Engineering qubits in silicon with atomic precision

Ludwik Kranz

Silicon Quantum Computing, Sydney, Australia

l.kranz@unsw.edu.au

The realisation of a large-scale error corrected quantum computer relies on our ability to reproducibly manufacture qubits that are fast, highly coherent, controllable, and stable. The promise of achieving this in a highly manufacturable platform such as silicon requires a deep understanding of the materials issues that impact device operation. In this talk I will demonstrate our progress to engineer every aspect of device behaviour in atomic qubits in silicon. This will cover the use of atomic precision lithography to achieve fast, controllable exchange coupling [1], fast, high fidelity qubit initialisation and read-out [2]; low noise all epitaxial gates allowing for highly stable qubits [3]; and qubit control [4] that provide a deep understanding of the impact of the solid-state environment [5] on qubit designs and operation.

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