NÉEL INSTITUTE Grenoble

Topic for Master 2 internship – Academic year 2021-2022

3D Superconducting Interconnects for Quantum Applications.

General Scope :

As part of Quantum Silicon Grenoble project, teams at CEA-LETI, CEA-IRIG and Néel Institute aim at building a quantum accelerator with silicon spin quantum bits (qubits). Compatible with large-scale production, existing integration processes on Si are a real advantage for the scalability of these qubits. However, the extreme qubit operating conditions (cryogenic temperatures ≤1K, high frequencies in the range of a few GHz, high signal density) require the development of adapted technological building blocks as well as multi-chip module platforms (see Fig.1), designed to bring control electronics circuits closer to the qubits in the cryostat.

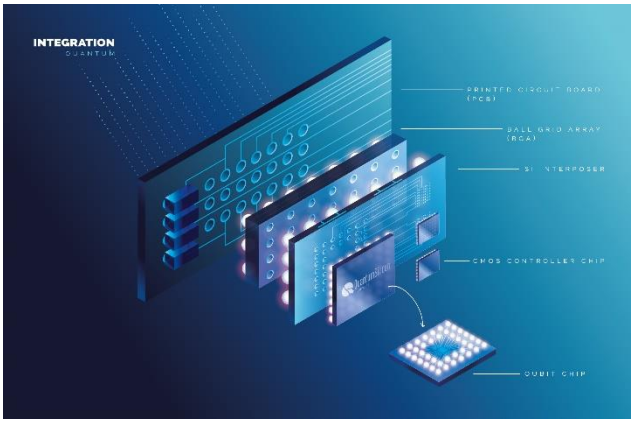

Figure 1- Example of multi-chip platform developed at Quantum Silicon Grenoble (credit: CEA).

Research topic and facilities available:
The integration of superconductors is promising to optimize the coupling between the qubits and their control electronics. Indeed, their vanishing resistance at low temperatures adds flexibility to the design and sizing of the interconnects (e.g. microbumps or routing tracks) located between the qubits and control electronics circuits. The low thermal conductivity of superconductors can be used to protect the qubits from the heat generated by the control electronics circuits integrated close-by. Finally, the low dispersion of superconductors favors high frequency signal transmission needed to encode and read the information stored in the qubits. This internship will focus on the fabrication (in CEA-LETI clean-room facilities) and characterization (electrical, structural and thermal) of superconducting interconnects.

Possible collaboration and networking:
This work is part of a large collaborative effort to develop and push the technology of spin qubit in silicon and investigate its potential scalability. The candidate will work in a consortium made of CEA-LETI, CEA-IRIG and Néel Institute researchers, at the interface between the integration, the characterization and the design teams.

Required skills:
We are looking for a motivated student, with a background in microelectronics, nanofabrication and/or condensed matter physics.

Possible extension as a PhD : Yes
Starting date: in between January and April 2022

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