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Order by disorder or energetic selection of the ground state in the XY pyrochlore antiferromagnet Er2Ti2O7 ? A neutron scattering study.

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Examples of materials where an “order by quantum disorder” mechanism is at play to select a particular ground state are scarce [1,2]. It has been recently proposed that the anti-ferromagnetic pyrochlore Er2Ti2O7 reveals a most convincing case of this mechanism [3,4,5]. Observation of a spin gap at zone centers was interpreted as a definitive proof of this physics [6]. We argue, however, that the magnetic anisotropy provided by the interaction-induced admixing between the CEF ground and excited levels gives an alternative energetic mechanism [7,8]. RPA calculations based on a mean field model taking into account explicitly the CEF anisotropy reproduce well new high resolution inelastic neutron scattering data. Here, the gap originates from the anisotropy rather than quantum fluctuations effects. The present study raises the question of the quantum order by disorder as the sole or even principal mechanism for the selection of the magnetic ground state in this material.

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