

Mars Organic Molecule Analyzer (MOMA) onboard ExoMars 2018

Harald Steininger
MPI for Solar System Research

H. Steininger¹, E. Steinmetz¹, D. K. Martin², B. Lustrement³, C. Kolleck,⁴ F. Goesmann¹, W. B. Brinckerhoff², P. R. Mahaffy², F. Raulin⁵, R. J. Cotter⁶, C. Szopa³ and the MOMA team, ¹ (Max-Planck-Institut für Sonnensystemforschung, Max-Planck-Strasse 2, 37191 Katlenburg-Lindau, Germany, steininger@mps.mpg.de), ² (NASA Goddard Space Flight Center, Greenbelt, Maryland 20771, USA), ³ (UPMC Univ. Paris 06, Université Versailles St-Quentin, CNRS/INSU, LATMOS-IPSL, 75005 Paris cedex, France), ⁴ (Laser Zentrum Hannover e.V., 30419 Hannover, Germany), ⁵ (LISA, Universités Paris Est-Créteil, Paris 7, Denis Diderot et CNRS, CMC, 94010 Créteil cedex, France). ⁶ (Howard Hughes Medical Institute, The Johns Hopkins University School of Medicine, Baltimore, Maryland 21205, USA)



Introduction

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

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ExoMars

ESA-Roscosmos mission to Mars

2016 Trace Gas Orbiter and Lander

2018 Lander with 300kg Rover

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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

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MOMA operational modes

Laserdesorption ionization-MS

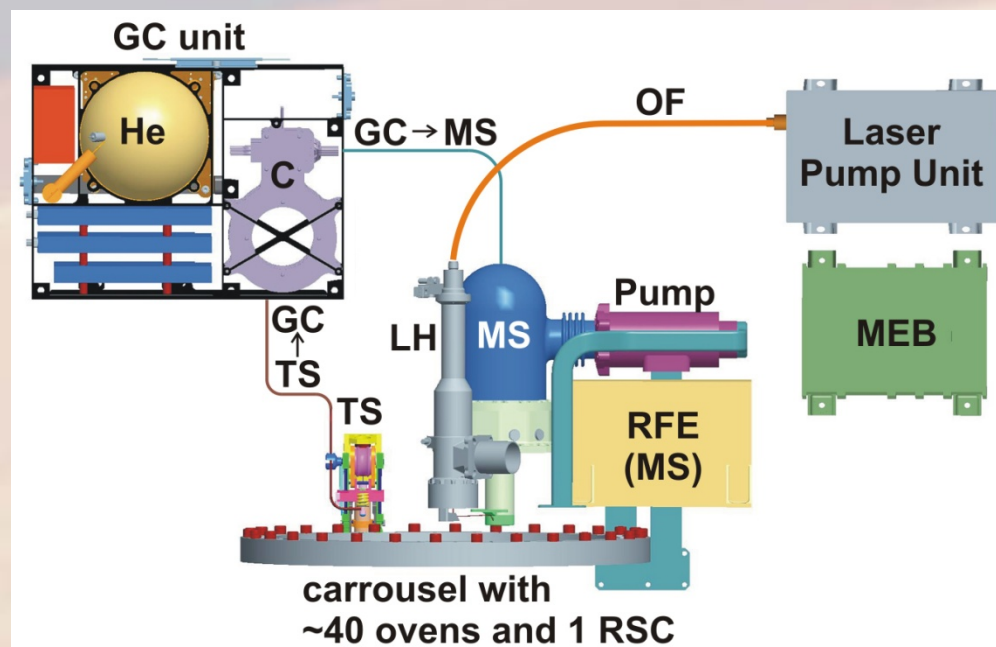
Gives access to high molecular weight compounds

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



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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)

