Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Color ice states, weathervane modes, and fluctuation-driven phase transition in a pyrochlore Heisenberg antiferromagnet YUAN WAN, Perimeter Institute for Theoretical Physics, MICHEL GINGRAS, University of Waterloo — We expose a new example of fluctuation-driven phase transition in the pyrochlore bilinear-biquadratic Heisenberg antiferromagnet, $H = \sum_{\langle ij \rangle} J\mathbf{S_i} \cdot \mathbf{S_j} + \mathbf{B}(\mathbf{S_i} \cdot \mathbf{S_j})^\mathbf{2}$, with positive biquadratic exchange interaction ($B > 0$), in the semi-classical limit ($S \gg 1$, $BS^2/J \sim O(1)$). We will show that this model possesses remarkable properties. First of all, the ground state manifold contains an extensively large family of non-coplanar spin states known as "color ice states", which are generalization of the familiar Ising spin ice states. Furthermore, the color ice states support two-dimensional analog of the weathervane modes in the classical kagome Heisenberg antiferromagnet. Finally, even though the bilinear and the biquadratic interactions admit a common ground state manifold, they produce different quantum fluctuations. As a result, the quantum order-by-disorder mechanism selects different states as BS^2/J changes, resulting in a phase transition purely driven by fluctuations. The talk is based on arXiv:1607.02185.

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Date submitted: 04 Nov 2016 Electronic form version 1.4