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The portable FLY SPec instrument concept: the complementary use of LIBS and reflectance spectroscopy for rover and human space exploration

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The landing of rovers and human crews in deep-space environments is one of the main challenges of the next Solar-System exploration era. Such a target, currently, implies a better knowledge of risks, the improvement of operations and scientific investigations and the miniaturization of the analysis probes. Instruments conceived for rovers that can be easily converted to human portable instruments and support multiple techniques are then fostered.
From this perspective, the extremely compact FLY SPec instrument is dedicated to the recognition of the surface resources through the complementary use of two spectroscopic channels: a laser induced breakdown spectroscopy (LIBS) and a near-infrared reflectometer equipped with a bi-dimensional detector for hyperspectral imaging. The combination of such analytic techniques allows a faster identification of minerals, soils and volatile reservoirs with the aim to collect proper samples during a surface campaign. According to the broad concept, indeed, the classification proposed by FLY SPec gives the correspondent reliability degree and responds to a prioritization tree in function of the scientific objectives of the mission, allowing a suitable sampling.
Such a procedure requires that the FLY Spec processing unit must be implemented with a spectral signature archive and matching processing system, implying a great laboratory activity for those materials that are not represented in database yet. Suitable sets of analogues must be selected, characterized, prepared and measured with two different techniques (i.e. reflectance spectroscopy and LIBS) in suitable environments. Eventually, laboratory data must be resampled and integrated in the processing system, to be readily used by FLY Spec during the campaign.