Laser-Induced Breakdown Spectroscopy

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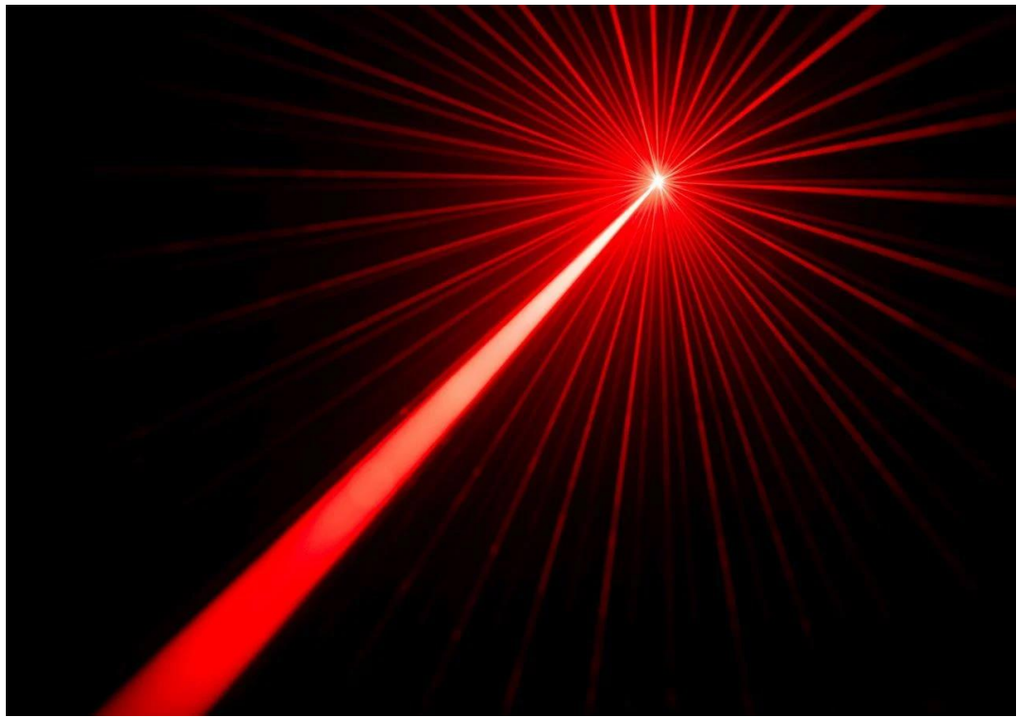


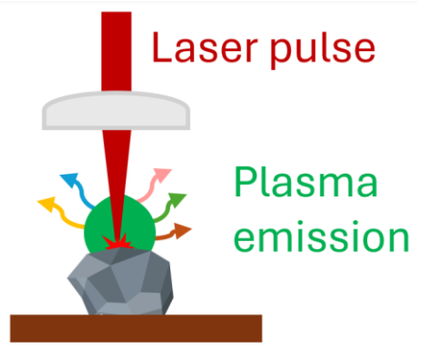
Goal of the project

@ Main goal

Build a system for determining the atomic composition of various materials using Laser-Induced Breakdown Spectroscopy (LIBS).

@ LIBS concept

Technique used to identify elements in a sample, by examining the light emitted from a plasma produced on its surface using a laser pulse.



Testbed

Find optimal experimental conditions

- Explore the potential of ultrashort laser pulses

Zemax

Optimize the design of a spectrometer

- Improve resolution

Time

Influence of the pulse duration

@ Advantages of ultrashort lasers

Ultrashort (fs to ps) laser pulses **reduce the thermal effects** on the sample:

- Minimal sample damage;
- Reduced variability between pulses;
- Improved spatial resolution;
- Increased signal-to-background ratio.

