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Adiabatic physics of an exchange-coupled spin-dimer system: magnetocaloric effect, zero-point fluctuations, and two-dimensional universal behavior[1] JOHN SINGLETON, NHMFL, Los Alamos, JAMIE BRAMBLEBY, PAUL GODDARD, Warwick University, MARCELO JAIME, NHMFL, Los Alamos, TOM LANCASTER, Durham University, L HUANG, JOCHEN WOSNITZA, HLD-EMFL, CRAIG TOPPING, Oxford University, K CARREIRO, HOPE TRAN, Z MANSON, JAMIE MANSON, Eastern Washington University — We present the magnetic and thermal properties of the bosonic-superfluid phase in the spin-dimer network Cu(pyz)(gly)ClO_4 (pyz = pyrazine; gly = glycinate) using both quasistatic and rapidly-changing pulsed magnetic fields. The entropy derived from heat capacity reveals that the pulsed-field measurements are strongly adiabatic in nature and are responsible for a significant magnetocaloric effect (MCE). In contrast to previous predictions we show that the MCE is not just confined to the critical regions, but occurs for all fields greater than zero at sufficiently low temperatures. We explain the MCE using a model of exchange-coupled dimer spin-states and highlight that failure to take this effect into account inevitably leads to incorrect interpretations of experimental data. In addition, the heat capacity in our material is suggestive of an extraordinary contribution from zero-point fluctuations and appears to indicate universal behavior with different critical exponents at the two field-induced critical points. The data point to a two-dimensional nature of spin excitations in the system.

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