

Real-time Dynamics of fermionic models on Superconducting Quantum Computers at the Utility Scale

Tuesday, January 13, 2026 3:45 PM (30 minutes)

In this talk, we present a large-scale quantum simulation of the one-dimensional Fermi-Hubbard model, a paradigmatic fermionic model, on IBM's superconducting quantum computers with over 100 qubits. By developing first-order and second-order optimized Trotterization circuits, we maintain a constant circuit depth in quantum simulation regardless of system size on superconducting quantum computers with limited qubit connectivity, such as IBM's quantum devices. Such a scalable Trotterization circuit design enables us to precisely investigate the relaxation dynamics in the Fermi-Hubbard model using IBM's quantum computers with over 100 qubits, and we validate our results against the Tensor Network-based method employing the time-dependent variational principle. Thereby, our quantum simulation framework advances beyond exact classical methods in the exploration of large-scale fermionic many-body systems.

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