INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Název: **Elektrochemická a spektroskopická analýza chřipkového proteinu**

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Reg.č.projektu: CZ.1.07/2.4.00/31.0023

Název projektu: Partnerská síť centra excelentního bionanotechnologického výzkumu

Electrochemical identification of influenza

Sequences of Pandemic-Causing Viruses Isolated and Detected by Paramagnetic Particles Coupled with Microfluidic System and Electrochemical Detector

Flow Injection Electrochemical Analysis of Complexes of Influenza Proteins with CdS, PbS and CuS Quantum Dots

Development of a Magnetic Electrochemical Bar Code Array for Point Mutation Detection in the H5N1 Neuraminidase Gene

Quantum Dots for Electrochemical Labelling of Neuramidinase Genes of H5N1, H1N1 and H3N2 Influenza

Paramagnetic Particles Isolation of Influenza Oligonucleotide Labelled with CdS QDs

Using of Paramagnetic Microparticles and Quantum Dots for Isolation and Electrochemical Detection of Influenza Viruses' Specific Nucleic Acids

Electrochemical Sensors and Biosensors for Influenza Detection

Paramagnetic particles coupled with an automated flow injection analysis as a tool for influenza viral protein detection

Easy to use and rapid isolation and detection of a viral nucleic acid by using paramagnetic microparticles and carbon nanotubes-based screen-printed electrodes

Spektroskopie laserem buzeného plazmatu LIBS

(Laser-Induced Breakdown Spectroscopy)

evropský sociální fond v ČR
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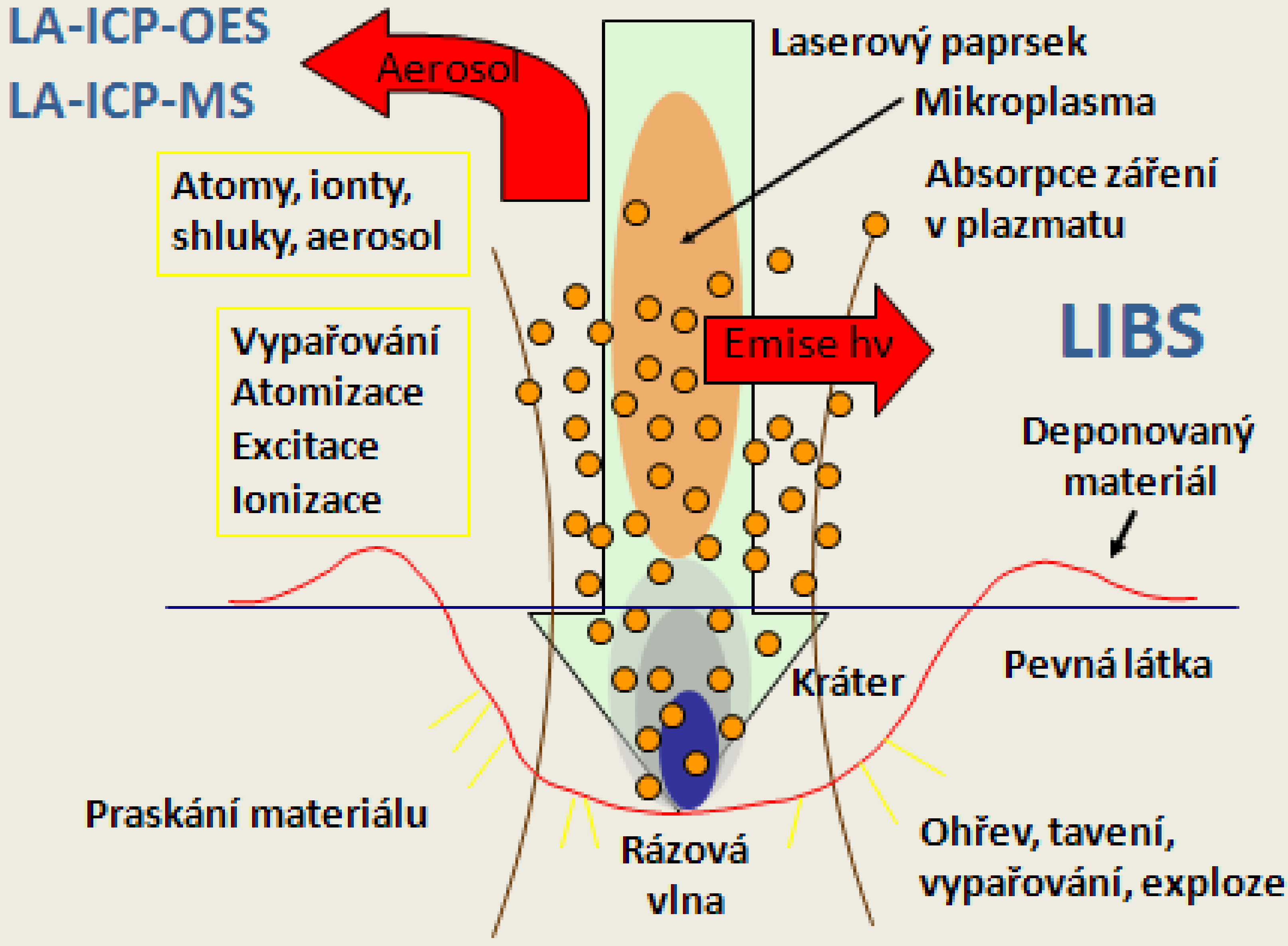
Interakce laserového záření se vzorkem



