

**ENCELADUS LIFE FINDER (ELF): A PROPOSED MISSION TO ASSESS THE HABITABILITY OF A PLUME-BEARING WORLD.** M. L. Cable<sup>1</sup>, L. J. Spilker<sup>1</sup>, F. Postberg<sup>2</sup>, J. H. Waite<sup>3</sup>, S. Kempf<sup>4</sup>, K. Clark<sup>1</sup>, K. Reh<sup>1</sup>, B. Sherwood<sup>1</sup> and J. I. Lunine<sup>5</sup>, <sup>1</sup>NASA Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA (Morgan.L.Cable@jpl.nasa.gov), <sup>2</sup>Heidelberg University, Heidelberg, Germany, <sup>3</sup>Southwest Research Institute, San Antonio, Texas, <sup>4</sup>University of Colorado, Boulder, CO, USA, <sup>5</sup>Cornell University, Ithaca, NY, USA (jlunine@astro.cornell.edu).

Enceladus, one of the moons of Saturn, has become popular recently due to the plethora of discoveries by the Cassini Mission. Not only does this moon have a stable, sustained plume emanating from its south polar terrain, but this plume also contains signatures that strongly suggest Enceladus has the ability to harbor life in its global, subsurface ocean.

We are in a unique position to assess the habitability of this ocean world. First, the ocean is accessible directly via the plume. By sampling the gas and grains of the plume, we can draw conclusions about the composition of the subsurface ocean, something that cannot be so easily achieved (so far) with other ocean worlds in the solar system. Second, the data from Cassini can be leveraged to design a targeted payload for a follow-on mission. Thanks to Cassini, we have bounds on parameters such as ocean pH and salinity, which are critical for selecting the best instruments to assess habitability and search for life. Additionally, the Cosmic Dust Analyzer (CDA) and Ion and Neutral Mass Spectrometer (INMS) instruments aboard Cassini mapped plume gas density and grain distribution, respectively. These measurements have provided for the generation of detailed plume gas and grain models, enabling careful mission planning to optimize parameters such as flyby altitude, trajectory and speed.

The Enceladus Life Finder (ELF) is a mission concept proposed to the recent New Frontiers call. By tasting the compounds in the gas and grains of the plume, ELF would address key questions of habitability and search for biosignatures. We will discuss the ELF concept and how the ELF payload uniquely addresses the habitability question. We will also discuss the implications of this type of habitability-focused mission for other ocean worlds such as Europa.