Name, Date

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MOMA Laser

Laser Pumpunit

- laserdiode module 808nm
- capacitor bank
- electronics

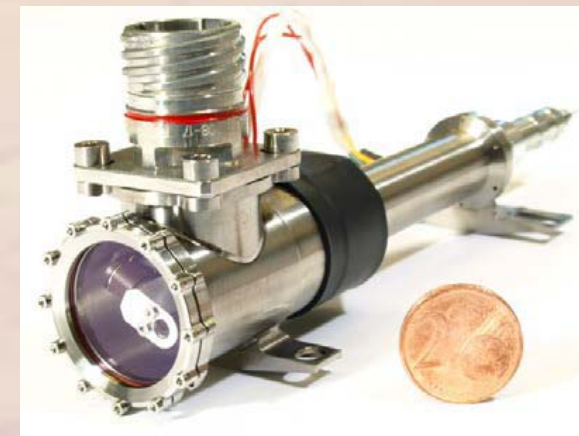
Laserhead

- Nd:YAG laser 1064nm
- two frequency doubling crystals (532 and 266nm)
- 400 μ m spot size on sample
- 250 μ J pulse energy
- 1ns pulse

Laser Pumpunit



Laserhead



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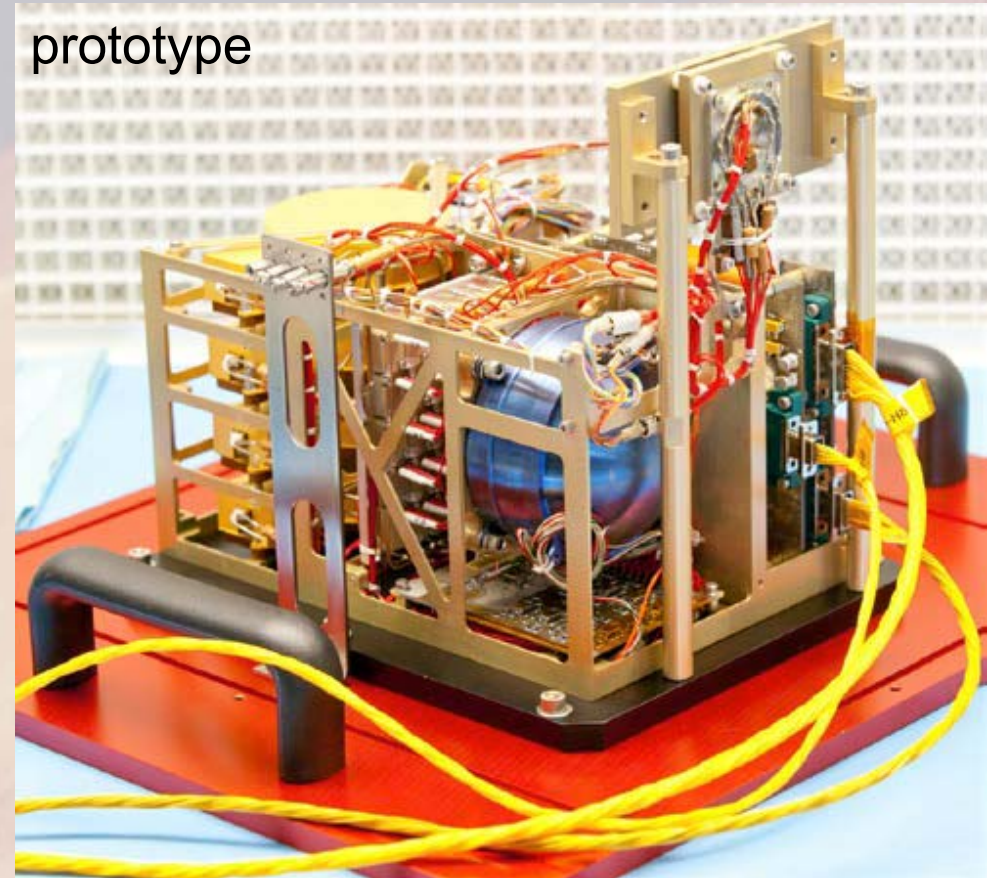


