SPIE Optical Engineering + Applications, 6-10 August 2017, San Diego, California, United States

doi: 10.1117/12.2274238

Towards non-classical walks with bright laser pulses

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ABSTRACT:

In the avid search for means to increase computational power in comparison to that which is currently available, quantum walks (QWs) have become a promising option with derived quantum algorithms providing an associated speed up compared to what is currently used for implementation in classical computers. It has additionally been shown that the physical implementation of QWs will provide a successful computational basis for a quantum computer. It follows that considerable drive for finding such means has been occurring over the 20+ years since its introduction with phenomena such as electrons and photons being employed. Principal problems encountered with such quantum systems involve the vulnerability to environmental influence as well as scalability of the systems. Here we outline how to perform the QW due to interference characteristics inherent in the phenomenon, to mitigate these challenges. We utilize the properties of vector beams to physically implement such a walk in orbital angular momentum space by manipulating polarization and exploiting the non-separability of such beams.