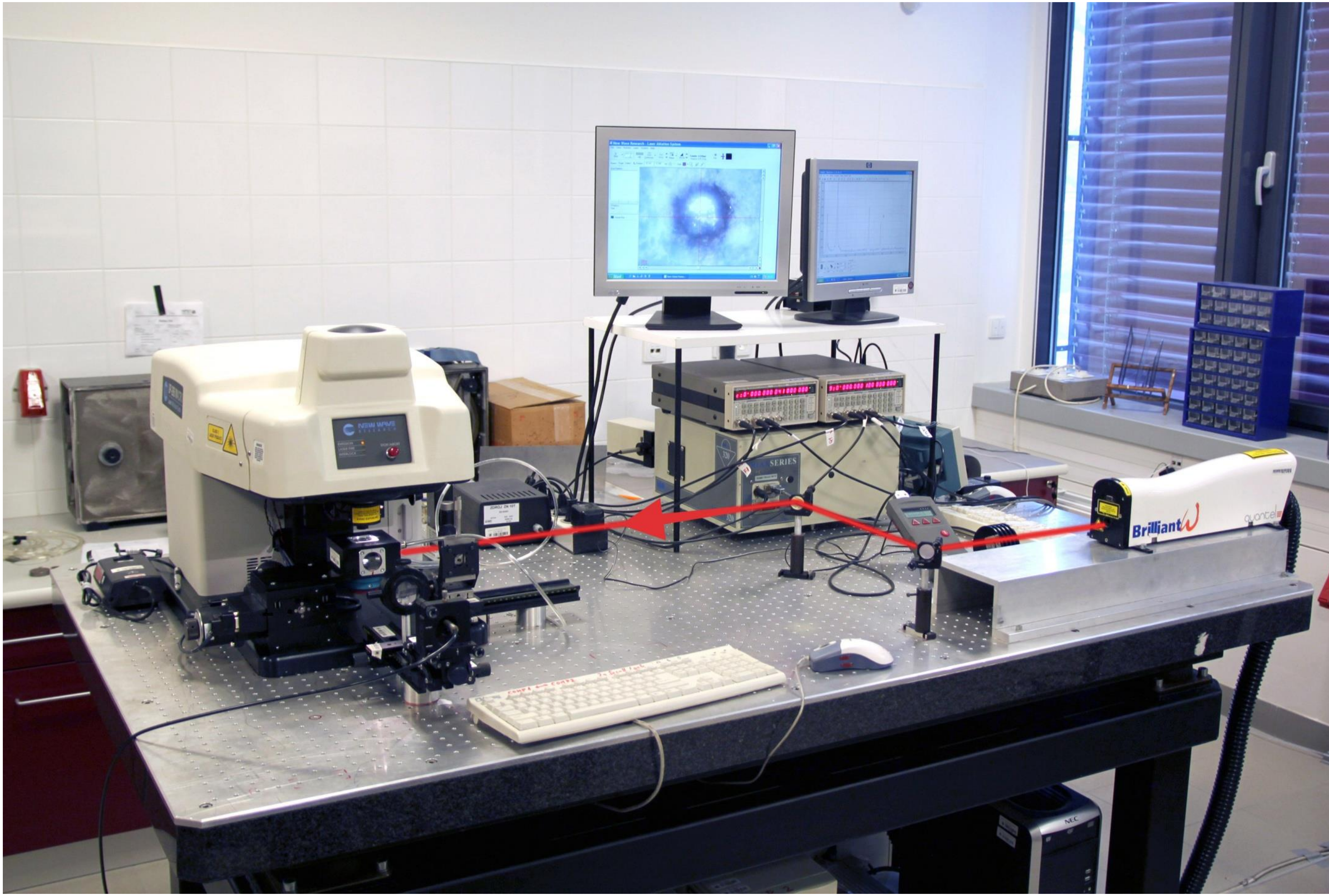
