

Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / internship supervisor:	
Nom / name: Sarazin	Prénom/ first name : Xavier
Tél : 0164468587	Fax :
Courriel / mail: sarazin@lal.in2p3.fr	
Nom du Laboratoire / laboratory name:	
Code d'identification :LAL (UMR 8607)	Organisme : CNRS / Univ. Paris-Saclay
Site Internet / web site: https://www.lal.in2p3.fr/	
Adresse / address: LAL, Centre scientifique Orsay, Univ. Paris-Sud, Bat. 200, B.P.34, 91898 Orsay Cedex	
Lieu du stage / internship place: LAL, Orsay, France	

Titre du stage / internship title:
Modification of the vacuum refractive index with intense laser fields, with the DeLLight experiment
Résumé / summary
<p>The quantum electrodynamics theory (QED) predicts that the vacuum optical refractive index must be modified when the vacuum is stressed by intense electromagnetic fields. Thus the vacuum is expected to be a nonlinear optical medium, as other standard optical media, with modification of the Maxwell equations. This nonlinear change of the vacuum refractive index has never been observed experimentally. The goal of the DeLLight experiment (Deflection of Light by Light) is to observe this nonlinear effect by using ultra short and ultra intense laser pulses (2 J in 30 fs), delivered by the LASERIX facility, installed in the Laboratoire de l'Accélérateur Linéaire (LAL) at Paris-Saclay University (Orsay, France). The basic idea of the DeLLight experiment is to observe the variation of the vacuum optical index by measuring a refraction effect at macroscopic scale. The non-linear interaction of the pump pulse with a lower intensity probe pulse creates a vacuum index gradient which induces a refraction of the probe pulse, similar to a mirage effect in vacuum. The refraction of the probe, of the order of a few tenths of picoradian, is detected by using a Sagnac interferometer. First tests of a Sagnac interferometer with femtosecond pulses have been already developed in order to study the sensitivity of the experiment. Preliminary simulations show that QED predictions could be observed with the current LASERIX facility. The DeLLight project is funded by the ANR agency for 3 years (oct. 2018 – oct. 2021). Additional information can be found on the web page: https://groups.lal.in2p3.fr/projetdellight/publications/</p> <p>The goal of the internship is to validate the DeLLight experimental method (Sagnac interferometer) by measuring with the current DeLLight prototype the index gradient produced by the nonlinear Kerr effect in a low pressure gas with femtosecond pulses. The student will have to participate to the optical alignment of the setup, to perform measurements, to analyse the collected data (CCD image analysis) and to compare results of his measurements with numerical simulations of the DeLLight experiment.</p> <p>The DeLLight research group is composed of two CNRS research directors in LAL (François Couchot and Xavier Sarazin) who are working in collaboration with the LASERIX facility team (3 researchers, 2 laser ingeniors and 1 technician). Also a 2-years post-doc, funded by ANR, will work on the project from march 2019 until march 2021. Ingeniors from LAL in mechanics and electronics/acquisition will be also involved in the project.</p>
Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Oui / Yes			
Si oui, financement de thèse envisagé/ financial support for the PhD: Ecole doctorale PHENIX Paris-Saclay			
Lumière, Matière, Interactions	X	Lasers, Optique, Matière	X

Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>