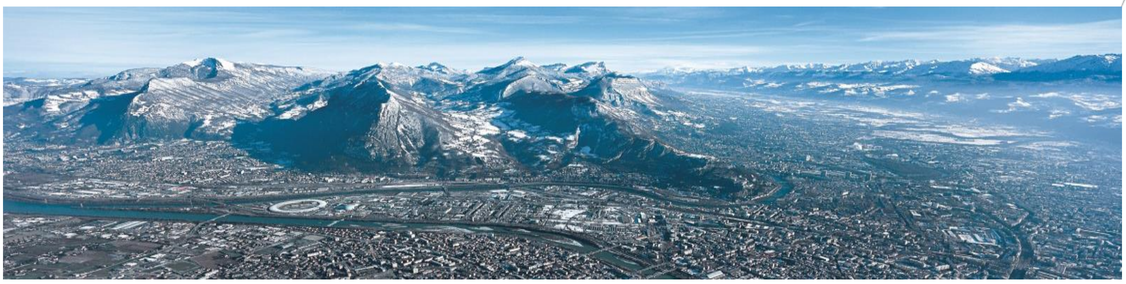

Master /PhD thesis Project

Lossless resilient microwave components based on disordered superconductors

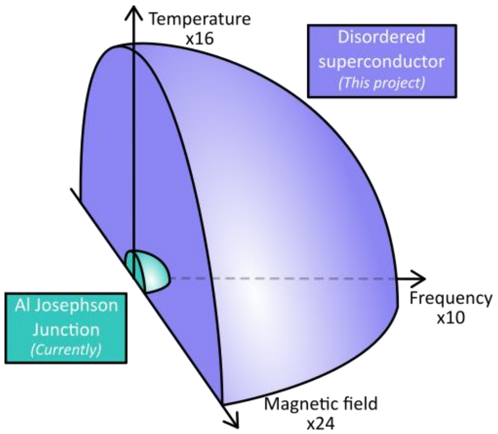

Fig. 1: Schematics of the working range improvement as function of magnetic field, frequency and temperature for lossless microwave components made from the disordered superconductors NbN compared to those based on aluminum Josephson Junctions.

During the last decades, superconducting quantum circuits have shown impressive results fueled by the so-called circuit Quantum ElectroDynamics (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. This non-linearity allowed the development of numerous non-linear lossless microwave components (tunable resonators [1], low noise amplifier [2] ...) 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 field $\lesssim$ 250mT, temperature $\lesssim$ 250mK and frequency $\lesssim$ 10 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 one order of magnitude.

The goal of the project is to demonstrate that the non-linearity of large gap disordered superconductors, here NbN, can advantageously replace Al JJ's in order to offer lossless microwave components to research communities working at large magnetic field [3] $\sim$ 6 T, temperature $\sim$ 4 K and frequency $\sim$ 100 GHz.

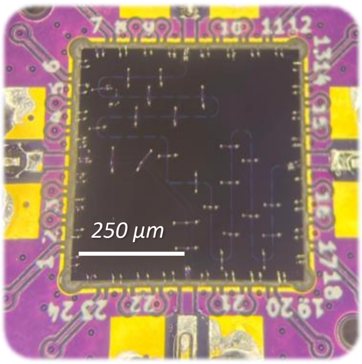

Fig. 2: Home-made PCB with a NbN circuit with two photonic–crystals, top-right, defining a microwave resonator, center, itself coupled to a feedline, bottom-left.

During the master project, you will collaborate on a daily basis with our entire team (www.lateqs.fr) with 30 people including 15 Ph.D. You will participate to the development of new samples that includes design, theory and nano-fabrication performed in our cleanroom facility. You will also learn to cool down samples to reach cryogenic temperatures and you will perform measurements using state-of-the-art DC and RF techniques.

This master project may continue as a PhD thesis.

APPLY NOW!

To apply for this position, send your application (including CV) by e-mail to:
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[1] Appl. Phys. Lett. 92, 203501, **2008**
[2] Appl. Phys. Lett. 118, 142601, **2021**
[3] Appl. Phys. Lett. 118, 054001, **2021**

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