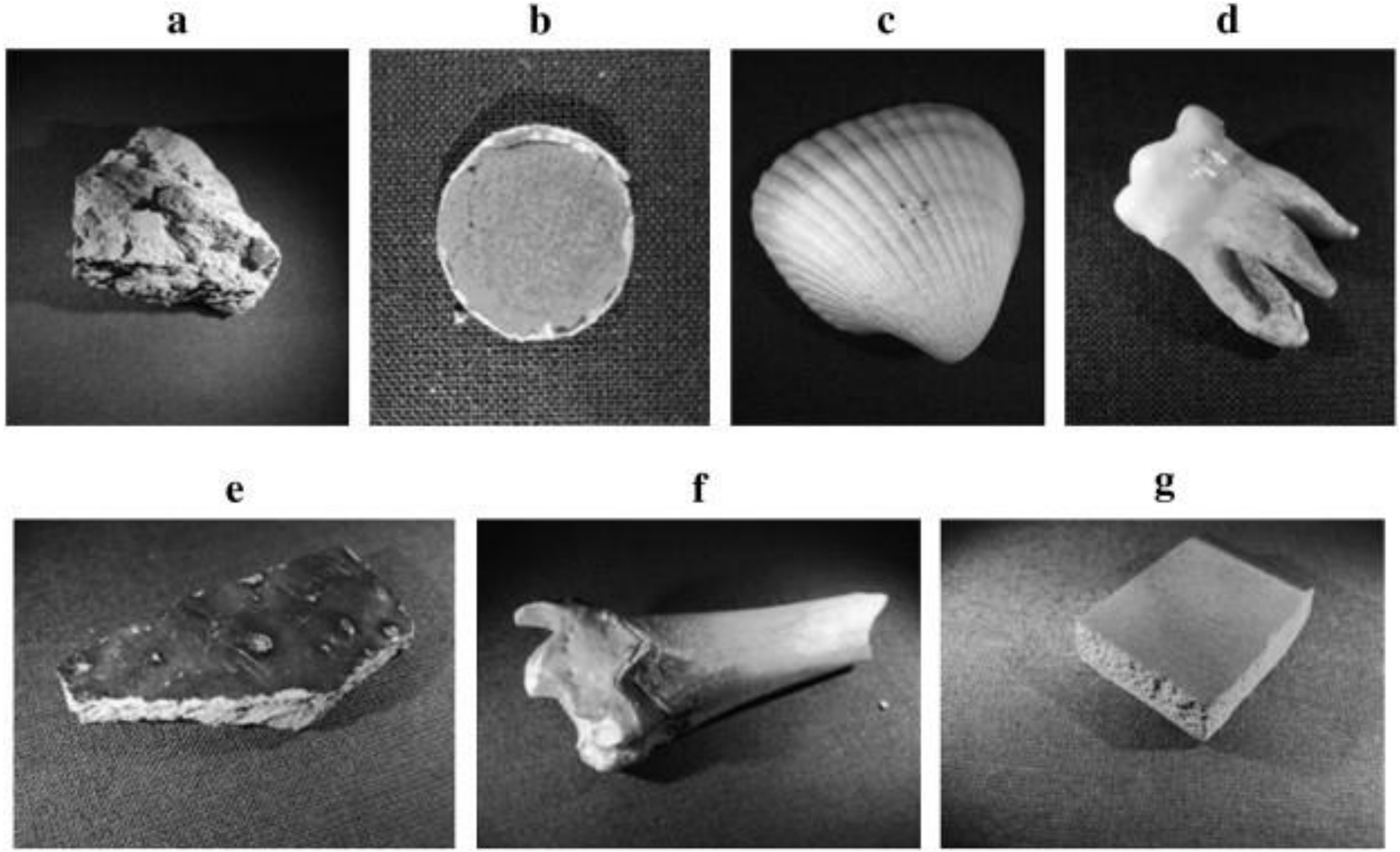


