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SPECTROMODULE: A MODULAR IN-SITU SPECTROSCOPY PLATFORM FOR EXOBIOLOGY
AND SPACE SCIENCES**Abstract**

The evolution of the solar system and the origin of life remain some of the most intriguing questions for humankind. Addressing these questions experimentally is challenging due to the difficulty to mimic environmental conditions representative for Early Earth and/or space conditions in general in ground based laboratories. Performing experiments directly in space offers the great chance to overcome some of these obstacles and to possibly find answers to these questions. Exposure platforms in Low Earth Orbit (LEO) with the possibility for long-duration solar exposure are ideal for investigating the effects of solar and cosmic radiation on various biological and non-biological samples. Up to now, the exobiology and space science research community has successfully made use of the International Space Station (ISS) via the EXPOSE facility to expose samples to the space environment with subsequent analyses after return to earth. The emerging small and nanosatellite market represents another opportunity for

astrobiology research as proven by the O/OREOS mission, where samples were analyzed in-situ. In this framework, the European Space Agency is planning the development of a novel Exobiology facility outside the ISS. The new platform, which can host up to seven different experiments, will combine the advantages of the ISS (long-term exposure, sample return capability) with near-real time in-situ monitoring of the chemical/biological evolution in space. In particular, ultraviolet-visible (UV/Vis) and infrared (IR) spectroscopy have been considered as key non-invasive methods to analyze the samples in-situ. Changes in the absorption spectra of the samples developing over time will reveal the chemical consequences of exposure to solar radiation. Simultaneously, spectroscopy provides information on the growth rate or metabolic activities of biological cultures. The first four selected experiments to be performed on-board are IceCold and OREOCube, Exocube. To prepare for the development of the Exobiology facility, ground units of the UV-VIS and IR spectrometers have been studied, manufactured and tested as precursors of the flight units. The activity led to a modular in-situ spectroscopy platform able to perform different measurements (e.g. absorbance, optical density, fluorescence measurements) at the same time on different samples. The paper will describe the main features of the platform installed under a solar simulator, the verification steps and approach followed in the customization of components –off-the shelf (COTS) to make them suitable for the space environment. The ground platform supports the establishment of analogue research capabilities able to address the long term objectives beyond the current application.