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**Large-scale cluster entanglement in the quantum optical frequency comb: from linear chains to n-hypercubes**[1] OLIVIER PFISTER, PEI WANG, MORAN CHEN, MATTHEW PYSHER, University of Virginia, YOSHICHIKA MIWA, University of Tokyo, RUSSELL BLOOMER, REIHANEH SHAHROKHSHAHI, University of Virginia, NICOLAS MENICUCCI, University of Sydney — Following our recent experimental demonstration of the continuous-variable entanglement of 60 resonant field modes (Qmodes) of a single optical parametric oscillator (OPO) into 15 independent quadripartite "square" cluster states, we present new theoretical and experimental developments that lead to considerable simplification of our previous proposal to implement large-scale continuous-variable cluster states in the quantum optical frequency comb (QOFC) of a single OPO. In particular, we will show how multiple hypercubic graph states can be experimentally generated in the QOFC of a few OPOs (as many as the hypercube's dimension), all of which are considerably simpler than in our previous proposals and experiments. We have found that the drastic need for tight boundaries of the entangled set of Qmodes no longer holds, as shown by a theoretical analysis of the errors on the cluster state caused by imperfect entangling interactions.

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