

The MOMA Mass Spectrometer: Overview of Technology and Charge Control

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The Mars Organic Molecule Analyzer (MOMA), a linear ion trap (LIT) mass spectrometer for the purpose of measuring signs of extinct and extant life on Mars, is being built and qualified at Goddard Space Flight Center in Maryland for the 2020 ExoMars mission and will be integrated into the ExoMars rover amongst other instruments in Italy.

The linear ion trap mass spectrometer is capable of measuring ion masses from m/z 50 to m/z 1000 by making use of two distinct ion sources. For lower mass range an electron ionization (EI) source is implemented (m/z 50-550). A laser desorption ionization (LDI) source is implemented for higher mass range (m/z 150-1000). In EI mode volatiles and semi-volatiles from crushed core samples taken from a depth up to 2 meters and delivered to ovens, are examined by gas chromatography with and without derivatization enhancement (four columns available). The LDI source is implemented for analysis of non-volatiles in/on crushed rock core samples, delivered to a tray underneath a 266 nm laser capable of 140 uJ with 1 ns wide pulses. The amount of ions produced and injected into the LIT by each 400 um-focused pulse is highly variable depending on, temperature mechanics, laser parameters and investigated sample. Considering ion trap charge control is essential for reliable operation to prevent excessive space charge that causes mass shifts and peak broadening, combined with the electronics, weight and power restrictions for space flight, a different method for charge control during LDI has been found and tested. Besides presenting an overview of the instrument technology this alternative method will be highlighted.