

Determination of the Presence of Biological Compounds in Aerosol Particles with a Linear Ion Trap

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Locations such as Enceladus and Titan are prime targets for astrobiological research due to the presence of water and organic species. Many of the methods of ionization employed on the space craft used to explore these regions involve high speed impacts which can be potentially destructive to any fragile organic species. The development of a flight-practical instrument capable of analyzing these organic species without destroying any higher order structures is crucial in the search for extraterrestrial life.

Herein the current development of an aerosol particle linear ion trap capable of determining the presence of biological compounds with fluorescence detection is discussed. The electrode geometry of the instrument is sourced from the mass analyzer of a commercial mass spectrometer and uses trapping waveforms from an external digital electronics system. Once validation of trapping efficacy has been done, the implementation of an aerosol generation device, a fluorescence excitation source, and detection device will be performed. Aerosol particles found in water plumes evolving from the surface of Enceladus or in the high altitude regions of Titan's atmosphere are the target of this device. It would collect natively charged aerosols in the potential well of the trap as a spacecraft transversed the area of interest. Multiple wavelengths from an excitation source oriented axially with the trap would be used to induce fluorescence in amino acids, nucleic acids, coenzymes, and chlorophylls contained in any of the trapped aerosol particles that could be observed by an orthogonally placed detector.