

Comparative Analysis of Efficient and Simplified BB84 in Satellite Communication Systems

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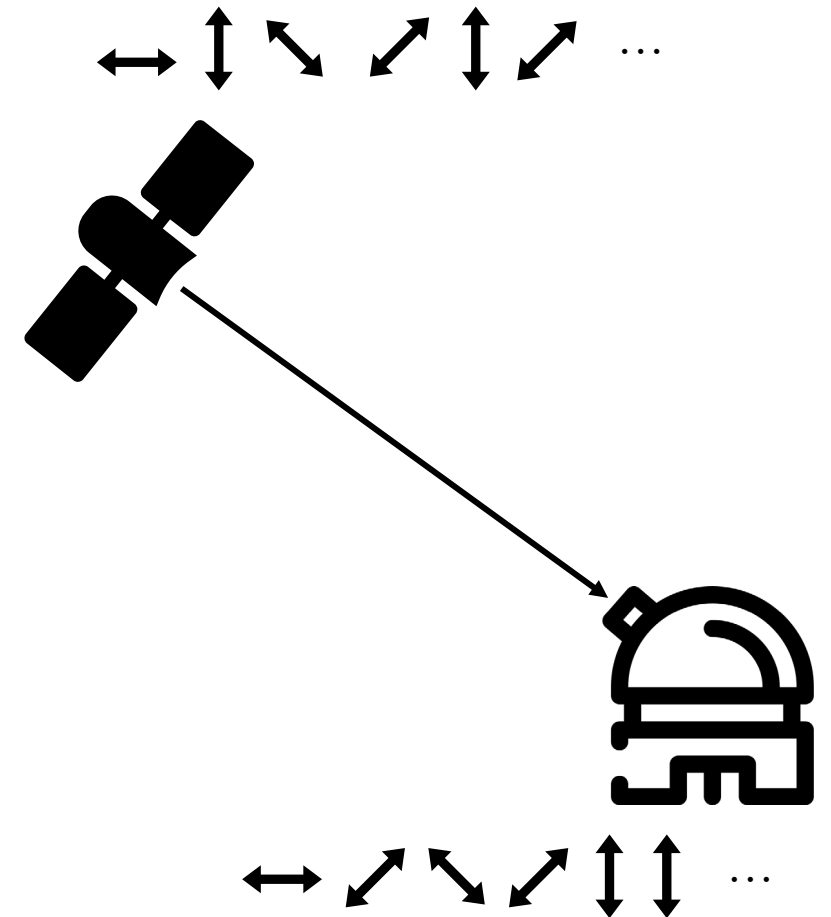
Gonçalo TEIXEIRA

Long Distance Quantum Key Distribution

Satellite Communications

Quantum Network

Quantum Cryptography

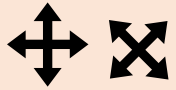


Efficient and Simplified BB84

Efficient BB84

4-state 2-decoy (4S2D)

4 state:



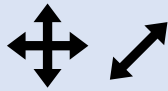
2 decoy:

