Proposition de stage
Master 2ème année
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Date de la proposition : 16 septembre 2024

Responsable du stage :

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Nom du Laboratoire : ONE group, Institut Quantique

Etablissement : Université de Sherbrooke Code d'identification : IRL CNRS-Sherbrooke

Site Internet : https://www.optonanoelectro.com/ https://www.usherbrooke.ca/iq/

Adresse : Sherbrooke, Québec, Canada

Lieu du stage : Institut quantique (IQ) de l'Université de Sherbrooke

Montant du financement de stage : 2 000 $ / mois + déplacement France-Sherbrooke remboursé

Titre du stage : Development of Single-photon detectors based on high-Tc superconductors

CONTEXT

High-temperature (high-Tc) superconductors are one of the leading candidates for the implementation of practical quantum detectors. In this context, the company **Ambature,Inc** which is a world leader in a-axis superconducting technology, is collaborating with the Université de Sherbrooke to push back the frontiers **of superconducting electronics and optoelectronics** performance by designing a new generation of high-Tc superconducting films and devising processes to implement them. These quantum detectors rely on extreme control of the growth of high-quality thin films, and the usual method for their production is not suited for industrial processes.

INTERSHIP PROJECT

The aim of this internship project is **to advance the development of nanowire single-photon detectors (SNSPDs) based on cuprates high-Tc superconducting films.** These novel sensing devices will take advantage of the high critical magnetic field and temperature of YBCO to expand their capabilities and performance. The successful candidate will (i) Fabricate arrays of high-quality nanowires made of c-axis YBCO thin films. The YBCO film will be electrically characterized in a Physical property measurement system (PPMS). (ii) Characterize the optoelectronic response of these nanowires and demonstrate single-photon detection (SPD) in YBCO. The photodetection performance (efficiency, response time, sensitivity) of the nanowires will be measured using a cryogenic optical setup. (iii) Explore the potential of a-axis YBCO thin films for single-photon detection. The aim is to understand the effect that the crystal axis of the nanowire in order to maximize the performance of YBCO nanowires for SNSPD applications.

WORK ENVIRONMENT

This internship will be supervised by UdeS experts in growth, and characterization of new quantum materials, Profs Mathieu Massicotte and Patrick Fournier. The work will be done mainly at the Institut quantique (IQ) and occasionally at the Interdisciplinary Institute for Technological Innovation (3IT). 3IT is a unique institute in Canada, specializing in the research and development of innovative technologies for energy, electronics, robotics and health. It holds a state-of-the art cleanroom with a complete micro-nanofabrication infrastructure. IQ is a new research institute equipped with cutting-edge research tools, that brings together world-renowned experts in quantum science and engineering. The PhD student will thus

benefit from a highly interdisciplinary research environment that combines students, technicians and professors working together to develop the technologies of the future.

PhD THESIS

This internship can lead to a PhD thesis.

Ce stage pourra-t-il se prolonger en thèse ? OUI

Si oui, financement de thèse envisagé ou acquis ?
Financement acquis pour une thèse à Sherbrooke.