Schéma systému double pulse LIBS - celkový pohled na zařízení

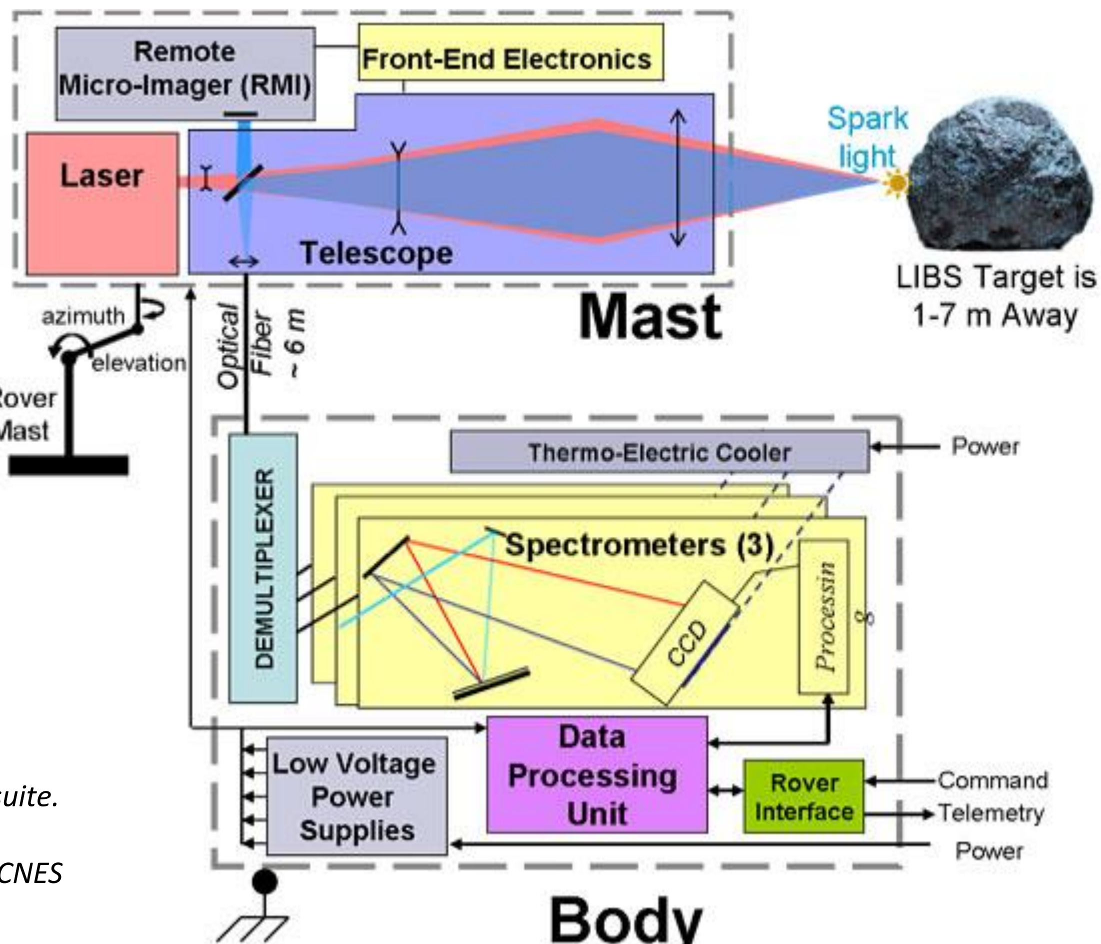
Aplikace - témata LIBS

- Povrchové mapování a mikroanalýza
- Sledování hloubkových profilů
- Studium archeologických nálezů
- Mapování biologických materiálů a biominerálů
- Studium předmětů kulturního dědictví
- Detekce mikročástic (nanočástic, kvantových teček)



Photographs of some samples used for analysis. a: mortar, b: soil pellet, c: shell, d: human tooth, e: ceramic fragment, f: swine bone, g: brick

Vitkova, G.; Novotny, K.; Prokes, L.; Hrdlicka, A.; Kaiser, J.; Novotny, J.; Malina, R.; Prochazka, D., Fast identification of biominerals by means of stand-off laser-induced breakdown spectroscopy using linear discriminant analysis and artificial neural networks. Spectrochimica Acta Part B-Atomic Spectroscopy 2012, 73, 1-6.



Block diagram of the ChemCam instrument suite. Credit: ChemCam/LANL/IRAP/CNES

The ChemCam instrument is the Chemistry and Camera instrument, one of 10 science instruments onboard the Curiosity rover. As the name implies, ChemCam is actually two different instruments combined as one: a Laser-Induced Breakdown Spectrometer (LIBS) and a Remote Micro Imager (RMI). The purpose of the LIBS instrument is to provide elemental compositions of rock and soil, while the RMI gives ChemCam scientists high-resolution images of the sampling areas of the rocks and soil that LIBS targets.

How does ChemCam Work? Mars is a dusty, windy planet. Dust is constantly being lifted and transported by wind through the atmosphere until it settles back to the surface where it covers everything, including rocks. ChemCam's number one objective is to determine the composition of rocks and soil. In order to determine the true composition of a rock, the dust needs to be removed. Otherwise, the composition of the rock is mixed with the composition of the dust.

ChemCam fires its laser (Figure 4) in a series of pulses to remove the outer layer of dust. Once the dust is removed, the laser is fired again (in a series of pulses) at the exposed rock surface. These laser pulses ablate, or vaporize, the outer surface of the rock. Electrons within the atoms hit by the laser become "excited" and emit light. The energy of the light that is emitted depends on the atom. For example, excited electrons within an atom of carbon will emit light with a different energy than excited electrons within an atom of oxygen. The emitted light (from all atoms present in the rock) is received by a telescope within the ChemCam housing. From the telescope, the light enters a spectrometer through an optical fiber where it is broken down and read by the onboard computer.

How Does ChemCam Work?

