S-Source Construction of Many-body States[1] CHRISTOPHER OL-UND, MAXWELL BLOCK, University of California, Berkeley, SNIR GAZIT, Hebrew University of Jerusalem, JOHN MCGREEVY, University of California, San Diego, NORMAN YAO, University of California, Berkeley — S-source is a method to construct a thermodynamic many-body wave function by iteratively building the ground state of a size 2L system from the ground state of the same system at size L. This is achieved by repeatedly optimizing a local unitary quantum circuit. We consider perturbative expansions of many-body wave functions with large gaps and derive the scaling of the error in the optimal s-source construction of the state. By doing this, we demonstrate that one can in principle parametrically reduce the errors by allowing our circuit to contain unitaries acting at longer distances, in agreement with the prediction that states can be perfectly constructed using quasi-local unitaries. We also present some further numerical benchmarking of the algorithm, and consider whether we can improve errors by rescaling the Hamiltonian parameters as a function of system size, following the intuition from renormalization group flow.

Christopher Olund
University of California, Berkeley

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