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V. Parigi - Multimode quantum optics in Continuous Variables Quantum Information technologies

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In the continuous variables (CV) approach, universal computation can be identified via a universal set of Hamiltonians, able to generate any arbitrary evolution as a combination of finite-time Hamiltonian unitaries, including Gaussian and non-Gaussian interaction - which are not easy to realise in an optical implementation. Differently form the discrete variables (DV) approach the two-modes entangling gate in the CV encoding is a Gaussian gate which can be implemented by combination of squeezing and linear optics. This has as consequence that the CV approach is particularly suitable for the one-way model of quantum computing based on cluster state. I will revise experimental generation of multimode quantum states for CV protocols and in particular the one based on optical frequency combs and parametric processes. The protocols, along with mode selective and multimode homodyne measurements, allow for the implementation of reconfigurable entanglement connections between the involved. This can be exploited for fabricating entanglement structures with regular geometry as cluster states or graphs with more complex topology which can emulate quantum physical systems in complex structures or quantum protocols in complex networks. I will also revise non-Gaussian operations, which are necessaries to reach a form of quantum advantage in this scenario