

PROPOSAL FOR A MASTER THESIS (Stage M2)

Temporal characterization of ultraviolet ultrashort laser pulses for material processing

Context:

In the field of laser processing of dielectric materials, transparent on the optical range, parameters such as laser pulse duration and laser wavelength are keys. In particular, femtosecond laser sources present the advantage of their high intensity, which allows inducing non-linear light absorption processes. These processes allow that part of the laser energy is deposited within any type of materials and potentially lead to transformations. However, because most femtosecond laser sources emit in the near infrared range, not much knowledge of the material responses is available in other spectral ranges.

Objectives of the master thesis:

In this project, it is proposed to explore the use of ultra-short pulses in the ultraviolet (UV) range for material processing, due to the interest of having a higher resolution due to its lower diffraction limit. This kind of pulses are accessible with current equipment of the LP3 laboratory. Two different tasks, but finally interconnected, are foreseen in the work plan.

The first is the design and assembly of an autocorrelator in this spectral range which will allow to temporarily characterize the pulses. In a first phase, the student will become familiar with the autocorrelation measurements using the equipment already available in other spectral ranges. The student will have the means to develop the strategy he or she considers appropriate for the needs of the project.

The second task will be to use the ultraviolet pulses to modify the surface of dielectric materials. In this project we intend to study the role of the pulse duration (ideally varying from 100 fs to 500 fs) when using UV-pulses, given the importance demonstrated in the infrared regime. Thus, for a rigorous comparison, the temporal characterization of the pulses with the developed autocorrelator will be essential.

Overall, the proposed work is eminently experimental; with a load of optical assembly and handling of concepts linked to ultra-fast optics and laser processing.

Location: LP3 laboratory, Campus de Luminy, 13009 Marseille, France

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Additional information:

- Working language: French or English
- Salary: 570€ / month in agreement with the French regulation.
- The proposed work is on the frame of the ERC project funded by the European Union *EXSEED - Extreme-Light Seeded Control of Ultrafast Laser Material Modifications*