Laser-Induced Breakdown Spectroscopy: From Terrestrial Carbon Sequestration to Roving Mars.

Laser-Induced Breakdown Spectroscopy (LIBS) is an elemental analysis technique that we currently use to probe a variety of terrestrial and Martian geological samples. LIBS involves focusing a high power laser onto the surface of a sample. The laser ablates material from the sample surface generating an expanding plasma containing electronically excited ions, atoms and small molecules. These excited species emit light as they relax to lower electronic states at wavelengths indicative of the elements present in the sample. Some of the emission is directed through a dispersive spectrometer and recorded with a charge coupled device (CCD). We have been using LIBS to probe soil core samples to develop a quantitative understanding of how carbon can be terrestrially sequestered. We are also building a LIBS instrument for ChemCam, an instrument selected for the NASA Mars Science Laboratory (MSL) Rover scheduled to launch in 2009. The ChemCam instrument will probe samples and determine the elemental composition up to nine meters from the rover mast. In this presentation, I will describe LIBS, the in situ and remote LIBS instrumentation development, and the quantitative analysis techniques used on geological samples.