
Northwestern Quantum Week Opening Science Workshop: Superconducting Qubits for Quantum Computing

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William D. Oliver

Dr. William D. Oliver is jointly appointed the Henry Ellis Warren (1894) Professor of Electrical Engineering and Computer Science and Professor of Physics at the Massachusetts Institute of Technology. He serves as the Director of the Center for Quantum Engineering, Associate Director of the Research Laboratory of Electronics, and Leader of the Engineering Quantum Systems Group at MIT. Will's research interests include the materials growth, fabrication, design, and measurement of superconducting qubits, as well as the development of cryogenic packaging and control electronics.

From 2003-2023, Will also worked at MIT Lincoln Laboratory – most recently as Laboratory Fellow (2017-2023) – where he was instrumental in growing the quantum computing group to its present levels. Will stepped down from this position to co-found Atlantic Quantum, a quantum computing start-up. Atlantic Quantum was acquired by Google in October 2025.

Emulating the Bose-Hubbard Model with Arrays of Superconducting Qubits

Abstract: In this talk, we study the propagation, entanglement, and entropy of quantum information using 3x3 and 4x4 arrays of superconducting qubits that emulate the two-dimensional (2D) hardcore Bose-Hubbard model. The 2D arrays feature site-selective, simultaneous control and readout of all qubits. We highlight several recent experimental demonstrations using these arrays, including quantum random walks, Anderson and Wannier-Stark localization [1], the crossover from area-law to volume-law entanglement [2], the realization of synthetic electromagnetic fields throughout the array [3], and studies of flat-band physics in rhombic lattices [4].

[1] npj Quantum Information 8, 35 (2022) | arXiv:2107.05035 (2021)

[2] Nature 629, 561-566 (2024) | arXiv:2306.02571 (2023)

[3] Nature Physics 20, 1881-1887 (2024) | arXiv:2405.00873 (2024)

[4] Physical Review X 15, 021091 (2025) | arXiv:2410.07878 (2024)