Atomic qubits in silicon
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Extremely long electron and nuclear spin coherence times have been demonstrated in isotopically pure Si-28 [1,2] making silicon a promising semiconductor material for spin-based quantum information. The two-level spin state of single electrons bound to shallow phosphorus donors in silicon in particular provide well defined, reproducible qubits [3]. An important challenge in these systems is the realisation of an architecture, where we can position donors within a crystalline environment with approx. 20-50nm separation, individually address each donor, manipulate the electron spins using ESR techniques and read-out their spin states.

We have developed a unique fabrication strategy for a scalable quantum computer in silicon using scanning tunneling microscope lithography to precisely position individual P donors in Si [4] aligned with nanoscale precision to local control gates [5] necessary to initialize, manipulate, and read-out the spin states [6-8]. We have published our approach to scale-up using 3D architectures for implementation of the surface code [9].

During this talk I will focus on demonstrating fast, high fidelity single-shot spin read-out [10], ESR control of precisely-positioned P donors in Si [11] and our results to demonstrating a two-qubit gate in donor qubits in silicon [12,13]. With important advances in control at the atomic-scale, I will attempt to highlight the benefits of single atom qubits in silicon.

References

Friday, February 1, 2019 11:00am - 12:00pm

This invitation is valid as a ticket for the IST Shuttle from and to Heiligenstadt Station. Please find a schedule of the IST Shuttle on our webpage (note that the IST Shuttle times are highlighted in dark green): http://ist.ac.at/fileadmin/user_upload/pdfs/IST_shuttle_bus.pdf
The IST Shuttle bus is marked IST Shuttle (#142) and has the Institute Logo printed on the side.