μ_1 - signal
 μ_2 - decoy
 μ_3 - decoy

Simplified BB84

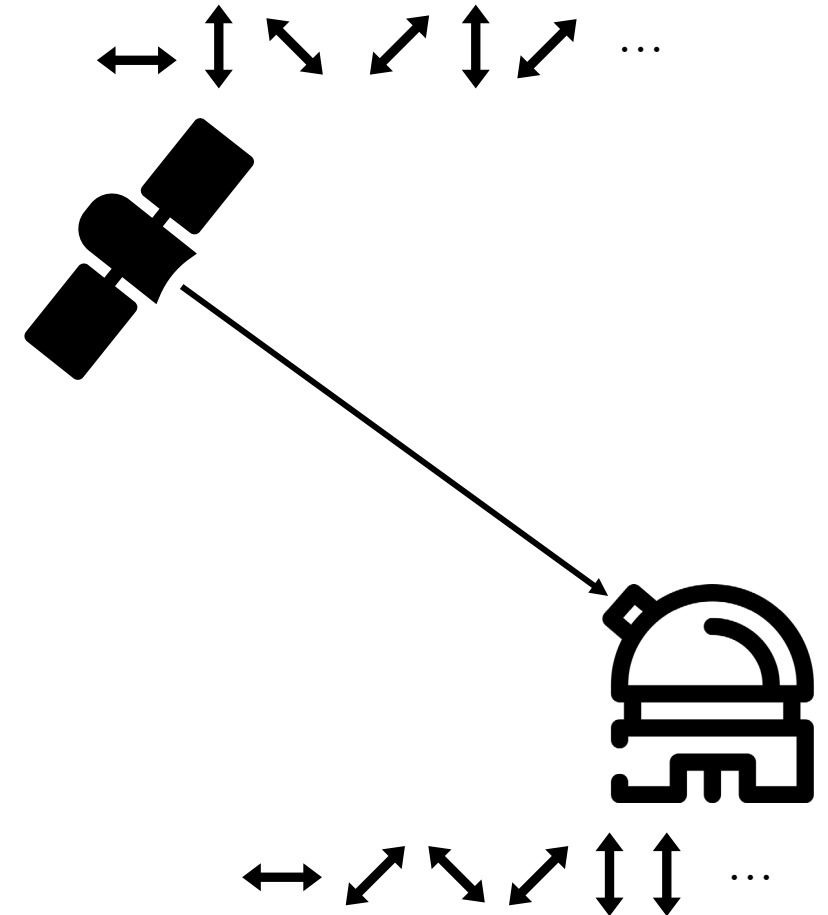
3-state 1-decoy (3S1D)

3 state:

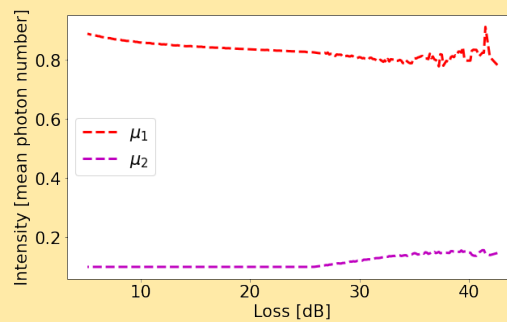
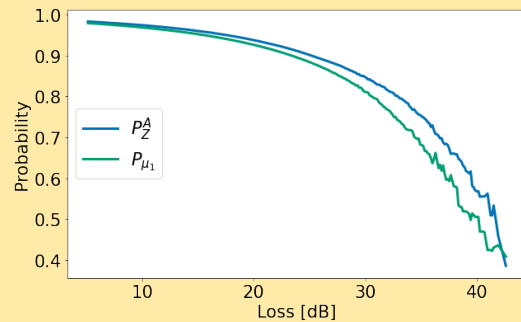


1 decoy:

