Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Paramagnetic ground states and field-driven Néel order in S=3/2 Heisenberg antiferromagnets on a honeycomb lattice GANESH RAMACHANDRAN, Department of Physics, University of Toronto, D.N. SHENG, Department of Physics and Astronomy, California State Univ., Northridge, Y.J. KIM, A. PARAMEKANTI, Department of Physics, University of Toronto — We study the spin-3/2 Heisenberg antiferromagnet on a honeycomb lattice with exchange interactions which frustrate Néel order. Our motivation stems from the recent synthesis of $Bi_3Mn_4O_{12}(NO_3)$, a spin-3/2 bilayer honeycomb lattice antiferromagnet which remains paramagnetic to the lowest temperature, but shows a field-induced Néel transition. We use a combination of spin wave theory, exact diagonalization, and bond operator theory to study the effects of quantum and thermal fluctuations, second-neighbor exchange, biquadratic exchange and bilayer coupling. Biquadratic terms give rise an AKLT valence bond solid ground state, and bilayer coupling leads to an interlayer dimer solid. Upon applying a magnetic field, both these states undergo a phase transition into a Néel long range ordered state. We comment on experimental consequences and disorder effects.

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Date submitted: 29 Dec 2010 Electronic form version 1.4