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Towards quantum computing over the rainbow: scalable multipartite entanglement in the optical frequency comb[1]

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Recently, a mapping has been discovered and mathematically proven between the quantum optical eigenmodes of a single cavity and the quantum harmonic oscillators ("qumodes") entangled in two-dimensional square-grid cluster states suitable for universal quantum computing over continuous variables. This mapping offers serious scaling potential, allowing the entanglement of thousands of qumodes in a single optical parametric oscillator at the only cost of linear increases of pump power and interaction bandwidth. Moreover, the entanglement operation is in constant time versus the size of the cluster state. I will discuss the experimental implementation of these concepts and report on their realization in my laboratory.

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