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Counting edge covers of a weighted graph on an ion trap quantum computer YINGYUE ZHU, Joint Quantum Institute, Department of Physics, University of Maryland, College Park, MD 20742, USA, BHUVANESH SUNDAR, Institute for Quantum Optics and Quantum Information of the Austrian Academy of Sciences, Innsbruck A-6020, Austria, CINTHIA HUERTA ALDERETE, NHUNG H. NGUYEN, Joint Quantum Institute, Department of Physics, University of Maryland, College Park, MD 20742, USA, KADEN R. A. HAZZARD, Department of Physics and Astronomy and Rice Center for Quantum Materials, Rice University, Houston, Texas 77005, USA, NORBERT M. LINKE, Joint Quantum Institute, Department of Physics, University of Maryland, College Park, MD 20742, USA — Quantum-classical hybrid schemes, such as the Quantum Approximate Optimization Algorithm (QAOA), are promising approaches to solving combinatorial optimization problems on near-term quantum hardware. Counting edge cover, which is a set of edges that leaves no isolated vertices on a graph, is one of these problems and has important applications in network reliability. We implement a modified QAOA scheme with an adapted mixing Hamiltonian on an ion trap quantum computer to count edge covers of a weighted 3-node star graph. This modified algorithm prepares the quantum system in a superposition of ground states with pre-determined weights for efficient counting. We demonstrate how the approximate solution becomes more exact with increasing number of QAOA-layers on real hardware, despite the additional gate errors.

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