Institut de Recherche Interdisciplinaire de Grenoble

Pheliqs Quantum Physics & Engineering

Master /PhD thesis Project

High quality superconducting resonators arrays for spin circuit quantum electrodynamics

Measurement box containing a chip with superconducting resonators

Quantum computing is currently pushing further the frontier of information technology. Among other fields, solid-state hole-spin qubits are a promising research area. Recently, we reached the strong-coupling regime between the spin of a single hole trapped inside the channel of a silicon transistor and a single microwave photon enclosed in a superconducting resonator [1]. This milestone paves the way to Circuit Quantum Electrodynamics (cQED) type experiments [2] where we leverage such large spin-photon couplings to perform advance quantum information experiments.

The aim of this project is to advance the field of spin cQED by fabricating superconducting resonator arrays made of superconducting thin films of NbN [3,4]. These arrays should allow to study the interaction between one spin and several microwave photonic modes, a first step toward quantum simulation. During the master project, you will participate to the development of new high quality resonators. This includes their design, modelling and their nanofabrication in our cleanroom facility as well as their characterization at cryogenic temperatures to reach the quantum mechanical ground state. You will also learn how to use high frequency measurement electronics as well as modern data acquisition and analysis software packages.

Our research team is part of the French national “Plan Quantique” and is a founder member of the “Grenoble Quantum Silicon” group. We also strongly collaborate with the L-SIM group for theoretical support.

During the master project, you will collaborate on a daily basis with a lively team of three permanent researchers and three PhDs and take part in an exciting adventure to bring spin qubits to a new level. This master project may continue as a PhD thesis.

[1] Nat. Nano 18, 741, **2023**
[2] Phys. Rev. A 75, 032329, **2007**
[3] Appl. Phys. Lett. 118, 054001, **2021**
[4] arXiv:2403.18150**, 2024**

APPLY NOW!

To apply for this position, send your application (including CV) by e-mail to: romain.maurand@cea.fr & simon.zihlmann@cea.fr

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