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Spin waves and quantum criticality in the frustrated XY pyrochlore antiferromagnet $\mathbf{Er_2Ti_2O_7}$[1]

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Geometrically frustrated magnetism in the three dimensional pyrochlore lattice often gives rise to unconventional magnetic states at low temperatures. The effective elimination of leading energetic terms via geometric cancellation allows weak perturbations to ultimately determine the behaviour of a magnetic material. In this talk, I will describe the manifold of low energy states in the antiferromagnetic XY pyrochlore $Er_2Ti_2O_7$, as measured by the time-of-flight neutron scattering technique. In zero applied magnetic field, the ground state is purported to be selected either by unusual anisotropic interactions, or via thermal and/or quantum fluctuations in an example of order-by-disorder [1,2]. Recently, we have shown that this state consists of coexisting short and long range orders[3], and that both orders can be destroyed by the application of modest magnetic fields [3]. This disordering of the magnetic system involves a seemingly continuous quantum critical point at $\mu_0 H_c \sim 1.6$ Tesla [3]. The properties of the induced quantum paramagnetic state, and the dependence of these properties on the direction of applied field will be discussed. I will also make comparisons with a recent theoretical treatment of $Er_2Ti_2O_7$ [2].

[1] Champion et al. Phys. Rev. B. 68, 020401 (2003)
[2] McClarty et al. arXiv:0810.2483v2
[3] Ruff et al. Phys. Rev. Lett. 101, 147205 (2008)

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