**Post-doctoral position for 3 years at Laboratoire**

**d’Optique Appliquée (Palaiseau)**

**Development of an X-ray source based on intense laser-plasma interactions for non-destructive testing**

**Context :**

Non-destructive testing (NDT) allows to detect and measure defects of the object as well as study their evolution, potential danger in terms of security (avoiding critical accidents caused by the rupture), performance (identification of repair actions to be made during the maintenance) and quality (for example, controlling quality of welding). Fields of application are very diverse: engineering (nuclear, fuel, gas, hydraulic, wind, etc.); land transport (in particular rail transport); the navy; aeronautics; aerospace; defense and security... Among various NDT processes, X-ray based inspection has strong advantage because it offers the best performance, particularly in terms of spatial resolution for large thicknesses of materials.

LOA and its partner SourceLAB (a LOA spin-off) have been running a world-unique project since 2015 to develop a laser-plasma gas accelerator for the non-destructive testing of dense and thick matter. This project, supported by the DGA, aims to put the world's first high-energy X-ray tomography demonstrator into operation at LOA. This is a breakthrough technological innovation for the NDT market. The sources currently used (conventional particle accelerators and

radioactive sources) remain limited in terms of spatial resolution and X-ray energy. The interest of laser-plasma sources is multiple: (i) sub-millimeter resolution for identification of small defects, (ii) versatility and potential for production of various radiations (X-rays, electrons, neutrons) from the same machine, allowing identification of specific elements in the images.

**Subject of the post-doctorat :**

The general goal of the post-doctoral fellow is to develop the capacities and optimize the performance of the X-ray source in terms of stability, resolution and signal-to-noise ratio and to demonstrate its relevance for NDT. The candidate will be supervised by a research engineer and a CNRS researcher. He will be a part of a team dedicated to this project, which includes in addition to the post-doc, a laser engineer, a CDD engineer who will work on the experiments and a doctoral student who will take care of the numerical part.

The first objectives will be the qualification of the X-ray source, which has just been put into operation, and its optimization at 10 Hz for a sub-1mm resolution. Secondly, the goal will be to perform the tomography of a thick part with sub-mm resolution, as well as to experimentally optimize the X-ray source to approach a sub-100 micron resolution, based on the results, obtained using numerical modeling.

The final goal will be to perform the tomography of objects of interest with the optimized system. The thickness of the considered parts will depend on the results obtained previously.

**Required profile:**

The candidate is expected to have strong skills in experimental physics and use of complex systems. He/she should have experience in using ultra-intense lasers for laser-matter interaction experiments. Skills in electron accelerators, associated X-ray sources, or X-ray imaging would be a plus.

He/she is expected to have a taste ffor teamwork, experimental research and

development of instrumentation.

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