

Abstract Submitted  
for the DAMOP12 Meeting of  
The American Physical Society

**Theory for adiabatic state evolution of a transverse field Ising model simulated in a Penning trap**<sup>1</sup> JAMES FREERICKS, Georgetown University, ADAM KEITH, North Carolina State University, C.-C. JOSEPH WANG, Georgetown University — We discuss the equilibrium positions and phonon modes of Be<sup>9+</sup> ions trapped in the NIST Penning trap and how one can use a laser-induced spin-dependent dipole force to generate a transverse field Ising model. Recent experiments have benchmarked the accuracy of the theory by measuring the average Ising spin-spin interaction and the transverse phonon mode frequencies and effective temperatures. Here we will discuss details about how one calculates the equilibrium positions, the phonon normal modes, and the theory behind the phonon mode thermometry. We will also discuss how a laser dipole force can be used to generate effective Ising spin-spin interactions and compare them to measurements in the case of weak coupling. Finally, we will discuss interesting prospects for new experiments both in analog quantum simulation and in phonon-spin entanglement.

<sup>1</sup>Supported by the Darpa OLE program and the Army Research Office under grant number W911NF0710576

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Date submitted: 27 Jan 2012

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