Opportunity Title: In-Situ Organic Detection Instrument Using Supercritical CO2 Extraction
Opportunity Reference Code: 0110-NPP-JUL24-JPL-TechDev

Organization National Aeronautics and Space Administration (NASA)

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Application Deadline 7/1/2024 6:00:59 PM Eastern Time Zone

Description One of the main goals of NASA space exploration missions involves the search for organic chemicals, which are not only ubiquitous in the solar system but also the chemical building blocks of life. Sample processing remains a key challenge to facilitate chemical detection and characterization. For example, pyrolytic release of organic molecules in the presence of perchlorates has been demonstrated to degrade native organic molecules before they are injected into the analytical instrumentation. Since perchlorates appear to be widespread on the Martian surface and because all in situ instrumentation designed to detect organic molecules that have been used on Mars to date have included pyrolysis, this limitation could be addressed by front-end sample preparation systems that extract organic molecules from Martian samples prior to delivery to the analytical instrument.

This work seeks to develop a fundamental technology for universal organic extraction by supercritical CO2 using CO2 harvested from the native Martian atmosphere. This technology can be used as a front-end to multiple organic analysis instruments, and while it is currently in development for Martian applications, it has applicability to all solar system targets where organic analysis is of high scientific priority. This work relates directly to multiple NASA objectives.

The postdoctoral fellow will be involved directly with all steps of this work. This will include conducting extraction efficiency studies to determine optimal operating conditions for various solid sample matrices and organic components, and characterizing ultimate extraction efficiencies under various potential operating conditions. These studies will inform the design and fabrication of a miniature supercritical extraction (MSE) system and a Mars Atmosphere CO2 Extractor (MACE), in which the NPP fellow will assist. The MSE and the MACE will be integrated with an RIT-MS, which the fellow will assist in demonstrating and overall testing in JPL's Mars Environmental chamber. Finally, the system will be demonstrated for end-to-end organic extraction and detection capability on various astrobiologically-interesting samples, potentially from Mono Lake, the Siberian permafrost, Death Valley, White Sands, Antarctic dry valleys and the Atacama Desert. Field testing may be appropriate, which will align with the NPP program's support and encouragement of postdoctoral fellow travel.

The ideal candidate will have a strong chemistry background, preferably in analytical, organic, bioorganic, or geological chemistry, or a related field, and should feel comfortable with basic engineering principles. Good communication (both written and verbal) skills are highly desirable, and a willingness to learn new tools and techniques is a must. The fellow should be highly capable of working independently and also willing to learn to lead

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small teams of undergraduate and graduate students.

Location:
Jet Propulsion Laboratory
Pasadena, California

Field of Science: Technology Development

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: https://www.nasa.gov/oiir/export-control.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

Eligibility Requirements

- **Degree:** Doctoral Degree.