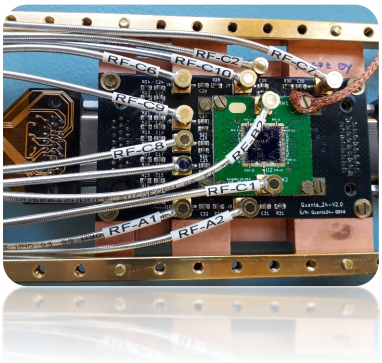
Master /PhD thesis Project

Silicon hole spin qubits hiding from the noise

Sample bonded and mounted, ready to be cooled to very low temperature



Quantum computing is currently pushing the frontier of information technology. Among other fields, solid-state hole-spin qubits in gate defined quantum dots are a promising research area. Recently, we have reached coherence times approaching 100 µs for a single hole spin in silicon, by decoupling the spin from electrical noise which is the main decoherence mechanism in these qubits [1].

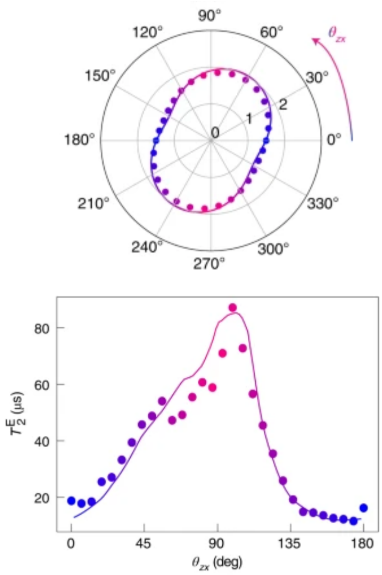
At the heart of this decoupling from electrical noise lies the anisotropic Zeeman interaction of the hole spin with an external magnetic field.

The aim of this master project is to characterize the anisotropic Zeeman interaction of a quantum dot containing three and five holes, going beyond the already well-known single occupied case. In doing so, possibly even longer coherence times might be found. The successful candidate will take over an experiment already running at 10mK and will perform measurements using state-of-the-art DC and RF techniques that will involve single spin manipulation and readout techniques.

Our research team is part of the French national “Plan Quantique” and is a founder member of the “Grenoble Quantum Silicon” group. A strong collaboration with the L-SIM group in the same building gives us a deep theoretical framework for our measurements.

This master project may continue as a PhD thesis, in order to answer open questions such as the origin of the remaining decoherence processes (possibly nuclear spins that can be removed by using isotopically purified ^{28}Si), the understanding of the energy relaxation times T1 of hole spin qubits, and the implementation of two qubit logic.

[1] Piot et al., Nature Nanotechnology 17, 1072, **2022**



Top: anisotropic Zeeman interaction of a single hole spin in a quantum dot as the magnetic field direction is varied in the plane of the device.
Bottom: Coherence time evolving with the magnetic field orientation approaching close to 100 µs. See Ref1 for more details.

APPLY NOW!

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

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