A high-resolution, large mass range cycloidal sector coded aperture miniature mass spectrometer for planetary exploration

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Target: Develop ideal mass spectrometer for *in situ* analysis of planetary materials with a mass range of up to 500 u, ability to measure stable isotopes with high precision (±1‰) and resolution to distinguish between isobaric species at low mass (<60 u) for a wide variety of potential missions

Science:

- Search for organic molecules indicative of life
- In situ high precision stable isotope ratio measurements for element cycling and past climates
- Detect chemical processes indicative of life using in situ stable isotope ratio measurements
- Resolution of isobaric interferences

Objectives:

- Demonstrate super-resolution data reconstruction in a cycloidal coded aperture mass analyzer
- Improve the temporal and spatial emission quality of carbon nanotube field emission electron ionization sources
- Combine super-resolution, spatially coded apertures, stable field emission sources, ion array detectors in a small cycloidal mass analyzer

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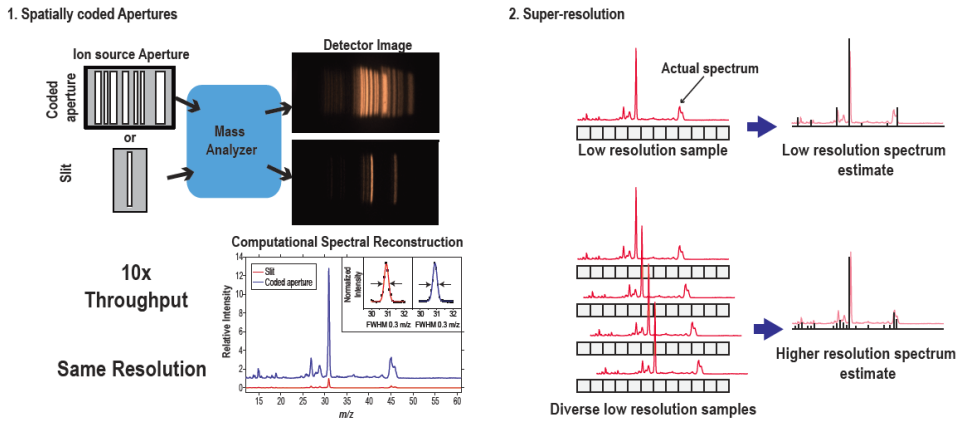

Figure Caption: Two of the key enabling technologies in this proposal including spatially coded apertures which enable miniaturizing a sector mass spectrometer instrument while maintaining throughput *and* resolution and super-resolution, which is a computational technique that estimates higher resolution signals from undersampled measurements

Key Milestones:

- Year 1: Demonstrate Super-resolution in a cycloidal coded aperture mass analyzer
- Year 2: Demonstrate improved temporal and spatial emission quality in CNT field emission sources
- Year 3: Combine super resolution, spatially coded apertures, improved CNT emitters, and ion array detectors in a prototype super resolution coded aperture cycloidal mass analyzer

TRL (1) to (4)