

Abstract Submitted
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Simultaneous generation of multiple quadripartite continuous-variable cluster states in the optical frequency comb of a single optical parametric oscillator MATTHEW PYSHER, University of Virginia, YOSHICHIKA MIWA, University of Tokyo, REIHANEH SHAHROKHSHAHI, RUSSELL BLOOMER, OLIVIER PFISTER, University of Virginia — We report the experimental generation of multiple, four-mode, continuous-variable cluster states from a single optical parametric oscillator (OPO) operating below threshold. We use a PPKTP crystal phasematching two concurrent nonlinear interactions to entangle the optical frequency comb formed by the OPO cavity. Four independent entanglement witnesses (a.k.a. infinitesimal operators of stabilizers, or “nullifiers”) display squeezing in each cluster state, and we utilize the large phase-matching bandwidth of the nonlinear interactions to display the simultaneous creation of several such cluster states using only a single pump frequency. A slightly more sophisticated version of this experimental method, using a crystal with three nonlinear interactions and 15 pump frequencies, has theoretically shown the ability to produce arbitrarily large square-grid cluster states suitable for universal one-way quantum computing.

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