Mars Organic Molecule Analyzer (MOMA) onboard ExoMars 2018

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Introduction

- ExoMars mission and instruments
- MOMA instrument
- MOMA for future missions
- Conclusion
ExoMars

ESA-Roscosmos mission to Mars

2016 Trace Gas Orbiter and Lander

2018 Lander with 300kg Rover
Instruments onboard ExoMars

Instruments outside the rover

Wisdom – ground penetrating radar
Clupi – microimager
PanCam – camera system
Drill – 2m

Instruments inside the rover

Raman Spectrometer
MicrOmega – infrared imaging spectrometer
Mars Organic Molecule Analyzer
MOMA operational modes

Laserdesorption ionization-MS
Gives access to high molecular weight compounds

Pyrolysis-GC-MS
Gives access to low mass compounds and breaks down high molecular mass refractory compounds

Derivatization-GC-MS
Makes compounds with polar functional groups and instable compounds accessible for the GC
Mass spectrometer and main electronic box by Goodard Space Flight Center

Gas chromatograph by LATMOS and Laboratoire Interuniversitaire des Systèmes Atmosphériques

Laser, oven and tapping station by Max-Planck-Institut für Sonnensystemforschung and the Laser Zentrum Hannover

Supporting Teams (Science)
MOMA Laser

Laser Pumpunit

• laserdiode module 808nm
• capacitor bank
• electronics

Laserhead

• Nd:YAG laser 1064nm
• two frequency doubling crystals (532 and 266nm)
• 400µm spot size on sample
• 250 µJ pulse energy
• 1ns pulse
MOMA Gas Chromatograph

Gas chromatograph

- four columns (one chiral column)
- complete pneumatic system
- injection trap
- TCD sensors
- control electronics
- coupled to the mass spectrometer
MOMA Mass Spectrometer

Mass spectrometer

- Linear iontrap MS
- Mass range upto 1000
- Inlet for laser desorption ions
- Split inlet for GC
- control electronics
- high voltage and high frequency generation
**MOMA performance**

Laser desorption ionization at Mars ambient pressure and introduction into the MS through a valve.

Electron impact ionization and introduction of the ions into the linear iontrap with ion lens system.
Titan-OMA
paradise for complex organics and tholines

Europa-OMA
Ganymed-OMA
Io-OMA
water ice as matrix

Comet-OMA
organic rich

Asteroid-OMA
organic content depending on the group

…-OMA has the capability to detect everything from biochemistry to simple primordial organic compounds

…-OMA is planetary protection compatible with missions to search for life
Conclusion

MOMA is the key instrument of ExoMars

MOMA is capable to detect a wide range of organic molecules

MOMA is an ideal instrument also for further future missions