Invited speaker

Prof. Michelle Y. Simmons

Silicon Quantum Computing, Australia

e-mail／michelle.simmons@unsw.edu.au

Engineering qubits in silicon with atomic precision

Abstract

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 for 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 [4,5] that provide a deep understanding of the impact of the solid-state environment [6] on qubit designs and operation. I will also discuss our latest results in quantum machine learning [7], analogue simulation [8,9] and demonstration of the highest efficiency Grover's algorithm to date [10].

References

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About the Author

Michelle Simmons is the CEO and founder of Silicon Quantum Computing and longstanding Director of the Australian Research Council Centre of Excellence for Quantum Computation and Communication Technology. As one of the world's leading experimental physicists, she is at the forefront of developing a silicon-based quantum computer and globally renowned for creating the field of atomic electronics. She has been awarded numerous international prizes, including the Royal Society Bakerian Medal from the UK, the US Feynman prize for Nanotechnology and the L'ORÉAL-UNESCO Laureate in the Physical sciences. In 2023 she was awarded the Prime Minister's Prize for Science. She is a Fellow of the Royal Academy of Science in the UK, and of the Academies of Science in Australia and the US. In 2018 she was named Australian of the Year.