Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

General compiler for reducing multi-qubit terms and controlling coupling strengths in AQC Hamiltonians NIKE DATTANI, Fukui Institute for Theoretical Chemistry, RICHARD TANBURN, Oxford University, Mathematical Institute, RICHARD NGO, Oxford University, Department of Computer Science, TOBY CATHCART-BURN, Oxford University, Mathematical Institute — After encoding the solution to your problem into the ground state of a Hamiltonian, it is necessary to "compile" the Hamiltonian into one which can be realized in existing hardware or in hardware that is likely to emerge in the near future. We have recently developed methods to reduce multi-qubit terms to 2-qubit terms without adding auxiliary qubits (https://arxiv.org/abs/1508.04816, https://arxiv.org/abs/1508.07190) and for controlling properties of the Hamiltonian such as the spectral gap, spectral width, number of local minima in a particular state, and strength of couplings between/among qubits (https://arxiv.org/abs/1510.07420). We combine these methods with established methods for reducing multi-qubit terms in worse cases where auxiliary qubits are needed, into a general purpose "compiler" that reads in a general Hamiltonian, and attempts to output a 2-local Hamiltonian with **as few extra qubits as possible** and **as large a spectral gap as possible** and **as small a spectral width as possible** and **coupling strengths that are as small as possible**. We show results on several types of AQC Hamiltonians: neural network Hamiltonians, computer vision problems, Ramsey number determination, integer factorization, and quantum chemistry.

Nike Dattani
Fukui Institute for Theoretical Chemistry

Date submitted: 14 Nov 2016 Electronic form version 1.4