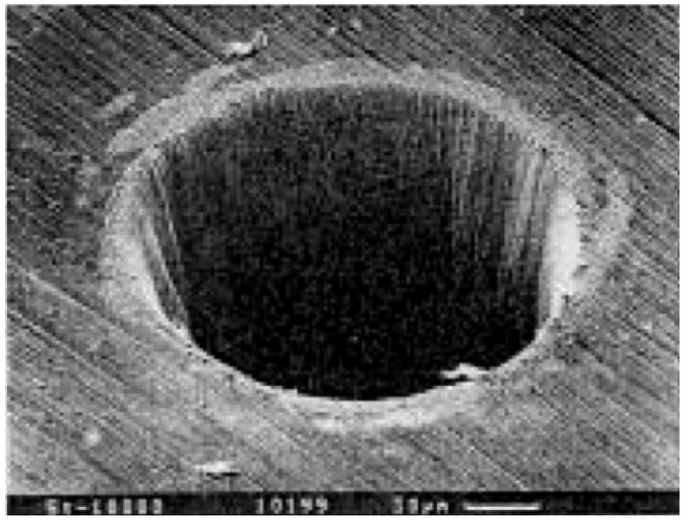
@ Drawbacks

Less robust plasma:

- Decreased signal.

Higher complexity and cost.

Nanosecond crater*



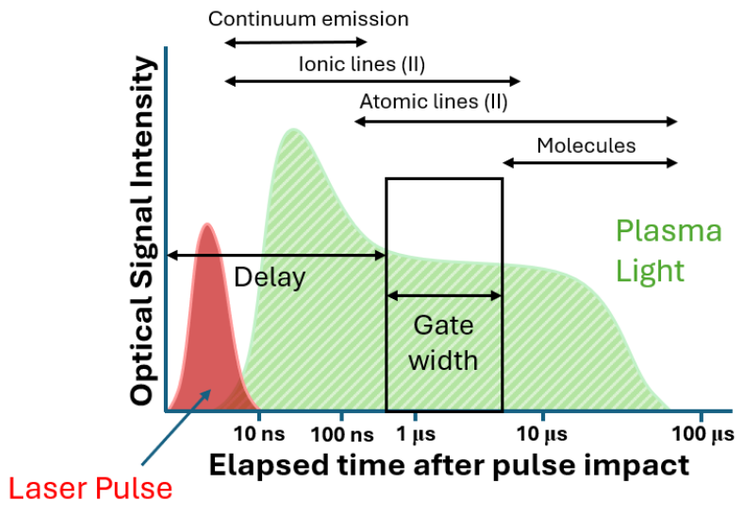
Femtosecond crater*

* Jagdish P Singh and Surya N Thakur. Laser-induced breakdown spectroscopy. Elsevier, 2020.

Optimal experimental conditions

@ Laser parameters

Vary pulse energy, the pulse duration and the wavelength



@ Detection window

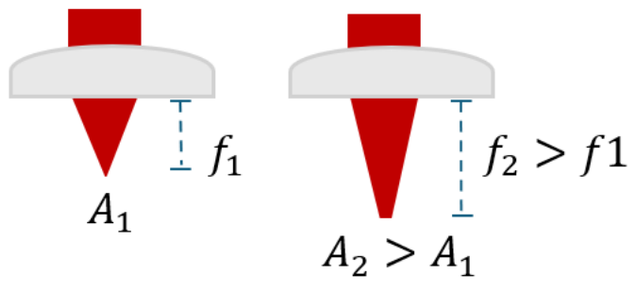
Control when signal is recorded:

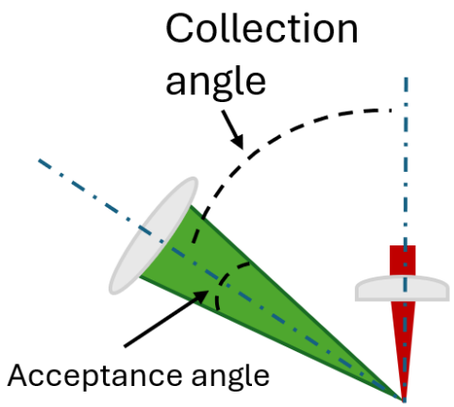
- Avoid the continuum background from the plasma.

@ Focusing optical system

Vary focal plane at the sample.

Vary interaction area.





@ Collection optical system

Vary collection angle.

Vary acceptance angle of the plasma light.