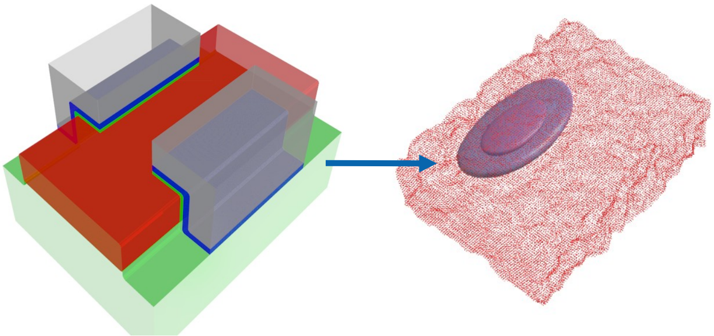
PhD position on the modeling of the dynamics of silicon quantum bits

A PhD position on the modeling of the dynamics of silicon quantum bits is open at the Institute for Nanosciences and Cryogenics (INAC) of the CEA, Grenoble, France. The PhD is expected to start late summer/autumn 2017 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 appropriate simulation tools.



Models for two « face two face » quantum bits. 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 thesis is to study the dynamics of electrons and spins in these devices by solving the time-dependent Schrödinger equation in the presence of electronic interactions. The electronic structure of the quantum bits will be modeled at the atomic scale using advanced tight-binding methods. Our aim is to optimize the control of the electrons and of their spins, and to understand how the interactions of these electrons with their environment limit the « coherence time » during which it is possible to manipulate quantum information. This thesis will be conducted in close collaboration with the experimental physics teams working on the subject at CEA/INAC, CEA/IRAMIS and CEA/LETI, and with the partners of CEA in Europe.

The position is funded by a grant from CEA (net grant: ~1690€/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:
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