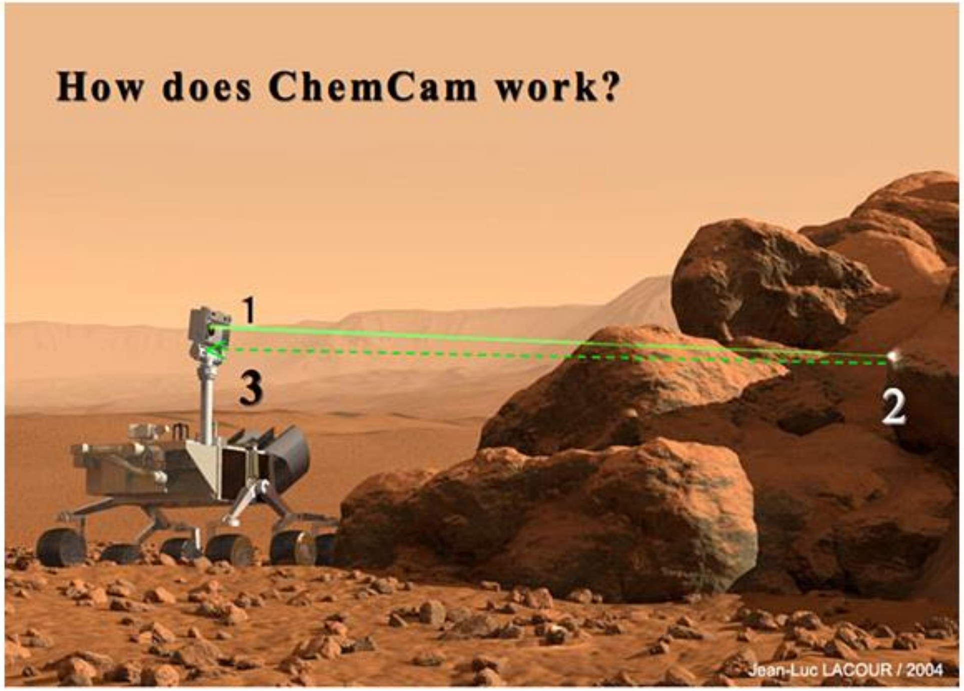


Figure 1. Credit: J-L. Lacour/CEA/French Space Agency (CNES)

<-------- Light from excited electrons in target rock entering the telescope.

1. ChemCam fires a laser (solid green line) in a series of pulses at a target (rock or soil). ChemCam's laser is powerful, but it is still invisible to the human eye. The green color of the laser depicted above is for illustrative purposes.

2. Electrons within the target become excited and emit light. The resulting flash of light is clearly visible to the human eye.

3. ChemCam receives this light (dashed green line) with a built-in telescope and it is sent down an optical fiber to the body of the rover. A spectrometer "reads" the light and identifies the types of atoms within the target. ChemCam will be able to distinguish different elements because each chemical element has its own unique "fingerprint." Sparks from different elements and rock types also have their own color (Figure 2). Knowing which atoms are present in the target rock tells ChemCam scientists its composition.

Why does ChemCam use a Laser? Previous spacecraft missions to Mars, like the Spirit and Opportunity rovers, had to undertake a rather laborious, and time-consuming, task of approaching a rock, brushing away dust, and, sometimes, grinding away outer layers of rock to take a measurement of a rock's true composition. To do all this, the rovers had to come into contact with the rock. When conducting a Mars mission, time is precious and efficiency is a necessity. It was not unheard of for Spirit and Opportunity to require two to three days to determine the composition of a rock. ChemCam's laser removes the need to touch the rock. It allows ChemCam to determine a rock's composition from a distance of up to 7 meters (~25 feet)! On average, the ChemCam team expects to take approximately one dozen compositional measurements of rocks per day.

