

Ground state and low-energy magnetic dynamics in the frustrated magnet CoAl₂O₄ as revealed by local spin probes

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Abstract

© 2015 American Physical Society. We report a combined experimental study of magnetic properties of a single crystal of the frustrated diamond lattice antiferromagnet CoAl₂O₄ with Co²⁺ electron spin resonance, ²⁷Al nuclear magnetic resonance, and muon spin rotation/relaxation techniques. With our local probes, we show that the frustration of spin interactions and the Co/Al site disorder strongly affect the spin dynamics. The experimental results evidence inhomogeneous and slow magnetic fluctuations and the occurrence of short-range electron spin correlations far above a characteristic temperature $T^* = 8$ K at which the spin system turns into a quasistatic state. Our data indicate that this spin order is likely short range and unconventional with spin fluctuations persistent even at $T \gg T^*$. The results of three spectroscopy techniques highlight a nontrivial role of structural disorder for the magnetism of a frustrated diamond spin lattice at the proximity to the critical point.

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