Advanced Multispectral Infrared Microimager (AMIM) for Planetary Surface Exploration

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Target: Any planetary surface (e.g., Moon, Mars, asteroids, comets)

Science:

- Determine the composition, mineralogy and textures of rocks and soils in-situ on planetary surfaces at the microscale.
- Investigate, map, and characterize the presence of water and other volatiles in-situ.
- Investigate regolith properties, composition, and formation processes on planetary surfaces.

Objectives:

- Design, build and characterize compact LED arrays coated with narrow-bandpass filters;
- Model and test the performance of the arrays under environmental conditions;
- Design, build and characterize a compact adjustable focus mechanism capable of focusing from 30 mm (< 30 μm/pixel) to infinity;
- Test the performance of the focus mechanism under environmental conditions;
- Build integrated instrument, composed of the LED arrays, adjustable focus mechanism, and commercial infrared camera for testing with relevant geologic samples and under environmental conditions.

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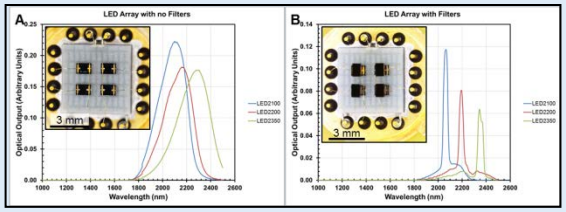

Figure 1: Proof-of-concept SWIR LED array without (A) and with (B) narrow-bandpass filters. AMIM would develop infrared LED arrays (range 0.4 to 2.6 μm) for spectroscopy.

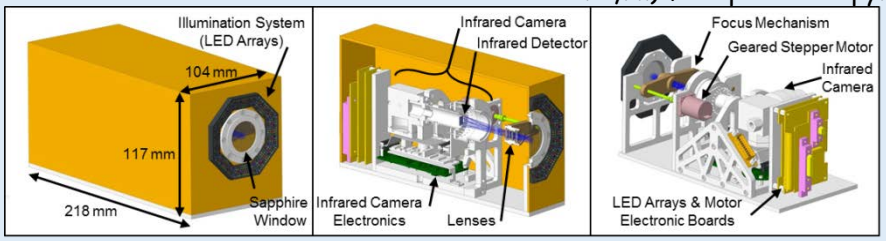

Figure 2: Different views of AMIM instrument with key components: LED illumination system with narrow-bandpass filters, adjustable focus mechanism, commercial infrared camera, and electronic boards. AMIM integrates mineralogy with microtexture by producing narrow-bandpass, multispectral images from the microscale (< 30 μm/pixel) to the mesoscale (few mm/pixel) over multiple wavelengths in the VNIR/SWIR (0.4 to 2.6 μm; can extend to 5.0 μm). AMIM can detect Fe-bearing silicates/oxides, carbonates, hydrated minerals and ices in-situ. It can operate during the day and night due to LED illumination.

Key Milestones:

- Development of LED Illumination System (YR1)
- Development of Adjustable Focus Mechanism (YR1)
- Development of Integrated Instrument (YR2)
- Testing of Integrated Instrument (YR2)

TRL 3 to 5