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MICROLIBS: ELEMENTAL MICRO-MAPPING FOR PLANETARY EXPLORATION

Abstract

The MicroLIBS instrument for in situ elemental micro-mapping is being developed by CNES with IRAP (FR) and LANL (US) laboratories. It meets the need for lightweight, low-cost instruments that can be rapidly to develop. The success of LIBS laser experiments on the MSL and Mars2020 missions (ChemCam and SuperCam instruments respectively) led CNES and its partners to develop the MicroLIBS instrument for future lunar missions at low weight and low cost, with similar performance to ChemCam and SuperCam, but with new capabilities of high scientific value.

With a weight of only 1.5kg, this miniaturized version on ChemCam/SuperCam (10kg) can be mounted on a tripod for use by astronauts on the lunar surface, or mounted on a small surface rover for near-real-time analysis of surrounding rocks. MicroLIBS can also be used to remove dust, and simply positioned from a platform without the aid of a turret or robotic arm, it carries out its observations using LIBS (laser-induced breakdown spectroscopy) in micro-scale scans on targets in its workspace.

MicroLIBS not only meets the needs of low-cost missions, but also and above all the microanalysis requirements identified in NASA's latest Decadal Survey. Sub-millimeter-scale analysis, or microanalysis, is crucial for future in situ missions to sort and select the most important samples worth bringing back to Earth. MicroLIBS will offer great geological diversity by analyzing multiple targets in each workspace. It enables complete in situ petrological analysis by performing micro-scans, akin to laboratory methods.

MicroLIBS design started in 2022, and current developments will result in a TRL-6 prototype by early 2025, for flight opportunities as early as 2026 or 2027. MicroLIBS science team is led by IRAP (France), LANL (US) and Purdue University (US).

The paper will present the design and functions of the MicroLIBS instrument, and the path to TRL-6 by next year. A special focus will be made on how human and robotic in-situ Moon missions can benefit from the versatility of this multi-mission, multi-platform breakthrough micro-scale elemental analyzer.