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Compensating Birefringence Effects in Fibre for Polarisation Encoded QKD

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Abstract content
   (Max 300 words)

Quantum Key Distribution employs the laws of quantum mechanics for the purpose of cryptography. Two parties are able to create and securely share a random key which is used to encrypt a message. Any eavesdropper attempting to anonymously retrieve the key will have to make measurements, thereby disturbing the system. Using this principle, a high error rate between the two authenticated parties indicates a compromise in the system and the process is aborted.

Fibre optic cables provide a convenient channel to implement QKD. In order to implement any polarisation encoded protocols, the state of polarisation of photons must be maintained within the fibre channel. However, the polarisation of light is altered when passed through a fibre. This is due to birefringence caused by impurities in the fibre or environmental stresses.

Utilizing polarisation mode dispersion, the state of polarisation can be corrected when a photon is transmitted through fibre. If the fibre is fixed, the environmental stresses result in a unique and constant change of polarisation. This can be compensated by rotating the polarisation of each photon appropriately before being measured. If the fibre is subjected to variable conditions, the change in the state of polarisation of photons must be monitored and adjustments must be made at suitable time intervals. These changes can be observed using a test signal and the effects may be corrected with the use of a polarisation controller. If one state on the Poincaré sphere is compensated, its orthogonal state will automatically be compensated as well. Since QKD protocols such as BB84 and B92 utilise two non-orthogonal bases, an additional polarisation controller is usually used for the second basis. However, by using a search algorithm, the polarisation controller can isolate the plane on the Poincaré sphere that passes through both bases, thus compensating non-orthogonal states with one device.

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yes

Level for award
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MSc

Main supervisor (name and email)
and his / her institution

Prof. F. Petruccione
petruccione@ukzn.ac.za
University of KwaZulu-Natal, NITheP

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Primary author: Ms PILLAY, Sharmini (University of KwaZulu-Natal)

Co-authors: Mr MIRZA, Abdul (University of KwaZulu-Natal); Prof. PETRUCCIONE, Francesco (University of KwaZulu-Natal, NITheP); Dr GIBBON, Tim (Nelson Mandela Metropolitan University)

Presenter: Ms PILLAY, Sharmini (University of KwaZulu-Natal)

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