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Implementation of a Quantum Variational Eigensolver in Superconducting Qubits MOLLIE SCHWARTZ, Quantum Nanoelectronics Laboratory, UC Berkeley, JARROD MCCLEAN, Computational Research Division, Lawrence Berkeley National Laboratory, CHRIS MACKLIN, Quantum Nanoelectronics Laboratory, UC Berkeley; Computational Research Division, Lawrence Berkeley National Laboratory, JONATHAN CARTER, WIBE ALBERT DE JONG, Computational Research Division, Lawrence Berkeley National Laboratory, IRFAN SIDDIQI, Quantum Nanoelectronics Laboratory, UC Berkeley; Materials Sciences Division, Lawrence Berkeley National Laboratory — The quantum variational eigensolver (QVE) represents an efficient implementation of quantum simulation that relies on a synergy between classical and quantum computing components. In this approach, a classical computer is used to map the target Hamiltonian onto a fermionic Hilbert space and to perform a variational update of the estimated ground state. This test state is then prepared in the quantum system, enabling an efficient estimation of the expectation value of the Hamiltonian and reducing the requirements for coherent qubit evolution. We present experimental progress toward implementing a QVE in superconducting qubits, capitalizing on the flexibility and scalability of the transmon cQED architecture.

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