Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 8 octobre 2018

Responsable du stage / *internship supervisor*:

Nom / *name*:	Huard	Prénom/ *first name* :	Benjamin
Tél :	04 72 72 85 59	Fax :	
Courriel / *mail*:	benjamin.huard@ens-lyon.fr		

Nom du Laboratoire / *laboratory name*:

Code d'identification : UMR 5672 Organisme : ENS de Lyon
Site Internet / *web site*: www.physinfo.fr
Adresse / *address:* 46 allée d'Italie, 69007 Lyon, France
Lieu du stage / *internship place*: Ecole Normale Supérieure de Lyon, France

Titre du stage / *internship title*: **Photocounter for propagating microwaves with superconducting circuits**

Subject: The intern will work within the framework of the QMiCS project (Quantum Technologies Flagship) whose aim is to enable quantum microwave communication and sensing. Our group has recently designed a superconducting circuit that enables several experiments and applications in quantum information processing. The student will demonstrate these applications using the current working device and further improve the circuit to realize other experiments.

During the internship, the student will realize a photocounter for propagating microwave modes that can resolve the photon number and does not destroy the system (quantum non demolition). If the internship goes well, the student will be offered a PhD position in order to work on the follow up of this project. First, she/he will demonstrate remote state preparation using the current device. Then, using two similar devices, she/he will demonstrate the teleportation of a quantum state of microwave light from one chip to another. If successful, we will reproduce this experiment with our collaborators in Garching, where we will realize teleportation between two dilution refrigerators in the microwave domain. Another part of the project will consists in benefiting from quantum illumination in order to improve microwave detection (quantum radar) with only a slight modification of our device. Finally, another variation of the same device will enable us to demonstrate quantum error correction on a qubit that is made of Schrödinger cat states of a microwave mode. In particular, we will demonstrate the protection against bit flip, which is currently missing.

Activities: The student will be in charge of performing experiments in close collaboration with a postdoctoral fellow. The activities involve superconducting circuit fabrication, microwave engineering, quantum limited measurements in the microwave domain, temporal shaping and analysis of microwave pulses, numerical simulations, data post-processing and manuscript writing. The position requires a sound knowledge of quantum information, a taste for both experiment and theory and a positive attitude to working in a team.

Location: Lyon is the second largest French city and is famous for its excellent quality of life, inexpensive housing and bars, restaurants, vibrant cultural life and close proximity to the Alpes and 2h by train distance to Paris and the Mediterranean sea. Travels to the experimental partners of the EU project in Finland and Germany should be expected.

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*: **no funding yet**

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