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## Hybrid Two-way QKD in Free Space

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### Abstract content <br> &nbsp; (Max 300 words)

Quantum Key Distribution (QKD) has developed into a commercially available technology in recent years. There are, however, many challenges that must be overcome in order to optimise this technology. One of the main bottlenecks in quantum communication is the short transmission distances that single photons are confined to, specifically in a fibre network. A free space channel can provide a longer transmission distance for the quantum signal.

The 'plug and play' scheme of Muller, et al. [1] is an auto-compensating scheme which uses phase encoding to enable secure communication between two parties. This scheme has been implemented in fibre-based commercial QKD units in the form of the id3100 Clavis2. Using a concept analogous to the "plug and play" scheme, a comparative design will be implemented using polarisation encoding for a hybrid, two-way, free space QKD scheme.

The laser source and single photon detectors are located in Bob's unit. Bright pulses are emitted from Bob via a circulator and transmitted towards Alice's unit. The pulses are then compensated for any turbulence effects and reflected and attenuated to a single photon level. Alice then encodes the information onto each photon and transmits them back to Bob. A second compensation technique is performed at Bob's unit prior to measurement. The initial bright pulse can also be used as an inbuilt tracking unit for the system. Since the optics required for the transmitter's unit is much smaller and cheaper than the receiver's unit, the free space "plug and play" scheme is ideal for connecting multiple end users to form a star topology network.

#### References:

[1] Muller, A., Herzog, T., Huttner, B., Tittel, W., Zbinden, H. and Gisin, N., Plug and play systems for quantum cryptography. Applied Physics Letters, 1996. 70(7): p. 793-795.

### Apply to be<br> considered for a student <br> &nbsp; award (Yes / No)?

Yes

### Level for award<br>&nbsp;(Hons, MSc, <br> &nbsp; PhD)?

PhD

### Main supervisor (name and email)<br>and his / her institution

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

Yes

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