Geophysical Research Abstracts
Vol. 15, EGU2013-8536, 2013
EGU General Assembly 2013

ChemCam Remote Microscopic Imager (RMI) Onboard Curiosity: Results of the First Three Months on Mars

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The ChemCam instrument onboard the Curiosity rover is a Laser-Induced Breakdown Spectrometer (LIBS) coupled to a Remote Micro-Imager (RMI) [1,2]. Its main objective is to remotely determine the elemental composition of soils and rocks situated at distances up to 7 meters from the rover. We focus on the imaging capability of ChemCam using the RMI and initial analysis of RMI data [3,4,5,6].
The objectives of the RMI are to provide geomorphologic context of the LIBS analyses, locate the laser pits, document the changes induced by the laser shots on the target, and study the martian rocks and soils at high resolution. It is also the main tool to check the focusing of the laser, which is directly related to the intrinsic quality of LIBS spectra. This is particularly important for targets displaying significant variations of depth within the scene, and for which the optimum focus distance might differ from one LIBS point to the other.
During the first months of the surface mission, well defined holes have been generally observed on soils, whereas the laser pits were sometimes hardly detectable on some rocks. RMI coupled to the LIBS therefore provides a way to investigate the rock hardness. The first images also demonstrate that the camera by itself adds a significant scientific value to the study of rocks by revealing their fine texture and morphology. Secondary imaging products have been produced. These include mosaics, color-added images using pansharpening to merge the black and white high resolution RMI images with the colors acquired by the MastCam multispectral cameras, and 3D-shape retrieval using the z-stack technique [7].

References: [1] Maurice et al., Space Sci. Reviews, Vol 170, Issue 1-4, pp. 95-166, 2012. [2] Wiens et al., Space Science Reviews, Space Sci. Reviews, Vol 170, Issue 1-4, pp. 167-227, 2012. [3] Le Mouélic et al., LPSC XLIV, 2013. [4] Langevin et al., LPSC XLIV, 2013. [5] Bridges et al.., LPSC XLIV, 2013. [6] Cousin et al. , LPSC XLIV, 2013. [7] Herkenhoff et al., JGR, 111, E02S04, 2006.