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Deterministic photonic cluster state generation from quantum dot molecules SOPHIA ECONOMOU, Naval Research Lab, MERCEDES GIMENO-SEGOVIA, TERRY RUDOLPH, Institute for Mathematical Sciences, Imperial College, London — Currently, the most promising approach for photon-based quantum information processing is measurement-based, or one-way, quantum computing. In this scheme, a large entangled state of photons is prepared upfront and the computation is implemented with single-qubit measurements alone. Available approaches to generating the cluster state are probabilistic, which makes scalability challenging. We propose to generate the cluster state using a quantum dot molecule with one electron spin per quantum dot. The two spins are coupled by exchange interaction and are periodically pulsed to produce photons. We show that the entanglement created by free evolution between the spins is transferred to the emitted photons, and thus a 2D photonic ladder can be created. Our scheme only utilizes single-spin gates and measurement, and is thus fully consistent with available technology.

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