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Quantum Computational Universality of the 2D Cai-Miyake-Dür-Briegel Quantum State TZU-CHIEH WEI, CN Yang Institute for Theoretical Physics, Stony Brook University, ROBERT RAUSSENDORF, Department of Physics and Astronomy, University of British Columbia, LEONG CHUAN KWEK, Centre for Quantum Technologies, National University of Singapore and Nanyang Technological University — Universal quantum computation can be achieved by simply performing single-qubit measurements on a highly entangled resource state, such as cluster states. Cai, Miyake, Dür, and Briegel recently constructed a ground state of a two-dimensional quantum magnet by combining multiple Affleck-Kennedy-Lieb-Tasaki quasichains of mixed spin-3/2 and spin-1/2 entities and by mapping pairs of neighboring spin-1/2 particles to individual spin-3/2 particles [Phys. Rev. A **82**, 052309 (2010)]. They showed that this state enables universal quantum computation by constructing single- and two-qubit universal gates. Here, we give an alternative understanding of how this state gives rise to universal measurement-based quantum computation: by local operations, each quasichain can be converted to a one-dimensional cluster state and entangling gates between two neighboring logical qubits can be implemented by single-spin measurements. Furthermore, a two-dimensional cluster state can be distilled from the Cai-Miyake-Dür-Briegel state.

Tzu-Chieh Wei
CN Yang Institute for Theoretical Physics, Stony Brook University

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