Abstract Submitted
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**Complete 3-Qubit Grover Search with Trapped Ions**[1] CAROLINE FIGGATT, Joint Quantum Institute and University of Maryland Department of Physics, DMITRI MASLOV, National Science Foundation, NORBERT LINKE, KEVIN LANDSMAN, SHANTANU DEBNATH, CHRISTOPHER MONROE, Joint Quantum Institute and University of Maryland Department of Physics — We present experimental results on a complete 3-qubit Grovers search. The algorithm is performed for all 8 possible single-result oracles and all 28 possible two-result oracles. Two methods of state marking, with and without an ancilla, are used for the oracles. All quantum solutions are shown to outperform their classical counterparts. The algorithms constituent gates include Toffoli-3 and Toffoli-4 gates, with process fidelities 89.6% and 70.5%, respectively. The experiments are performed on a programmable quantum computer consisting of a linear chain of five trapped $^{171}Yb^{+}$ ions. We execute modular one- and two-qubit gates through Raman transitions driven by a beat note between counter-propagating beams from a pulsed laser [1]. The systems individual addressing capability [2] provides arbitrary single-qubit rotations as well as any two-qubit XX-entangling gate, which are implemented using a pulse-segmentation scheme [3]. [1] PRL 104, 140501 (2010), [2] Nature 536, 63 (2016), [3] PRL 112, 19502 (2014).

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