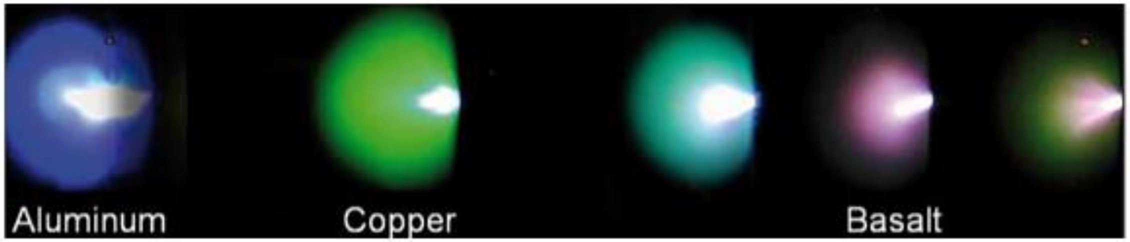
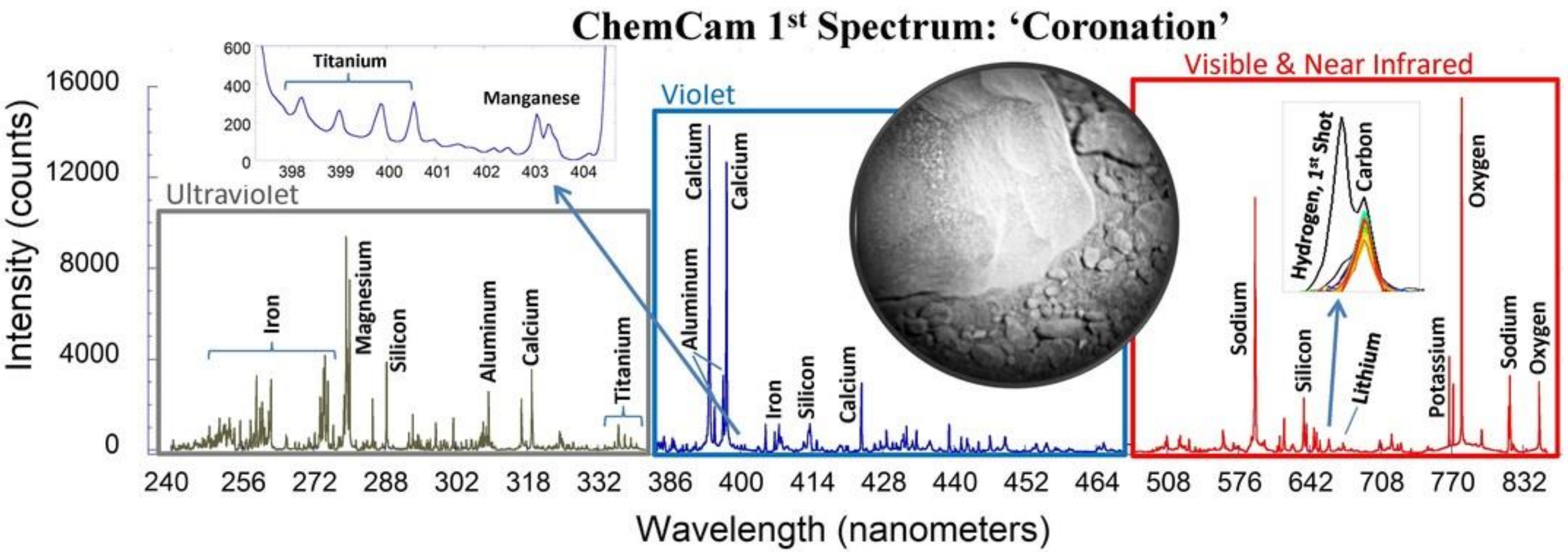


