SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Poster session (2D)

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RAMAN LASER SPECTROMETER FOR PLANETARY MISSIONS

Abstract

The Raman Laser Spectrometer is one of the Pasteur Payload instruments, within the ESA's ExoMars mission.

Purpose: Two missions are part of ExoMars: one consisting of an Orbiter plus an Entry, Descent and Landing Demonstrator (launch in 2016) and the other including a Rover as part of ESA-Roscosmos collaboration (launch in 2018). ExoMars Rover would carry a drill and a suite of instruments dedicated to exobiology and geochemistry research and its main Scientific objective is "Searching for evidence of past and present life on Mars".

Methodology: Raman Spectroscopy is used to analyse the vibrational modes of a substance. It relies on the inelastic scattering of monochromatic light produced by atoms and molecules. The radiation-matter

interaction results in the energy of the exciting photons to be shifted up or down. The shift in energy appears as a spectral distribution and therefore provides a unique fingerprint by which the substances can be identified and structurally analyzed.

Results: RLS expected main characteristics are as follows:

• Laser excitation wavelength: 532 nm • Irradiance on sample: 0.6 – 1.2 kW/cm2 • Spectral range: 150-3800cm-1 • Spectral resolution: between 6 cm-1 and 8 cm-1 • Spectral accuracy: ¡ 1 cm-1 • Spot size: 50 microns

Currently, development of extended Phase B is on going and it is expected to hold a delta-PDR before end of 2013. During this phase, instrument performances are being evaluated by means of simulation tools and development of an instrument prototype. Improvements and alternatives for other planetary applications: Raman Laser Spectrometer is a powerful tool for in situ planetary exploration, alone or in combination with other techniques and can support the planetary science inside the coming missions. Among the potential alternatives we consider the following: 1) Combination of Raman internal and external capabilities by means of an external optical head on a robotic arm or moreover using remote Raman. 2) Combination of Raman and LIBS technics. In both cases the spectrometer would be shared by means of an optical switch in the spectrometer aperture. The technology preparations needs to consider the environmental differences between Mars and the other planet, namely thermal and radiation environment. Delta-validation should be taken into account for components susceptible to such conditions.

Conclusions: The RLS is a key tool to achieve ExoMars objectives and its current technological development provides a promising future for being used on other planetary missions as a non-destructive analysis technique.