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How to implement a quantum algorithm on a large number of qubits by controlling one central qubit ALEXANDER ZAGOSKIN, SAHEL ASHHAB, J.R. JOHANSSON, FRANCO NORI, RIKEN Advanced Science Institute, and the University of Michigan — It is desirable to minimize the number of control parameters needed to perform a quantum algorithm. We show that, under certain conditions, an entire quantum algorithm can be efficiently implemented by controlling a single central qubit in a quantum computer. We also show that the different system parameters do not need to be designed accurately during fabrication. They can be determined through the response of the central qubit to external driving. Our proposal is well suited for hybrid architectures that combine microscopic and macroscopic qubits. More details can be found in: A.M. Zagoskin, S. Ashhab, J.R. Johansson, F. Nori, Quantum two-level systems in Josephson junctions as naturally formed qubits, Phys. Rev. Lett. 97, 077001 (2006); and S. Ashhab, J.R. Johansson, F. Nori, Rabi oscillations in a qubit coupled to a quantum two-level system, New J. Phys. 8, 103 (2006).

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