

Experimental Quantum Physicist

A 2-year post-doctoral research position is available at the “LATEQS” laboratory of CEA – Grenoble ^[1]

About the job

We are looking for a highly motivated postdoctoral researcher to join our ongoing research efforts on advanced microwave superconducting devices based on NbN, a highly disordered superconductor. The position is available immediately, with a flexible start date, for a two-year contract and possible extension upon mutual agreement.

Project description

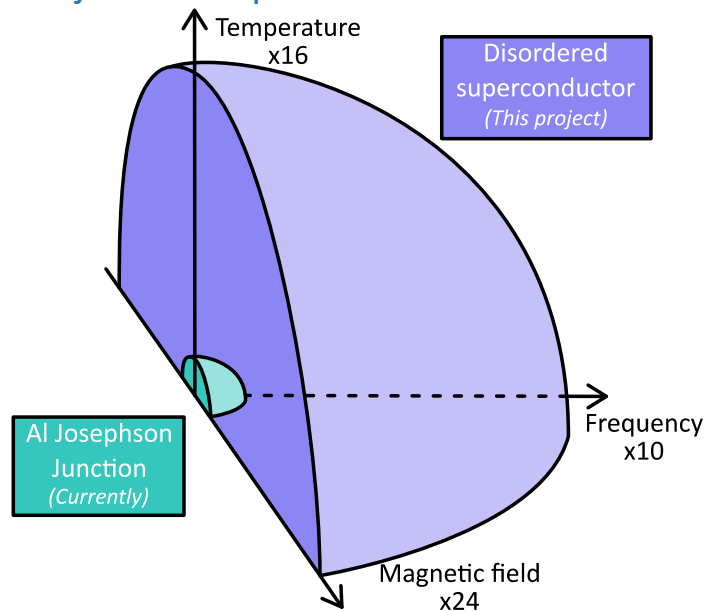


Figure 1: Schematics of the working range improvement as function of magnetic field, frequency and temperature for lossless microwave components made from the disordered superconductors NbN compared to those based on aluminum Josephson Junctions.

During the last decades, superconducting quantum circuits have shown impressive results fueled by the so-called circuit quantum electro dynamics (cQED) architecture where the quantum signal is carried by photons at microwave frequencies. cQED experiments often rely on the technology of aluminum Josephson Junctions (JJ's) which can be understood as non-linear inductors. The control of the non-linearity is at the heart of superconducting qubits, as shown *e.g.* by the emblematic “Transmon” qubit. Alongside superconducting qubits, this non-linearity allowed the development of numerous non-linear lossless microwave components (tunable resonators and couplers, quantum limited amplifiers (QLA), ...) which became essential tools for state-of-the-art cQED experiments. Yet, as a consequence of being built upon aluminum

JJ's, all of these components are restricted to low magnetic fields $\lesssim 250\text{mT}$, temperatures $\lesssim 250\text{mK}$ and frequencies $\lesssim 10\text{GHz}$, strongly limiting the range of their application.

As illustrated in Fig.1, the use of disordered superconductors with a large superconducting gap such as NbN would alleviate these constraints by at least one order of magnitude ^[3].

The goal of the project is to demonstrate that the non-linearity of a large gap disordered superconductor, such as NbN, can advantageously replace Al JJ's to provide non-linear and lossless microwave components for spin-qubit experiments. A first project goal is the demonstration of a parametric amplifier based on NbN working under high magnetic field.

[1] LATEQS: <https://www.lateqs.fr/>

[2] PTA: <http://pta-grenoble.com/fr/>

[3] C. Yu, *et. al*, *Nat. Nanotechnol.*, **18**, 741-756 (2023)



Your tasks

- Fabricate ^[2] and measure your own microwave devices
- Supervise students working with NbN ^[3]
- Develop a strong synergy with other research project of the “LATEQS” group ^[1]

Requirements

- An experimental PhD or postdoc in the field of superconducting circuit
- Skills in cryogenics and high frequency measurements
- Fabricated superconducting circuits in a cleanroom

Bonus if you have

- A strong background in Python
- Knowledge of the theory of superconducting circuits
- Strong team spirit

Environment:

Our research group, hosted at CEA Grenoble, is part of the French national “Plan Quantique” and closely collaborates with in-house theory colleagues. The lab is located on a big scientific campus gathering not only CEA with its strong microelectronics research (300 mm clean room) but also other major scientific institutions such as CNRS (Institut Néel), ERSF (synchrotron), ILL (neutron source) and many high-tech companies as well as the University Grenoble Alpes. Grenoble is a vibrant city offering many cultural activities, lovely bars and delicious restaurants. Located in the heart of the Alps it is the paradise for all outdoor enthusiasts.

The team itself hosts ~10 researchers supervising ~10 students and a few postdocs.

Benefits

- Expected yearly gross salary: 40,800€ to 46,800€ depending of experience
(Median French gross salary ~30,000€)
- 25 vacation days (French law) + 24 RTT (flexible time off)
- Half of transportation cost coverage (French law)
- Contribution to sports, artistic & cultural activities

How to apply

Application with a short statement of your research interest and how it relates to this project, including CV, publication list and preferentially two reference letters should be sent to: etienne.dumur@cea.fr

[1] LATEQS: <https://www.lateqs.fr/>

[2] PTA: <http://pta-grenoble.com/fr/>

[3] C. Yu, *et. al*, *Nat. Nanotechnol.*, **18**, 741-756 (2023)