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Flucutation driven selection at crticality: the case of multi-k partial order on the pyrochlore lattice[1] ZHIHAO HAO, BEHNAM JAVANPARAST, University of Waterloo, MATTHEW ENJALRAN, Southern Connecticut State University , MICHEL GINGRAS, University of Waterloo, Canadian Institute for Advanced Research, Perimeter Institute for Theoretical Physics — We study the problem of partially ordered phases with periodically arranged disordered sites on the pyrochlore lattice. The periodicity of the phases is characterized by one or more wave vectors $k = \{\frac{1}{2}\frac{1}{2}\frac{1}{2}\}$. Starting from a general microscopic Hamiltonian including anisotropic nearest-neighbor exchange, long-range dipolar interactions and second- and third-nearest neighbor exchange, we identify using standard mean-field theory (s-MFT) an extended range of interaction parameters that support partially ordered phases. We demonstrate that thermal fluctuations beyond s-MFT are responsible for the selection of one particular partially ordered phase, e.g. the "4-k" phase over the "1-k" phase. We suggest that the transition into the 4-k phase is continuous with its critical properties controlled by the cubic fixed point of a Ginzburg-Landau theory with a 4-component vector order-parameter. By combining an extension of the Thouless-Anderson-Palmer method originally used to study fluctuations in spin glasses with parallel-tempering Monte-Carlo simulations, we establish the phase diagram for different types of partially ordered phases. Our result reveals the origin of 4-k phase observed bellow 1K in Gd2Ti2O7.

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