Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Ordering in a frustrated pyrochlore antiferromagnet proximate to a spin liquid GREGORY A. FIETE, Kavli Institute for Theoretical Physics, UC Santa Barbara, DORON L. BERGMAN, LEON BALENTS, Department of Physics, UC Santa Barbara — We perform a general study of spin ordering on the pyrochlore lattice with a 3:1 proportionality of two spin polarizations[1]. Equivalently, this describes valence bond solid conformations of a quantum dimer model on the diamond lattice. We determine the set of likely low temperature ordered phases, on the assumption that the ordering is weak, i.e the system is close to a "U(1)" quantum spin liquid in which the 3:1 proportionality is maintained but the spins are strongly fluctuating. The nature of the 9 ordered states we find is determined by a "projective symmetry" analysis. All the phases exhibit translational and rotational symmetry breaking, with an enlarged unit cell containing 4 to 64 primitive cells of the underlying pyrochlore. The simplest of the 9 phases is the same "R" state found earlier in a theoretical study[2] of the ordering on the magnetization plateau in the $S = 3/2$ materials $CdCr_20_4$ and $HgCr_20_4$. We suggest that the spin/ dimer model proposed therein undergoes a direct transition from the spin liquid to the R state, and describe a field theory for the universal properties of this critical point, at zero and non-zero temperatures. [1] D. L. Bergman, G. A. Fiete, and L. Balents, cond-mat/0511176. [2] D. L. Bergman, R. Shindou, G. A. Fiete, and L. Balents, cond-mat/0510202.

Gregory A. Fiete
Kavli Institute for Theoretical Physics, UC Santa Barbara

Date submitted: 12 Jan 2006 Electronic form version 1.4