Back

Oral or Poster Contributed Presentation CTP_EARLY

CTP02: AI, Spectroscopy, and Emerging Technologies

Overview of First Four Years on Mars with SuperCam's Remote LIBS and Co-Boresighted Techniques

Tuesday, October 7, 2025 5:10 PM - 5:30 PM EDT

Location: Meeting Room #8

Presenting Author(s)

RW

Roger C. Wiens

Professor
Purdue University
West Lafayette, Indiana, United States

Non-Presenting Author(s)

SM

Sylvestre Maurice

IRAP
Toulouse, Midi-Pyrenees, France

SC

Sam M. Clegg, PhD (he/him/his)

Scientist
LANL
Los Alamos, New Mexico, United States

AC

Agnes Cousin

IRAP
Toulouse, Midi-Pyrenees, France

AO

Ann Ollila

LANL
Los Alamos, New Mexico, United States

RA

Ryan Anderson

USGS
Flagstaff, Arizona, United States

TG

Travis Gabriel

USGS
Flagstaff, Arizona, United States

OB

Olivier Beyssac

UPMC
Paris, Ile-de-France, France

CB

Candice Bedford

Purdue
West Lafayette, Indiana, United States

EC

Elise Clave

DLR
Berlin, Berlin, Germany

SC

Stephanie Connell

Purdue
West Lafayette, Indiana, United States

Henry Manelski

PhD Candidate
Purdue University
West Lafayette, Indiana, United States

UW

U. Wolf

LANL
Los Alamos, New Mexico, United States

NM

Noah D. Martin

Graduate Student
Purdue University
Lafayette, Indiana, United States

BC

Baptiste Chide

IRAP
Toulouse, Midi-Pyrenees, France

OF

Olivier Forni

IRAP
Toulouse, Midi-Pyrenees, France

AU

Arya Udry

UNLV
Las Vega, Nevada, United States

OG

Olivier Gasnault

IRAP
Toulouse, Midi-Pyrenees, France

Susanne Schroeder

SS
DLR
Berlin, Berlin, Germany

JM
Juan Madariaga
U. Bilbao
Bilbao, Pais Vasco, Spain

JJ
Jeff Johnson
Applied Physics Laboratory, JHU
Laurel, Maryland, United States

In fifteen words or less, explain the significance of this contribution (Novel Aspect).:
SuperCam LIBS provides comprehensive elemental compositions, complemented by Raman, VISIR, imaging, and acoustics, on Mars.

Abstract Text:
The SuperCam instrument provides remote sensing on NASA's Perseverance rover using LIBS, visible and infrared reflectance and remote time-resolved Raman and luminescence spectroscopies, as well as imaging and acoustic recording. Its LIBS operates much the same as ChemCam on Curiosity, but to longer distances (~12 m) [see Manelski et al., this meeting, for plasma diagnostics]. Following ChemCam, SuperCam uses rasters of 1x5, 1x10, and 3x3 points, each usually using thirty laser pulses, each pulse providing a spectrum. The first five are discarded, avoiding surface dust; the remainder are usually averaged together but can be used separately to determine shallow depth trends. Calibration is accomplished via a large spectral library from > 800 standards using a ground-based clone at Los Alamos, plus > 20 replicate standards on the rover for comparison. SuperCam has returned > 300,000 LIBS spectra from ~1,000 targets to date. The geology of Jezero crater, Perseverance's landing site, is significantly different from Curiosity's: while the latter was dominated by fine-grained sediments, Jezero is mostly igneous with coarser grains. Olivine- and pyroxene-rich lithologies are high in Fe and Mg, and studies of the ratios of these elements have revealed variably evolved magmas along the > 35 km rover traverse. Pure feldspars have also been observed and characterized by their Na-Ca-K ratios. The primary minerals have been altered in many locations to Fe-Mg carbonates and other compositions including kaolinite (enriched in Al2O3 to > 40 wt%), serpentine, montmorillonite, and hydrothermally-produced minerals including quartz. Enrichments of Cl have been observed in altered surface materials, mostly in the crater floor, where Raman spectra indicated the presence of Na perchlorates. In the ancient river valley (Neretva Valles) that empties into the crater, we discovered enrichments to > 1 wt% nickel in connection with iron sulfides observed by the PIXL instrument and with macromolecular organic materials observed by the SHERLOC instrument. SuperCam's LIBS has also been used as a discrete sound source for acoustic experiments to determine the sound speed, to probe micro-turbulence in Mars' thin atmosphere, to estimate rock hardness, and study soil properties [N. Martin et al., this meeting].