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Classification of quantum phases for the star-lattice antiferromagnet via a projective symmetry group analysis TING-PONG CHOY, YONG BAEK KIM, University of Toronto — We study possible quantum ground states of the Heisenberg antiferromagnet on the star lattice, which may be realized in the recently discovered polymeric Iron Acetate, $Fe_3(\mu_3\text{-}O)(\mu\text{-}OAc)_6(H_2O)_3[Fe_3(\mu_3\text{-}O)(\mu\text{-}OAc)_{7.5}]_2 \cdot 7H_2O$. Even though the Fe^{III} moment in this material carries spin-5/2 and the system eventually orders magnetically at low temperatures, the magnetic ordering temperature is much lower than the estimated Curie-Weiss temperature, revealing the frustrated nature of the spin interactions. Anticipating that a lower spin analog of this material may be synthesized in future, we investigate the effect of quantum fluctuations on the star-lattice antiferromagnet using a large-N Sp(N) mean field theory and a projective symmetry group analysis for possible bosonic quantum spin liquid phases. It is found that there exist only two distinct gapped Z_2 spin liquid phases with bosonic spinons for non-vanishing nearest-neighbor valence-bond-amplitudes. In particular, the spin liquid phase which has a lower energy in the nearest-neighbor exchange model can be stabilized for relatively higher spin magnitudes.

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