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Quantum effects in a half-polarized pyrochlore antiferromagnet DORON BERGMAN, RYUICHI SHINDOU, Department of Physics, UC Santa Barbara, GREGORY FIETE, Kavli Institute for Theoretical Physics, UC Santa , LEON BALENTS, Department of Physics, UC Santa Barbara — We study quantum effects in a spin-3/2 antiferromagnet on the pyrochlore lattice in an external magnetic field, focusing on the vicinity of a plateau in the magnetization at half the saturation value, observed in $CdCr_2O_4$ and $HgCr_2O_4$. Our theory, based on quantum fluctuations, results in an effective quantum dimer model of the dynamics. We predict the existence of a symmetry-broken ground state on the plateau, even with only nearest-neighbor microscopic exchange. This symmetry broken state consists of a particular arrangement of spins polarized parallel and antiparallel to the field in a 3:1 ratio on each tetrahedron. It quadruples the lattice unit cell, and reduces the space group from $Fd\bar{3}m$ to $P4_332$. We also predict that for fields just above the plateau, the low temperature phase has transverse spin order, describable as a Bose-Einstein condensate of magnons. Other comparisons to and suggestions for experiments are discussed.

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