

Spin-based quantum processing leveraging industry-standard silicon CMOS manufacture

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In this talk I will discuss the advantages and challenges facing the development of quantum computers employing spin-based quantum processors that can be manufactured using industry-standard silicon CMOS technology, which is the technology underpinning our company Diraq. I will begin by discussing the development of SiMOS quantum dot qubits, including the demonstration of high-fidelity single-qubit gates [1], the first demonstration of a two-qubit logic gate [2], and assessments of silicon qubit fidelities [3,4]. I will then explore the technical issues related to scaling a CMOS quantum processor [5] up to the millions of qubits that will be required for fault-tolerant QC, including the use of global microwave fields capable of controlling millions of qubits [6] and demonstrations of silicon qubit operation above one kelvin [7,8]. I will also present very recent results obtained on qubits fabricated at imec using standard CMOS manufacture on 300mm silicon wafers, including randomized benchmarking of single qubit gates indicating single-qubit control fidelities of $F_{1Q} > 99.9\%$. I will conclude by discussing the technology roadmap for our company Diraq as we work towards the goal of developing fault-tolerant quantum computers that are compact and which will have much lower power requirements than competing qubit technologies.

References

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