

Mass Spectrometry for Planetary Missions: Future State-of-the-Art

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Mass spectrometers (including gas chromatographs) are arguably some of the most complex instruments ever flown in space. As planetary missions have gone from the reconnaissance phase of exploration to one of detailed investigation, instruments and techniques have evolved accordingly. Common to all flight instruments, whether photon or particle sensing, are generalized requirements for high resolution and sensitivity within tightly constrained spacecraft resources. One example is the desire for sensors capable of finding evidence of “life” on planetary surfaces. However, the peculiarities of electron and ion optics (as opposed to photon optics), which is the basis of mass spectrometry, make these goals particularly difficult to achieve. This paper presents a discussion of the principles and techniques behind mass spectrometers that could be developed for future planetary missions, rather than an exhaustive review of existing capabilities.