Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Improving prospects for experimental realization of exotic quantum magnetism in alkaline earth atoms KADEN HAZZARD, JILA/NIST Boulder, SALVATORE MANMANA, Goettingen, LARS BONNES, Innsbruck, GANG CHEN, CU-Boulder, STEFAN WESSEL, Aachen, VICTOR GURARIE, MICHAEL HERMELE, CU-Boulder, ANA MARIA REY, JILA/NIST Boulder —
We show how one can use recently developed experimental tools for cold atoms in optical lattices – alkaline earths, reduced dimensionality, and artificial gauge fields – to improve the feasibility of reaching exotic phases of matter. A first unambiguous experimental identification of these exotic phases, such as topological phases and spin liquids, would transform many-body physics. Alkaline earth atoms are predicted to harbor such a "chiral spin liquid" state at zero temperature. However, cold systems have struggled to reach sufficiently low temperatures, even for conventional phases such as antiferromagnets. Here we show that the large nuclear spin, $I \leq 9/2$, and special SU($N = 2I + 1$) symmetry of alkaline earths allow magnetism to persist to substantially higher entropies as N is increased [1]. This enhancement is even more dramatic in one dimension [2,3]. Finally, artificial gauge fields may enlarge the parameter regime occupied by the chiral spin liquid and facilitate its adiabatic preparation.

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Kaden Hazzard
JILA/NIST Boulder

Date submitted: 29 Jan 2013 Electronic form version 1.4