Contrats doctoraux 2026

Titre du projet de thèse : Single-shot ultrafast measurements, associating nonlinear optics and novel data analysis concepts

Directeur(s) de thèses : Christophe Szwaj (PhLAM) / Serge Bielawski (PhLAM)

Résumé du projet de thèse (en 20 lignes maximum) :

Recording complex light pulses in one shot, and in a « complete way » (i.e., including the enveloppe and carrier) has become possible recently. Research in the field has been motivated by a demand in accelerator development (in particular synchrotron radiation facilities and free-electron lasers), as well as in THz science, for the study of rapidly evolving phenomena. A collaboration started, on the subject, between the PhLAM (who is at the origin of several method in the field), and several accelerator facilities (DESY/European XFEL, the FELBE free-electron laser, and the Karlsruhe Institute of Technology), in the famework of an International Reserarch Program (IRP) for 2026-2031, and the PhD is proposed within this framework.

Research subject : The aim is to develop totally new photonic systems allowing to record complex light pulses in unexplored spectral domains (from THz to IR) in single-shot, and perform pioneer applications experiments using Free-Electron Lasers. Classical method relies on probing the signal of interest with a femtosecond laser pulse. However such techniques are still limited (in term of optical frequencies, big data stream management, etc.) that severely limits their application ranges.

The candidate will therefore have to significantly advance in the domain, by testing new ideas and concepts, and by using the knowledge and equipments (Free Electron Laser THz/IR sources, ultrafast cameras, etc.) of the IRP consortium. Depending on the candidate profile, the research will focus on more experimental and/or more numerical & theoretical aspects. So far, foreseen directions include the search for nonlinear materials allowing THz recording methods to be extended to the IR, advanced conceptual methods such as conpressed sensing, temporal holography, etc.

The PhD will be performed at PhLAM (Lille, France), in close collaboration German laboratory (DESY, HZDR, and KIT), where part of the experiments (e.g., on Free-Electron Lasers) will be made.

Date de recrutement envisagée : 01/09/2026

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Remarques/commentaires supplémentaires :