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Continuous and Discontinuous Quantum Phase Transitions in a Model Two-Dimensional Magnet SARA HARAVIFARD, Argonne National Laboratory / The University of Chicago, ARNAB BANERJEE, The University of Chicago, JONATHAN LANG, GEORGE SRAJER, Argonne National Laboratory, DANIEL SILEVITCH, The University of Chicago, BRUCE GAULIN, McMaster University, HANNA DABKOWSKA, Brockhouse Institute for Material Research, THOMAS ROSENBAUM, The University of Chicago — The Shasty-Sutherland model consists of a set of spin 1/2 dimers on a 2-dimensional square lattice which are predicted to change from isolated, gapped excitations to a collective, ordered ground state by tuning the ratio of the intra to inter-dimer coupling. We compress the model Shastry-Sutherland material, SrCu2(BO3)2, in a diamond anvil cell at cryogenic temperatures to continuously tune the coupling energies and induce changes in state. High-resolution x-ray measurements exploit a remarkably strong spin-lattice coupling to ascertain the physics of the magnetic transition. The singlet-triplet gap energy is suppressed continuously with increasing pressure, vanishing completely by 2 GPa. This continuous quantum phase transition is followed by a structural distortion at higher pressure corresponding to the onset of long-range order.

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