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Quantum Bootstrapping via Compressed Quantum Hamiltonian Learning NATHAN WIEBE, Microsoft Research, CHRISTOPHER GRANADE, DAVID CORY, Institute for Quantum Computing — Recent work has shown that quantum simulation is a valuable tool for learning empirical models for quantum systems. We build upon these results by showing that a small quantum simulators can be used to characterize and learn control models for larger devices for wide classes of physically realistic Hamiltonians. This leads to a new application for small quantum computers: characterizing and controlling larger quantum computers. Our protocol achieves this by using Bayesian inference in concert with Lieb-Robinson bounds and interactive quantum learning methods to achieve compressed simulations for characterization. Whereas Fisher information analysis shows that current methods which employ short-time evolution are suboptimal, interactive quantum learning allows us to overcome this limitation. We illustrate the efficiency of our bootstrapping protocol by showing numerically that an 8-qubit Ising model simulator can be used to calibrate and control a 50 qubit Ising simulator while using only about 750 kilobits of experimental data.

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