



Master Thesis Project

Spin and microwave photon speaking together

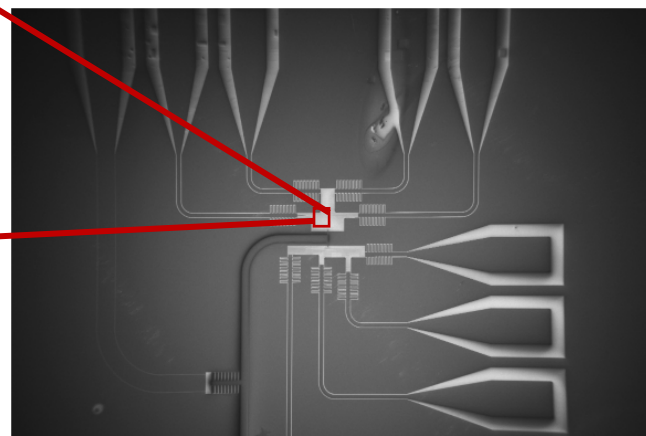
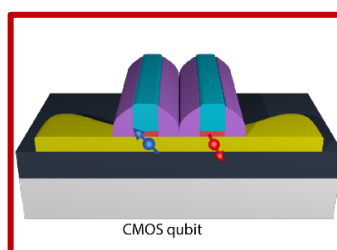
Quantum computing is a major new frontier in information technology with the potential for disruptive impact. Solid state implementations of qubits, especially spin qubits [1,2], are among the most promising ones. Diverting silicon technology is the approach explored in our Lab. The working principle of the qubit is to trap a spin inside the channel of a silicon transistor and to manipulate this spin via microwave signal applied on the gate electrode [3].

To go a step towards computing architecture, one may want to couple distant qubits. To take up this challenge a microwave photon can be used as a quantum mediator between the qubits. Practically, silicon transistors are embedded in a superconducting microwave resonator enabling the coupling between the spin and the microwave photons trapped in the resonator [4-6]. The figure below shows the chip fabricated in our laboratory for this spin/photon interaction to take place.

During the master project, you will take part of this exciting experiment in order to make spin and microwave photon speaking together. You will participate to the fabrication of the chip, with nano-fabrication steps done in our clean-room. You will also learn to cool down this chip in a dilution refrigerator to a base temperature of 10milliKelvin. Finally, you will perform the complex measurements of this hybrid physics at the interplay between spin qubit and microwave circuitry. For that, you will have to control the electrostatic gating of the silicon transistor in order to set the spin qubit working point while monitoring the microwave response of the photon cavity. Experimental results and new manipulation protocols will be widely discuss with theoreticians participating to this project. This master project may continue as a PhD thesis.

References:

- [1] Hanson R. et al. Rev.Mod. Phys. (2007)
- [2] Zwanenburg F. et al. Rev. Mod. Phys. (2013)
- [3] Maurand et al. Nature Communications (2016)
- [4] Landig, A. J. Nature (2018)
- [5] Mi, X. et al. Nature (2018)
- [6] Samkharadze, N. et al. Science (2017).



APPLY NOW!

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

Photons and spin circuits on the same silicon chip!