

Advanced materials and industrial processes for superconducting qubits

Record number : OPR-522

Overview

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ADMINISTRATIVE UNIT(S)

Faculty of Engineering
Department of Electrical and Computer
Engineering
Interdisciplinary Institute for Technological
Innovation
Institut quantique

LEVEL(S)

Postdoctoral Fellowship

LOCATION(S)

3IT - Institut interdisciplinaire d'innovation
technologique
Institut Quantique Sherbrooke

Project Description

You

We are looking for a creative and talented individual that will lead at Institut quantique (IQ) the development and technological transfer of nanofabrication processes of scalable superconducting qubits for quantum computing. For this position, the fellow will be at the heart of an international academic and industrial consortium working in a multidisciplinary approach to enable industrial-grade quantum computing technologies. Candidates with a solid expertise in experimental quantum application and/or nanofabrication are encouraged to apply. Applicants should have an excellent publication record and/or a strong potential for technological transfer of their research results, as required by our Postdoctoral Fellowships program. The fellow will need to have completed his or her PhD in the 4 years prior to starting the position.

Us

The Institut quantique (IQ) is a research institute that focuses on quantum science and technologies. It is part of the Chaîne d'Innovation Intégrée of Université de Sherbrooke (UdeS), along with the Institut Interdisciplinaire d'Innovation Technologique (3IT) and the Centre de Collaboration MiQro Innovation (C2MI). IQ brings together experts in quantum materials, quantum information and quantum engineering with the aim of performing top-quality fundamental research and developing the quantum technologies of the future. Our institute includes state-of-the-art experimental research infrastructure, maintained by a team of skilled technicians and research associates.

The project

The fellow will be working in an academic-industrial research consortium regrouping IQ, 3IT, Nord Quantique – a quantum computing startup, the University of Glasgow and Oxford Instruments Nanotechnology Tools Ltd (UK). The research project aims to take advantage of recent advances in micro-nanofabrication to pave the way for the development of large-scale silicon-based quantum devices for computing applications. In that scope, superconducting qubits are considered as the leading approach to quantum computing and quantum devices. Enhancing the qubit coherence time is key to progress with more reliable devices and enable error-correction protocols in superconducting-based quantum computers. It has been recognized that superconducting film properties and processes methods plays a key role in improving coherence times by significant factors. We thus aim to develop industry-compatible and scalable qubits based on NbN superconducting circuitry and aluminum Josephson junction. Hence, high-quality nano-patterning, thin film deposition and etching processes

on silicon have to be developed and optimized. Using silicon as a substrate would allow to fabricate scalable quantum devices using variants of mature CMOS manufacturing processes, which are currently used to fabricate classical computer chips. There is still work to do to develop processes and structures that can bridge the gap between high performance qubits and large-scale integration.

Leveraging the state-of-the-art clean room at 3IT and the leading-edge qubit characterization installations of IQ, the fellow will be responsible to design, fabricate and demonstrate high-quality superconducting circuits on silicon using industry-compatible manufacturing processes. The Sherbrooke-based startup Nord Quantique will provide the technological means to prototype superconducting quantum devices with industrial standards. The fellow will thus work in a stimulating interdisciplinary research environment, which will offer the opportunity to overcome technology blocks currently hindering the fabrication of a truly scalable quantum computer based on superconducting qubits on silicon. The fellow will benefit from (i) the expertise of Prof. Michel Pioro-Ladrière's group in design and characterization of solid-state quantum devices; (ii) the expertise of Prof. Dominique Drouin's group in nanofabrication at 3IT and its clean room equipped with state-of-the-art tools such as RAITH electron beam writer and Plasma Etcher Oxford Cobra; (iii) the expertise of Nord Quantique in design and manufacturing of scalable of superconducting qubit platforms; (iv) the industrial-grade atomic layer deposition (ALD) processes of Oxford Instruments Nanotechnology Tools Ltd.

The fellowship

- Highly competitive salaries are offered
- Discretionary research and travel funds are included
- Courses in languages, entrepreneurship and intellectual property are available at the Université de Sherbrooke
- No teaching is required but involvement in summer schools and workshops is encouraged

How to apply

- Submit a CV, 2 recommendation letters and a short description of your research interests and proposed research program on next-generation superconducting qubits (maximum 2 pages).
- Applications and letters should be sent to Yann.Beilliard@USherbrooke.ca

Discipline(s) by sector

Natural Sciences and Engineering

Electrical Engineering and Electronic Engineering

Funding offered

Yes

Partner(s)

Nord Quantique, Oxford Instruments Nanotechnology Tools Ltd (UK)

The last update was on 16 February 2021. The University reserves the right to modify its projects without notice.