

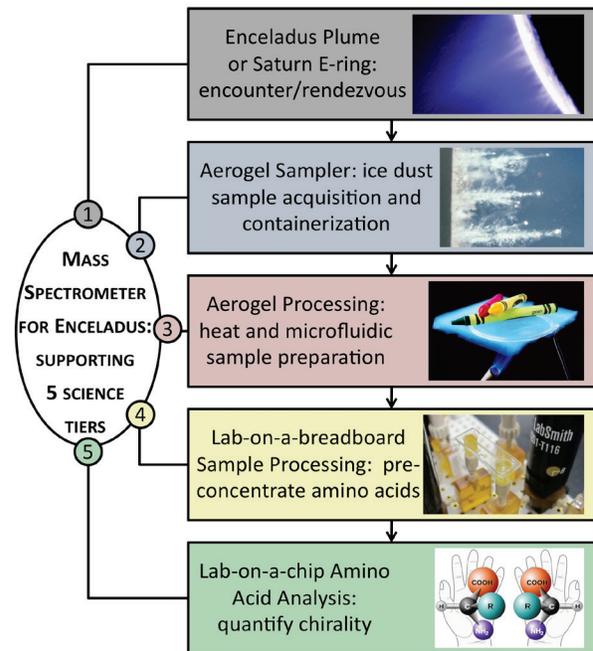
**ENCELADUS REMOTE ORGANIC DETECTION: AEROGEL ICE PARTICLE COLLECTION AND IN SITU MASS SPECTROMETER ANALYSIS.** J. P. Kirby<sup>1</sup>, S. M. Jones<sup>2</sup>, P. A. Willis<sup>2</sup>, M. S. Anderson<sup>2</sup>, and A. G. Davies<sup>2</sup> <sup>1</sup>Planetary Science Institute (1700 E. Ft. Lowell, Suite 106, Tucson, AZ 28519, jpkirby@psi.edu), <sup>2</sup>NASA Jet Propulsion Laboratory.

**Introduction:** A new astrobiology science instrument concept is presented for a future mission to Enceladus [1]. Water ice particles and gas jets from the south polar regions of Enceladus form a massive plume that supplies material to Saturn and its E-ring [2, 3]. The Enceladus Amino Acid Sampler (EAAS) will address fundamental astrobiology science questions by providing detailed *in situ* chemical analysis of Enceladus jet and plume material [4]. The EAAS instrument concept enhances and expands the capabilities demonstrated by the Ion and Neutral Mass Spectrometer (INMS) instrument on the Cassini spacecraft [5, 6]. The INMS instrument has the capability to detect small amino acids, such as glycine and alanine [7]. However, INMS was not designed to collect hypervelocity ice particles in an aerogel matrix nor does the Cassini spacecraft have the capability to assess the chirality of amino acids for establishing biotic origin.

An aerogel matrix inlet to a mass spectrometer (MS) enables collection and analysis of hypervelocity ice dust particles in flight onboard a spacecraft [8], while mitigating sample alteration from dust impact with the instrument, as observed with the Cometary and Interstellar Dust Analyzer on the Stardust mission [9]. EAAS will enable the discovery of the identity, inventory *and* chirality of free amino acids. The composition of a habitable subsurface ocean, postulated to be present on Enceladus [10, 11, 12], could be determined with remote chemical analysis with EAAS, which is compatible with mission formulations for either an orbiter [1] or sample return spacecraft [13].

#### Enceladus Exploration EAAS Science Tiers:

1) *Enceladus Encounter.* Hypervelocity encounter with the Enceladus plume or jets for real-time operation analogous to INMS provides ground truth measurements and calibration to INMS data [5, 6]; 2) *Aerogel Sampler.* An aerogel matrix sampler inlet decelerates and entrains hypervelocity ice AND dust particles [13], liberating volatiles upon capture which are analyzed by the MS in near real-time; 3) *Analysis of Volatiles Captured by Aerogel Chemisorption and Physisorption.* A sealable aerogel container allows for on-orbit, post-encounter heating or processing the aerogel with liquids or carrier gases, which are then fed to the MS for analysis; 4) *Amino Acid Inventory Determination.* Sample pre-concentration with a lab-on-a-breadboard subsystem separates and pre-concentrates amino acids for MS analysis [14]; 5) *Amino Acid Chirality Quanti-*



*fication.* Post-encounter lab-on-a-chip subsystems separate amino acids and quantify amino acid chirality, with MS detection for sample verification [15].

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