université de BORDEAUX

Job opportunity Sept. 2023 – Post-doc

Surface-enhanced laser-induced breakdown spectroscopy using 3D-printed microstructures

Laboratory: ICMCB - UMR 5026 CNRS – Université de Bordeaux – Bordeaux INP
Supervisor: Prof. Bruno Bousquet
1 September 2023 – 30 September 2024

LIBS (laser-induced breakdown spectroscopy) has demonstrated high potential in the frame of elemental analysis, especially because it enables to detect all the elements of the periodic table, including the light elements. But, despite of significant successes in elemental analysis, LIBS is still pointed out for its lack of sensitivity compared to other techniques. NELIBS (nanoparticle-enhanced LIBS) has thus been proposed to overcome this drawback and it has been demonstrated that the analytical performance NELIBS better than those of standard LIBS [1]. Moreover, considering that 3D-microstructures printed by direct laser writing have been recently exploited to make high efficiency laser-driven proton sources [2], the present project aims at experimentally and theoretically studying the enhancement of the LIBS signal resulting from the interaction of a laser beam with a 3D-microstructure printed on the surface of a material. This new approach will be called SELIBS for surface-enhanced LIBS.

The research program is based on three parts:

- Physical modelling of the electromagnetic wave interacting with the 3D-microstructure in order to describe the new conditions of plasma formation related to SELIBS.
- Fabrication of the 3D-microstructures by direct laser writing and characterization of topology.
- Experimental comparison of time-resolved SELIBS/LIBS spectra. Experimental data are expected to provide useful information about the temporal evolution of plasma temperature and electron density, as well as excitation/deexcitation and recombination processeses.

The candidate should be ideally awarded of a PhD in Physics, with good skills in electromagnetism, plasma and numerical modelling, together with good skills in optical experiments.

Extension of this one-year research program to a second year is expected if the related funding is obtained.

[1] M. Dell'Agio et al. Spectrochimica Acta Part B. Volume 148, October 2018, Pages 105-112.

[2] C. Qin et al. COMMUNICATIONS PHYSICS | https://doi.org/10.1038/s42005-022-00900-8