

A high TRL low resource "2 in 1" concept for magnetospheric plasma mass spectrometry on high radiation planetary missions

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The Helium, Oxygen, Proton, Electron (HOPE) spectrometer was flown on the Van Allen Probes in 2012 to study the low energy plasma environment that provides the source of free energy for the relativistic electrons encircling Earth's radiation belts. The low resource HOPE instrument has TRL 9 and is radiation hard to fly directly within the high radiation environment for a nominal two year mission. The instrument measures electrons and ions from a few eV/q to 50 keV/q on alternate sweeps of one electrostatic analyzer head, hence a "2 in 1" approach. On each, time of flight analysis using coincidence, channeltron detectors, a modest high voltage, and thin carbon foils is employed. This presentation will focus on the technological innovations of the HOPE design and areas of possible future utility. Additional time of flight capability could be added with minimal rework and allow even more utility. Geometric factor optimization could also be easily accommodated. We propose that such a capable instrument could be considered as a lower cost solution suitable for high radiation planetary missions. In times of limited cost caps, the relative gains in cost and volume from such an approach may be substantial for new, challenging targets to moons and outer planets.