LABORATORY ANALYSES OF ORGANO-SULPHATE SAMPLES TO SUPPORT MARS 2020 AND EXOMARS ROVERS ORGANIC DETECTIONS. A. Alberini[1,2], C. G. Florentino[3], G. Poggiali[1,4], T. Fornaro[1] and J. R. Brucato[1]; [1]INAF-Astrophysical Observatory of Arcetri, largo E. Fermi 5, 50125 Florence, Italy, [2]Department of Physics and Astronomy, University of Florence, Via Giovanni Sansone 1, 50019 Sesto Fiorentino (Florence), Italy, [3]Department of Analytical Chemistry, University of the Basque Country UPV/EHU, P.O. Box 644, 48080 Bilbao, Basque Country, Spain, [4]LESIA – Observatoire de Paris PSL, Université PSL, CNRS, Sorbonne Université, Université de Paris, 5 place Jules Janssen, 92190 Meudon, France.
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Introduction: One of the goals of the SuperCam and SHERLOC instruments of the Mars 2020 Perseverance rover is the detection of organic matter in the soil of Jezero crater. SHERLOC detected fluorescence signals that can be interpreted as possible organic matter both in the igneous rocks of the crater floor [1] and in the sedimentary rocks of the Delta front, with stronger signals in association with sulphates. As well as SHERLOC, the Perseverance SuperCam suite, including a VISIR spectrometer [2] operating in the 1.3-2.6 μm range, can detect organic matter if present at higher concentrations. In addition, in the next years the ExoMars rover will analyse Martian subsurface samples with the Analytical Laboratory Drawer (ALD), i.e., Mars Organic Molecule Analyzer (MOMA), MicrOmega and Raman Laser Spectrometer (RLS).

Aims: In support of these promising observations, laboratory experiments have been developed at the INAF - Arcetri Astrophysical Observatory to shed light on the photoprotective properties of magnesium sulphate hydrate against UV photodegradation of abiotic aromatic organic compounds plausibly present on Mars, such as carboxylic acids, and biotic aromatic compounds such as nucleic acid components. Classifying minerals as photocatalysts or photoprotectors is key to understanding the photostability of organics adsorbed on them. These results will also indicate which mineral-organic complexes are most likely to be detected [3].

Methods: We used a Xenon enhanced UV lamp simulating the solar spectrum and a Bruker VERTEX 70v FTIR interferometer equipped with a Harrick diffuse reflectance accessory to acquire reflectance spectra of different samples. UV light was directed onto the sample inside the interferometer sample compartment through an optical fiber, allowing the study of the degradation kinetics in real time by monitoring the changes in the infrared spectrum of the sample [4,5].

Conclusions: In this talk we will present the experimental results on photoprotection of molecule-sulphate complexes to understand the spectral data acquired from the Mars 2020 rover Perseverance. In addition to understanding which molecules are most likely to be detected on Mars, the ultimate goal of our team is to create a database of infrared spectroscopic features for molecule-mineral complexes of different classes and concentrations, which will aid in the interpretation of spectroscopic data not only from the Mars 2020 mission, but also from ExoMars and future planetary missions.

References:

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