Contribution ID: **209** Type: **Oral Presentation**

Validation of a numerical simulation to study the decoherence of quantum orbital angular momentum entanglement due to atmospheric turbulence

Friday, 15 July 2011 08:45 (15 minutes)

<p>The orbital angular momentum (OAM) state of light has been the object of much interest within the quantum information community lately mainly because it can be used to implement higher dimensional entanglement. Unfortunately, the OAM cannot be used for quantum communication through optical fibers in use today because these fibers support only modes with zero OAM values. One can alternatively use free-space communication. However, one needs to understand how atmospheric turbulence affects quantum entanglement. In recent years, numerical simulation has become a very important and successful approach for solving complex problems and to gain more insight into scientific phenomena. In this work, we present a numerical simulation to study the decoherence of quantum entanglement between a pair of qubits due to atmospheric turbulence. The qubits are photons entangled in their OAM mode. The photons propagate in a turbulent atmosphere modeled by a series of consecutive phase screens based on the Kolmogorov theory of turbulence and the concurrence is used as entanglement measure. We validate our simulation scheme with the formula derived in "Nature Physics 4 99 - 102 (2008)" stating that the entanglement reduction under a one-sided noisy channel is independent of the initial state and completely determined by the channels action on a maximally entangled state.

Level (Hons, MSc,
   PhD, other)?

PhD

Consider for a student
   award (Yes / No)?

Yes

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

No

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Session Classification: LOS

Track Classification: Track C - Lasers, Optics and Spectroscopy