

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Science, Instruments and Technologies (3B)Author: Mr. Ryan Jackson
University of New Mexico (UNM), United StatesOVERVIEW OF THE CHEMCAM INSTRUMENT ONBOARD THE MARS SCIENCE LABORATORY
CURIOSITY ROVER**Abstract**

The ChemCam instrument on the Mars Science Laboratory (MSL) rover, also called Curiosity, consists of a Laser Induced Breakdown Spectroscopy (LIBS) instrument which performs 400 m diameter chemical analyses from 1.5 m to 7.0 m away, as well as a panchromatic Remote Micro Imager (RMI) for context. ChemCam's LIBS uses a Nd:KGW laser to provide up to 14 mJ pulses on target, and to collect the resulting plasma flash it uses a 110 mm diameter telescope, which transfers the signal to three spectrometers in the body of the rover. ChemCam analyses are planned and organized by individual sequences (which have a unique target name) usually consisting of a line-scan or grid raster pattern of observation points, where each point is observed with multiple laser shots, and where an emission spectrum is recorded for each laser shot. Major-element compositions are reported in terms of the oxide abundances of SiO₂, TiO, Al₂O₃, FeOT (Total Fe as FeO), MgO, CaO, Na₂O, and K₂O. The abundances are quantified from the spectra using a multivariate calibration algorithm trained on a library of 400 standards. A number of minor and trace elements are also quantified. The RMI has a focus range of 1.2 m to infinity, a field of view of 20 mrad, and pixel angular size of 19.6 μ rad which means the RMI has the highest angular resolution of any camera on Mars. A more in depth description of the ChemCam instrument can be found in Wiens et al. and Maurice et al. (Spa. Sci. Rev. v.170, 95, 167, 2012). As of the 1591st sol (Martian day) of the MSL mission, ChemCam has run 1961 sequences on 928 working sols. In those sequences, the instrument has analyzed 1735 targets on the Martian surface, with 13,046 unique LIBS points, and 422,889 individual laser shots. In addition, the instrument has taken 7,032 images of Martian targets. In addition, non-laser passive reflectance spectra covering the 400-850 nm range are used to provide information on mineralogy. The technique can be used in conjunction with normal LIBS sequences or separately. Passive spectra can be collected from kilometer distances, much greater than the 7 meter limit of LIBS observations. The instrument can also return long distance RMI images in order to observe, in great detail, far away features such as the Peace Vallis alluvial fan and layered units within Mount Sharp.