Master Thesis/Semester Project: Strontium Titanate Varactors for Charge Sensing with Spin Qubits

The Quantum Coherence Lab is looking for a highly motivated student in Physics or Nanosciences who would like to join our group for a Master Thesis/Project. Our research focusses on Quantum Transport in nanostructures, aiming towards the realisation of a scalable Quantum bits (qubits). To this end, we engineer quantum dots in silicon which confine holes. The spins of these holes can be used to implement qubits, as we have recently demonstrated [1].

To further improve our readout scheme, we are currently investigating gate-based reflectometry as a method to sense the movement of individual charges on and off those quantum dots [2]. This involves variable capacitance diodes (varactors) which are essential for good sensitivity of the reflectometry setup. While off-the-shelf varactors have provided good initial results, more sophisticated devices made from strontium titanate should increase the measurement stability and allow for more robust experiments at high magnetic fields and millikelvin Temperatures [3,4].

As a master student in our group, you will be involved in simulation, clean-room fabrication and characterization of the produced varactor devices at room- and liquid helium temperatures. You will furthermore get hands-on experience measuring quantum dots using the fabricated varactors and operating the radio-frequency electronics involved in the reflectometry. As a part of the NCCR SPIN, the federal research initiative revolving around spin qubits, you will get to join talks and other events from the network and meet researchers from our partner institutions including IBM and the ETHs.

Ideal starting date: **Feb. 2022** or according to agreement

For further information please contact:

Rafael Eggli

Mail: rafael.eggli@unibas.ch

Office: 1.10

Prof. Dr. Dominik Zumbühl

Mail: dominik.zumbuhl@unibas.ch

Office: 1.16 a

References:

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[3] N. Ares et al. (2016), *Phys. Rev. Appl.* **5**. 034011.

[4] P. Apostolidis et al. (2020), arXiv:2007.03588.