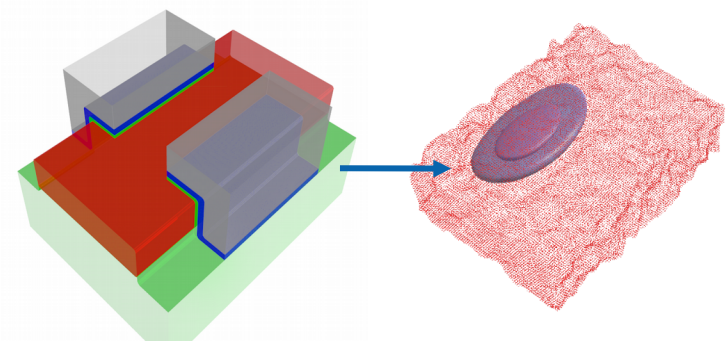
# PhD position on the modeling of silicon two qubit gates

A PhD position on the modeling two qubit gates on silicon is open at the Institute for Nanosciences and Cryogenics (INAC) of the CEA, Grenoble, France. The PhD is expected to start late summer/autumn 2019 and lasts three years.

« Quantum computers » are expected to solve problems beyond the reach of conventional computers. In a quantum computer, the information is not simply stored as a series of « 0 » or « 1 », but as a coherent superposition of all possible states. The preparation, coherent manipulation and measurement of such quantum states is extremely challenging. One promising option for making quantum bits is to divert silicon metal-oxide-semiconductor (MOS) transistors in order to trap one or a few electrons and use their spin to store and manipulate quantum information. The CEA Grenoble fabricates and characterizes such devices, and develops suitable simulation tools.



Models for two « face two face » quantum dots. On the left, finite elements model for the electrostatics (silicon in red, $SiO_2$ in green, $HfO_2$ in blue, and metal gates in gray). The metal gates control the potential in silicon; they can be used to trap, manipulate and « measure » electrons. On the right, atomistic model for the silicon wire, with the iso-probability surfaces of the first electron trapped under the left gate.

The objective of this PhD is to study the dynamics of two (or more) qubit gates by solving the time-dependent Schrödinger equation in the presence of electronic interactions in a realistic geometry (1D and 2D arrays of qubits). Our purposes are to understand the physics of the “exchange” interactions between qubits, to identify the mechanisms limiting the coherence and fidelity of the elementary quantum operations (noise, phonons, ...), and to propose innovative solutions for the design of the devices as well as for the manipulation protocols. This study will be carried out in close collaboration with the experimental physics teams working on this topic at CEA and CNRS, in the frame of the European ERC Synergy project quCube and of the French ANR project MAQSi.

**The position is funded by a grant from CEA** (net grant: ~1600 €/month).

The candidates must have a Master in quantum or solid-state physics. They shall send a CV, a letter of motivation and two contacts for references to Yann-Michel Niquet (yniquet@cea.fr).

For any inquiry, please contact:
Yann-Michel Niquet
CEA - DRF/INAC/MEM/L_Sim
17, rue des Martyrs
38054 Grenoble cedex 9
Tel: +33 (0)4 38 78 43 22
E-mail: yniquet@cea.fr
Google: https://scholar.google.fr/citations?user=h02ymwoAAAAJ
ResearchGate: https://www.researchgate.net/profile/Yann-Michel_Niquet

More about INAC: http://inac.cea.fr/en/index.php
https://www.youtube.com/watch?v=YLtQbRo7tUk
More about quantum silicon in Grenoble: https://www.quantumsilicon-grenoble.eu/
More about Grenoble: http://www.grenoble-tourisme.com/en/