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Optically generated 2-dimensional photonic cluster state from coupled quantum dots SOPHIA ECONOMOU, Naval Research Lab, NETANEL LINDNER, Department of Physics, Technion-Israel Institute of Technology, Haifa, Israel, TERRY RUDOLPH, Imperial College London — We propose a method to generate a two-dimensional cluster state of polarization encoded photonic qubits from two coupled quantum dot emitters. We combine the recent proposal [Phys. Rev. Lett. 103, 113602 (2009)] for generating 1-dimensional cluster state strings from a single dot, with a new proposal for an optically controlled conditional phase (CZ) gate between the two quantum dots. The entanglement between the two quantum dots translates to entanglement between the two photonic cluster state strings. Further inter-pair coupling of the quantum dots using cavities and waveguides can lead to a 2-dimensional cluster sheet. Detailed analysis of errors indicates that our proposal is feasible with current technology. Crucially, the emitted photons need not have identical frequencies, and so there are no constraints on the resonance energies for the quantum dots, a standard problem for such sources.

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