SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 3 (3C)

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RAMAN LASER SPECTROMETER FOR EXOMARS

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 Scientic 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.

The RLS Instrument is composed by the following units: • SPU (Spectrometer Unit) • iOH: (Internal Optical Head) • ICEU (Instrument Control and Excitation Unit)

Other instrument units are EH (Electrical Harness), OH (Optical Harness) and RLS SW On-Board.

The RLS is being developed by an European Consortium composed by Spanish, French, German and UK partners. It will perform Raman spectroscopy on crushed powdered samples inside the Rover's Analytical Laboratory Drawer.

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, a delta-PDR is going on (February-March 2014). During phase B, instrument performances have been evaluated by means of simulation tools and development of an instrument prototype. Phase C/D will starting April 2014. 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 in situ planetary missions as a non-destructive analysis technique alone or in combination with other techniques.