MOMA Gas Chromatograph

Gas chromatograph

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

prototype



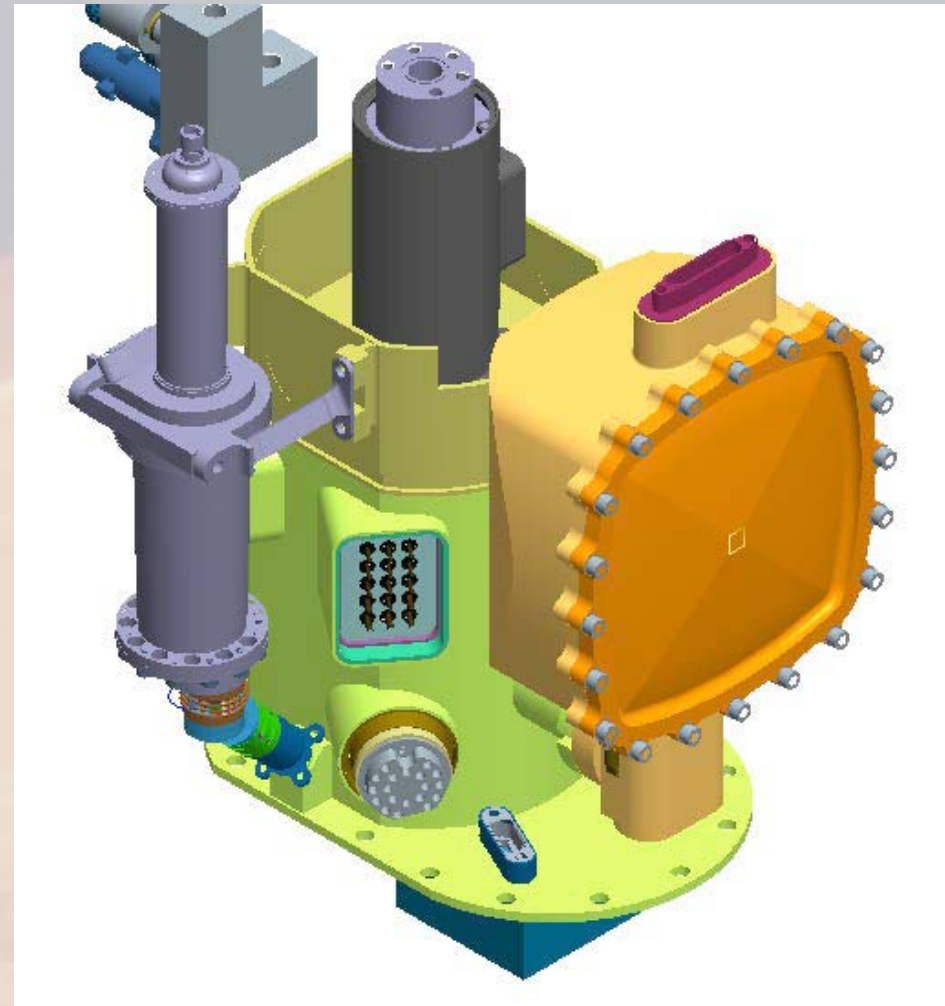
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MOMA Mass Spectrometer

