# In-Situ Organic Extraction, Separation and Detection using Supercritical $CO_2$ and Superheated Water

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**Target:** The surfaces of Mars, comets, asteroids, and other planetary bodies.

## Science:

- We are proposing an integrated *in situ* instrument to extract biomarkers from soil, regolith, etc, unaltered then concentrate them, separate them and introduce them into detection instruments for biomarker analysis. In that sense, the proposed work supports the search for organics and chemical signatures of life in the solar system (a key goal underscored by the recent PICASSO call).

## Objectives:

- Build an end-to-end breadboard instrument that uses either supercritical $CO_2$ ($scCO_2$) or superheated water (SHW) as solvent to extract compounds of astrobiological interest from soil matrix (even in the presence of oxidizing inorganic salts), then concentrate, separate, and detect them at the ppb level.
- Validate the system methodically by using the samples covering a full range of varying polarity at optimal temperatures (40-75 ℃ for scCO2 and 40-200 ℃ for SHW). Optimize the system for the integrity of extractants, the minimal use of power and solvent consumption.

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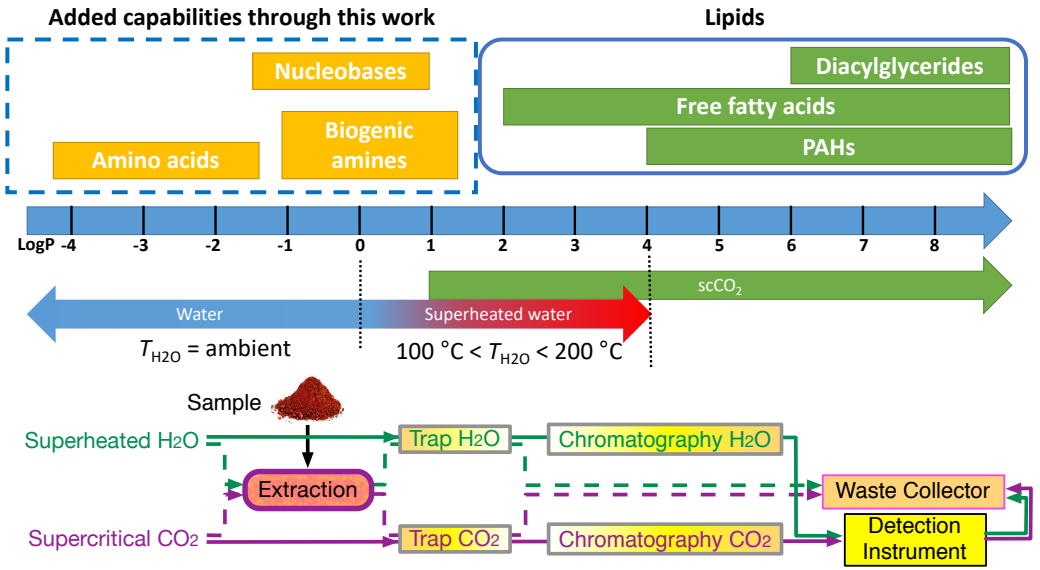


The concept of our proposed instrument: using either $scCO_2$ or SHW, to extract, trap/desalt (dashed), separate (solid line), and detect the organic compounds of astrobiological interest and over a large range of hydrophobicities.

## Key Milestones:

- Year 1: Demonstration of end-to-end extraction and detection of analytes with SHW with the proposed system.
- Year 2: Integration of key components and optimization of the system through systematical method development and verification.
- Year 3: Full demonstration of the entire system by using controlled and real field samples at low ppb levels.

**TRL 2 to 4**