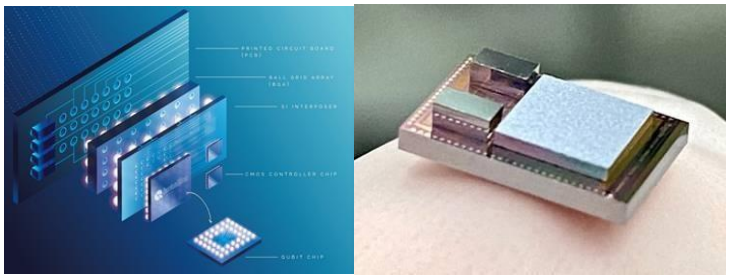
NÉEL INSTITUTE Grenoble

Post Doc position– Academic year 2021-2022

Semiconductor quantum devices controlled with cryo-electronic circuits in high cooling power cryogenic system

Context: The scaling of quantum nanoprocessors requires the development of integrated electronics as close as possible of the quantum chips. In this context, electron spin qubits in semiconductors have been identified as a promising platform due to both its long coherence time and the possibility to leverage the well-established fabrication of microelectronic foundries for Si based quantum devices. Their direct compatibility with CMOS electronics enables potentially to co-integrate in a compact manner quantum devices and control electronics. This is the purpose of the workplan to investigate such interface between control and quantum systems. It will be important for the integration of larger and larger quantum systems but also for extracting statistical information on the qubit properties.

Objectives and means available: The aim of this project is to measure and characterize a spin qubit quantum device integrated with a CryoCMOS control system. As shown on the picture, control and quantum chips will be integrated using tridimensional architecture. The experiment will take place in a dedicated cryostat designed and developed at the Néel institute to deliver enough cooling power to maintain the quantum device at low temperatures while being operated with on-chip cryoelectronics. The candidate will be first responsible for characterizing all the different circuits individually in the new cryogenic environments. She/He finally will test and measure the integrated circuits. At all steps, she/he will benefit from the extensive knowledge of the Néel group and the CEA-LETI in the design and characterization of spin qubit devices and CryoCMOS circuits.



Schematic and optical picture of CryoCMOS circuits hybridized with a quantum chip on a micro-fabricated interposer. Copyright CEA-LETI

Interactions and collaborations: This work is part of a large collaborative effort between the CEA-IRIG, CEA-LETI and CNRS-Institut Néel to develop and push the technology of spin qubit in silicon and investigate its potential scalability. Therefore, the candidate will work in close collaboration with the LETI's integration and characterization team which is developing fast characterization procedure for the cryo-prober, the electronic team of the CEA-LETI designing the CryoCMOS circuits and the QUANTECA team and cryogeny department of the Néel institute in charge of developing the dedicated cryostat.

Skills and training: It is mandatory to have presented a PhD thesis defense in the following topics: condensed matter, micro–nanotechnologies or CMOS device design/fabrication. It is essential to have good knowledge of semiconductor devices, in particular on the physics of quantum dot and spin as well as being at ease with measurement automation and data analysis. Good written and spoken English skills are required, as well as communication skills, ability of writing reports/articles, and team work.

Foreseen start for the position: immediate
Salary : from 2050 to 2850 euros after tax, depending on experience
Duration : 24 months

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