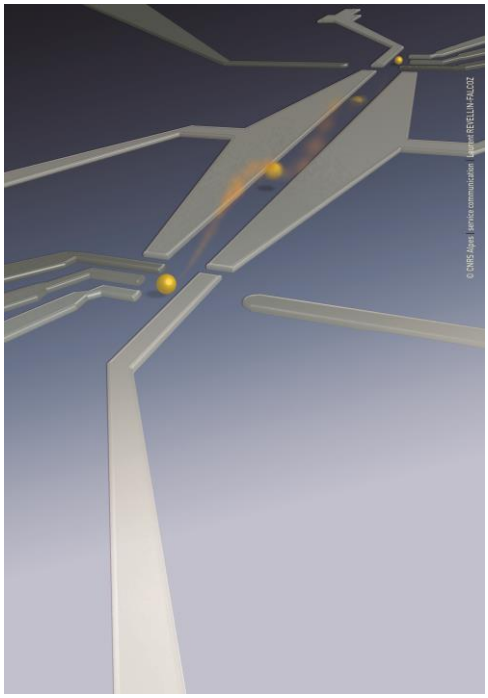
Chair of Excellence in experimental Si-based quantum computation

Coherent Transfer of individual electron spin in CMOS compatible devices

Context: In Si spin-based quantum computing, all the basic quantum operations have been demonstrated with high fidelities and the first quantum processors with few qubits are now available. Being able to displace individual electron spins while keeping their coherence is an interesting fundamental property of such a platform and it represents an interesting functionality to scale the system up. An important experimental effort has been invested in semiconductor quantum devices to study coherent electron spin displacement and its physics. Various strategies in quantum dot arrays or in quantum channels have been proposed and investigated. First results on spin transfer fidelity quantification and few microns coherent electron spin transfer have been demonstrated.

In Grenoble, we have an important research effort dedicated to spin-based quantum computation, with both the investigation of fundamental physical properties of the electron spin qubit in various semiconductor systems and its implementation using CMOS technology, and more precisely the FDSOI technology. The chair of excellence will be part of a large project funded by the French government aiming at developing and optimizing novel functionalities for spin-based quantum computing and understanding their fundamental properties.



Artistic impression of the transfer of a single electron between two distant quantum dots

Objectives and means available: The chair of excellence is valid for 5 years max. The goal of the project is to explore the potential of electron displacement one step further and push it towards incorporation in spin-based quantum computing processors. The candidate will benefit from the know-how and the infrastructure (Cryogeny and electronics) present at Institut Néel in the Quanteca group. The candidate will have the opportunity to build his/her own team. Funding includes salaries for candidate, additional salaries for the team and equipment.

Keywords: quantum transport, spin qubits, quantum coherence, Si-based quantum computing, coherent control

Further readings: S. Hermelin et al., Nature (2011), B. Bertrand et al., Nature Nano (2016), P-A Mortemousque et al., PRX Quantum (2021), B. Jadot et al., Nature Nano (2021)

Possible collaboration and networking: The excellence chair 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. The consortium is also involved in many networks aiming at the development of spin-based quantum computation including H2020 Flagship QLSI.

Required profile: The candidate should have a strong background/experience in at least one of the following fields: nanofabrication, cryogenics, transport measurements, spin physics.

Foreseen start for the position : 10/2022-04/2023
Salary: Up to 3000 euros net, depending on experience
Funding: Up to 1Meuros in total
Duration: 5 years maximum

Contact

Tristan Meunier
Institut Néel/ CNRS-
Université Grenoble Alpes
tristan.meunier@grenoble.cnrs.fr

Matias Urdampilleta
Institut Néel/ CNRS-
Université Grenoble Alpes
matias.urdampilleta@grenoble.cnrs.fr

Maud Vinet
CEA-Leti
maud.vinet@cea.fr