Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Dynamical generation and detection of entangled quantum magnetic states in ultracold polar molecules KADEN HAZZARD, SALVATORE MANMANA, UC Boulder, JILA, NIST, ALEXEY GORSHKOV, Institute for Quantum Information, California Institute of Technology, ANA MARIA REY, UC Boulder, JILA, NIST — We show that *existing* ultracold polar molecule experiments in optical lattices may generate strongly correlated many-body states by mimicking far-from-equilibrium dynamics of models of quantum magnetism. Recent theory shows that molecules' rotational states can emulate quantum spins with strong (100-10,000Hz) "spin-spin" interactions. Applying external fields generates a zoo of models: spin-1/2 and larger Heisenberg and XXZ models, and well beyond. We consider the dynamics of the easily prepared fully polarized initial state for the XXZ case predicted to be realized in current experiments. Our analytic and DMRG calculations show that the dynamics can: (i) verify and characterize the spin model (XXZ) description of the system, (ii) generate interesting, entangled states (e.g., cat states, GHZ), and (iii) explore behavior where no quantitative theory is presently possible.

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Date submitted: 11 Nov 2011 Electronic form version 1.4