Standoff Ultra-Compact Raman (SUCR) system development for faster daytime mineralogy and Raman imaging

PI: Nurul Abedin/NASA LaRC

Target: A standoff micro-Raman system with rapid analytical speed will be applicable practically anywhere landed missions are attempted, such as landers or rovers on Mars, Europa, and Moon.

Science:

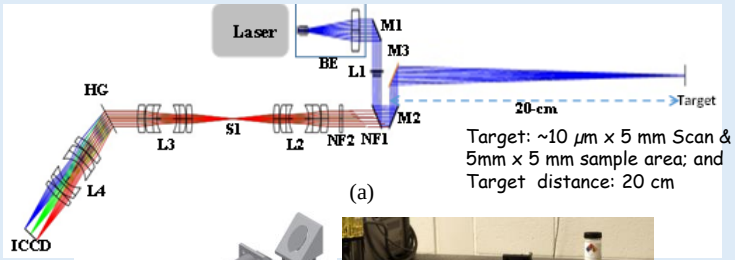
- The SUCR system will be able to solve most of the limitations of the current micro-Raman systems.
- To make microscopic Raman images of important mineral targets during day or night time operations.
- Detect any biological material hidden inside a geological setting. The gain in science return from a standoff biomarker detector will significantly save time for a lander/rover to identify important sites nearby.

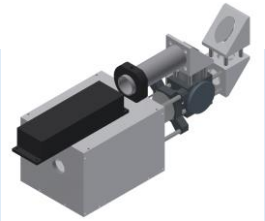
Objectives:

- SUCR measurements are at several centimeters;
- Detection of all minerals: light and dark;
- Detect water, biological, and organic compounds - Develop rapid search and scan mode for bio-detection;
- Detect time-resolved bio-fluorescence and minimize mineral fluorescence;
- Faster Raman area maps with line scanner; and
- Context imaging.

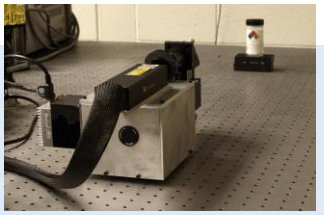
CoIs: Dr. Arthur Bradley (NASA LaRC); Dr. Anupam Misra (Co-PI) and Dr. Shiv Sharma (University of Hawaii)

Product:





(b)



(c)

Figure: Stand-off Ultra-Compact Instrument shows Zemax ray trace design in (a), where BE: Beam Expander; M1: Mirror, M2 & M3: Scanning Mirrors; L1: Cylindrical lens; L2: Micro. Obj., L3 & L4: C-mount lenses; HG: Holographic grating; NF1: 45 degree notch filter; NF2: 0 - 8 degree notch filter; and S1: Slit; 3-D enclosure designed for Raman spectrograph in (b); and laser is focused on a naphthalene sample.

Key Milestones:

- Develop compact spectrograph (2/15/17 – 1/14/18);
- Software development (1/15/17 – 1/14/19);
- Miniaturization of the system (11/15/17 – 3/14/19);
- Lab tests and science study (10/15/17 – 9/14/19); and
- Integrate system into breadboard system, test, and data analysis (TRL 4) (11/15/18 – 11/14/19)

TRL (entry:2) to (exit:4)