Abstract Submitted for the DAMOP13 Meeting of The American Physical Society

Optimizing Adiabaticity in a Trapped-Ion Quantum Simulator<sup>1</sup> PHIL RICHERME, CRYSTAL SENKO, SIMCHA KORENBLIT, JACOB SMITH, AARON LEE, CHRISTOPHER MONROE, Joint Quantum Institute, University of Maryland Department of Physics and National Institute of Standards and Technology, College Park, Maryland 20742 — Trapped-ion quantum simulators are a leading platform for the study of interacting spin systems, such as fully-connected Ising models with transverse and axial fields. Phonon-mediated spin-dependent optical dipole forces act globally on a linear chain of trapped Yb-171+ ions to generate the spin-spin couplings, with the form and range of such couplings controlled by laser frequencies and trap voltages. The spins are initially prepared along an effective transverse magnetic field, which is large compared to the Ising couplings and slowly ramped down during the quantum simulation. The system remains in the ground state throughout the evolution if the ramp is adiabatic, and the spin ordering is directly measured by state-dependent fluorescence imaging of the ions onto a camera. Two techniques can improve the identification of the ground state at the end of simulations that are unavoidably diabatic. First, we show an optimized ramp protocol that gives a maximal probability of measuring the true ground state given a finite ramp time. Second, we show that no spin ordering is more prevalent than the ground state(s), even for non-adiabatic ramps.

<sup>1</sup>This work is supported by grants from the U.S. Army Research Office with funding from the DARPA OLE program, IARPA, and the MURI program; and the NSF Physics Frontier Center at JQI.

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Date submitted: 28 Jan 2013