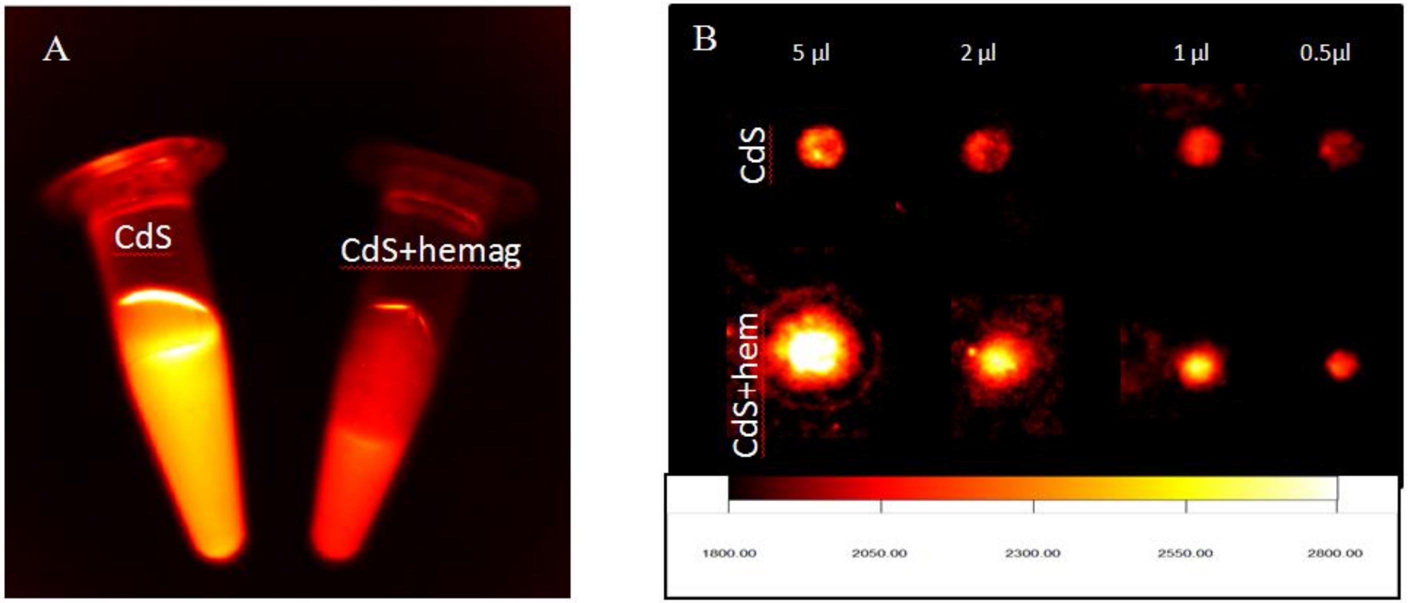
Figure 2. Different elements, such as aluminum and copper, and rock types like basalt, give off their own color of light when zapped by a laser. Credit: Sirven et al., JAAS



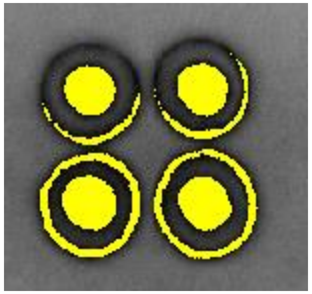
Credit: NASA/JPL-Caltech/LANL/CNES/IRAP

Spectroscopic identification of influenza

The method is based on nanoparticles preparation and applications on filter paper for a significant simple and fast evidence for the presence of viral protein, particularly influenza. Coupled quantum dots after their application to the surface of carriers improve their yield and thus represent an ideal tool for identifying the presence of the pathogen. Evaluation test is performed simply by UV light.

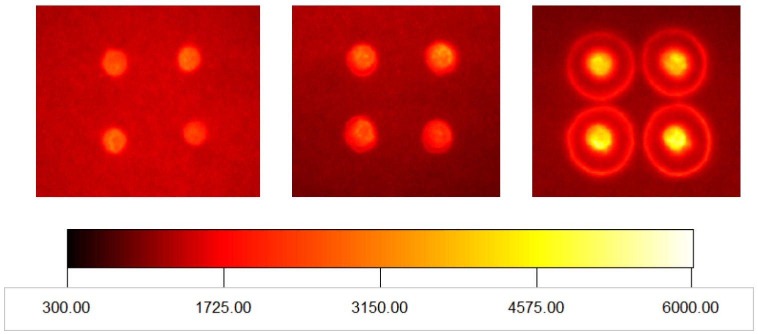


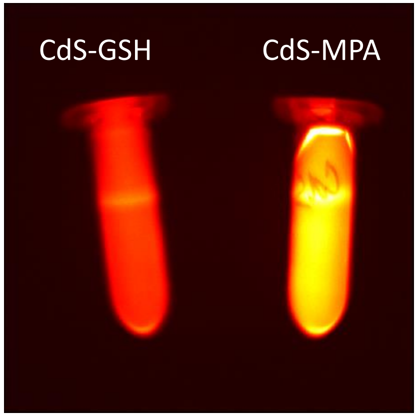
Paper as the surface…



CdS-GSH injected, different volumes

0.5 µl 1 µl 5µl





Fluorescence (In vivo Xtreme system by Carestream (Rochester, NY, USA), excitation wavelength 460 nm, emission wavelength 700 nm)

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Thank you for attention

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