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



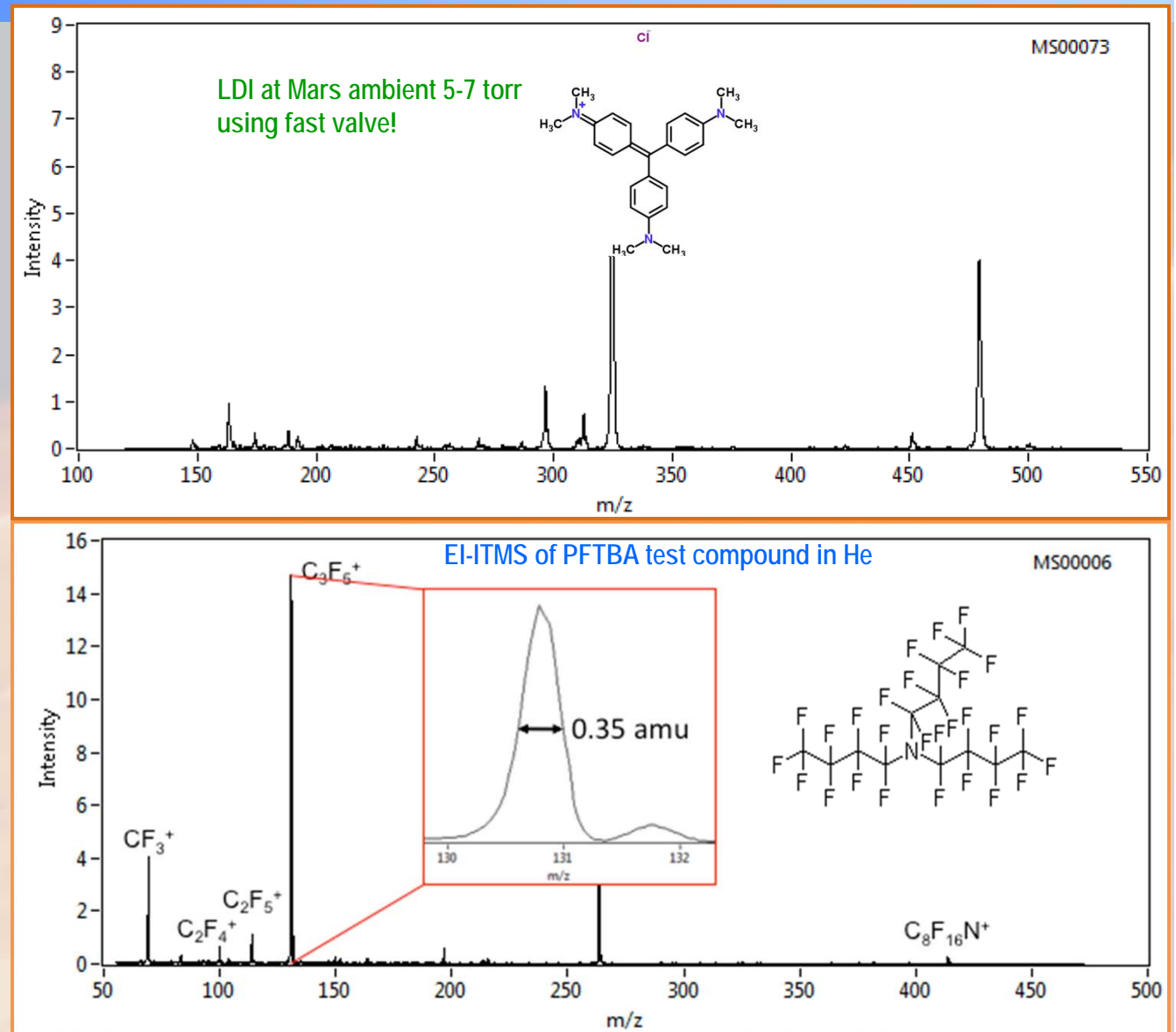
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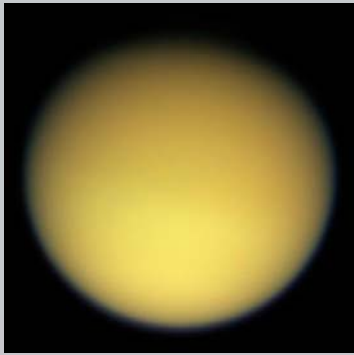
MOMA performance

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

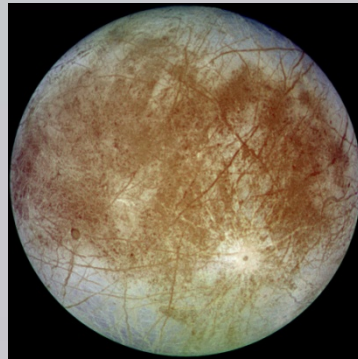


MOMA for future missions



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

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