PRoViScout - Planetary Robotics Vision Scout
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D3.2.1 Organics / Biological Substudy Report

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EXECUTIVE SUMMARY

Instrumentation currently under development for extended in situ exploration of martian surface rocks and regolith in the interests of astrobiology and the search for biosignatures of microbial life generally falls into one of two categories. These are I) devices designed to carefully identify the chemical and structural components of the sample, and II) devices designed to survey rapidly for possible signatures of extant or fossil life, and so select targets for closer inspection with the type I instruments.

Here we describe work on two techniques and associated instruments for the EU-FP7 PRoViScout project [WA.01] suitable for application as a type II instrument, with the ability to rapidly survey for niches of native martian organics or organisms.

The underlying principle of the first technique is that of imaging fluorescence, driven by ultraviolet excitation light provided by either short wavelength LEDs or laser diodes at a much greater range.

This report details work on a) characterisation of the fluorescence response of different astrobiological targets by experimentally generating high-spectral-resolution excitation-emission matrices (EEMs) which will assist with the selection of optimal wavelengths for driving and detecting fluorescent signal. b) determination of the window of opportunity before such fluorescent signals are degraded by the martian surface conditions. Two studies were conducted: the destruction of biosignatures of photosynthetic cyanobacteria by cosmic rays on Mars, and the degradation of the fluorescence of polycyclic aromatic hydrocarbons (PAHs) by unfiltered solar UV radiation. c) the design, development and field testing of a hand-held fluorescence imaging device, WALI (the Wide Angle Laser Imager). This is comprised of both white-light and 365nm UV LED light sources, a sample light-exclusion tube, and sensitive DSLR camera for acquiring imagery. Much of this work has also now been published in the peer-reviewed literature, as indicated.

The second technique is the use of hyperspectral imaging to search for materials which are either organic or micro-organisms or their UV-resistant sheaths using spectral absorption or spectral reflectance features. Examples are shown of the prototype and initial results obtained during the PRoViSG Tenerife field trial.

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