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Quantum communication with OAM entangled photons

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Abstract content
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We consider Laguerre-Gaussian modes to study the evolution of an OAM entangled bipartite photonic state in atmospheric turbulence. Photon pairs are generated via spontaneous parametric down-conversion and one photon from each pair is propagated through turbulence. To compare our results with previous work, the turbulent atmosphere is simulated with a single phase screen based on the Kolmogorov theory of turbulence and we only consider two level photonic quantum system (qubits). A full quantum state tomography is performed to reconstruct the two-qubit density matrices for a range of scintillation strengths and the concurrence is used as a measure of entanglement. Our results show how the initial OAM mode is increasingly scattered into neighbouring modes as we increase the scintillation strength. We compare the evolution of entanglement for different values of the OAM and we show how entanglement evolution in turbulence depends on the OAM value used.

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