integrated Photonic Imaging Spectrometer

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Objective

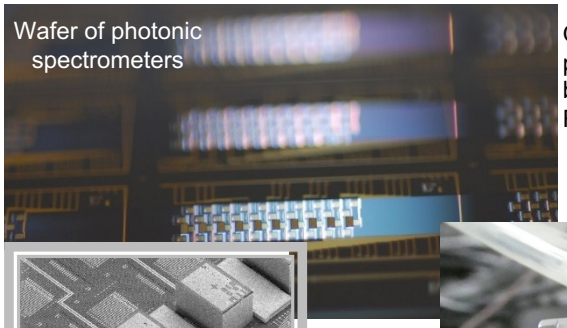
Develop next-generation compact SLI instrument based on NGAS photonic waveguides

Reduce instrument volume by x25, mass by x7 compared to current multispectral approach

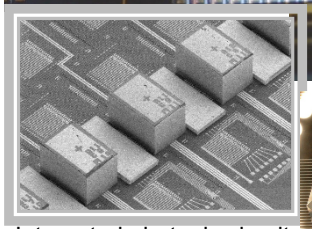
Enable new science and data products through hyperspectral imaging (HSI) while preserving SLI data continuity through band aggregation

Build and test a heterogeneously integrated photonic instrument covering two SLI bands: Band 9 (1.36 – 1.39µm at 3nm resolution) and Band 6 (1.56 – 1.66µm at 6nm resolution) with scalability to all SLI VNIR and SWIR bands

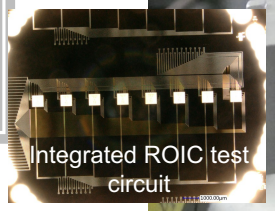
Demonstrate integrated instrument performance in a relevant environment

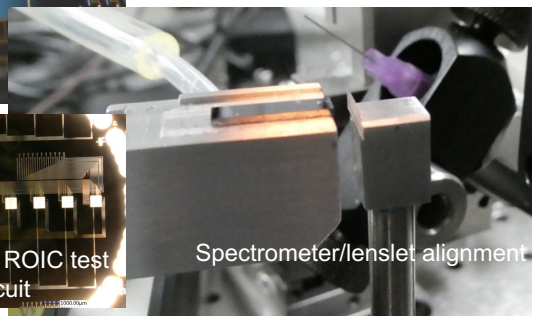


Optical and environmental testing on prototype photonic spectrometer has been completed. Integration-ready ROICs have been fabricated.



Integrated photonic circuit details





Approach

Leverage NGAS technical investments to execute prototype instrument development in SWIR wavelengths – Advance TRL 3 waveguide and detector designs

Evaluate multiple ROIC approaches including NGAS photons-to-bits technique – downselect and fabricate custom ROIC for integration with detection layers

Integrate Waveguides, Detectors, and ROIC arrays into Photonic Spectrometer Elements (PSEs) and stack multiple PSEs to form a photonic HSI instrument

Procure lenslet array and align with PSEs

Integrate foreoptic and demonstrate instrument performance; test instrument in a relevant environment

Key Milestones

- Demonstrate spectrometer with integrated detectors 09/17
- Demonstrate functional spectrometer with integrated mechanical ROIC 11/19
- Complete waveguide photolithography process dev 09/20
- Complete preliminary env testing of integrated device 09/21
- Complete ROIC test circuit integration 10/22
- Optimize and fabricate updated waveguides and filters 10/23
- Demonstrate ROIC functionality 12/23
- Demonstrate integrated spectrometer with updated photonic design and integrated ROICs 05/24
- Design and fabricate photonic spectrometer electronic and mechanical interface (stacking) 06/24
- Integrate and test spectrometer package 09/24

$TRL_{in} = 3$ **$TRL_{current} = 4$**