Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 7 novembre 2013

Responsable du stage / *internship supervisor*:			
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Nom du Laboratoire / *laboratory name*: Laboratoire Traitement et Communication de l'information			
Code d'identification : UMR 5141		Organisme : Télécom ParisTech	

Site Internet / *web site*: http://iq.telecom-paristech.fr/

Adresse / *address:* 46 rue Barrault 75013 Paris

Lieu du stage / *internship place*: 46 rue Barrault 75013 Paris

Titre du stage / *internship title*: **Quantum cryptography with continuous variables**

Résumé / *summary*

The field of quantum information processing and communications offers the prospect of better and more secure future communications. One of its main applications is quantum key distribution (QKD), which allows two parties to share a secret key that can be subsequently used for message exchange, even in the presence of eavesdroppers with unlimited power. This is impossible by classical means. In the recent years, QKD has been the subject of great progress that has led to the development of commercial systems and to the implementation of quantum cryptography telecommunication networks.

A quantum key distribution protocol that is particularly appealing because it requires only standard telecommunication components and allows high-rate and long-distance communication is based on continuous variables of the electromagnetic field. In particular, it is based on the modulation of coherent light emitted by a laser and on homodyne detection techniques. It has been implemented in an all-fiber system at telecommunication wavelength, which is optimal for long-distance communications in optical networks, and has been used in multiple high-performance experiments in our lab, which leads the research in the field [Jouguet et al, Nature Photonics 2013].

Despite these promising developments, practical QKD implementations are subject to attacks that exploit channels carrying information present in the system that may not be taken into account in the security proofs (due, for instance, to reflections from optical components, use of other wavelengths etc). One way that has been proposed recently to overcome this problem relies on the so-called measurement-device-independent techniques. Our goal here will be to experimentally adapt these techniques to continuous variables in order to enhance the practical security of our system. This will require developing a heterodyne detector and putting in place a system providing a common phase reference between the emitter and the receiver.

The intern student will benefit from close relationships with the startup company SeQureNet, which commercializes a continuous-variable QKD system and will develop the software for implementing the measurement-device-independent protocol. She or he will also have the opportunity to be involved in adjacent ongoing activities in our group related to the development of an integrated continuous-variable QKD setup using silicon photonics.

The internship is primarily of experimental nature and may lead to a PhD in this or a closely related subject starting from Fall 2014 subject to appropriate funding. The subject requires knowledge in optics, photonics, and quantum mechanics.

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

Si oui, financement de thèse envisagé/ *financial support for the PhD***: EDITE, Institut Mines/Télécom, Université Paris-Saclay, Région lle-de-France, CNRS**

Lasers, Optique, Matière	x	Lumière, Matière : Mesures Extrêmes	x
Plasmas : de l'espace au laboratoire			

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