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*:	DELAYE	Prénom/ *first name* :	Philippe
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Nom du Laboratoire / *laboratory name*: Laboratoire Charles Fabry (LCF)

Code d'identification : UMR 8501 Organisme : CNRS / IOGS

Site Internet / *web site*: www.institutoptique.fr

Adresse / *address:* 2 Avenue Augustin Fresnel, 91127 Palaiseau Cedex

Lieu du stage / *internship place*: Palaiseau

Titre du stage / *internship title*: **Stimulated emission tomography for characterization of photon pairs**

Tomographie d'émission stimulée pour la caractérisation de paires de photons

Résumé / *summary*

Entangled photon pair sources are a basic device of quantum communications systems. One common way to realize these sources is to use nonlinear mechanisms (spontaneous parametric down conversion and spontaneous four wave mixing) in waveguides. In such mechanisms one or two pump photons interact with the nonlinear media to create a pair of signal and idler photons that are correlated and even entangled. The properties of emitted pairs are usually characterized using single photon detectors coupled to time correlators, that measure the simultaneous emission of the two photons of the pairs. As these experiments operate in the spontaneous regime of pure single photon emission, the number of emitted photons is small leading to time consuming experiments which are delicate to implement, especially when the emission spectrum has to be characterized.

That's why some years ago a new type of experimental set-up was proposed to characterize such source: Stimulated Emission Tomography [1], which consist in seeding the emission of the pairs of photons by a tunable signal sources and measuring the stimulated idler photons simultaneously created with an optical spectrum analyzer. When properly operated such a set-up allow to characterize quantum properties of the emission spectrum of the source of pairs of photons, with higher flux of generated pairs that allow to use classical measurement techniques [2], and thus more easily and rapidly.

The aim of the proposed internship will be to implement such a Stimulated Emission Tomography experiment to characterize the source of pairs of photons developed in the Nonlinear Material and application (MANOLIA) group. We study several architectures of sources based on liquid filled hollow core photonic crystal fibers or nanofibers, the development of such an experimental technique will allow a more rapid characterization of the sources and thus opening the way for an easier and more efficient optimization of the performances of such sources. Using one of the fibered sources developed in the group, the student will realize the experimental set-up and characterize it, by comparing the spectrum observed in the stimulated regime, with the response obtained in the spontaneous regime with single photon detectors. Theoretical models will also be developed to understand the obtained results and strengthen the comparison. Based on these results, the potential of the Stimulated Emission Tomography technique will be evaluated in view of its implementation on the different sources developed by the MANOLIA group.

[1] M. Liscidini, J.E. Sipe, "*Stimulated emission tomography*". Phys. Rev. Lett. **111**, 193602 (2013)

[2] M. Cordier et al. "*Active engineering of four-wave mixing spectral entanglement in hollow-core fibers*" ARXIV 1807.11402.

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : Oui**

Si oui, financement de thèse envisagé/ *financial support for the PhD***: EDOM, DGA, …**

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**