μ_1 - signal
 μ_2 - decoy

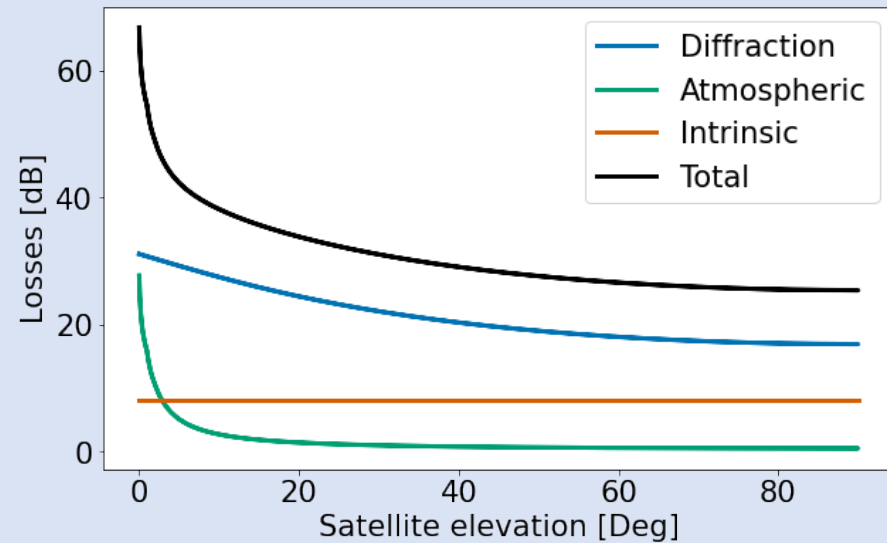
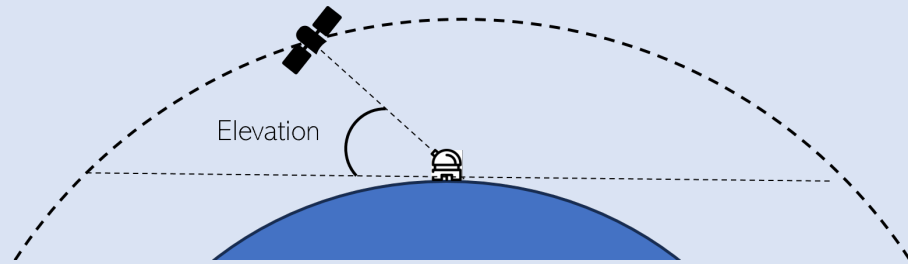


Optimized Communication for 3S1D
 (Variable Parameters)



Satellite Communication

Optical Channel Losses

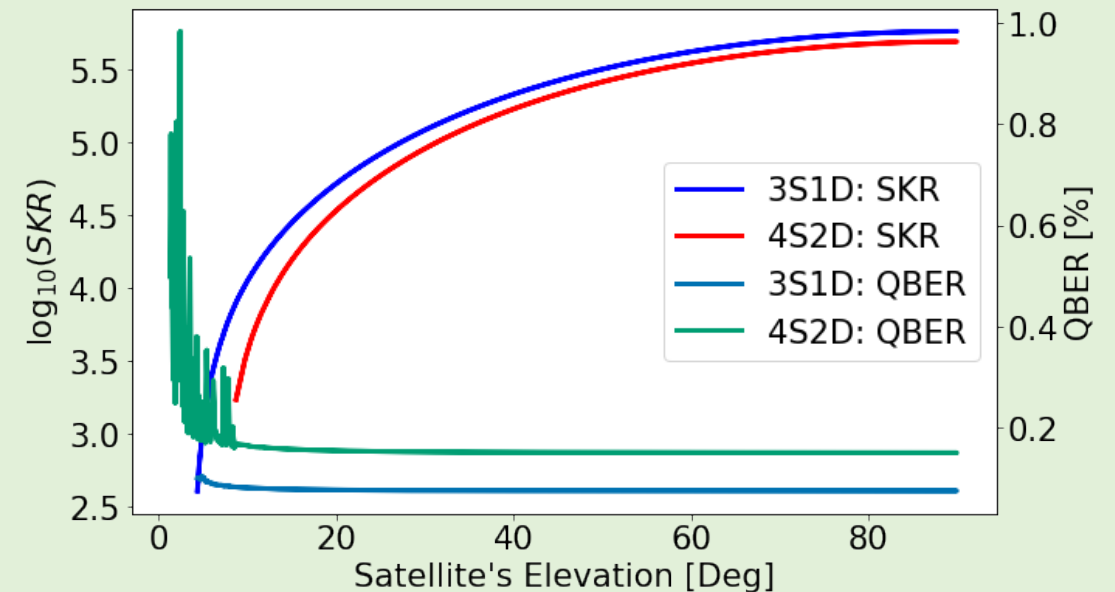


Figures of Merit

SKR – Secret Key Rate

QBER – Quantum Bit Error Rate

Satellite Communication Rate



Conclusion

The 3S1D protocol, in general, outperforms the 4S1D, particularly in High-loss scenarios.

The SKL after one path have a length in bits of 80Mbits for 3S1D and 60Mbits for the 4S2D.

The QBER during transmission is below 0.2% which is suitable for secure quantum key distribution

Thank you for your attention!