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Scrolling the quantum optical frequency comb: one-way quantum computing with hybrid time-frequency entanglement OLIVIER PFISTER, PEI WANG, University of Virginia, RAFAEL ALEXANDER, University of Sydney, MORAN CHEN, NIRANJAN SRIDHAR, University of Virginia, NICOLAS MENICUCCI, University of Sydney — On the heels of the experimental demonstrations of record-scale one-dimensional cluster-state entanglement — suitable for implementing single-qumode quantum computing gates — in the time domain [S. Yokoyama et al., Nat. Photon. 7, 982 (2013)] and the frequency domain [M. Chen et al., Phys. Rev. Lett. 112, 120505 (2014)], we show here that both degrees of freedom can be combined to generate a two-dimensional square-grid cluster-state — suitable for universal quantum computing — from a single optical parametric oscillator. This method, the most compact yet, has the potential to reach 10^9 entangled qumodes, based on the current state of the art.

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