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Multi-channel, turbulence resistant Quantum Key Distribution

Quantum hybrid entanglement between two photons occurs when the two photons in question are entangled non-locally in different independent degrees of freedom. In our case, if we measure the polarization of one photon, we may infer what the spatial mode of the other will be, and vice versa. The resilience of polarization to turbulence and the ability to encode a large amount of information into the spatial degree of freedom implies that hybrid entanglement offers significant improvements to conventional Quantum Key Distribution protocols, which conventionally make use of only the polarization degree of freedom. Here we make use of an all-digital approach to couple spatial information to polarization thereby accessing higher order spatial modes than what would be allowed by static elements. In doing so, we are able to create multiple channels through which simultaneous communication may occur thereby boosting peer-to-peer communication speeds and allowing for simultaneous multi-party communication. We also demonstrate the technique's resilience to turbulence by sending every photon carrying the polarisation information of each channel through turbulence. We believe this novel technique would be of value to the Quantum Optics and Quantum Information communities.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

Primary author: ORNELAS, Pedro (University of the Witwatersrand)

Co-authors: NAPE, Isaac (Structured Light Lab, School of Physics, University of Witwatersrand); Mr DE OLIVEIRA, Andre (Universidade Federal de Santa Catarina); Prof. SOUTO RIBEIRO, Paulo (Universidade Federal de Santa Catarina); FORBES, Andrew (U. Witwatersrand)

Presenter: ORNELAS, Pedro (University of the Witwatersrand)

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