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MICROLIBS: A MICRO-SCALE ELEMENTAL ANALYZER FOR MARS AND THE MOON

Abstract

The success of the ChemCam and SuperCam instruments onboard the Curiosity and Perseverance NASA rovers led the team that designed and developed them to propose a miniaturized version of these LIBS lasers with the same level of performances. This paper will present the concept of this new instrument called MicroLIBS and the path forward to develop a first version in 2024. IRAP, LANL and CNES designed an instrument that will change the paradigm of exploration missions on of Mars or other planetary bodies. Microanalysis of the chemical composition of surface rocks is becoming an essential scientific measurement for future in situ exploration missions. Its size and weight reduction, from 10kg to 1.5kg will allow its integration into many other low-cost platforms looking for analysis at submillimeter scale (rover, drone), the next step forward for in situ planetary exploration.

The LIBS technique benefits from a decade of experience on Mars with the ChemCam (since 2012) and now SuperCam (since 2021) instruments on Mars. They have proven the technique's reliability and capability to analyze rocks at a submillimeter scale for geological investigations, especially on a Martian surface or in the vacuum environment on the Moon.

MicroLIBS will operate at a distance of 20 to 50 cm enabling significant mass reduction compared to ChemCam and SuperCam designs. A remote micro-imager provides dust-free micro-textures with elemental grid overlaid on areas smaller than 1 cm. Operating faster than its predecessors, MicroLIBS will have the capability to perform 30x30 grid measurements. A handheld version for astronaut will also be investigated as part of this development.

MicroLIBS can hence provide micro-scale elemental analyses with a science return similar to contact instruments, for lower cost as it can operate remotely with high precision from a mobile platform under-carriage and with no need of arm deployment nor platform turret. It is overall low risk (heritage-based), low mass, and low cost with significant improvements in terms of accuracy and rapidity.

The paper will present the design and functions of the MicroLIBS instrument, and the legacy of past missions and instruments. The development plan for the next two years will be elaborated, and a special focus will be made on the genericity of the instrument to make it a multi-mission, multi-platform breakthrough micro-scale elemental analyzer.