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The ground state of the $Er_2Ti_2O_7$ pyrochlore XY antiferromagnet: Energetic vs. order-by-disorder selection JEFFREY G. RAU, University of Waterloo, SYLVAIN PETIT, LLB, CEA-CNRS, CEA-Saclay, MICHEL J. P. GINGRAS, University of Waterloo — Conclusive evidence of order by disorder is rare in real materials. One of the strongest cases presented has been for the pyrochlore antiferromagnet $Er_2Ti_2O_7$, with the ground state selection proceeding not only through order by disorder, but induced through the effects of quantum fluctuations. This identification relies on the smallness of higher spin interaction terms that could provide an alternate route to picking the ground state. Here we re-evaluate the arguments that lead to this conclusion. We show that classical effects are much more competitive than has been previously reported and must be considered in detail to establish the mechanism of ground state selection in $Er_2Ti_2O_7$. From a realistic model of the crystal field excitations we explicitly compute these terms using strong coupling perturbation theory. From these higher-spin interactions, we calculate the effects on the excitation spectrum and ground state energy at the purely classical level. Implications for the interpretation of recent experiments on $Er_2Ti_2O_7$ will be discussed.

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