Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Quantum simulations of the Dicke and transverse Ising models with hundreds of trapped ions K.A. GILMORE, J.E. JORDAN, J.G. BOHNET, J.J. BOLLINGER, NIST - Boulder, A. SAFAVI-NAINI, R.J. LEWIS-SWAN, A. SHANKAR, M. HOLLAND, A.M. REY, JILA,NIST, U. Colorado, J. COHN, J.K. FREERICKS, Georgetown Univ., M. GÄRTTNER, Kirchhoff-Institut für Physik, Universität Heidelberg — Quantum simulators, where one well-controlled physical system mimics another complex system, may enable understanding of quantum many-body physics that cannot be fully studied using conventional techniques on classical computers. We describe quantum simulations of a network of interacting spins performed with 2-dimensional arrays of hundreds of Be^+ ions crystallized in a Penning trap. We discuss how we engineer the Dicke model, where the spins are coupled to a single phonon mode, and the limits in which this becomes the transverse-field Ising model, an effective spin model. We summarize experiments exploring adiabatic protocols for preparing low energy entangled states. We also present results of an EIT (Electromagnetic Induced Transparency) cooling experiment that shows average motional quantum numbers $\bar{n} < 1$ can be achieved in a few hundred microseconds.

John Bollinger
NIST - Boulder

Date submitted: 26 Jan 2018 Electronic form version 1.4