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Photon-mediated interactions: a scalable tool to create and sustain entangled states of N atoms CAMILLE ARON, Laboratoire de Physique Thorique, cole Normale Suprieure, CNRS, Paris, France and Instituut voor Theoretische Fysica, KU Leven, Leuven, Belgium, MANAS KULKARNI, New York City College of Technology, City University of New York, HAKAN TURECI, Princeton University — We propose and study the use of photon-mediated interactions for the generation of steady-state entanglement between N atoms that are separated by arbitrary distances. Through the judicious use of coherent drives and the placement of the atoms in a network of Cavity QED systems, a balance between their unitary and dissipative dynamics can be precisely engineered to stabilize a long-range correlated state of qubits in the steady state. We discuss the general theory behind such a scheme, and present an example of how it can be used to drive a register of N atoms to a generalized W-state, and the entanglement sustained indefinitely. The achievable steady-state fidelities for entanglement and its scaling with the number of qubits are discussed for presently existing superconducting quantum circuits. While the protocol is primarily discussed for a superconducting circuit architecture, it is ideally realized in any Cavity QED platform that permits controllable delivery of coherent electromagnetic radiation to specified locations.

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