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Dimensional reduction at the BEC quantum critical point in $BaCuSi_2O_6$. SUCHITRA SEBASTIAN, IAN FISHER, Stanford University, NEIL HARRISON, MARCELO JAIME, PETER SHARMA, NHMFL, Los Alamos National Laboratory, CRISTIAN BATISTA, Theoretical Division, Los Alamos National Laboratory, LUIS BALICAS, NHMFL, Tallahassee, NAOKI KAWASHIMA, Institute for Solid State Physics, University of Tokyo — We present results on the magnetic spin dimer system $BaCuSi_2O_6$, which can be tuned across a Bose-Einstein condensation (BEC) quantum critical point (QCP) to an ordered BEC of spins by applying an external magnetic field. Experimental results reveal a continuous crossover in critical scaling behaviour near the QCP from 3d to 2d BEC universality, indicating that dimensionality itself is an emergent property at the QCP of this particle density-tuneable BEC. Geometrical frustration leading to inter-layer decoupling is identified as the mechanism responsible for this unique manifestation of a lower dimensional QCP in the 3d $BaCuSi_2O_6$ spin system. While the theoretical concept of dimensional reduction has been extensively discussed in many different contexts as a route to low dimensionality in bulk materials, this is the first experimental realisation of dimensionally reduced criticality.

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